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ABSTRACT

The implications of natural resource exports for non-resource trade*

Foreign exchange windfalls such as those from natural resource revenues change non-resource exports, imports, and the capital account. We study the balance between these responses and, using data on 41 resource exporters for 1970-2006, show that the response to a dollar of resource revenue is, approximately, to decrease non-resource exports by 75 cents and increase imports by 25 cents, implying a negligible effect on foreign saving. The negative per dollar impact on exports is larger for countries which have good institutions and higher income levels. These countries have a higher share of manufacturing in their non-resource exports, and we show that manufactures are more susceptible than other products to being crowded out by resource exports.

JEL Classification: E21, E62, F43, H63, O11 and Q33
Keywords: dutch disease, exports, imports, natural resources, resource curse and trade

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1. Introduction

Around one-fifth of world trade is in natural resources.[1] For 21 countries natural resources account for more than 80% of total exports and for 9 of these countries resource exports are more than 50% of GDP (IMF 2007). A key mechanism through which natural resources affect the domestic economy is through the impact of these foreign exchange earnings on non-resource trade. The balance of payments condition implies that resource exports are accommodated through some combination of lower non-resource exports, higher imports, and changes in the capital account and in other items such as remittances. The objective of this paper is to provide estimates of the size of these effects. To what extent do natural resource exports crowd out other exports, draw in imports, or lead to adjustment in other elements of the balance of payments?

The extensive literature on the Dutch disease (see van der Ploeg 2011 for a survey) suggests that natural resource exports will lead to contraction of production of tradables, possibly with adverse effects if there are external benefits to tradable production.[2] Theoretical modelling, from Corden and Neary (1982) through to Sachs and Warner (1997) is based on models with an aggregate tradable goods sector or an aggregate of domestic goods.[3] These are appropriate assumptions for understanding the general equilibrium effects of resource revenues, but they mask heterogeneity within the traded goods sector. Exports and import competing production will generally have quite different factor intensities, and possibly also different market structure, degrees of commodity concentration, and returns to scale. There is no a priori reason to think that the effects should fall equally on exports and imports, or that the implications of changes should be the same in the two sectors.

Despite a well-developed theoretical literature on the Dutch Disease, the empirical literature is quite thin. The effect of commodity prices on the real exchange rate exchange rate is studied by Cashin et al. (2004) and Chen and Rogoff (2002); they find evidence that a commodity price increase is associated with real exchange rate appreciation. Impacts on manufacturing output are found by several authors. Beine et al. (2012) find that an appreciation of the Canadian dollar related to natural resource extraction led to significant employment losses

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[1] We take natural resources to be non-renewables, defined as fuels plus minerals..

[2] Numerous studies indicate that rapid export growth is a key ingredient of overall growth. Furthermore, there is evidence that exports of more sophisticated and higher valued products correlates with economic development, e.g. Hausmann et al. (2007), Hummels and Klenow (2005), Schott (2004) and Harding and Javorcik (2011).

[3] An exception is Chen and Rogoff (2002).

in the Canadian manufacturing sector. Ismail (2011) uses data on manufacturing industries in oil-exporting countries and estimates a negative relationship between oil-prices and industry output. Stijns (2003) employs a gravity framework and finds a Dutch disease effect of resource exports as an increase in world energy prices decreases manufacturing exports. Considering foreign aid as the windfall, Rajan and Subramanian (2011) find that aid inflows are associated with lower growth rates of industries with relatively high proportions of value added going to exports; they suggest that the effect works via a real exchange rate appreciation. Prati and Tressel (2006) find negative associations between aid and the balance of trade, and between aid and exports.

While the existing empirical literature has searched for the effect of resource exports on exchange rates and on output and employment in manufacturing industries, this paper quantifies the effects that necessarily occur in elements of the balance of payments. A central building block in understanding the impact of resource exports is to understand the extent to which they damage exports, draw in imports, or are accommodated elsewhere in the balance of payments. We find that the impact of exports of natural resources falls most heavily on non-resource exports with, for our preferred estimates, a 74 cents contraction per dollar of resource exports. Imports rise by 23 cents per dollar, as there is an increase in consumption of imported goods and/or reduction of import-competing activities. Together, these changes in trade account for virtually all of the foreign exchange earned by resources so there is, on average, little effect on the rest of the balance of payments. Disaggregating across products, the impact on exports is greater for manufacturing products than for food and agriculture; on average, each dollar of resource exports reduces manufacturing exports by 46 cents.[4] Looking across countries, we find a larger negative effect on exports in countries with higher income and better governance. This is, at least in part, a compositional effect. Such countries have a higher share of manufacturing in their exports, and manufacturing exports have the largest response to non-resource exports. Any endogeneity-bias in the estimates is found to be small and results are shown to be robust to alternative sets of controls and cross-sectional dependence.

The next section of the paper sets out our conceptual framework and the econometric strategy. Section 3 presents empirical estimates of long responses and discusses variation in these across countries and products. In section 4 we present the dynamics of the effects. Section 5

[4] That is, more than half the export reduction falls on manufactures, although manufactures account for less than half of non-resource exports of goods and services.

addresses potential endogeneity of resource exports and other econometric challenges, and section 6 concludes.

2. The model

The relationships we investigate take the general form

$$Y_{it} = F(R_{it}, country_{it}\, controls, I_i, u_{it}). \quad (1)$$

The dependent variables, Y_{it}, are components of country *i*'s non-resource balance of payments at date *t*. We look at two main dependent variables: non-resource exports, X_{it}, defined as total exports of goods and services minus resource exports: and non-resource imports, M_{it}, , i.e. total imports of goods and services minus resource imports.[5] The key parameters we seek to identify are the effects of gross resource exports, R_{it}, which we define as exports of fuel plus metals and ores. Our focus is on net-exporters of natural resources, defined as countries with net resource exports averaging more than 1% of GDP in the period 2000-2006.

Resource revenues affect non-resource exports and imports through two principal mechanisms. One is direct spending of the revenues, this creating demand for imports and for domestic exportables. The other is through a price effect; additional spending on non-tradables increases their price, this typically raising the wage and appreciating the real exchange rate. The benchmark model is Corden and Neary (1982) which aggregates imports and exports into a single tradable good, whereas we separate out these goods. One way to do this is to build a multi-sector model with distinct import and export sectors, and we sketch such a model in appendix 1. Another alternative is to extend a Helpman-Krugman trade model to include resources and a non-traded goods sector. Since this approach provides the foundation of the gravity model of trade, and since we anchor our econometrics in the gravity approach, this is the route we follow.[6] While the main ingredients of such a model are familiar, we outline them and the extensions we make in the remainder of this sub-section.

A representative consumer in country *j* has utility function

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[5] We are also able to back out the effects on non-resource balance, defined as *NRB* = *X* – *M*. The current account, *S*, is defined as: *S* = *NRB* + *RNET* + *NY* + *NCT*, where *NRB* is net non-resource exports, *RNET* is net resource exports, *NY* is net income from abroad and *NCT* is net current transfers from abroad. Workers' remittances are defined as current transfers. We disaggregate by sector in section 3.3.

[6] We abstract from the "resource movement effect" in Corden and Neary (1982).

$$U_j = \left(Z_j\right)^{1-\mu}\left(\left[\sum_i n_i x_{ij}^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}\right)^{\mu}, \qquad (2)$$

where Z_j is consumption of non-tradables with expenditure share $1-\mu$, and tradables are made up of varieties of differentiated goods; n_i denotes the number of varieties produced in country i and x_{ij} is the sales in country j of a single variety produced in i. There is a country specific price index for tradables, denoted G_j and taking the form

$$G_j = \left[\sum_i n_i \left(p_i T_{ij}\right)^{(1-\sigma)}\right]^{1/(1-\sigma)} \qquad (3)$$

where p_i is the price of a good produced in i and T_{ij} is the iceberg shipping cost factor. Given these preferences and prices, the quantities of each variety sold, x_{ij}, are

$$x_{ij} = p_i^{-\sigma}\left(T_{ij}\right)^{1-\sigma} E_j G_j^{\sigma-1} \qquad (4)$$

where E_j is total expenditure on tradables in country j. The values of bilateral trade flows from i to j are $Y_{ij} \equiv n_i p_i x_{ij}$ so, using (4),

$$Y_{ij} = n_i p_i^{1-\sigma}\left(T_{ij}\right)^{1-\sigma} E_j G_j^{\sigma-1}. \qquad (5)$$

This setting yields expressions for the exports and imports of each country. Adding the bilateral trade flows of country 1 across other countries, country 1 exports and imports are

$$X_1 = n_1\left(p_i\right)^{1-\sigma} FMA_1, \qquad FMA_1 \equiv \sum_{j>1}\left(T_{1j}\right)^{1-\sigma} E_j G_j^{\sigma-1}, \qquad (6)$$

$$M_1 = E_1 G_1^{\sigma-1} FSA_1, \qquad FSA_1 \equiv \sum_{i>1} n_i \left(p_i T_{i1}\right)^{(1-\sigma)}. \qquad (7)$$

The variables FMA_1 and FSA_1 are foreign market access and foreign supplier access and give the effect of conditions in other countries on country 1 trade (see Redding and Venables 2004). FMA_1 summarises rest of the world demand and market conditions for country 1 exports, and FSA_1 summarises the supply and production conditions for its imports. Equations (6) and (7) are the relationships that we are interested in, and there are two tasks to be completed. The first is to understand the effects of resource exports on the country 1 equilibrium, particularly their impact on the endogenous variables E_1, n_1, p_1, and G_1, and hence on non-resource trade performance. The second is to measure the rest of the world influence on country 1 trade, as summarised in FMA_1 and FSA_1.

2.1 Resources and equilibrium:

To find equilibrium in country 1 the supply side of the economy has to be specified. We suppose that country 1 has exogenous labour endowment L_1 and resource exports R_1. The non-tradable sector produces a homogenous product, with one unit of labour producing one unit of output. The tradable sector produces differentiated products, as above, and we assume that each variety is produced by a single firm that uses one unit of labour, produces one unit of output, and makes zero profits. These assumptions ensure that prices in each sector are equal to the wage.[7] The value of country 1 income is therefore $p_1L_1 + R_1$ and expenditure on tradables is

$$E_1 = \mu[p_1 L_1 + R_1]. \quad (8)$$

Labour market clearing is $n_1 + (1-\mu)(p_1 L_1 + R_1)/p_1 = L_1$ where the first term is demand for labour in tradables (one unit of labour per firm) and the second demand in non-tradables (value of output divided by price). Rearranging, the number of firms is

$$n_1 = \mu L_1 - (1-\mu)R_1 / p_1 \quad . \quad (9)$$

We have assumed that each firm breaks even producing one unit of output, so demand must be such that $\sum_j x_{1j} = 1$. This requires, from equation (4) with T_{11} =1, that price satisfies

$$p_1^{\sigma} = E_1 G_1^{\sigma-1} + FMA_1. \quad (10)$$

Notice that describing the firm this way is a short cut to the results of the Dixit-Stiglitz model in which the same condition is derived via increasing returns to scale and a price-cost mark-up.[8] Finally, we write the price index, equation (3), as

$$G_1^{1-\sigma} = n_1 p_1^{1-\sigma} + FSA_1, \quad (11)$$

Given conditions in the rest of the world, as summarised in FMA_1 and FSA_1, equations (8) – (11) are four equations in unknowns E_1, n_1, p_1, and G_1.

Equilibrium values of these variables depend on R_1. The dependence is not transparent, but can be found by linearising (8) – (11), and this is done in appendix 2. The appendix gives the impact of an increase in R_1 on each of the endogenous variables and establishes unambiguous

[7] This is without loss of generality, merely reflecting the units in which labour and non-tradables are measured.
[8] We take this short-cut purely in order to simplify exposition of a well known model.

increases in p_1, G_1 and E_1, and a fall in n_1, the number of varieties of tradables produced in country 1. The price effects correspond to appreciation of the real exchange rate and, as expected, are smaller the larger is the elasticity of demand, σ. The reduction in n_1 is larger the greater is the share of non-tradables in expenditure, this reflecting the direct spending effect. Although tradables come from a single sector, the presence of intra-industry trade means that export and import responses can be quite different. Using the linearization given in the appendix and (6) and (7) the effect on non-resource trade is,

$$\frac{dX_1}{dR_1} = \frac{\mu - \sigma\left[\mu^2 - \mu + 1\right]}{\left[\sigma(1+\mu) - \mu\right]}, \qquad \frac{dM_1}{dR_1} = \frac{\sigma\mu(2-\mu)}{\left[\sigma(1+\mu) - \mu\right]}, \qquad dX_1 + dR_1 = dM_1. \tag{12}$$

For $\sigma > 1$ and μ ε (0, 1) these expressions imply $dX_1 / dR_1 < 0, dM_1 / dR_1 > 0$. The dependence of these on the underlying parameters σ and μ is fully mapped out in appendix 2. To illustrate, if if $\mu = 0.3$ and $\sigma = 6$ then for each dollar of R, non-resource exports fall by 60c and imports rise by 40c. Increasing σ unambiguously reduces both responses, i.e. means that more of the impact falls on a reduction in exports (the negative derivative has larger absolute value), rather than an increase in imports. While we have written down the model for a single tradable goods sector, it is readily extended to several sectors, and a higher sectoral σ shifts more of the response to exports rather than imports.

2.2 Market access, supplier access and gravity.

The non-resource export and import equations (6) and (7) that underlie our specification contain variables describing both the domestic economy and conditions in the rest of the world, the latter summarised in FMA_1 and FSA_1. Following the methodology of Redding and Venables (2004) values of these for each country can be found by gravity estimation. Equation (5) is bilateral trade flows, depending on exporter country characteristics, $n_i p_i^{1-\sigma}$, importer country characteristics, $E_j G_j^{\sigma-1}$, and between country frictions, $T_{ij}^{1-\sigma}$. The exporter and importer country characteristics can be estimated as fixed effects for each importer and each exporter in a gravity equation. FSA_1 and FMA_1 are simply the sum of these, times the between-country effects, for countries other than 1. Our gravity estimates and corresponding calculations of FSA_1 and FMA_1 are given in appendix 4. These summary measures are the appropriate way to capture all information available from a gravity model that is pertinent to the geographically aggregate trade flows that are our focus.

2.3 Econometric specification

The specification we use is log-linear, as is standard in the gravity literature:

$$\ln(X_{it}) = \alpha + \beta_X \ln(R_{it}) + \gamma_X \ln(NRGDP_{it}) + c_X \ln(FMA_{it}) + I_i + I_t + u_{it}, \quad (13)$$

$$\ln(M_{it}) = \alpha + \beta_M \ln(R_{it}) + \gamma_M \ln(GDP_{it}) + c_M \ln(FSA_{it}) + I_i + I_t + u_{it}. \quad (14)$$

These correspond to equations (6) and (7). We have already discussed the dependence of *X* and *M* on resource exports. *FMA* and *FSA* capture *all* the rest of the world features that are contained in the gravity model. Country size evidently matters (formally, via L_1 in equations (8) and (9)) and we capture this by *GDP*. For the non-resource export equation (the supply side) we work with non-resource *GDP*, *NRGDP*, defined as *GDP* minus value added in the mining and extraction sector. For imports (the demand side) we use total *GDP*. Other time invariant country characteristics are captured by country fixed effects and common time-shocks by year fixed effects.

While we follow the structure of our model and common practise in estimating these equations in log-linear form, results are more clearly interpreted not as elasticities, but as the value of the change in non-resource exports and imports per unit resource exports. We therefore also report values $b_X \equiv \beta_X X_{it} / R_{it}, b_M \equiv \beta_M M_{it} / R_{it}$ giving the absolute changes in non-resource exports and imports per unit resource exports; these are evaluated at the appropriate means, away from which values are approximations.

Most of our results estimate (13) and (14) using panel data, but we have a first look (section 3.1) at the data by presenting results based on a cross-section of countries.[9] The cross-sections are based on long time-averages and the panel estimates pick up a cointegrating relationship between the variables, so β can in both cases be interpreted as the long run coefficient. To get at the dynamics we estimate an error correction model by adding short-run

[9] In this case we add area, each countries endowment of land, as a control.

dynamics to the long-run solution estimated in levels (section 4).[10]

A concern when estimating (13) and (14) is endogeneity bias, as non-resource trade and resource exports could be determined simultaneously by a background factor not picked up by our controls. Given our comprehensive controls, we assume in sections 3 and 4 that resource exports are exogenous with respect to non-resource trade. Endogenous cross-sectional variation of natural resources is not an issue as we include country fixed effects in our panel-specifications. Endogeneity could arise through the timing of resource exports; however, this is largely determined by resource availability and, once licences to explore and extract are granted, technical considerations which govern the rate of extraction from each oil field or mine. In section 5 we relax this assumption and use country-specific resource price indexes to instrument for the value of resource exports. The indexes are constructed from global resource prices and country-specific, time-invariant weights. We show that any endogeneity bias in our estimates is relatively small.[11]

A full definition of variables and description of data is given in appendix 3. Our sample is determined by data availability. The panel-data unit root tests used to detect cointegration and ensure that our estimates are not spurious require no-gaps in the data and at least six observations per country. We have, for the countries with a gap, used the longest period without gaps. We end up with 706 observations over 41 countries classified as resource net-exporters. Both the cross section analysis and the panel data analysis are based on the period 1970 - 2006.

3. Econometric results

3.1 Cross section

The relationship we seek to capture reflects, in part, the long run economic structures of the economies under study. Many resource rich economies – Saudi Arabia or Gulf States – have had resource revenues for a long period of time, and have never developed significant non-resource

[10] Pesaran and Smith (1995) show that for cross sectional estimates based on time-averages of I(1)-variables, one does not need to worry about spurious correlation. The cross sectional estimate is one way to get at the long-run estimate. Our panel estimates can be seen as the first step in the original Engle and Granger (1987) approach to cointegration and is an alternative route to the long-run estimate. A third route was to estimate an error correction model without imposing the long-run relationship (i.e. from the first step in Engle and Granger), and instead estimate the long-run relationship freely within the error correction model, and we obtained very similar results. We present these results and discuss issues relating to non-stationarity in appendix 6.

[11] For a discussion of the exogeneity of resource exports see van der Ploeg and Poelhekke (2010).

export sectors. Because of this long-run aspect of the issue, we start with cross-section analysis based on long-run averages. Table 1 presents OLS estimates based on averages across 1970-2006 for 41 resource net-exporters.

Table 1: Cross-section

	(1) ln X	(2) ln M
ln R	**-0.246***	**0.192****
	(0.129)	(0.074)
ln NRGDP	1.190***	
	(0.127)	
ln FMA	0.237**	
	(0.113)	
ln GDP		0.718***
		(0.083)
ln FSA		0.244***
		(0.077)
ln Area	-0.145**	-0.008
	(0.058)	(0.029)
Constant	-3.900	-3.578**
	(2.585)	(1.699)
Observations	41	41
R-sq	0.85	0.96
$b = \beta * Y/R$	-0.39	0.42
Y/R	1.59	2.18

Note: Robust standard errors in parentheses. * 0.10 ** 0.05 *** 0.01 here and throughout. Based on averages 1970-2006. Dummies for landlocked and island status were insignificant and did not change the results.

The estimated coefficients of the resource effects are significant and have the expected signs. The orders of magnitude are best seen in the lower part of the table. This gives the per unit effect, obtained by multiplying the estimated elasticity, β, by the ratio of the average value of the dependent variable ($Y = X, M$) to R. An additional dollar of resource exports reduces non-resource exports by 39 cents and increases non-resource imports by 42 cents.

These results are consistent with standard models, in which the foreign exchange windfall allows the economy to shift factors from sectors producing tradable goods to sectors producing non-tradable goods. Notice that these results imply that non-resource trade adjustment does not fully accommodate resource exports (the change in non-resource trade balance is 39 + 42 = 81 cents, less than unity), implying that there is change in other elements of the balance of payments, such as increased holdings of foreign assets.

3.2 Panel

We now open up the time dimension of the data. By including country fixed effects, we control for unobservable time-invariant heterogeneity and hence exploit the within country variation only. Opening up the time-dimension increases statistical power by increasing the number of observations from 41 to more than 700. The time dimension also allows us to estimate the dynamics of the adjustment to a resource exports. The long-run results are presented in table 2. In section 4 we discuss the dynamics towards the long-run.

The panel-data unit root tests reported in the lower part of appendix table A4 reject the existence of a unit root in the errors, indicating a cointegrating relationship. The resource exports variable is significant at the 1% level in the equations for both non-resource exports and imports. As can be seen in the lower part of the table (row $b = \beta*Y/R$), these elasticities translate to a 74c crowding out of exports and 23c increase in imports per dollar-increase in resource exports. The estimated standard errors imply 90% confidence intervals of [-90c, -59c] for exports and [11c, 35c] for imports. The test reported in the lower row of table 2 shows that we can reject the hypothesis $\beta_x = -\beta_M$. The point estimates imply a negligible savings response.[12]

These panel results indicate that the resource effect falls more heavily on non-resource exports than on imports, although it is more equally divided between the two in the cross section. It is important to note that persistent differences across countries are captured by our country fixed effects, whereas the cross-section estimates reflect only these persistent differences across countries. As the variation exploited is very different in the two cases, we do not necessarily expect the effects to be exactly the same. In particular, countries which discovered resource deposits during the sample period, followed by large increases in the quantity of resource exports, may have undergone sharp adjustments in their tradable goods sectors. This would be picked up in the panel estimates, but not necessarily in the cross sectional estimates.

[12] There is also a reduction in resource imports of 4 cents per dollar (results available on request). The point estimates therefore indicate that each dollar of resource exports is met by a 93 cent change in other goods and services trade, comprised of 74c fall in non-resource exports, 23c increase in non-resource imports, and 4c fall in resource imports.

Table 2: Panel data

	(1)	(2)
	ln X	ln M
ln R	**-0.343*****	**0.085*****
	(0.044)	(0.026)
ln NRGDP	0.835***	
	(0.130)	
ln FMA	0.197***	
	(0.075)	
ln GDP		0.878***
		(0.068)
ln FSA		0.261***
		(0.042)
Observations	706	706
Countries	41	41
R-sq	0.71	0.78
$b = \beta * Y/R$	-0.74	0.23
b, 90% confidence interval	[-0.90, -0.59]	[0.11, 0.35]
Y/R	2.17	2.73
Test, H0: $\beta_X = -\beta_M$	F(1, 1252) = 84.11, p-value = 0.00	

Note: Robust standard errors in parentheses. Panel estimates throughout obtained by "xtivreg2" in Stata. Test across models performed by "reg3". Unit root tests on the residuals are reported in the lower part of table A4 and they reject a unit root in all tests at least at the 5%-level. Country and year FE included.

3.3 Heterogeneity across products

Export and import responses are likely to vary across sectors, since direct spending effects will differ, and responses to price changes will operate via different supply and demand elasticities. In some of the literature the Dutch disease is thought of as a process of de-industrialization, where a positive windfall of foreign exchange induces decline of manufacturing. This is worrying to many observers as manufacturing sectors are often held to have higher productivity growth and more learning by doing than sectors producing non-tradable goods. In table 3 we therefore report results for exports and imports of agriculture and food (Xaf, Maf), manufactures (Xma, Mma), and services (Xsv, Msv), separately.

The estimates suggest that the effects of resource exports on imports of manufactures and of food and agriculture have similar elasticities, while the effect on service imports is larger.

Absolute effects (*b*, penultimate row) are largest for imports of manufactures, since these are, on average, more than eight times larger than imports of agriculture and food.

Looking at exports, the crowding out effect is much larger for manufactures than for food and agriculture, with services intermediate. The elasticity is more than twice as large, and the difference is significant.[13] A high manufacturing elasticity might be expected since manufacturing is relatively 'footloose', compared to agriculture's dependence on land, a specific and non-tradable factor. The absolute changes per dollar reported in the bottom part of the table reflect both the elasticity and the average volume of exports. This suggests that it is manufacturing exports that bear the brunt of accommodating resource exports; manufacturing exports fall, on average, 46 cents for every dollar of resource exports, while food and agricultural exports fall by 6c and service exports by 17c.

Table 3: Product disaggregation

	(1) ln Xaf	(2) ln Xma	(3) ln Xsv	(4) ln Maf	(5) ln Mma	(6) ln Msv
ln R	**-0.171*****	**-0.395*****	**-0.266*****	**0.075*****	**0.088*****	**0.159*****
	(0.036)	(0.058)	(0.036)	(0.020)	(0.033)	(0.030)
ln NRGDP	0.010	0.795***	1.165***			
	(0.140)	(0.148)	(0.189)			
ln FMA	0.026	0.239*	0.061			
	(0.083)	(0.123)	(0.083)			
ln GDP				0.771***	0.985***	0.694***
				(0.081)	(0.090)	(0.103)
ln FSA				0.027	0.287***	0.259***
				(0.048)	(0.061)	(0.063)
Observations	706	706	694	706	706	699
Countries	41	41	41	41	41	41
R-sq	0.60	0.65	0.33	0.82	0.69	0.38
$b = \beta * Y/R$	-0.06	-0.46	-0.17	0.02	0.17	0.10
Y/R	0.38	1.16	0.65	0.22	1.88	0.63

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject a unit root in the residuals by most tests. Due to negative figures, the samples are somewhat smaller for services trade and this precludes unit root testing. The estimates are practically identical if we restrict the exercise to the smaller services sector sample. Country and year FE included.

[13] Cross-equation tests confirm statistically significant differences between β_{Xaf} and β_{Xma} (F = 22.85, p-value = 0.00) and between β_{Xma} and β_{Xsv} (F = 7.80, p = 0.01).

3.4 Heterogeneity across countries

Resource exporters differ in their dependence on natural resource exports and in other characteristics likely to influence the effect of resources, such as level of development and institutional quality. In this section we investigate how this heterogeneity shapes responses. We start by running separate regressions for different levels of resource dependency and per capita income, and then investigate the role of governance as measured by rule of law and control of corruption. We end the section by combining the heterogeneity across different products explored in section 3.3 and the heterogeneity across countries in terms of governance measures.

The left hand side of Table 4 presents the estimates when we split the sample according to resource dependency, defined according to the median net resource exports as share of GDP over 2000-2006. [14] The more resource dependent countries have a higher elasticity of export response and smaller elasticity of import response. However, precisely because resource exports are large for this group, the per dollar responses ($b = \beta * Y/R$, penultimate row) are smaller. The main message is that for resource dependent economies the trade impact per unit is relatively small (32c reduction in non-resource exports, and small fall in imports per dollar resource exports); the impact is borne by other parts of the balance of payments including foreign saving and remittances. This is consistent with the observation that some highly resource dependent countries have built up substantial sovereign wealth funds (some Gulf States, Norway), and import large quantities of labour (some Gulf States). For countries in which resource exports are a smaller share of GDP more of the impact is felt on other trade flows, reducing non-resource exports by 57c per dollar and raising imports by 51c, suggesting dissaving.

The right hand panel of table 4 divides the sample by per capita income (as classified by the World Bank in 2009). There is a tendency for countries with higher income to have a larger export response and smaller import response, both in terms of the elasticity and in terms of the unit effect. 91 cents of a dollar of resource exports are spent on reducing exports in the higher income group, compared to 47 cents in the lower group; on the import side, 15 cents increase for the richer countries and 29 cents for the poorer countries. This is at least partly due to the differing composition of exports between the two groups. For the higher income group 55% of non-resource exports are manufactures (17% agriculture and food, 29% services), while for the

[14] See appendix table A2 for a list of the countries.

lower income group 42% of non-resource exports are manufactures (24% agriculture and food, 35% services). Given the different product-class elasticities reported in table 3, this difference in shares has the effect of increasing the aggregate elasticity for the higher income group. This is insufficient to account for the entire change, although a higher level of product disaggregation could increase the effect.

Table 4: Heterogeneity; income groups and resource dependency

	Resource Dependency				Income groups			
	Highly dependent		Less dependent		High/ upper middle		Lower middle /low	
	(1) ln X	(2) ln M	(3) ln X	(4) ln M	(5) ln X	(6) ln M	(7) ln X	(8) ln M
ln R	**-0.611*****	-0.038	**-0.150*****	**0.118*****	**-0.406*****	**0.054***	**-0.283*****	**0.119*****
	(0.045)	(0.024)	(0.020)	(0.018)	(0.046)	(0.032)	(0.059)	(0.022)
ln NRGDP	0.958***		0.957***		0.697***		1.293***	
	(0.264)		(0.090)		(0.135)		(0.243)	
ln FMA	-0.060		0.245***		0.194***		0.674***	
	(0.155)		(0.052)		(0.073)		(0.200)	
ln GDP		1.056***		0.690***		1.030***		0.482***
		(0.097)		(0.084)		(0.084)		(0.081)
ln FSA		0.040		0.262***		0.210***		0.203*
		(0.084)		(0.044)		(0.043)		(0.119)
Observations	279	279	427	427	466	466	240	240
Countries	20	20	21	21	23	23	18	18
R-sq	0.64	0.75	0.88	0.86	0.78	0.80	0.67	0.79
$b = \beta^*Y/R$	-0.32	-0.04	-0.57	0.51	-0.91	0.15	-0.47	0.29
Y/R	0.52	1.12	3.78	4.29	2.25	2.77	1.65	2.40

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject a unit root in the residuals in all cases, except for exports in the highly dependent sample and imports in the lower middle/low income sample. Country and Year FE included. Income groupings are based on the World Bank's country classification. Results are similar if we instead group countries according to the median GDP per capita in 2005 (measured in PPP prices). Resource dependency is defined from the average net resource exports in the year 2000-2006, with resource dependent defined as countries taking a value higher than the median.

Institutional quality is found to be important in various aspects of countries' responses to resource wealth. In their seminal paper on the resource curse, Sachs and Warner (1997) found that economies with a high ratio of natural resource exports to GDP experienced slower growth than economies less abundant in natural resources. Mehlum et al. (2006) nuanced this finding, by showing that only countries with poor institutions suffer this negative growth effect. In the same spirit, Aslaksen and Andersen (2008) found that the negative effect is present in democratic presidential countries and not in democratic parliamentary countries. More generally, Acemoglu and co-authors have in a series of works shown that the quality of institutions matters for economic performance (e.g. Acemoglu et al. 2005). Their results suggest that good institutions are essential in establishing the incentives and business climate necessary for a competitive exports sector. Do they matter in the present context?

To answer this question we interact resource exports with two measures of governance, Rule of Law and Control of Corruption;[15] a higher score on each measure, the better the governance is held to be. Results are reported in table 5, with columns (1) and (3) reporting rule of law, and (2) and (4) control of corruption. For both measures, the governance indicator interacted with resource exports has a significant negative effect on both exports and imports. Better governance according to these two measures therefore amplifies the negative effect of resource exports on non-resource exports, and dampens the positive effect on imports. The lower part of table 5 quantifies this by evaluating effects at the levels of two specific countries, Ecuador (ECU) and Chile (CHL). Of our 41 countries, Ecuador has relatively low scores on our two governance indicators, ranked 27 in terms of Rule of Law and 32 in terms of Control of Corruption. Chile ranks as 4 on both indicators, only behind Norway, Canada and Australia. The difference is large, with a much larger export effect for Chile than Ecuador (-96c compared to -39c for rule of law), and smaller import effect (about 0c compared to 19c).

[15] Note that we define the interaction variables such that they are measured in deviations from their sample means, i.e. the coefficient on the resource exports variable is the effect at the mean of the interacted variable. All interaction variables are time-invariant, hence the country-fixed effects capture their direct effect and there is no need to include them separately in the regressions.

Table 5: Heterogeneity; governance

	(1) ln X	(2) ln X	(3) ln M	(4) ln M
ln R	**-0.386*****	**-0.376*****	**0.068*****	**0.073*****
	(0.034)	(0.035)	(0.025)	(0.025)
ln R x Rule of Law	-0.147***		-0.055***	
	(0.026)		(0.018)	
ln R x Control of Corruption		-0.151***		-0.051***
		(0.030)		(0.019)
ln NRGDP	0.900***	0.872***		
	(0.127)	(0.126)		
ln FMA	0.192***	0.181***		
	(0.064)	(0.067)		
ln GDP			0.898***	0.890***
			(0.069)	(0.069)
ln FSA			0.276***	0.267***
			(0.042)	(0.042)
Observations	706	706	706	706
Countries	41	41	41	41
R-sq	0.73	0.72	0.79	0.79
$b = \beta * Y/R$	**-0.84**	**-0.82**	**0.19**	**0.20**
Y/R	2.17	2.17	2.73	2.73
Interaction var ECU	-0.66	-0.85	-0.66	-0.85
β, ECU	-0.29	-0.25	0.10	0.12
$b = \beta * Y/R$, ECU	**-0.39**	**-0.33**	**0.19**	**0.21**
Y/R ECU	1.36	1.36	1.82	1.82
Interaction CHL	1.31	1.45	1.31	1.45
β, CHL	-0.58	-0.59	-0.00	-0.00
$b = \beta * Y/R$, CHL	**-0.96**	**-0.99**	**-0.01**	**-0.00**
Y/R CHL	1.66	1.66	2.09	2.09
Interaction var min	-1.41	-1.18	-1.41	-1.18
Interaction var mean	-0.00	0.00	-0.00	0.00
Interaction var max	2.00	2.18	2.00	2.18

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject a unit root in the residuals in all tests. ECU and CHL refer to Ecuador and Chile, respectively. Country and Year FE included. ECU and CHL refer to Ecuador and Chile, respectively. *Y/R*, ECU, CHL refers to the actual ratio of X or M to R in year 2000.

These results may be driven partly by the compositional effects that we noted above for income differences. Countries with good governance have a higher share of manufactures in non-resource exports,[16] and, as we have seen, manufactures are more susceptible to being crowded out by resources. However, at our level of product disaggregation, this is not the whole story. We investigate further by disaggregating by product type, as in table 3. Looking just at the rule of law indicator, results are presented in table 6. The negative coefficient on the interaction term indicates that, even within manufactures, better rule of law increases the sensitivity of manufacturing exports to non-resource exports; coefficients on agriculture and food and on services are not significant. One possible reason for the negative interaction is a compositional effect within manufactures. Countries with good governance are more likely to attract more 'footloose' modern industry. It is precisely such industry that is likely to be crowded out by real exchange rate effects.[17] The effects are quantitatively large, as indicated by the hypothetical examples of Chile and Ecuador; the largest component of the difference in the aggregate response is from manufacturing; resource exports reduce manufacturing exports by 25c per dollar in Chile, and just 5c per dollar in Ecuador.

The message is therefore that countries with good governance are more vulnerable to Dutch disease effects in manufacturing, than are countries where governance is such that they have few of these mobile sectors in the first place. Corresponding to better governance amplifying the (negative) impact of resources on manufacturing exports, it dampens the effect on imports. Conversely, a country with relatively poor governance, little export response, and little saving from resource revenues, necessarily has a relatively large increase in imports. Evaluating effects for our examples of Ecuador and Chile, Ecuador would see increasing imports in each product class (by as much as 13c for manufactures), while import effects are negligible for hypothetical Chile.

[16] The correlation coefficient between the rule of law and share of manufactures in non-resource export is 0.27 (-0.35 with share of food and agriculture, 0.06 with services).

[17] As we saw in the model of section 2, a higher value of σ implies a higher price elasticity of export demand, and that more of the impact falls on a reduction in exports.

Table 6: Heterogeneity; product classes and governance

	(1) ln Xaf	(2) ln Xma	(3) ln Xsv	(4) ln Maf	(5) ln Mma	(6) ln Msv
ln R	**-0.185******	**-0.460******	**-0.273******	**0.061******	**0.063****	**0.160******
	(0.039)	(0.050)	(0.039)	(0.019)	(0.032)	(0.034)
ln R x Rule of Law	-0.047	**-0.221******	-0.023	**-0.044******	**-0.082******	0.002
	(0.032)	(0.047)	(0.030)	(0.014)	(0.024)	(0.027)
ln NRGDP	0.031	0.893***	1.175***			
	(0.143)	(0.146)	(0.192)			
ln FMA	0.025	0.231**	0.061			
	(0.081)	(0.107)	(0.083)			
ln GDP				0.787***	1.015***	0.693***
				(0.081)	(0.092)	(0.102)
ln FSA				0.040	0.311***	0.259***
				(0.048)	(0.060)	(0.064)
Observations	706	706	694	706	706	699
Countries	41	41	41	41	41	41
R-sq	0.61	0.68	0.34	0.82	0.70	0.38
*b = β*Y/R*	**-0.07**	**-0.53**	**-0.18**	**0.01**	**0.12**	**0.10**
Y/R	0.38	1.16	0.65	0.22	1.88	0.63
Interaction var ECU	-0.66	-0.66	-0.66	-0.66	-0.66	-0.66
β, ECU	-0.15	-0.32	-0.26	0.09	0.12	0.16
*b = β*Y/R*, ECU	**-0.12**	**-0.05**	**-0.10**	**0.02**	**0.13**	**0.08**
Y/R ECU	0.79	0.17	0.39	0.18	1.14	0.50
Interaction var CHL	1.31	1.31	1.31	1.31	1.31	1.31
β, CHL	-0.25	-0.75	-0.30	0.00	-0.05	0.16
*b = β*Y/R*, CHL	**-0.19**	**-0.25**	**-0.17**	**0.00**	**-0.07**	**0.07**
Y/R CHL	0.77	0.34	0.55	0.18	1.51	0.40
Interaction var min	-1.41	-1.41	-1.41	-1.41	-1.41	-1.41
Interaction var mean	-0.00	-0.00	0.00	-0.00	-0.00	0.00
Interaction var max	2.00	2.00	2.00	2.00	2.00	2.00

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject a unit root in the residuals in all tests, except two for exports of agriculture and food products. Due to negative figures, the samples are somewhat smaller for services trade and this precludes unit root testing. The estimates are practically identical if we restrict the exercise to the smaller services sector sample. ECU and CHL refer to Ecuador and Chile, respectively. *Y/R*, ECU, CHL refers to the actual ratio of X or M to R in year 2000.

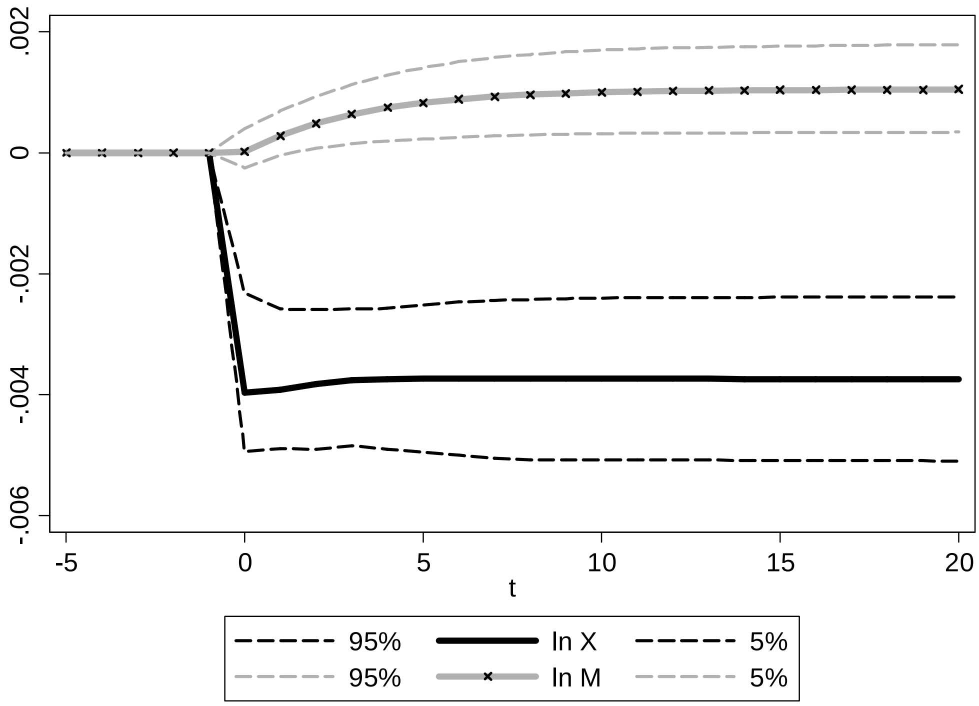
4. Speed of adjustment

Theory suggests that a number of factors will affect the speed at which the economy adjusts to windfalls. One is the extent to which a windfall is expected to be permanent or temporary; if temporary, adjustment might not be to the full annual value of the windfall, but only to its permanent income equivalent. A second concerns the speed with which the exchange rate and domestic relative prices change. A third is to do with the speed with which the quantity side of the economy can adjust (see Van der Ploeg and Venables 2010).

We add dynamics by estimating an error correction model of the relationships (2) and (3). Description and results are presented in appendix 6. Based on the error correction models, Figure 1 shows the dynamic responses in non-resource exports and imports to a one percent permanent increase in resource exports. The export effect reaches most of its long run effect on impact, suggesting a remarkably rapid mechanism. This may not be surprising, as some of the structural adjustments in the economy may start before the exports of natural resources are observed. Forward looking agents beginning to adjust at the date of announcement of the resource find and investments in natural resource extraction and exports facilities, necessarily preceding exports flows, may trigger early and rapid structural change. Imports, on the other hand, may react only when the foreign exchange windfall appears, hence the observed slower imports response seems reasonable.[18]

[18] The optimal inter-temporal responses for a country facing foreign exchange windfalls are similar to those from fiscal revenue windfalls from natural resource extraction. See Harding and van der Ploeg (forthcoming) for theory and evidence on the latter. We leave it for future research to identify present value effects in our context.

Figure 1: speed of adjustment



Note: The graph shows the response to a permanent increase in ln *R* of 0.01, based on the estimated models presented in column 1 and 3 in table A5 in appendix 6, i.e. an error-correction model with a lagged dependent variable and only contemporaneous first differences of the other variables. We employed standard non-parametric bootstrapping with 750 replications to construct the 90-percent confidence bands (following Imbs et al. 2005).

5. Econometric robustness

5.1 Robustness check I: endogenous resource exports

As discussed in section 2 above, the estimates we present rely on the exogeneity of resource exports, i.e. should be uncorrelated with the error terms in (13) and (14) or an endogeneity bias may occur.[19] Since markets for natural resources are global it is reasonable to assume that

[19] Hsiao, C. (1997) discusses identification under cointegration.

resource exporters are price takers.[20] We take advantage of this exogenous price variation and instrument resource exports with a country-specific resource price index. The index is constructed by combining global price indexes for 75 resource commodities, defined at the SITC 4 digit level, with country-specific value shares constructed from trade data at the SITC 4 digit level. We keep shares fixed for each country across time, using the 1985 values. This early date makes the resulting instrument less prone to the influence of any potential background factors correlated with non-resource trade and exploration, production and exports of natural resources. The instrument is available for 35 countries. Details on the construction of the index are presented in appendix 5.

The upper panel of table 7 presents the first stage estimates; column (1) for the export relationship and column (2) for the import relationship, differing only by the controls. The export price index is found to be positively correlated with the resource exports, significant at the one-percent level. The F-test for the instrument reported in the very bottom part of table 7 suggests that the instrument predicts the export value well and the partial R-squared is close to 0.10. The reported p-value from the under-identification test (Kleibergen-Paap rk LM test) suggests that the model is identified.

Moving on to the second stage estimates reported in the lower panel of table 7, we find the usual negative effect of resource exports on non-resource exports in column (1). Column (2) presents the OLS-estimates on the same sample. The estimated elasticity is -0.22 in 2SLS, compared to -0.32 in OLS. This indicates that OLS over-estimates the negative effect on the non-resource export performance. Turning to imports, results indicate that OLS under-estimates the import effect, with estimated elasticities of 0.18 and 0.09 in column (3) and (4). These IV-elasticities translate into -53 and +53 cents change in non-resource exports and imports, respectively, implying small negative savings.

As our constructed price indexes are arguably exogenous with respect to non-resource trade performance, while the value of resource exports may be affected by factors also relevant for non-resource trade, the difference between the IV- and OLS-estimates could be attributed to an endogeneity-bias in OLS. If, for example, countries being productive in manufacturing invest less in extraction and exports of natural resources or they consume more of the natural resources

[20] Although for oil, OPEC, may be able to affect the price. The empirical evidence casts doubt on its ability to do so (see Barsky and Kilian 2004 and Hamilton 2008).

themselves, for example as inputs in their manufacturing production, there would be a negative correlation between exports of natural resources and manufacturing exports, creating a bias in OLS consistent with what we observe.

An alternative explanation for the differences in the IV- and the OLS-estimates is that the effects of a price change may be different than the effects of a quantity change. Price changes are true windfalls, inducing resource allocations only via relative price changes. Quantity changes require re-allocations of real resources such as land, capital and labour. In addition, the optimal responses in an inter-temporal setting may be different in the two cases. Hamilton (2008) presents evidence suggesting that the real price of oil follows a random walk without drift over the long run. A change in the oil price may therefore be seen as a permanent change (today's price is the best forecast for the future price). A change in the quantity, on the other hand, may be more temporary as the resource will be depleted. If price and quantity changes trigger different optimal responses in terms of the allocation of resources between tradable and non-tradable activities, and between consumption today versus in the future, we would expect that the IV- and OLS-estimates presented in table 7 would be different, as the IV-estimates relies on the variation in the price-index only. If the quantity of resource exports is endogenous, we would need a separate instrument affecting quantity only to identify the quantity effect.[21]

With this caveat regarding the interpretation of the differences between the IV- and OLS-estimates presented in table 7, the IV-estimates confirm the main messages of this paper: foreign exchange earnings from resource exports trigger a contraction in non-resource exports, an expansion of non-resource imports, and a saving out of a dollar windfall close to zero.

[21] In a complementary exercise, valid under the assumption that the quantity of resource exports is exogenous, we allowed for separate effects of the quantity and price of resource exports (where the quantity was defined as the value of resource exports deflated by the resource price index). The elasticity w.r.t. quantity was estimated to be larger (more negative) than the elasticity w.r.t to the price in the exports equation, -0.33 vs. -0.27, but the difference was not statistically significant.. The unit changes were -83 and -66 cents per dollar resource exports The quantity and price elasticities estimated in the imports equation were 0.08 and 0.14, translating into 23 and 44 cents per dollar resource exports. This difference was statistically significant at the eight percent level All four elasticities were significant at least at the five percent level. Kilian et al. (2009) investigate the effects of different types of oil price shocks on the external balances of oil exporters as a group and oil-importers as a group.

Table 7: Instrumental variable estimation

First stage

	(1) ln R	(2) ln R
ln Resource Price Index	**0.614*****	**0.636*****
	(0.121)	(0.121)
ln NRGDP	0.044	
	(0.191)	
ln FMA	0.383***	
	(0.121)	
ln GDP		0.561**
		(0.280)
ln FSA		0.073
		(0.114)
Observations	648	648
R-sq	0.48	0.48

Second stage and OLS-estimates

	(1) ln X 2SLS	(2) ln X OLS	(3) ln M 2SLS	(4) ln M OLS
ln R	**-0.223*****	**-0.323*****	**0.181*****	**0.085*****
	(0.071)	(0.044)	(0.050)	(0.028)
ln NRGDP	0.759***	0.762***		
	(0.130)	(0.128)		
ln FMA	0.143*	0.185**		
	(0.080)	(0.073)		
ln GDP			0.803***	0.863***
			(0.090)	(0.073)
ln FSA			0.267***	0.263***
			(0.045)	(0.042)
Observations	648	648	648	648
Countries	35	35	35	35
R-sq	0.71	0.72	0.76	0.78
$b = \beta * Y/R$	-0.53	-0.76	0.53	0.25
Y/R	2.37	2.37	2.95	2.95
F instrument	25.83		27.80	
Part. R-sq instrument	0.08		0.09	
Underidentification. test, p	0.00		0.00	

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject a unit root in the residuals in all tests. Country and Year FE included.

5.2 Robustness check II: alternative controls

We embedded our export and import equations in the gravity model of trade. The choice of control variables was guided by theory. Non-resource GDP, *NRGDP*, controlled for own-country supply capacity of non-resource goods and foreign market access, *FMA*, controlled for factors affecting demand in the export equation. *GDP* controlled for own-country demand and foreign supplier access, *FSA*, controlled for supply capacities of other countries in the import equation. This specification resembled the "structural gravity model" proposed by Anderson and Van Wincoop (2003). In particular, their multilateral resistance terms, capturing all bilateral trade barriers as well as world income shares were soaked up by our *FMA* and *FSA* measures. It is well known that the multilateral resistance terms can be captured by the inclusion of importer and exporter fixed effects in gravity estimation on bilateral data (Feenstra 2004). In addition, our specifications controlled for own-country time-invariant characteristics such as landlockedness, area size and island status by the inclusion of country fixed effects. Finally, year dummies controlled for global shocks relevant for non-resource trade performance.

Although our preferred specifications were inspired by theory and produced stable and sensible results, we suggest that the conclusions of the paper are not sensitive to the choice of control variables. Table A6 in appendix 6 present the export and import equation with different combinations of the own country variables (*NRGDP* and *GDP*) and the other-country variables (*FMA* and *FSA*). We choose to include only one of the two latter variables at a time, although both might be suggested to affect both exports and imports in a general equilibrium model, as they are highly correlated and the estimates would be subject to a colinearity problem. For exports we find that the magnitude varies between -72 and -81 cents reduction per dollar of resource exports. For imports the magnitude varies between +19 and +30 cents. Table A7 repeats our benchmark estimation of table 2 excluding year dummies. The magnitude of the export effect then drops from -74 to -57 cents, while the import effect increases from +23 to +27 cents. We conclude that our results are stable to alternative sets of controls.

5.3 Robustness check III: cross-sectional dependence

An issue receiving considerable attention in the econometric literature on dynamic panels using macroeconomic data is cross sectional dependence.[22] Unobserved common shocks across countries may lead to correlation in the error-terms and biased and inefficient estimates (Pesaran 2006). Our inclusion of year fixed effects is likely to reduce any cross sectional dependence, as they control for cross sectional dependence to the extent the impact of common shocks is identical across countries (De Hoyos and Sarafidis 2006). Furthermore, theory gives in our case guidance on the sources from which remaining cross sectional dependence may arise, and this is captured by the control variables *FMA* and *FSA*. These are like spatial lag variables and their inclusion resembles a standard solution to cross sectional dependence (Pesaran 2006). Nevertheless, we re-estimate our benchmark models with the pooled common correlated effects (CCEP) estimator suggested by Pesaran (2006). The CCEP procedure is to add as controls global, year-specific means of the dependent and independent variables interacted with country-specific dummies. Global shocks are in that way accounted for and they are allowed to have differential impacts across countries. The results presented in table A8 show that the messages of this paper are robust to accounting for cross-sectional dependence.

6. Conclusions

The possible adverse effects of foreign exchange windfalls on the tradable sector has been a recurring theme of literature on the Dutch disease, on the resource curse, and also on the implications of scaling up aid. There are alternative windows through which researchers can get a view on the issues. Such effects should be associated with relative price changes and real exchange appreciation, at least in the short-run, although finding these effects empirically has proved elusive. Variations in production structure are observable, but empirical work is hindered both by data issues and by the myriad factors that shape comparative advantage. The approach of this paper is to look directly at the trade and balance of payments data. This has the advantage of simplicity, with some clear structure imposed by balance of payments accounting and some robust empirical support provided by gravity models of trade. The approach enables us to divide

[22] See Eberhardt and Teal (2011) for a discussion.

tradables into imports and exports, activities that are, in many economies, quite different. We obtain a number of results showing how resource exports affect these different non-resource trade flows.

Exports of natural resources crowd out non-resource exports, at a rate of around three-quarter of a dollar to a dollar of resource exports, while drawing in imports at around a quarter of a dollar to the dollar. These estimates imply very little response in savings (foreign asset accumulation), although this varies across countries. Countries with a high share of resource exports in GDP have on average positive saving (the non-resource export and import response is less than resource exports), while countries with a lower share of resource exports have dissaving. The largest part of the impact falls on trade in manufactures, rather than agriculture and food or services. Thus, on average, each dollar of resource exports reduces exports of manufactures by 46c, service exports by 17c, and exports of agriculture and food by just 6c. The crowding out of non-resource exports is greater in higher income countries, and in countries with better governance. This is due, at least in part, to the fact that these countries have a higher share of manufacturing in their total non-resource exports. More generally, the result is probably driven by the fact that these countries are more likely to host 'footloose' manufacturing, which can be crowded out by quite small relative price changes. Countries without the potential to host such sectors are less vulnerable to this Dutch disease effect. Our results are valuable to policy makers in resource rich countries who should be aware of how, given their particular country circumstances, their non-resource trade is likely to be affected by their resource exports.

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Appendix 1: A 3-good model

Distinct non-resource export and import response can be derived from a three sector model with non-tradables (price p_n), exportables (p_x) and import competing goods (p_m). Resource revenue is R, the economy's expenditure function is $e(p_n, p_x, p_m)u$ where u is utility, and the revenue (or GNP) function is $r(p_n, p_x, p_m)$; fixed endowments of factors are suppressed in the notation. Assuming for simplicity that there is no asset accumulation, the budget constraint is

$$R + r(p_n, p_x, p_m) = e(p_n, p_x, p_m)u$$

Non-traded goods market clearing is

$$r_n(p_n, p_x, p_m) = e_n(p_n, p_x, p_m)u$$

where subscripts denote partial derivatives. Prices of tradable goods, p_x, p_m are fixed. These two equations implicitly define the two endogenous variables, p_m and u, as a function of R.
The effect of variation in R can be found by totally differentiating and rearranging to give
$\frac{du}{dR} = \frac{1}{e}$, $\frac{dp_n}{dR} = \frac{1}{(r_{nn} - e_{nn})} \cdot \frac{e_n}{e} > 0$. Non-resource exports are $X = r_x - e_x u$ and imports $M = r_m - e_m u$. Totally differentiating and using expressions for the change in p_n and u,

$$\frac{dX}{dR} = \frac{(r_{xn} - e_{xn})}{(r_{nn} - e_{nn})} \cdot \frac{e_n}{e} - \frac{e_x}{e}, \qquad \frac{dM}{dR} = -\frac{(r_{mn} - e_{mn})}{(r_{nn} - e_{nn})} \cdot \frac{e_n}{e} + \frac{e_x}{e} \tag{A1}$$

The first expression on the right hand side of each of these expressions is a relative price effect giving the general equilibrium effect of a change in the price of non-tradables on supply and demand for the export and import competing good; in the first expression this is generally negative, and in the second positive. The second terms are income effects and, once again, for normal goods have negative on exports and positive on imports. It follows from homogeneity of revenue and expenditure functions that $d(M - X)/dR = 1$.

Appendix 2: Resources and equilibrium

Equilibrium conditions implicitly defining the variables E_1, n_1, p_1, and G_1 are:

$$E_1 = \mu[p_1 L_1 + R_1] \tag{A2}$$

$$n_1 = \mu L_1 - (1-\mu)R_1 / p_1 \tag{A3}$$

$$p_1^{\sigma} = E_1 G_1^{\sigma-1} + FMA_1. \tag{A4}$$

$$G_1^{1-\sigma} = n_1 p_1^{1-\sigma} + FSA_1, \tag{A5}$$

Linearising these around an equilibrium with $p_1 = G_1 = 1$, $R_1 = 0$, $L_1 = 1$, $n_1 = E_1 = \mu$ and hence $FMA_1 = FSA_1 = 1 - \mu$, gives

$$dE_1 = \mu[L_1 dp_1 + dR_1] \tag{A6}$$

$$dn_1 = (\mu - 1)dR_1 \tag{A7}$$

$$\sigma dp_1 = dE_1 + (\sigma - 1)E_1 dG_1 . \tag{A8}$$

$$(1-\sigma)dG_1 = dn_1 + (1-\sigma)n_1 dp_1 . \tag{A9}$$

The effects of a change in *R* are:

$$\frac{dE_1}{dR_1} = \frac{\mu[\sigma(1-\mu^2)+\mu]}{(1-\mu)[\sigma(1+\mu)-\mu]} > 0 \tag{A10}$$

$$\frac{dn_1}{dR_1} = \mu - 1 < 0 \tag{A11}$$

$$\frac{dp_1}{dR_1} = \frac{\mu(2-\mu)}{(1-\mu)[\sigma(1+\mu)-\mu]} > 0 . \tag{A12}$$

$$\frac{dG_1}{dR_1} = \frac{\sigma[\mu^2+1-\mu]-\mu}{(\sigma-1)(1-\mu)[\sigma(1+\mu)-\mu]} > 0 . \tag{A13}$$

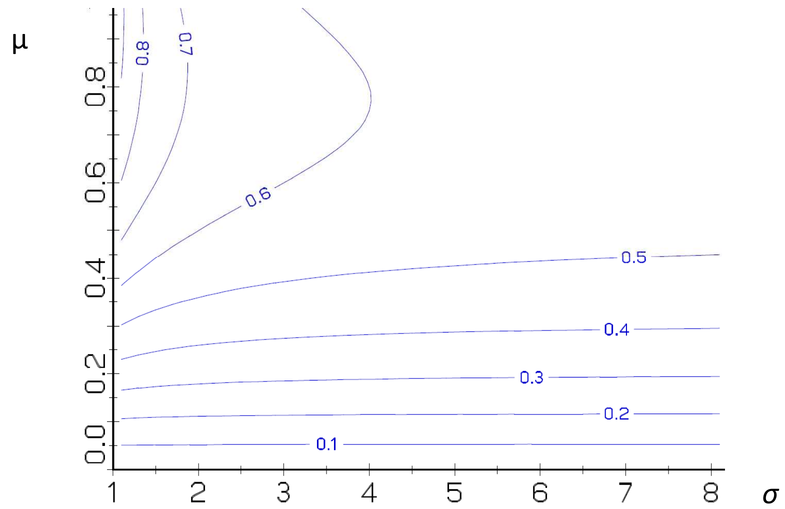
From these, the response of non-resource trade to an increase in resource exports is:

$$\frac{dX_1}{dR_1} = FMA_1 \frac{\mu-\sigma[\mu^2-\mu+1]}{(1-\mu)[\sigma(1+\mu)-\mu]} = \frac{\mu-\sigma[\mu^2-\mu+1]}{\sigma(1+\mu)-\mu} \le 0 , \tag{A14}$$

$$\frac{dM_1}{dR_1} = FSA_1 \frac{\sigma\mu(2-\mu)}{(1-\mu)[\sigma(1+\mu)-\mu]} = \frac{\sigma\mu(2-\mu)}{\sigma(1+\mu)-\mu} \ge 0. \tag{A15}$$

The dependence of these relationships on μ and σ is illustrated in Figure A1. For example, if $\mu = 0.3$ and $\sigma = 6$ then for each dollar of resource revenue exports fall by 60c and imports rise by 40c. The import effect is non-monotonic in μ and is largest at an intermediate value of μ. In the limiting case of $\sigma \to \infty$ the maximum value of $dM_1/dR_1 =$ 0.536, attained at $\mu = 0.73$. A higher value of σ unambiguously reduces dM_1/dR_1, i.e. places more of the impact on a reduction in exports rather than increase in imports.

Figure A1: Contours of $dM_1/dR_1 = 1 + dX_1/dR_1$



Appendix 3: Data

Data on Gross domestic product (*GDP*) and aggregate trade are from World Development Indicators (WDI).[23] Trade measures are exports and imports of goods and services (BoP), resource exports and imports covering fuel, metals and ores; exports and imports of agriculture and food products (*Xaf* and *Maf*), and manufacturing products (*Xma* and *Mma*). Non-resource exports (*X*) are defined as: exports of goods and services (BoP) minus exports of fuel, metals and ores; non-resource imports (*M*) are defined analogoulsy. The non-resource balance (*NRB*) is an abbreviation for net non-resource exports (*X-M*). Exports and imports of services are defined as residuals: $Xsv = X – Xaf – Xma$; $Msv = M – Maf - Mma$.

Data on bilateral non-resource exports used in the gravity estimation are from Comtrade.[24] The bilateral country-fixed variables used in the gravity estimations (distance and dummies for contiguity, common official primary language and colonial relationship) and the unilateral country-fixed variables used in the regressions on aggregate data (area and dummies for landlocked and island status) are from CEPII.[25] Both the Comtrade data and the trade data from WDI are presented in current USD. We deflate them with the GDP deflator of the U.S. GDP, which is found by dividing U.S. GDP in current USD by U.S. GDP in fixed USD with year 2000 as the base year, both from WDI. *GDP* is measured in 2000 USD.

[23] See: http://publications.worldbank.org/WDI/
[24] See: http://wits.worldbank.org/wits/ and appendix 4 for details.
[25] See: http://www.cepii.fr/anglaisgraph/bdd/distances.htm

FMA (foreign market access) and *FSA* (foreign supplier access) are used as control variables. Appendix 4 explains how they are constructed. They are denominated in 2000 USD.

Non-resource GDP, *NRGDP*, is calculated from National accounts data calculating value added and GDP from the production side, published by the UN. *NRGDP* is defined as total value added minus value added in Mining and Utilities (ISIC C and E).[26] The data are in 2005 USD.

The governance measures, Rule of Law and Control of Corruption, are from The Worldwide Governance Indicators (WGI) project, country averages over 1996-2006. Rule of law "captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence." Control of Corruption "captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests."[27]

Table A1: Descriptive statistics

Variable	Mean	Standard dev.	Min	Max
X	23.00	44.27	0.06	297.40
M	28.86	46.79	0.36	329.60
Xaf	3.99	6.44	0.00	46.80
Maf	2.34	3.56	0.06	25.06
Xma	12.29	29.68	0.00	184.20
Mma	19.90	35.32	0.15	240.00
Xsv*	6.86	10.96	0.00	70.78
Msv*	6.72	9.58	0.01	65.01
R	10.59	16.20	0.01	183.20
NRGDP	113.88	181.23	1.27	964.74
GDP	108.22	153.91	0.98	844.60
FMA	1.81	4.99	0.11	52.17
FSA	2.16	5.20	0.11	52.54
ln Area in sq. kms	13.546	1.699	6.519	16.653
Island dummy	0.095	0.293	0	1
1 if landlocked	0.126	0.332	0	1
RNET/GDP (2000-2006)	14.044	13.211	1.446	45.298
Rule of Law	-0.09	0.95	-1.50	1.91
Control of Corruption	-0.01	1.00	-1.19	2.16
Resource Price Index (1985)*	1.142	0.459	0.148	2.974
Observations	706			

Note: Variables X – FSA measured in billions of 2000 USD. RNET/GDP in %. *Reduced sample size as in tables.

[26] See: http://unstats.un.org/unsd/snaama/dnlList.asp
[27] See: http://info.worldbank.org/governance/wgi/resources.htm

Table A2: Countries and years included

	Code	Country	First	Last	Obs.	Income	Res. Dep.
1	ARG	Argentina	1976	2006	31	H	ND
2	AUS	Australia	1970	2006	37	H	ND
3	AZE	Azerbaijan	1996	2006	11	L	D
4	BGR	Bulgaria	1996	2006	11	H	ND
5	BHR	Bahrain	2000	2005	6	H	D
6	BOL	Bolivia	1976	2006	31	L	D
7	BWA	Botswana	2000	2006	7	H	D
8	CAN	Canada	1970	2006	37	H	ND
9	CHL	Chile	1975	2006	32	H	ND
10	CIV	Cote d'Ivoire	1995	2006	12	L	ND
11	CMR	Cameroon	2000	2006	7	L	ND
12	COL	Colombia	1970	2006	37	H	ND
13	DZA	Algeria	1977	1991	15	H	D
14	ECU	Ecuador	1980	2006	27	L	ND
15	EGY	Egypt, Arab Rep.	1977	2006	30	L	ND
16	GAB	Gabon	1996	2005	10	H	D
17	GIN	Guinea	1995	2002	8	L	ND
18	IDN	Indonesia	1981	2006	26	L	ND
19	KAZ	Kazakhstan	1995	2006	12	H	D
20	KWT	Kuwait	1992	2001	10	H	D
21	MEX	Mexico	1986	2006	21	H	ND
22	MNG	Mongolia	1996	2001	6	L	ND
23	MOZ	Mozambique	2000	2006	7	L	D
24	MYS	Malaysia	1974	2006	33	H	ND
25	NAM	Namibia	2000	2006	7	H	ND
26	NER	Niger	1995	2006	12	L	ND
27	NGA	Nigeria	1996	2003	8	L	D
28	NOR	Norway	1988	2006	19	H	D
29	OMN	Oman	1979	2006	28	H	D
30	PER	Peru	1982	2006	25	H	ND
31	PNG	Papua New Guinea	1981	1990	10	L	D
32	RUS	Russian Federation	1996	2006	11	H	D
33	SAU	Saudi Arabia	1990	1996	7	H	D
34	SDN	Sudan	1999	2006	8	L	ND
35	SYR	Syrian Arab Republic	1977	1987	11	L	D
36	TTO	Trinidad and Tobago	1982	2005	24	H	D
37	VEN	Venezuela, RB	1971	2006	36	H	D
38	VNM	Vietnam	1997	2006	10	L	ND
39	YEM	Yemen, Rep.	2001	2006	6	L	D
40	ZAF	South Africa	1974	1983	10	H	ND
41	ZMB	Zambia	1997	2006	10	L	D
		Sum			706		

Note: H (L): high income or upper middle (lower middle or low) income country according to World Bank country classification of July 2009. D (ND): above (below) median in terms of average net resource exports 2000-2006.

Appendix 4: Gravity estimates

Analysis is based on the workhorse model of international trade flows, the gravity model. This states that bilateral exports between countries *i* and *j*, x_{ij}, is a function of exporter country *i* characteristics, s_i, importer country *j* characteristics, m_j, and 'between' country frictions

$$x_{ij} = s_i t_{ij}.m_j, \quad i \neq j. \qquad \text{(A16)}$$

The focus of this paper is on countries' exports and imports to and from all destinations, which we denote X_i and M_i, so

$$X_i = s_i \sum_{j \neq i} t_{ij}.m_j \quad , \qquad M_i = m_{i.} \sum_{j \neq i} t_{ij}.s_j \; . \qquad \text{(A17)}$$

We proceed in two stages. First, we estimate the bilateral trade model in order to obtain values for the terms in the summation signs in (A17). Following the methodology of Redding and Venables (2004) this can be done using fixed effects for the country and importer characteristics, s_i and m_j, and the usual measures of proximity (distance, contiguity....) for the between country frictions. We use non-resource trade and obtain estimates of foreign market access and foreign supplier access,

$$FMA_i = \sum_{j \neq i} t_{ij}.m_j \quad , \quad FSA_i = \sum_{j \neq i} t_{ij}.s_j \; . \qquad \text{(A18)}$$

The former is a measure of how the fixed effects measuring foreign countries' import demands, interacted with each countries' proximity to country *i*, determine country *i*'s market access. The latter is analogous on the import side, measuring country *i*'s access to foreign sources of supply. Using these expressions, $X_i = s_i FMA_i$, $M_i = m_i FSA_i$.

We constructed annual bilateral non-resource trade flows by aggregating across all non-resource trade flows available at the SITC 4-digit product level (also those smaller than 100 000 USD). We estimated a log-linear version of the gravity equation (A16) on cross sections covering all countries available except those with a population smaller than 0.5 million, starting with the first cross section in 1970 and ending with the last in 2006. Hence we obtained 37 sets of coefficients. The dependent variable was log of exports from country *i* to *j*, ignoring zeros. As robustness, we did in early stages also experiment with the inclusion of zeros, estimating with the Pseudo Poisson Maximum Likelihood estimator (PPML) used by Santos Silva and Tenreyro (2006), but concluded that it would be unlikely to affect our results.

Table A3: Descriptive statistics of the estimated gravity coefficients

	Coefficient estimate				t-value	p-value
	Mean	25-percentile	Median	75-percentile	Mean	
ln Distance	-1.32	-1.44	-1.31	-1.23	-41.69	0.00
Colony dummy	1.08	0.88	0.96	1.27	9.50	0.00
Common language dummy	0.76	0.70	0.79	0.85	11.67	0.00
Contiguity dummy	0.70	0.55	0.73	0.94	5.19	0.06

Table A3 presents statistics on the estimated coefficients across the 37 cross-sections. Our estimates of the distance elasticity have a mean of -1.32. This agrees with the findings of Disdier and Head (2008), who found that the mean distance elasticity across 1467 estimates in 103 papers was -0.9 with a standard deviation of 0.39, and that the distance elasticity has been relatively large since the middle of the 20th century. The three bilateral dummy variables for colony, common language and contiguity status show the expected positive sign.

Figure A2: Estimated gravity coefficients and corresponding std. errors

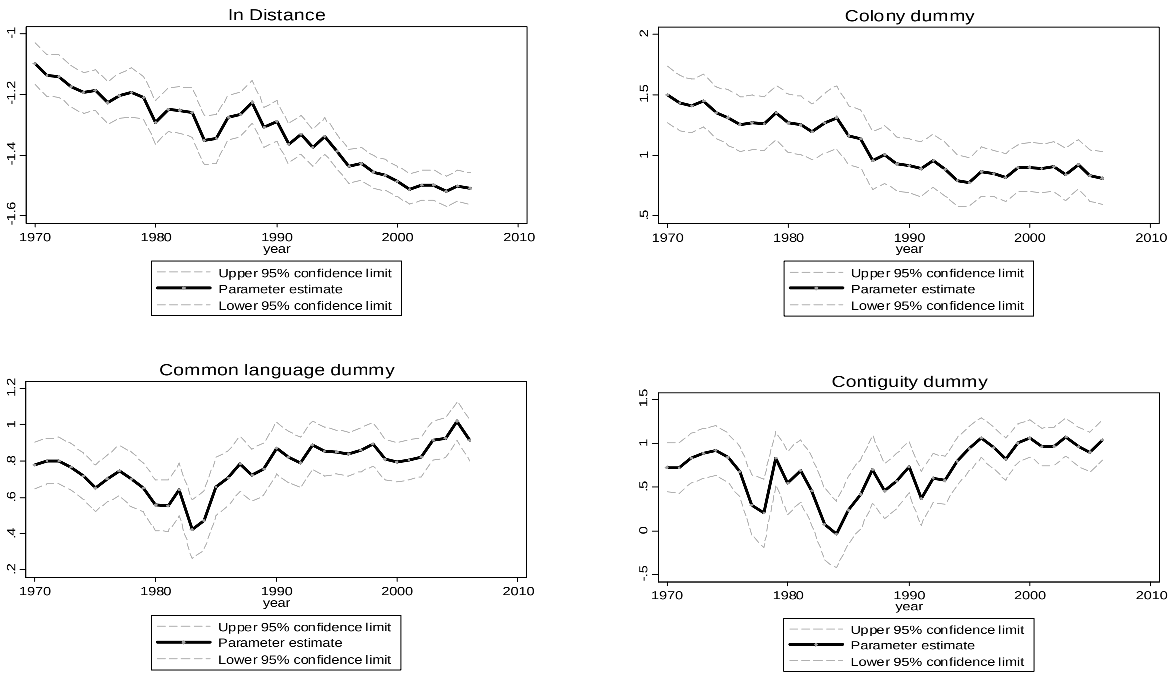


Figure A2 presents the estimated coefficients and their standard deviations across the different cross sections. The negative elasticity of distance has grown stronger over time. The elasticity of colony status decreased until the mid-1990s and has since been stable. The elasticities of common language and contiguity dummies fluctuate throughout the sample, but show now clear trend. It is important to notice that the gravity model is estimated on data from Comtrade, which only covers merchandise trade. However, we want to look at the impact of resource trade on all non-resource trade, services as well as merchandise. We assume that the measures FMA_i and FSA_i derived from merchandise trade are proxies for the impact of market access and supplier access on trade as a whole.

Appendix 5: Price indexes for resource trade

Like Deaton and Miller (1995) and Collier and Goderis (forthcoming) we use global prices to construct exogenous price indexes for resource imports and resource exports. We construct a price index corresponding to gross resource exports for each country. We use Comtrade data[28] at the 4-digit SITC level to identify the level of gross exports corresponding to our definition of resources. We end up with 75 different resources and attach their global price index (set to 1 in 2000 for all the resources) to each of them. The sources of the prices are the IMF[29], the World Bank[30] and the U.S. Geological Survey[31]. Further details on the resource trade data and the prices used are available on request from the authors.

The export index for country *i* is defined as: $PI_{it} = \sum_p w_{ip,exports} * PI_{pt,\,exports}$, where the weights, *w*, are $w_{ip,\,exports} = exports_{ip,1985} / \sum_p (exports_{ip,1985})$

We choose to use time-invariant weights and use the weights as in 1985 for all years. The advantage is that all the time-variation in the resulting price index then arises from the commodity-specific global price indexes. The variation in our instrument hence is exogenous to each country (assuming that each country is a price taker). The disadvantage of using time-invariant weights is that the price index may be a poor reflection of the price index the country actually meets in its imports and exports markets if the composition of the resources trade changes much over time. However, the price indexes are found to have good predictive power on the value of resource exports.

Appendix 6: Econometric issues

Panel-data unit root tests of the variables included in (13) and (14) suggest in general that the series are integrated of order 1, i.e. non-stationary in levels and stationary in first differences. Regarding the tests, we run the unit-root tests reported in lower part of table A4. See the table-note for explanation. The tests are not always conclusive, but series are found to be integrated of

[28] The data can be downloaded from http://wits.worldbank.org/wits/
[29] http://www.imf.org/external/np/res/commod/index.asp
[30] http://go.worldbank.org/3AWKN2ZOY0
[31] http://minerals.usgs.gov/ds/2005/140/#data

the same order, i.e. a unit root is often either rejected for all series by a particular test or not rejected for all series by a particular test. This is important as the key is that the series should be integrated by the same order for there to exist a stable relationship between them. As the tests in the lower part of table A4 show, we can reject the existence of a unit root in the residuals in (13) and (14) in all tests. This indicates either a cointegrating relationship between non-stationary series integrated of the same order or a relationship between stationary variables. Panel-data unit root tests reject the existence of a unit root in the residuals and hence offer support for a cointegration relationship between the variables in (13) and (14). As is well know from the dynamic panel literature, the estimates can then be interpreted as the long-run relationship between the variables. We do the tests reported in table A4 for all regressions using panel data and comment on the results in the note of each table throughout the paper. The full results of the cointegration tests are available upon request from the authors. We conclude that our estimates are not spurious due to the time-series properties of our variables. See van der Ploeg and Poelhekke (forthcoming) for a recent application of these dynamic panel data procedures.

Table A5 presents an error-correction version of our benchmark models of table 2. In column (1) and (3), we estimate the long-run relationship between our variables within the error-correction framework. This represents and alternative estimation of the long-run relationship to the level estimation presented in table 2 and the cross-section estimation presented in table 1. The strength of the error-correction approach is that the included short run dynamics may help in separate out short-run noise. In column (2) and (4), we follow the two-stage approach of Engle and Granger (1987) and impose the estimated co-integrating relationships presented in table 2 as the long-run solution, i.e. we include the residuals from table 2 as the error correction terms. Comparing column (1) and (2) and column (3) and (4), we see that the estimated short run dynamics and the adjustment coefficients are very similar. The error-correction models generate long-run elasticites of -0.38 and 0.10 for non-resource exports and imports (presented in the bottom of column (1) and (2)), which are similar to the elasticities of -0.34 and +0.09 found in table 2. We have experimented with the inclusion of different lags in the short run dynamics. Across seven different specifications, the long-run export elasticity varies between -0.37 and -0.44 and is always significant at the 1-percent level. The long-run import elasticity is 0.10-0.11 in all seven specifications and significant at least at the 3-percent level. Results are available on request.

Table A6 – A8 are discussed in section 5 of the main text.

Table A4: Cointegration tests

	(1) ln X	(4) ln M
ln R	-0.343***	0.085***
	(0.044)	(0.026)
ln NRGDP	0.835***	
	(0.130)	
ln FMA	0.197***	
	(0.075)	
ln GDP		0.878***
		(0.068)
ln FSA		0.261***
		(0.042)
Observations	706	706
Countries	41	41
R-sq	0.71	0.78
*b = β*Y/R*	-0.74	0.23
Y/R	*2.17*	*2.73*
IPS Z-t-tilde-bar (0 lag)	-5.17	-1.94
p-value	.	.
IPS Z-t-tilde-bar de-mean (0 lag)	-5.17	-1.94
p-value	.	.
IPS W-t-bar (1 lag)	-4.59	-7.84
p-value	0.00	0.00
IPS W-t-bar de-mean (1 lag)	-4.59	-7.84
p-value	0.00	0.00
Fisher inv. chi-squared P (0 lag)	351.19	105.30
p-value	0.00	0.04
Fisher mod. inv. chi-squared P (0 lag)	21.02	1.82
p-value	0.00	0.03
Fisher inv. chi-squared P de-mean (0 lag)	351.19	105.30
p-value	0.00	0.04
Fisher mod. inv. chi-squared P de-mean (0 lag)	21.02	1.82
p-value	0.00	0.03
Fisher inv. chi-squared P (1 lag)	241.41	273.67
p-value	0.00	0.00
Fisher mod. inv. chi-squared P (1 lag)	12.45	14.97
p-value	0.00	0.00
Fisher inv. chi-squared P de-mean (1 lag)	241.41	273.67
p-value	0.00	0.00
Fisher mod. inv. chi-squared P de-mean (1 lag)	12.45	14.97
p-value	0.00	0.00

Note: Robust standard errors in parentheses. IPS refers to the Im-Pesaran-Shin test. H0: all countries contain a unit root. H1: some countries are stationary. Z_t-tilde-bar is reported only in samples where T is at least 10 per country. When lags are included, the W_t-bar statistic is reported. The Fisher-type test reported is also based on Augmented Dickey Fuller (ADF) tests. H0: all countries contain a unit root. H1: At least one country is stationary. The inverse chi-squared and the modified inverse chi-squared statistics are reported. Both the IPS and the Fischer type tests allow for country-specific autoregressive parameters. "de-mean" refers to subtraction of cross-sectional averages have been subtracted from the series to account for possible cross-sectional dependence. "lag" refers to the number of lags included in the ADF regressions. All tests are run in Stata using "xtunitroot". Country and year FE included.

Table A5: Dynamics, error correction model

	(1) D.ln X	(2) D.ln X	(3) D.ln M	(4) D.ln M
Short-run dynamics:				
L.Dependent variable	0.027	0.035	0.054	0.057
	(0.056)	(0.055)	(0.040)	(0.040)
D.ln R	-0.414***	-0.406***	-0.001	-0.003
	(0.054)	(0.051)	(0.016)	(0.015)
D.ln NRGDP (D.ln GDP)	0.769**	0.787***	2.157***	2.132***
	(0.305)	(0.301)	(0.191)	(0.170)
D.ln FMA (D.ln FSA)	0.075	0.047	0.012	0.023
	(0.074)	(0.075)	(0.046)	(0.044)
Long-run:				
L.ln X (L.ln M) / Adj. coeff.	-0.465***	-0.469***	-0.255***	-0.256***
	(0.127)	(0.127)	(0.027)	(0.027)
L.ln R	-0.177***		0.026**	
	(0.048)		(0.010)	
L.ln NRGDP (L.ln GDP)	0.376***		0.255***	
	(0.122)		(0.055)	
L.ln FMA (L.ln FSA)	0.144**		0.045*	
	(0.057)		(0.025)	
Observations	624	624	624	624
Countries	41	41	41	41
R-sq	0.44	0.44	0.56	0.56
Long run coeff.: ln R	**-0.38**		**0.10**	
Long run p-val: ln R	0.00		0.01	

Note: Robust standard errors in parentheses. Controls in the imports equations are referred to in parentheses. The long run coefficient for exports in column (1) is calculated as coefficient[L.ln R]/-coefficient[L.ln X], and similarly for imports in column (3). The corresponding p-values presented below the long-run coefficients are calculated with the non-linear test procedure "testnl" in Stata, and indicate the level of significance at which we can reject that the long run-coefficient is zero. In column (2) and (4), the estimated co-integrating relationship is imposed as the error correction term (i.e. the error term from the models presented in table 2). Country and year fixed effects are included.

Table A6: Robustness with respect to alternative controls

	(1) ln X	(2) ln X	(3) ln X	(4) ln X	(1) ln M	(2) ln M	(3) ln M	(4) ln M
ln R	**-0.333*****	**-0.335*****	**-0.374*****	**-0.364*****	**0.084*****	**0.068*****	**0.095*****	**0.110*****
	(0.044)	(0.044)	(0.046)	(0.046)	(0.027)	(0.024)	(0.023)	(0.025)
ln NRGDP	0.888***	0.779***					0.854***	0.799***
	(0.126)	(0.138)					(0.060)	(0.067)
ln GDP			1.038***	0.999***	1.033***	0.941***		
			(0.139)	(0.153)	(0.068)	(0.059)		
ln FSA		0.200***		0.150**				0.270***
		(0.059)		(0.060)				(0.043)
ln FMA			0.192***			0.354***	0.344***	
			(0.072)			(0.050)	(0.053)	
Observations	706	706	706	706	706	706	706	706
Countries	41	41	41	41	41	41	41	41
R-sq	0.70	0.70	0.72	0.72	0.77	0.79	0.79	0.78
$b = \beta * Y/R$	-0.72	-0.73	-0.81	-0.79	0.23	0.19	0.26	0.30
Y/R	2.17	2.17	2.17	2.17	2.73	2.73	2.73	2.73

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject the existence of a unit root in the residuals in all tests. Country and year FE included.

Table A7: Excluding year dummies

	(1) ln X	(4) ln M
ln R	**-0.263*****	**0.099*****
	(0.041)	(0.024)
ln NRGDP	1.178***	
	(0.098)	
ln FMA	0.398***	
	(0.053)	
ln GDP		0.586***
		(0.056)
ln FSA		0.305***
		(0.037)
Observations	706	706
Countries	41	41
R-sq	0.64	0.72
$b = \beta * Y/R$	-0.57	0.27
Y/R	2.17	2.73

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject the existence of a unit root in the residuals in all tests, except four for the imports equation. Country FE included.

Table A8: The pooled common correlated effects estimator (CCEP)

	(1) ln X	(8) ln M
ln R	-0.302***	0.046**
	(0.043)	(0.022)
ln NRGDP	0.632***	
	(0.162)	
ln FMA	0.290***	
	(0.067)	
ln FSA		0.235***
		(0.055)
ln GDP		1.286***
		(0.095)
Observations	706	706
Countries	41	41
R-sq	0.83	0.91
$b = \beta * Y/R$	-0.66	0.13

Note: Robust standard errors in parentheses. We run the same unit root tests as reported in the lower part of table A4 and reject the existence of a unit root in the residuals in all tests. Country and year FE are included. In addition, the pooled common correlated effects (CCEP) procedure means that we include the global means for each year for the dependent and the independent variables interacted with a country dummy. This ensures that global shocks, allowing for heterogeneous impacts across countries, are controlled for.