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Managing commodity booms: Dutch disease and economic performance

BASIL OBERHOLZER

Abstract:

Commodity booms are usually associated with commodity-exporting countries suffering from real exchange rate appreciation and negative economic consequences, that is, Dutch disease. Yet, there are different ways to manage or not manage the commodity rent earned via exports. Based on a monetary theory of exchange rates and a heterogenous sample of countries, this analysis shows that Dutch disease during commodity booms is not an inevitable outcome. Different macroeconomic characteristics of countries give way to different outcomes. In particular, richer countries, countries with trade surplus as well as those with a history of low inflation are better equipped to avoid real appreciation. Evidence unambiguously shows that countries with real appreciation experience structural change away from manufacturing toward less productive sectors such as construction. Macroeconomic dynamics and political economy factors make it more difficult for developing countries to make long-term use of the rent gained during commodity booms.

University of Bern, Switzerland,
email: basil.oberholzer@gmx.ch

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1. Introduction

High and rather volatile global prices of commodities since the beginning of the 21st century have revived interest in the macroeconomic effects of commodity booms. Observations of premature deindustrialization in several developing and emerging countries (Bruno et al., 2011; Page, 2012; Oreiro et al., 2020) have also brought the role of Dutch disease back to the debate. The original hypothesis of a real exchange rate appreciation during commodity booms and a crowding-out of the non-booming sectors was derived using a neoclassical framework merely based on real terms (Corden, 1984; Corden and Neary, 1982). Yet, it is also an important concept in heterodox economics despite several different aspects such as the latter's focus on long-term overvaluation of the exchange rate due to the commodity rent instead of only short-term effects during booms.

This article takes a monetary perspective of Dutch disease by arguing that the phenomenon is not a necessity arising from economic theory but an empirical issue, which may apply in some cases but can also be avoided through several factors. In particular, the trade balance and capital flows may react in various ways to a change in terms of trades while the monetary policy response may follow different patterns, too. There is neither a natural tendency to a balanced trade account nor an automatic exchange rate changes to trigger such a tendency.

This theoretical hypothesis is tested for a selection of 58 countries where commodities make up for the major part of their exports. Apart from this common feature, the sample is heterogenous as it consists of advanced economies as well as developing and emerging countries with different sectoral focus regarding commodities. The empirical analysis consists in investigating macroeconomic characteristics of the countries such as income level, trade balance, nominal devaluation history, exchange rate regime, and sectoral focus, with regard to their ability to explain the existence or non-existence of Dutch disease.

It will be seen that Dutch disease is relevant for the poorer countries, notably those with trade deficits, while the real exchange rates of richer economies tend not to respond to higher commodity prices. There are a couple of macroeconomic, institutional, and political economy factors such as exchange rate regime and history of inflation that help explain this result. It seems that most poor countries are not able to make use of the opportunity provided by high commodity prices to steer productivity, industrialization, and competitiveness in the long term.

The remainder of this paper is structured as follows: section 2 gives an introduction to the understanding of nominal and real exchange rates in this analysis. Section 3 introduces the econometric method and section 4 presents the results. Those results are discussed in section 5. Section 6 concludes.

2. Theoretical foundations of exchange rates in brief

The term of Dutch disease was introduced by Corden and Neary (1982) and describes the impact of an increase in commodity prices on a country's real exchange rate and structural change. In a neoclassical framework of full employment and automatic market-clearing in real terms, they identify two main disease effects during commodity booms: the spending effect describes the spending of the extra income from export returns, which triggers a price increase and real appreciation; the resource movement effect involves reallocation of the workforce to the booming sector, thus shrinking the non-booming sectors and triggering deindustrialization (Corden, 1984, pp. 360-361).

In the majority of relevant literature, Dutch disease is defined in a more general way where a real appreciation caused by various possible reasons causes deindustrialization. For instance, Lartey (2011) measures the relevance of financial openness and capital inflows on the real exchange rate in developing countries whereas Lartey et al. (2012), Ojapinwa and Nwokoma (2018) and Daway-Ducanes (2019) analyse the specific effect of remittances on real appreciation and domestic resource reallocation. With Bresser-Pereira's (2016, 2020) new developmentalism approach, the issue of exchange rate overvaluation in this larger sense has been integrated into a comprehensive heterodox macroeconomic framework. It considers the exchange rate to be a critical "macroeconomic price" that, if overvalued,

hampers a country's industrialization. Dutch disease thus is perceived as a long-term rather than a cyclical problem because it leads countries to rely on commodity rents instead of developing their industrial sector (Boyer, 2015, pp. 254-258). In this field, there are various contributions measuring the importance of the real exchange rate for economic growth in general and the manufacturing sector in particular (see for instance Esfahani et al., 2010; Gabriel and Ribeiro, 2019; Gabriel et al., 2020; Libman et al., 2019; Rodrik, 2008, 2015). These studies feed into the debate on Kaldor's 'first law', that is, the role of the manufacturing sector itself as an innovation and learning centre for the overall growth and development process and its spill-over effects to other sectors (see for example Tregenna, 2009; Rodrik, 2015; Szirmai and Verspagen, 2015).

Our empirical analysis emphasizes commodity-exporting countries and their response to global commodity price booms. By investigating how different countries react in different ways and hence are or are not able to avoid Dutch disease, we also shed some light on rent economies' long-term challenges with their external account. By rent economies, we mean countries which strongly rely on commodity exports and who's domestic business cycle is driven by those export returns and hence global commodity prices (Boyer, 2015, p. 255).

Mainstream models of exchange rates usually can be traced back to the purchasing power parity (PPP) model and the Dornbusch (1976) model whereas there exist basic as well as extended versions of both frameworks. The former acts on the assumption that trade imbalances entail excess demand for the currency of the surplus country relative to that of the deficit country, the exchange rate as the relative price of currencies adjusts in a way to restore balanced trade (Sarich, 2006, p. 473). Depending on currencies being free-floating or pegged, adjustment takes place via a change in the nominal exchange rate or, respectively, the price levels of the trading economies. In addition to the basic PPP model, the Dornbusch model incorporates the financial market by modelling an exchange rate pattern, which also ensures equilibrium of interest rates. This bidirectional causality between relative prices and the trade balance and the corresponding re-equilibration of the domestic economy gives rise to the argument that structural change is a result of optimization rather than a possible source of faster or slower economic growth (see for instance Cimoli and Porcile, 2016, p. 217; Pérez Caldentey, 2016, p. 37).

However, according to heterodox approaches, in a world where exchange rates are influenced not only by demand for an exogenously given money supply but by income effects, capital flows and uncertainty, there is no automatic adjustment to an equilibrium with balanced trade (see Harvey, 2005). Moreover, as the theory of currency hierarchies argues, not all currencies are affected by macroeconomic events in the same way since financial markets treat currencies differently depending on their position in the international monetary system (see Kaltenbrunner, 2015).

In order to theoretically assess the impact global commodity booms can have on the real exchange rate, a distinction between the effect on the nominal exchange rate on the one hand and on the domestic price level on the other hand is helpful. The nominal exchange rate is determined by the forces affecting demand for and supply of currency in the foreign exchange market (Cencini, 2000, p. 9). A country that runs a current account surplus but does not issue a global key currency earns its export returns in foreign currency. A current account surplus (deficit) increases demand for the domestic (foreign) currency relative to the foreign (domestic) currency and thus triggers an increase (decrease) in the international price of that currency, that is, its exchange rate. However, demand for a currency can be fully

accommodated by the banking system. Hence, the central bank of a surplus country can monetize the whole surplus by providing the domestic currency at an unaltered exchange rate (ibid., pp. 2-4). On the other hand, a deficit country may access a foreign loan to cover its net expenses such that demand for foreign currency can be accommodated equally. Trade imbalances thus involve a tendency to alter nominal exchange rates but a tendency is by no means a necessity.

Payments for trade are not the only international monetary flows as capital flows can equally exert demand pressure in the foreign exchange market and are responsible for short-term exchange rate movements and also potential self-enforcing long-run effects. Capital flows themselves are influenced by differentials in interest rates and expected profits as well as speculative expectations of future exchange rate changes (see Oberholzer, 2020, pp. 148-149). Usually, financial flows are pro-cyclical, which implies that during commodity booms commodity-exporting countries face upward pressure from capital inflows in addition to the increased commodity rent.

International relative prices in addition to the nominal exchange rate are influenced by additional factors. Once the nominal exchange rate and the international price level are given, the real exchange rate is determined by the domestic price level. In relation to rent economies during commodity booms, there is the effect of the monetization of export returns via the banking system, which increases the money available in the domestic economy. It may enter circulation, exert nominal demand, and drive up the price level (Boyer, 2015, p. 255). To the extent that the commodity boom goes along with a nominal appreciation, prices in the non-booming sectors face downward pressure in order to avoid a loss in international competitiveness. However, in contrast to the prediction of price and trade rebalancing in neoclassical exchange rate models, prices may not so easily adjust to the requirements of international markets. A sector's production costs relative to those of its foreign competitors are eventually defined by the wages in that sector. Those wages are the result of bargaining between social classes according to their respective strengths instead of being automatically set in a way to restore balanced trade (Shaikh, 2016, p. 514). This is why a commodity boom can have an impact not only on the real exchange rate but also on the composition of a country's output.

Whether a commodity boom actually gives way to a real appreciation depends on whether the forces at play regarding the nominal exchange rate and price levels are mitigated or even offset by opposing macroeconomic dynamics or by economic and monetary policy action. First, a commodity price boom may potentially not even lead to an improvement in the current account if a country spends the additional income originating from the export returns for imports. This result might also materialize dynamically when additional income is not only spent for import but also in the domestic economy where the demand stimulus increases production such that the import propensity out of the additional income eventually rebalances the current account (that is, being back at its initial level). We may even imagine that a commodity boom ends up in a trade deficit. This happens when a commodity boom triggers very high growth rates in the domestic economy such that a wave of pro-cyclical foreign direct investment and other capital inflows sets in to finance investment and consumption, which increase import demand (see also McCombie and Thirlwall, 1997). In the long term, such a boost in investment, given that it goes to productive facilities, can lay the base for an improvement in the trade balance, hence in the current account (see Libman et al., 2019, p. 1090).

In addition to increasing imports, appreciation pressure in the foreign exchange market may also be eased by other components of the balance of payments. Even though we have argued above that commodity booms may be accompanied by procyclical capital inflows, there may also be a tendency in the opposite direction. Namely, profits earned in the booming sector may be transferred abroad, to be denoted as capital flight, particularly when the sector is dominated by private companies in a country with a history of strong macroeconomic volatility while itself contributing to this volatility (see for instance Ndikumana and Boyce, 2018). To the extent that the commodity rent is shifted out of the country, upward pressure on the exchange rate is offset.

Finally, central banks in booming countries may prevent real appreciation, first, by accommodating any monetary flows and therewith keeping the nominal rate stable. Second, the monetization of export returns, which tends to drive up domestic prices (to the extent demand meets bottlenecks on the supply side) can be neutralized via sterilization. Sterilization means that the central bank issues bonds in order to withdraw monetary units from the economy (Boyer, 2015, p. 255; Guzman et al., 2018, p. 58; Rangarajan and Prasad, 2008). The overall price level then basically is not expected to change.

3. Methodology

While there are no sufficient data available for a large number of countries to identify the individual policy measures implemented in each country during commodity booms, there are still macroeconomic characteristics, which may allow an indirect interpretation with respect to a country's ability to manage the exchange rate effects of commodity booms.

A panel data analysis enables an extensive analysis with some justification for generalization regarding if and how Dutch disease affects commodity-dependent economies. The analysis in this place covers a large sample of countries, which can be classified as commodity exporters according to the following definition: we consider the countries whose share of primary commodities in total goods exports are at least 60 percent on average for the period from 1995 until 2018 for which UNCTAD (2020) provides data. Out of these countries, the very small island states are removed due to data constraints as well as due to tourism making up for most of export returns. Moreover, several other of these countries are not selected since data are either missing (for example Afghanistan and Somalia) or not reliable due to economic turbulences or political reasons (for instance Myanmar and Venezuela). The remaining sample consists of 58 heterogenous commodity-exporting countries covering both high- and low-income countries from all continents with different sectoral focus either on fossil fuels, mining, or agriculture (see Appendix for the full list of countries). The period considered runs from 1990 until 2019. Starting from 1990 allows us to also include countries of the former Soviet Union.

The methodology to assess the macroeconomic impact of high commodity prices proceeds in two stages. First, we assess the impact of high commodity prices on the real exchange rate. Second, we test for the influence of exchange rate changes on patterns of real investment in the domestic economy and hence on industrialization or deindustrialization.

The real exchange rates, *rer*, are calculated with data from the Penn World Table 10.0 and express a country's exchange rate to the US. The definition is such that a lower value means a stronger exchange rate. The terms of trade, denoted as *tot*, are provided by the IMF (Gruss and

Kebhaj, 2019). The data series are constructed by compiling the world prices of 45 commodities according to their relevance for the respective country. A country's commodity export prices then are divided by the IMF's unit value index for manufactured exports to deflate by price developments that are not explained by commodity price changes. The weight of an individual commodity in a country's index is rolling over time according to its historical importance.

In econometric analysis that involves the relationship between the terms of trade and exchange rates, it is hard to find explaining macroeconomic variables that can be considered as exogenous (see also Ismail, 2010). Most variables that could be added as explaining factors of the exchange rate are likely not to be independent of the terms of trade. Usually, structural models are suggested to solve the endogeneity problem and hence are applicable to examine Dutch disease effects (see for instance Jbir and Zouari-Ghorbel, 2011). However, they are not appropriate for the comparison of a large set of countries and may also pretend doubtful precision. Nonetheless, it is possible in a panel analysis to include independent explaining variables in addition to the terms of trade variable, namely variables describing countries' macroeconomic characteristics. This is why in the first stage of the procedure we test how those characteristics influence Dutch disease effects—that is, how they affect the relationship between the terms of trade and the real exchange rate. These characteristics are, first, an index of countries' GDP per capita, *i_gdppc*. For the period considered, GDP per capita is averaged for each country. The largest value is set to 1 such that all countries are assigned a value between 0 and 1. This is how the level of GDP can be included in a way that it is fairly exogenous to terms of trade. This would not be the case if we took variable GDP in each year, as in such a case it would be influenced by the country's terms of trade.

The second variable is an index of countries' average trade balance, *i_nx*. Again, the largest value of the average trade balance among the countries is set to 1 such that the values range between -1 and 1. Current account data would be more accurate here. However, they are not available for many countries. Additionally, trade balance and current account data usually are strongly aligned in the long term. The trade balance affects the pressure on the exchange rate and might alter the effect of commodity booms. Another variable, *av_depr*, expresses the average annual nominal currency depreciation of countries. Continuous depreciation might influence countries' perception of how currency inflows during periods of high commodity prices should be managed. The fourth variable, *d_peg*, is a dummy that assumes the value 1 for countries which have either explicitly pegged their exchange rate to a leading reserve currency, introduced the US Dollar as official currency, or are part of a monetary union, and 0 for all other countries. Countries, which had such a regime only for a few years like Zimbabwe, for example, with the US Dollar from 2013 until mid-2019 are also given a value of 0.

The fifth characteristic distinguishes countries according to their sectoral focus. Two dummies, *d_mining* and *d_agri*, get a value of 1 if a country's goods exports are dominated by mining or agricultural products, respectively, and a value of 0 if their exports are mostly made up of fossil fuels. In most cases, classification is easy because one category makes up for clearly more than 50 percent of exports. A few countries such as Benin or Mozambique have to assigned to a category according to its relative strong weight with other sectors also having a significant share. The categories are assessed by referring to the World Bank's WITS database (WITS, 2021).

In this large panel, it is reasonable to assume country-specific effects, which is why we employ a fixed effects model in the following regressions. This is confirmed by the Wald test

for both stages of the procedure. In principle, the Hausman test would also provide support for a random effects model. However, including fixed effects improves the model's explanation power by much more than random effects (the latter not being shown here). Moreover, since the Breusch-Pagan Lagrange-Multiplier test provides evidence of cross-sectional dependence, we correct standard errors by applying White cross-section standard errors. In order to also account for autocorrelation and heteroskedasticity, an AR(1) process is included and standard errors are adjusted by cross-section weights. The macroeconomic characteristics are tested individually since dependence among them is rather likely. In a dynamic panel estimation, the endogenous variables could be estimated jointly. However, the condition of linear variables is not fulfilled as we estimate dynamic interaction terms (see Roodman, 2009, p. 86).

4. Results

Table 1 shows the result of the first stage of the procedure whereas rer and tot are expressed in natural logs. The effect of a change in the terms of trade might also be tested with a lag. While the nominal exchange rate is likely to respond fast, the price level components of the real exchange rates react with some delay. Tests with contemporary variables revealed the most significant results, which is why they are presented here. In the first column, the basic estimate shows that a change in the terms of trade has a significant negative impact on the real exchange rate. This implies that the first precondition of Dutch disease, that is, a negative impact of commodity booms on a country's international competitiveness, is confirmed.

However, as the other columns of table 1 reveal, there are considerable differences of Dutch disease effects depending on countries' characteristics. The second column shows that a higher per-capita income mitigates the negative impact of increasing terms of trade on the real exchange rate. For the richest countries of the sample with an index value of close to 1, the mitigating effect is such that the major part of the overall impact on the real exchange rate is offset. As the third column shows, the long-term state of the trade account also helps explain the strength of Dutch disease effects. Surplus countries feature smaller Dutch disease effects than deficit countries. In the fourth column, evidence is clear that a history of continuous nominal depreciation increases the appreciating effect of a commodity boom. The additional dummy, d_cod, accounts for the Democratic Republic of the Congo where average depreciation is a multiple of the other countries' values, thus denoting an outlier. Results for currency regimes in column (5) provide evidence that countries with non-floating currencies, that is, either pegged currencies, US Dollar, or membership in a monetary union are significantly less affected by Dutch disease effects. Finally, the impact of commodity booms is also different according to the type of commodity a country's exports. Whereas basically all of the defined categories involve significant impacts on the real exchange rate, the effect is stronger for the mining sector than for fossil fuels and agricultural exports.

Table 1—*Influence of macroeconomic characteristics on Dutch disease effects (dependent variable: rer)*

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.35***	1.39***	1.42***	1.42***	1.40***	1.36***
	(12.88)	(13.08)	(14.43)	(17.06)	(13.30)	(11.85)
tot	-0.13***	-0.15***	-0.14***	-0.13***	-0.18***	-0.10***
	(-5.29)	(-5.80)	(-6.19)	(-5.99)	(-7.42)	(-3.01)
*i_gdppc*tot*		0.09*				
		(1.80)				
*i_nx*tot*			0.09**			
			(2.40)			
*av_depr*tot*				-0.06***		
				(-3.57)		
*d_cod*tot*				0.78***		
				(3.08)		
*d_peg*tot*					0.12***	
					(4.47)	
*d_mining*tot*						-0.10***
						(-2.75)
*d_agri*tot*						-0.04
						(-0.68)
AR(1)	0.87***	0.87***	0.87***	0.85***	0.87***	0.87***
	(50.48)	(50.17)	(50.22)	(59.63)	(50.47)	(51.28)
Adj. R^2	0.94	0.94	0.94	0.95	0.95	0.95
SE	0.11	0.11	0.11	0.11	0.11	0.11
DW	1.78	1.79	1.79	1.77	1.79	1.78
F-statistic	480.88	474.49	476.97	464.59	478.31	470.64
Obs.	1682	1682	1682	1624	1682	1682

Notes: fixed effect equations with t-values in parentheses adjusted for heteroskedasticity, autocorrelation and cross-sectional dependence (cross-section weights and White cross-section standard errors and covariance). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

After having tested and characterized the impact of commodity prices on the real exchange rates, the second stage now tests for the effects of altered real exchange rates on the real economy. That is, to fully account for the existence of Dutch disease, it must be assessed whether a change in international relative prices involves structural change or whether economic structures remain unaffected. Data on sectoral shares in GDP are provided by UNSTATS. Table 2 reveals the results of the real exchange rate's impact on the share of manufacturing in GDP, *shareman* (in logs), again including cross-country fixed effects. Since structural change usually is a relatively slow phenomenon, we test for the relationship with different lag lengths and employ the same specifications as in the first stage otherwise. The coefficients are positive and highly significant. This means that a weaker real exchange rate (increase in *rer*) precedes a higher share of manufacturing in GDP or, respectively, an appreciation shrinks the manufacturing share.

Table 2—*Influence of real exchange rate changes on the share of manufacturing in GDP (dependent variable: shareman)*

	(1)	(2)	(3)	(4)
Constant	-2.27***	-2.31***	-2.32***	-2.33***
	(-113.87)	(-96.48)	(0.00)	(-97.56)
rer(-1)	0.05***	0.04***	0.04***	0.04***
	(3.61)	(3.01)	(3.17)	(3.49)
rer(-2)		0.04**	0.04**	0.04**
		(0.01)	(2.30)	(2.44)
rer(-3)			0.02**	0.01*
			(2.30)	(1.79)
rer(-4)				0.03***
				(4.57)
AR(1)	0.92***	0.91***	0.91***	0.91***
	(98.00)	(95.39)	(98.13)	(102.62)
Adj. R^2	0.99	0.99	0.99	0.99
SE	0.11	0.10	0.10	0.10
DW	1.83	1.77	1.80	1.79
F-statistic	2156.78	2074.21	2056.29	1976.755
Obs.	1624	1566	1508	1450

Notes: fixed effect equations with t-values in parentheses adjusted for heteroskedasticity, autocorrelation and cross-sectional dependence (cross-section weights and White cross-section standard errors and covariance). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The same test is conducted for the share of construction in GDP, *shareconst* (in log). The construction sector serves as an approximation to investment that can be considered as unproductive, or at least not directly productive, because it goes into real estate or infrastructure projects and as such does not, or not directly, contribute to a country's export capacity or import substitution. Table 3 shows that significance is less than in the case of the share of manufacturing but still unambiguous and clear: a stronger exchange rate (lower value of *rer*) is followed by a higher share of construction in GDP.

The change in the respective shares of the manufacturing and construction sectors in GDP in response to a change in the real exchange rate may not only be caused by a change in the nominator, that is, absolute value added in those sectors, but in the denominator, that is, GDP growth. With the same specifications, we test for the impact the real exchange rate has on economic growth. The growth variable, *growth*, is expressed as a growth factor (for instance, growth rate of 5 percent → 1.05) such that the series can be transformed into logs. Table 4 provides the results for different lag lengths. Not only are the coefficients all insignificant, their values are also very small. This supports the interpretation that Dutch disease involves not only relative but absolute structural change where one (or more) sectors expand at the cost of others.

Table 3—*Influence of real exchange rate changes on the share of construction in GDP (dependent variable: shareconst)*

	(1)	(2)	(3)	(4)
Constant	-2.84***	-2.81***	-2.79***	-2.78***
	(-58.07)	(53.01)	(-57.23)	(-68.21)
rer(-1)	-0.04**	-0.04**	-0.04**	-0.05***
	(-2.01)	(-1.99)	(-2.12)	(-2.63)
rer(-2)		-0.02	-0.01	-0.01
		(0.26)	(-0.60)	(-0.54)
rer(-3)			-0.04**	-0.03
			(-2.24)	(-1.54)
rer(-4)				0.00
				(0.11)
AR(1)	0.92***	0.93***	0.92***	0.92***
	(92.91)	(92.62)	(84.09)	(91.73)
Adj. R^2	0.97	0.97	0.97	0.97
SE	0.18	0.18	0.18	0.18
DW	1.76	1.77	1.73	1.71
F-statistic	1020.53	969.80	956.38	884.24
Obs.	1622	1565	1508	1450

Notes: fixed effect equations with t-values in parentheses adjusted for heteroskedasticity, autocorrelation and cross-sectional dependence (cross-section weights and White cross-section standard errors and covariance). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4—*Influence of real exchange rate changes on the share of construction in GDP (dependent variable: growth)*

	(1)	(2)	(3)	(4)
Constant	0.03***	0.03***	0.03***	0.03***
	(7.18)	(5.29)	(5.31)	(5.77)
rer(-1)	0.01	-0.00	0.00	0.00
	(1.08)	(-0.06)	(0.30)	(0.32)
rer(-2)		0.01	0.01	0.01
		(0.98)	(0.55)	(0.48)
rer(-3)			0.00	-0.00
			(0.09)	(-0.12)
rer(-4)				0.00
				(0.14)
AR(1)	0.35***	0.37***	0.36***	0.32***
	(15.85)	(18.98)	(15.90)	(11.76)
Adj. R^2	0.23	0.31	0.30	0.31
SE	0.23	0.06	0.06	0.05
DW	1.97	2.01	1.99	1.96
F-statistic	9.44	12.46	11.68	11.67
Obs.	1624	1566	1508	1450

Notes: fixed effect equations with t-values in parentheses adjusted for heteroskedasticity, autocorrelation and cross-sectional dependence (cross-section weights and White cross-section standard errors and covariance). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

5. Discussion

The empirical analysis in the previous section confirms the existence of Dutch disease on average of the countries considered. Both the terms of trade go along with a real appreciation while appreciation precedes deindustrialization and growing investment in non-productive construction. The country sample seems large enough and significance seems to be sufficiently strong to make a claim for a certain generalization.

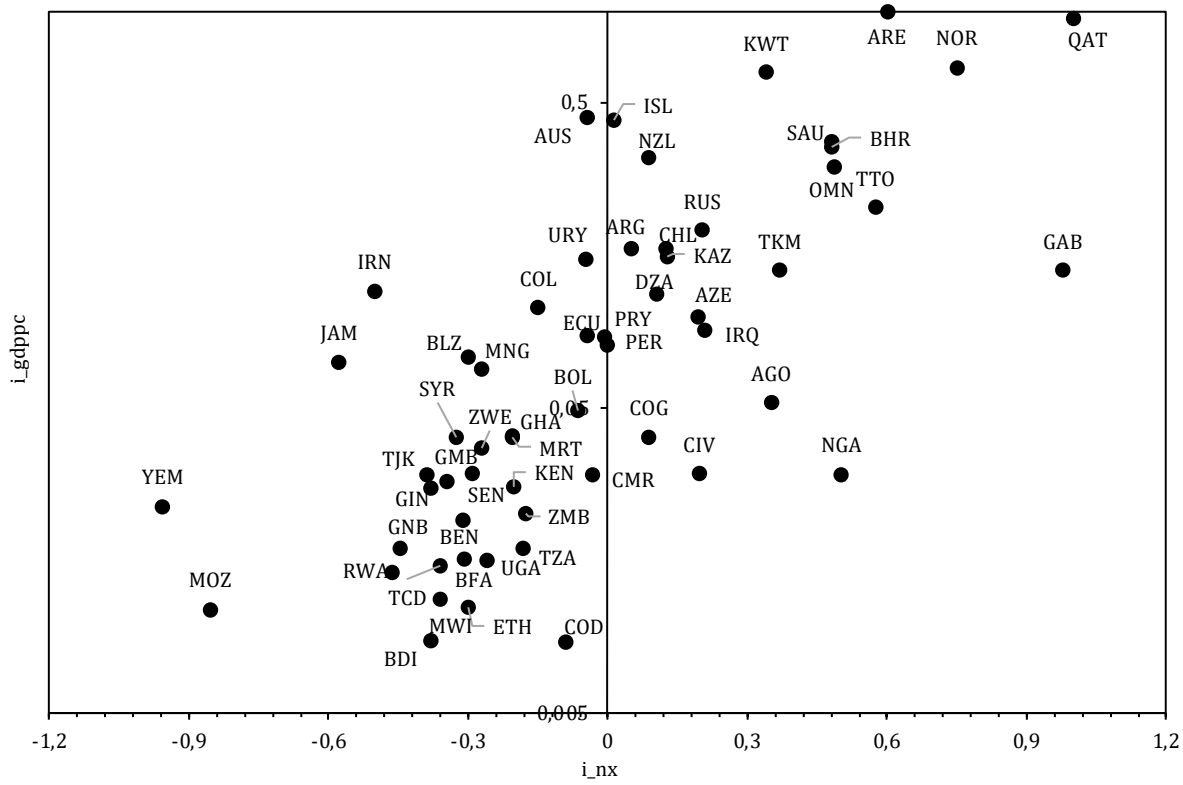
However, the theory of exchange rates based on a monetary analysis and the consequence of multiple possible outcomes is also confirmed. Evidence of Dutch disease applies on average while specific country characteristics involve significant deviations. Dutch disease thus is a possibility, but it is not inevitable. A selected number of macroeconomic characteristics of countries reveals that depending on a country's situation and macroeconomic policies, a real appreciation following a commodity boom may be strongly mitigated or even made insignificant. The following explanations aim at connecting the dots of empirical evidence provided above.

Richer countries, as measured by GDP per capita, are significantly less affected by real appreciation in times of commodity booms. It thus seems that Dutch disease also includes an important political economy element. In times of a commodity boom, preventing or not preventing Dutch disease is also a matter of admitting increasing purchasing power to the population's income in terms of imports. Pressure to relieve tight restrictions on consumption in developing countries is certainly much higher than in rich countries. Monetization of the commodity rent and its spending in the domestic economy instead of reinvesting it abroad or sterilizing it is also likely to happen in a more pronounced way in poor countries. Our data thus support the 'exchange rate populism' hypothesis according to which policy makers do not want to keep the exchange rate at a competitive level but rather aim to increase their own popularity (Bresser-Pereira, 2018, 2020).

With the observation that real exchange rate appreciation applies more to countries with a trade deficit, it may be argued that it is precisely the existence of Dutch disease, which leads to currency appreciation and, eventually, a trade deficit in the long run. While there is certainly truth in this, there is also an argument that, additionally, the causality might go in the opposite direction. This is supported by evidence of nominal exchange rate behavior. Countries with persistent trade deficits (again assuming the current account is on a similar pattern) tend to exhibit depreciating nominal exchange rates. As a result, inflation tends to increase via imports of production inputs and workers' bargaining in the labor market aiming to maintain purchasing power. These countries get into the vicious cycle of inflation and further nominal devaluation partly as a consequence of the persisting deficit, partly due to the aim of restoring competitiveness. In principle, a commodity boom allows these countries to improve their external account as well as the attractiveness of their currencies given that most of them are at rather low positions in the international hierarchy of currencies (see Kaltenbrunner, 2015). They get the chance to stop nominal depreciation and to break the vicious cycle of continuous inflation. Moreover, past deficits mean that many agents in the economy are externally indebted. A regain of purchasing power lightens the burden of debt servicing (Oberholzer, 2020, p. 155). This is an additional reason why deficit countries are willing to let Dutch disease happen. Moreover, these countries have the same incentive in the long term, namely, to support the exchange rate in an endeavor to reduce inflation. This may give rise to long-run real overvaluation (Bresser-Pereira, 2016, 2020).

This explanation is supported by the relationship between the trade balance and GDP per capita plotted in figure 1. The two axes represent the two macroeconomic index variables, *i_gdppc* and *i_nx* that were used in the panel tests whereas *i_gdppc* is scaled in logs. Richer countries tend to be those with trade surpluses. They have stable currencies while existing wealth reduces pressure to monetize commodity export returns in the domestic economies. These aspects reinforce each other meaning that the richer the country, the more policy space they have in times of commodity booms and the more they can stabilize currency and run trade surpluses.

Figure 1—*Relationship between trade balance in percentage of GDP (i_nx) and GDP per capita (i_gdppc, in logs), 1990–2019*



Source: elaboration based on Penn World Table 10.0.
Country abbreviations: AGO Angola, ARE United Arab Emirates, ARG Argentina, AUS Australia, AZE Azerbaijan, BDI Burundi, BEN Benin, BFA Burkina Faso, BHR Bahrain, BLZ Belize, BOL Bolivia, CHL Chile, CIV Côte d'Ivoire, CMR Cameroon, COD Democratic Republic of the Congo, COG Congo Republic, COL Colombia, DZA Algeria, ECU Ecuador, ETH Ethiopia, GAB Gabon, GHA Ghana, GIN Guinea, GMB Gambia, GNB Guinea Bissau, IRN Iran, IRQ Iraq, ISL Iceland, JAM Jamaica, KAZ Kazakhstan, KEN Kenya, KWT Kuwait, MNG Mongolia, MOZ Mozambique, MRT Mauretania, MWI Malawi, NGA Nigeria, NOR Norway, NZL New Zealand, OMN Oman, PER Peru, PRY Paraguay, QAT Qatar, RUS Russia, RWA Rwanda, SAU Saudi Arabia, SEN Senegal, SYR Syria, TCD Chad, TJK Tajikistan, TKM Turkmenistan, TTO Trinidad and Tobago, TZA Tanzania, UGA Uganda, URY Uruguay, YEM Yemen, ZMB Zambia, ZWE Zimbabwe

As a note on this issue, many of the richest countries in the sample are oil-exporting countries. They have sufficient policy space to properly manage the commodity rent and prevent Dutch disease. In Norway, Oman, Saudi Arabia, the United Arab Emirates, and other countries, oil production is completely or predominantly owned by the public sector. Export returns directly enter the countries' sovereign wealth funds meaning that they are reinvested abroad. While returns of the funds are used for government expenditures and retirement pension, the commodity rent itself, or at least its extra amount during commodity booms, is basically not monetized (see also Sivramkrishna, 2016; Velculescu, 2008). In fact, sterilization of the financial inflow takes place implicitly but comprehensively when the government and pension funds beneficiaries are not paid in money but endowed with additional claims in the funds. For the political economy reason of commodity booms bringing relief to macroeconomic constraints and distribution issues, low-income countries are much less likely to make sterilization efforts.

There are obviously exceptions to this rule. Australia, for instance, is a special case in this regard as it is able to keep its currency's value stable despite a persistent trade deficit. However, it is a wealthy country and thus its capacity to get indebted and to attract foreign financial flows is likely to be higher than that of developing countries.

Testing for the relevance of exchange rate regimes for Dutch disease effects has revealed that countries with pegged currencies, monetary union members and dollarized countries are less prone to real appreciation. This argument is partially covered by the impact of average nominal depreciation tested by *av_depr* since in there these countries assumed a value of 0 denoting zero depreciation. These countries are not caught in a cycle of inflation and continuous devaluation. However, *d_peg* additionally covers the effect that in the fixed regime countries any Dutch disease effect can only come via a change in domestic inflation through monetization of export returns. Evidence suggests that fixing a currency eliminates the main effect of real appreciation, implying that nominal exchange rate change makes up for the larger share of Dutch disease effects in countries with a more flexible regime. As part of this difference, fixed currency countries send clear signals to financial markets. In times of commodity booms, optimism among speculators and other foreign investors is likely to increase appetite for betting on currency appreciation in boom countries. Flexible currency countries thus may be more a target of such capital flows than countries with pegged regimes, which is partially in line with other contributions (see Rangasamy and Mihaljek, 2011) but also adds an additional argument opposed to findings that capital flows in pegged regimes involve stronger real appreciation than in flexible ones (see for example Combes et al., 2012).

Fixing a currency helps mitigate Dutch disease effects for countries of various characteristics as this applies to rich surplus countries such as Saudi Arabia as well as poor deficit countries such as Chad or Senegal. However, these countries face a different kind of challenge as they lack monetary policy sovereignty, which is an important aspect for a developmental state making use of commodity prices to implement long-term growth strategies (see Chang, 2002, p. 262). In particular, dollarized economies and member countries of the CFA monetary unions cannot impose capital controls because such policy tools are not available at the national level whereas the CFA rules guarantee permanent free currency convertibility (Pigeaud and Sylla, 2021). This means that financial inflows cannot be slowed down.

Finally, there are certain differences between the Dutch disease effects of different commodity classes while none of them is *per se* free of an appreciating impact on the real

exchange rate. However, the effect is larger for mining-focused countries than for fossil fuel and agricultural exporters. A detailed explanation would require more sophisticated analysis. An interpretation along the lines of the above theory may be that the share of companies owned by the governments is higher in the energy sector than in the mining sector. This allows them to manage the export returns better in line with macroeconomic requirements in order to prevent real appreciation. That is, the government can decide to establish a sovereign wealth fund as is the case in many of the oil-exporting countries, thus preventing the monetization of the commodity rent and the upward-pressure on prices in the domestic economies. By contrast, private companies—for example, in the real estate sector—neglect macroeconomic effects and might look for short-term profits. Agricultural production is usually dominated by private corporations or private smallholder farmers. Yet, the effect on real appreciation might be smaller than with mining-oriented countries, because the smallholder farms' propensity to spend additional income is likely to be higher than in the mining sector where employment effects are small and hence profits tend to be highly concentrated (see Slack, 2010). A considerable part of the additional income thus may be spent for income, hence compensating for the effect of high commodity prices on the current account.

Finally, the second stage of the econometric analysis has shown that real appreciation clearly involves undesired structural change by a falling share of manufacturing and an increasing share of construction in GDP. The results are more pronounced and less mixed than in Aslam et al. (2016, pp. 36-37), where countries are assessed individually. The evidence that there is no significant effect of real exchange rate change on the rate of economic growth is a hint that countries, which actually face an appreciation in times of increasing commodity prices, fail to make use of the favorable periods to increase economic growth sustainably. This result adds to the debate in literature regarding the importance of the real exchange rate for economic growth (see for instance Rodrik, 2008; Libman et al., 2019; Mhlongo and Nell, 2019). On the one hand, the results take the side of proponents denying a persistent impact of a change in the real exchange rate (see for instance Blecker and Setterfield, 2019, pp. 477-478; Bruno et al., 2011). On the other hand, the influence on structural change supports the position that the exchange rate has real relevance and therefore, potentially, also on long-term growth. Again, this points to the importance of macroeconomic management of commodity booms in order to prevent deindustrialization and actually guiding commodity export returns into productive activities favoring long-term industrialization.

6. Concluding remarks

This analysis started from the analytical result that Dutch disease is a possibility depending on macroeconomic, institutional, and political economy circumstances rather than a necessity arising from the economics of commodity booms. In fact, the impact of a change in the terms of trade on a country's real exchange rate and economy depends on, first, how the commodity rent is spent and, second, the country's monetary management. The empirical analysis has confirmed that a positive terms of trade shock does not inevitably lead to a real exchange rate appreciation since there are various qualifying factors for this result to hold.

From a theoretical perspective, commodity booms thus can yield a variety of outcomes regarding their impact on the real exchange rate. It is found that Dutch disease is experienced more in countries with permanent trade deficits and lower per-capita incomes. Moreover,

countries, which have a history of continuous nominal depreciation, that is, a loss of their currency's value, also tend to exhibit real appreciation during commodity booms whereas countries with pegged or integrated currencies face less real appreciation. An explanation for this might be that poor countries are under pressure to make commodity rents available in the domestic economy by monetizing them in domestic currency and satisfy people's needs via expenditures. Moreover, these countries' histories of continuous nominal depreciation put them into a vicious cycle of continuous nominal depreciation and inflation. A commodity boom allows them to strengthen their currency and to break the cycle. Finally, real appreciation is particularly expressed in countries with strong mining sector exposure. These results tell us that macroeconomic dynamics respond differently to commodity booms across countries whereas different macroeconomic characteristics allow countries to implement—to different degrees—policy responses in order to avoid appreciation. Empirical evidence is unambiguous in the sense that those countries that actually face real appreciation tend to have declining shares of manufacturing in total output while the construction sector grows. This can be interpreted in a way that commodity rents in these countries are not primarily invested in productive sectors.

Commodity booms provide a chance for developing countries to get out of stagnation, currency devaluation and external deficits. Yet, real appreciation brings about structural change away from the manufacturing sector, thus reducing the potential of long-term productivity growth and innovation. On the other hand, this argument also points to the issue of structural trade deficits and a stagnating industrial sector or even deindustrialization of poor countries beyond the business cycle of commodity booms as stemming from the lack of competitiveness. In face of continuously depreciating currencies and resulting inflation in many countries it is questionable whether a one-time long-term devaluation of the currency is effective and feasible in tackling this challenge and restoring a competitive exchange rate. Demand is an essential condition to bring about prosperity, meaning that commodity booms are a chance to kick off a long-run growth process. But this is hardly enough given that many countries are not more competitive after the boom. In this sense, this analysis also confirms the importance of supply-side measures such as public investment and industrial policies (Medeiros, 2020; Oreiro et al., 2020, p. 333). A larger resource pool in developing countries will increase the options to avoid Dutch disease in future commodity booms and provide the chance to improve their currencies' position in the international hierarchy.

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Appendix

Countries included in the panel analysis: Algeria, Angola, Argentina, Australia, Azerbaijan, Bahrain, Belize, Benin, Bolivia, Burkina Faso, Burundi, Cameroon, Chad, Chile, Colombia, Congo Republic, Côte d'Ivoire, Democratic Republic of the Congo, Ecuador, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Iceland, Iran, Iraq, Jamaica, Kazakhstan, Kenya, Kuwait, Malawi, Mauritania, Mongolia, Mozambique, New Zealand, Nigeria, Norway, Oman, Paraguay, Peru, Qatar, Russian Federation, Rwanda, Saudi Arabia, Senegal, Syria, Tajikistan, Tanzania, Trinidad and Tobago, Turkmenistan, Uganda, United Arab Emirates, Uruguay, Yemen, Zambia, Zimbabwe