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The implications of natural resource exports for non-resource trade^{*}

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Abstract

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 show that the response to \$1 of resource revenue is, for our preferred estimates, to decrease non-resource exports by 74 cents and increase imports by 23 cents, implying a negligible effect on foreign saving. The negative per \$1 impact on exports is larger for manufactures than for other sectors, and particularly large for internationally mobile manufacturing sectors. While standard Dutch disease analysis points to contraction of the tradable sector as a whole, division into non-resource exports and imports is important if, as suggested by much development literature, a higher share of exports to GDP is associated with faster growth. The large negative impact of resources on these exports points to the difficulty resource rich economies face in diversifying their exports.

Keywords: natural resources, Dutch disease, resource curse, trade, exports, imports.

JEL codes: E21, E62, F43, H63, O11, Q33

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1. Introduction

Around one-fifth of world trade is in non-renewable natural resources.¹ In 21 countries such natural resources account for more than 80% of total exports and in 9 of these resource exports are more than 50% of GDP (IMF 2007, 2012). One of the ways in which natural resources affect these countries is through the impact of foreign exchange earnings from resource exports on non-resource trade. The balance of payments condition implies that resource exports must be 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 displace 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 the non-resource tradable goods sector, possibly with adverse effects on real income if there are external benefits to tradable production. Theoretical modelling, from Corden and Neary (1982) through to Sachs and Warner (1997) and Arezki and Ismail (2013), is based on models that distinguish between tradable and non-tradable goods, but do not disaggregate within tradables.² This aggregation masks heterogeneity within the traded goods sector which, we think, is important for understanding the economic impact of natural resources. If resource exports displace other exports then the volume of trade is unchanged, while production of these exports decline. Alternatively, if the economy spends earnings from resource exports on additional imports, then total trade increases and non-resource export sectors may be unscathed.

This matters, as both theoretical and empirical work points to the importance of the level and composition of trade for growth and development. On the theory side, if there are product-level increasing returns to scale then exporting to the world market can raise productivity in a way that import competing production for a small domestic market cannot. Empirically, growth accelerations are associated with increases in the ratio of trade to GDP (Jones and Olken 2008, Hausmann et al. 2005), and many sustained growth stories are associated with high levels of manufacturing exports (Johnson et al. 2006). Exporting firms typically have higher productivity than import competing firms (Bernard et al. 2012), and more sophisticated export bundles are associated with faster growth (Hausmann et al. 2007). A repeated concern of policy makers in resource rich economies is the difficulty faced in establishing a more diversified export bundle

¹ We focus on non-renewables, defined as fuels plus minerals, in line with the ‘resource curse’ literature. Such exports (in particular their time variation) can reasonably be taken to be exogenous, as discussed in section 3.3.

² An exception is Chen and Rogoff (2002).

and economic base. Given these research findings and policy concerns, it is important to establish the extent to which contraction of the non-resource tradable sector occurs as a lower level of exports or a higher level of imports (and lower import competing production). 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 \$1 of resource exports. Imports rise by 23c per \$1, due to 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 other items of the balance of payments (they imply foreign saving of just 3c per \$1). A corollary is that the overall increase in trade is quite modest; for each \$1 increase in resource exports these estimates imply that total exports increase 26c ($1 - 0.74$) and imports go up 23c.

Disaggregating across products, the negative impact on exports is greater for manufacturing products than for food and agriculture. On average, each \$1 of resource exports reduces manufacturing exports by 46c, i.e. more than half the export reduction falls on manufactures, although manufactures account for less than half of non-resource exports of goods and services. Within manufacturing, exports from sectors that consist of relatively footloose producers and are likely to be relatively advanced seem to be hardest hit. In particular, we find that sectors that produce goods with low transportation cost are most sensitive to natural resource exports. 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.

Taken together, the results suggest that resource exports are damaging for other export sectors, particularly so for relatively advanced manufacturing exports, likely to be the type of activity that developed countries would like to keep and developing countries would like to attract. Together with the literature on the importance of trade and manufactured exports for growth, these findings point to the difficulty that resource rich countries face in achieving diversification and more broadly based economic growth.

In its focus on elements of trade and the balance of payments, the present paper is distinct from existing empirical literature on the Dutch disease, which looks at the effect of natural resources on the real exchange rate or on production. The effect of commodity prices on the real exchange rate is studied by Cashin et al. (2004) and Chen and Rogoff (2002), who 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 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, and Prati and Tresselt (2006) find negative associations between aid and the balance of trade, and between aid and exports.³ Our results are consistent with these, but go beyond them in quantifying the effects of resource exports on the trade performance of different sectors.

The next section of the paper sets out our conceptual framework and the econometric strategy. Section 3 presents empirical estimates of aggregate responses, together with dynamic effects. Section 4 looks at heterogeneity, exploring the way in which responses vary across sectors and across country types. Section 5 addresses the robustness of our results, and section 6 concludes.

2. The model

The relationships we investigate take the general form

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

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} , total imports of goods and services minus resource imports.⁴ 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 2000-2006.⁵

Resource revenues affect non-resource exports and imports through two principal mechanisms. One is direct spending of the revenues, this creating domestic demand for imports and for exportables. The other is through a price effect; additional spending on non-tradables

³ There is now also a literature on sub-national impacts (U.S. counties), prompted largely by the recent oil and gas boom in the U.S. Jacobsen and Parker (forthcoming) and Michaels (2010) study the impact on a variety of outcome measures, while Allcott and Keniston (2014) study responses in manufacturing industries. They find that resource booms have a positive effect on local manufacturing, principally through the supply of inputs to the sector.

⁴ We are also able to back out the effects on the non-resource balance, $NRB = X - M$. 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 (including workers' remittances).

⁵ We choose this time-period for defining net resource exporters because of the unbalanced character of our panel. See table A2 for details. We provide robustness checks to other sample definitions in appendix 6.

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

2.1 The impact of resources on non-resource trade:

The main ingredients of a Helpman-Krugman trade model are familiar. This section outlines such a model and makes the extensions needed to apply it to the effect of resource revenues on non-resource trade.

A representative consumer in country j has utility function

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

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

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

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 in each country, x_{ij} , are

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

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),

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

⁶ The model focuses on ‘the spending effect’ and abstracts from the ‘resource movement effect’ (Corden and Neary 1982). The two effects are qualitatively the same for our objects of interest: contraction of the non-resource tradable sector and division of the contraction between imports and exports. Our econometric estimates capture the combined effect.

We focus on a particular country (country 1) to show how resource exports affect trade. Adding country 1's bilateral trade flows with other countries, country 1 imports and non-resource exports are

$$M_1 = E_1 G_1^{\sigma-1} FSA_1, \quad FSA_1 \equiv \sum_{i>1} n_i (p_i T_{i1})^{(1-\sigma)}. \quad (6)$$

$$X_1 = n_1 (p_1)^{1-\sigma} FMA_1, \quad FMA_1 \equiv \sum_{j>1} (T_{1j})^{1-\sigma} E_j G_j^{\sigma-1}, \quad (7)$$

The variables FMA_1 and FSA_1 are foreign market access and foreign supplier access and give the effect of trade barriers and 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.

The effect of the domestic economy on trade flows enters (6) and (7) through variables E_1 , n_1 , p_1 , and G_1 , and to find these the supply side of country 1 has to be specified. We suppose that country 1 has exogenous labour endowment L_1 and resource exports R_1 . Non-tradable production is perfectly competitive and uses one unit of labour to produce 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 $p_1 L_1 + R_1$ 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

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

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) with (7), as

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.

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

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 , which in turn determine imports and non-resource exports, (6) and (7).

Equilibrium values of these variables depend on resource exports, R_1 . The dependence is not transparent, but can be found by linearising (8) – (11), as explained in appendix 2. It can be established that an increase in R_1 unambiguously increases p_1 , G_1 and E_1 , while reducing n_1 , the number of varieties of tradables produced in country 1. The focus of the present paper is the impact of an increase in R_1 on non-resource exports and imports. Defining $\varsigma \equiv X_1 / n_1 p_1$ as the share of output of the tradable goods sector that is exported, the linearization establishes that, for a small change around $R_1 = 0$,

$$\frac{-dX_1}{dR_1} = \frac{\sigma[1 - \varsigma\mu] + \varsigma - 1}{\sigma[2 - \varsigma] + \varsigma - 1} \geq 0, \quad \text{with} \quad \frac{dM_1}{dR_1} = 1 + \frac{dX_1}{dR_1}. \quad (12)$$

For $\sigma > 1$ and $\mu, \varsigma \in (0,1)$ these expressions imply that resource exports reduce non-resource exports, $dX_1 / dR_1 < 0$, and raise imports, $dM_1 / dR_1 > 0$. Providing the share of tradables in the economy is not too large (see appendix), the export response is likely to be greater than the import response the more open is the economy (the higher the share tradable goods sector output exported, ς) and the larger is σ , the elasticity of export demand. Thus, for $\mu = 0.3$ and $\sigma = 6$, if $\varsigma = 0.5$ then for each \$1 of R , non-resource exports fall by 54c and imports rise by 46c; if $\varsigma = 0.8$ then non-resource exports fall by 62c and imports rise by 38c. While we have presented the model for a single tradable goods sector, it is readily extended to several sectors and, sector by sector, the loss of exports is greater the larger are (sectoral) ς and μ . These theoretical predictions are consistent with empirical results presented in following sections.

In addition to illustrating differential responses of imports and non-resource exports to resource exports, this model also provides a gravity underpinning that is used in the following econometrics. The dependence of country 1 imports and exports on conditions in the rest of the world are summarised in foreign market and supplier access, FMA_1 and FSA_1 , (equations (6) and (7)). 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 trade flows that are our focus, and are used as controls in the following econometrics.

2.2 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). The previous sub-section 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 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 the absolute changes in non-resource exports and imports per unit resource exports $b_X \equiv \beta_X X_{it} / R_{it}$, $b_M \equiv \beta_M M_{it} / R_{it}$; 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.¹⁰

A concern when estimating (13) and (14) is endogeneity bias, as non-resource trade and

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

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.

resource exports could be determined by a background factor not picked up by our controls. Given our comprehensive controls, we assume in sections 3.1 and 3.2 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 technical considerations which govern the rate of extraction from each oil field or mine. In section 3.3 we relax this assumption and use country-specific resource price indexes to instrument for the value of resource exports. The indexes are from Bazzi and Blattman (2014) and based on global resource prices and country-specific weights. We show that any endogeneity bias in our estimates is small.¹¹

A full definition of variables and description of data are given in appendix 3. Both our cross section analysis and the panel data analysis are based on the period 1970 – 2006 and we limit our sample to countries with net-resource exports above one percent of GDP on average over 2000 - 2006. The panel-data unit root tests used to detect cointegration and ensure that our estimates are not spurious, require that there are no gaps in the data and at least six observations per country. We have, for countries with a gap, used the longest period without gaps. We end up with 706 observations over 41 countries classified as resource net-exporters. Table 6 splits the sample according to resource dependency and income levels, while Table A7 presents estimates for larger samples. The main findings of this paper are robust to different sample definitions. We cluster standard errors at the country-level to take into account potential serial-correlation in the residuals.

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 and the Gulf States – have had resource revenues for a long period of time, and have never developed significant non-resource 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. 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 effects, b_X , b_M , obtained by multiplying the estimated elasticity, β , by the ratio of the

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

average values of the dependent variable ($Y = X, M$) and R . An additional \$1 of resource exports reduces non-resource exports by 39 cents and increases non-resource imports by 42 cents.

These results are consistent with our model, 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.

Table 1: Cross-section

	ln X	ln M
ln R	-0.246 [*] (0.129)	0.192 ^{**} (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 ^{**} (0.058)	-0.008 (0.029)
Constant	-3.900 (2.585)	-3.578 ^{**} (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 not significant.

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, and dynamics towards the long-run in section 3.4.

The panel-data unit root tests reported in the lower part of appendix Table A4 reject the existence of a unit root in the residuals, indicating a cointegrating relationship. The resource export variable is significant at the 1% level in the non-resource export equation, while it is just about not significant in the non-resource imports equation.¹² As can be seen in the lower part of the table (row $b = \beta \cdot Y/R$), these elasticities translate to a 74c crowding out of exports and 23c increase in imports per \$1 increase in resource exports. The estimated standard errors imply 90% confidence intervals of [-1.08c, -41c] for exports and [-0.02c, 48c] 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.

Table 2: Panel data

	(1) ln X	(4) ln M
ln R	-0.343*** (0.093)	0.085 (0.056)
ln NRGDP	0.835*** (0.239)	
ln FMA	0.197 (0.129)	
ln GDP		0.878*** (0.133)
ln FSA		0.261*** (0.074)
Observations	706	706
Countries	41	41
R-sq	0.32	0.40
$b = \beta \cdot Y/R$	-0.74	0.23
b , 90% confidence interval	[-1.08, -0.41]	[-0.02, 0.48]
Y/R	2.17	2.73
Test, $H_0: \beta_x = -\beta_M$	$\chi^2(1) = 3.16$, p-value = 0.08	

Note: Standard errors clustered at the country-level in parentheses. The imports effect has a p-value of 0.127. It is significant at the 1% level when we use robust standard errors. Panel estimates throughout obtained by “xtivreg2” in Stata. Test across models performed by “suest” in Stata with standard errors clustered at country-level. 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.

¹² The p-value for the resource exports coefficient in the non-resource imports equation is 0.127. All tables in this paper use standard errors clustered at the country-level to account for potential serial correlation in the residuals. If we instead use robust standard errors, the resource exports coefficient becomes significant at the 1%-level.

These panel results indicate that the resource effect falls more heavily on non-resource exports than on imports, impacting exports harder than was found in the cross-section. 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 had resource discoveries during the sample period may have undergone adjustments in their tradable goods sectors. This would be picked up in the panel estimates, but not necessarily in the cross sectional estimates.

3.3 Endogenous resource exports

The estimates presented above rely on the exogeneity of resource exports, i.e. they should be uncorrelated with the error terms in (13) and (14) or an endogeneity bias may occur.¹³ Since markets for natural resources are global, it is reasonable to assume that resource exporters are price-takers.¹⁴ We take advantage of this exogenous price variation to instrument resource exports with a country-specific resource price index constructed by Bazzi and Blattman (B&B, 2014). Appendix 5 presents details on the instrument and Table 3 presents results.

The lower panel of Table 3 presents the first stage estimates; column (1) for the export relationship and column (3) for the import relationship, only differing by the controls. As expected, the export price index is positively correlated with resource exports with significance at the one percent level. The F-statistics, the under-identification test (Kleibergen-Paap rk LM test) and the partial R-squared reported in the middle of Table 3 suggest that the instrument predicts resource exports with acceptable strength.¹⁵

Moving on to the second stage estimates reported in the upper panel of Table 3, 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 -0.38 with IV, compared to -0.35 with OLS. This indicates very small, if any, bias in the OLS-estimates. Turning to imports, the OLS may slightly under-estimate the effect, with an estimated elasticity of 0.18 in the IV-model and 0.09 in the OLS-model. These IV-elasticities translate into -71 and +43 cents change in non-resource exports and imports, respectively, implying small negative savings. We find it comforting that the IV-results are so similar to the OLS-results, which may

¹³ Hsiao, C. (1997) discusses identification under cointegration.

¹⁴ 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).

¹⁵ Note that the instruments is very strong when we use robust standard errors instead of standard errors clustered at the country-level, with F-statistics of 34 and 41 for non-resource exports and imports, respectively.

indicate that exogeneity of resource exports is a reasonable assumption in our setting.

Table 3: Instrumental variable estimation

Second stage and OLS

	(1) ln X IV	(2) ln X OLS	(3) ln M IV	(4) ln M OLS
ln R	-0.380*** (0.122)	-0.349*** (0.090)	0.172*** (0.046)	0.086 (0.057)
ln NRGDP	0.791*** (0.256)	0.792*** (0.250)		
ln FMA	0.238 (0.251)	0.217 (0.171)		
ln GDP			0.787*** (0.118)	0.846*** (0.126)
ln FSA			0.330*** (0.091)	0.328*** (0.084)
Observations	591	591	591	591
Countries	36	36	36	36
R-sq	0.69	0.69	0.77	0.78
$b = \beta * Y/R$	-0.71	-0.65	0.43	0.22
Y/R	1.86	1.86	2.52	2.52
F-statistic first stage	8.13		11.03	
Part. R-sq instrument	0.15		0.18	
Underidentification test p	0.03		0.02	

First Stage

	ln R	ln R
Resource Price Index	0.122*** (0.043)	0.131*** (0.040)
ln NRGDP	0.066 (0.493)	
ln FMA	0.438 (0.350)	
ln GDP		0.748 (0.631)
ln FSA		-0.030 (0.445)
Observations	591	591
R-sq	0.49	0.50

Note: Standard errors clustered at country-level in parentheses. The coefficients on ln R are significant at the 1% - level and the F-stats for the first stage are 34 and 41 when we use robust standard errors. 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.

Given the similarity between the OLS- and IV-estimates, we choose to move ahead with OLS. This comes with the benefits of a larger sample, which will be important when we slice up the sample to investigate heterogeneity. The OLS estimates also allows for effects of both quantity and price changes, whereas the IV-estimates rely on variations in prices only. 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. For example Arezki et al. (2015) find that news about giant oil discoveries have rapid effects on the current account, saving rate and investments. Some of these investments may be to develop production capacity from the new oil fields, as was the case in Norway in the 1970s. This is an example where a quantity shock plays a different role than a similarly sized price shock.¹⁶

3.4 Speed of adjustment

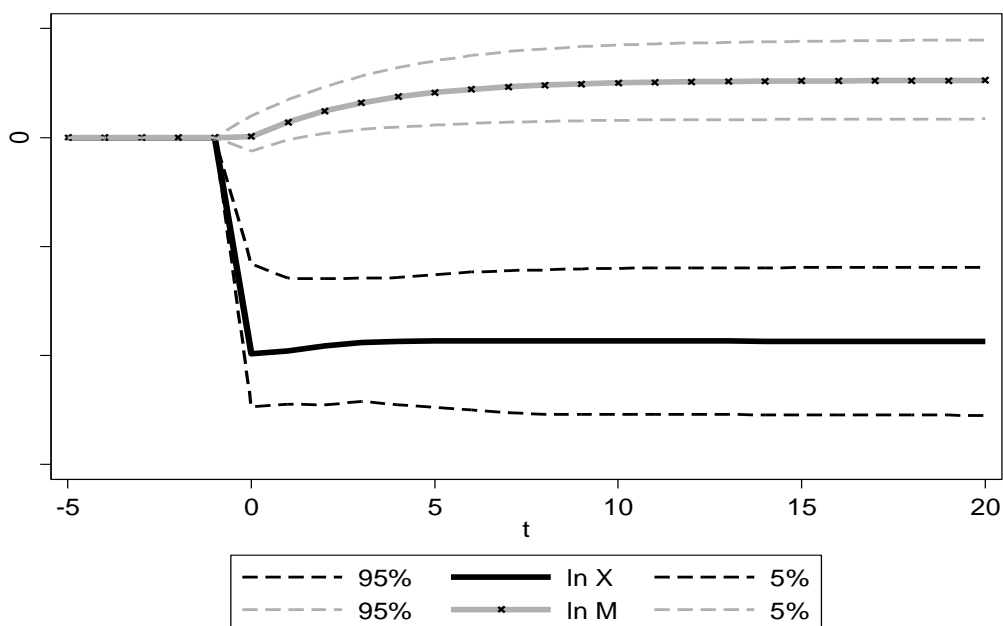
Theory suggests that a number of factors will affect the speed at which the economy adjusts to windfalls. One is the extent to which a windfall is expected to be permanent or temporary; if temporary, adjustment might not be to the full annual value of the windfall, but only to an estimate of its permanent income equivalent. A second concerns the speed with which the exchange rate and domestic relative prices change, and a third is to do with the speed with which the quantity side of the economy can adjust (see van der Ploeg and Venables 2013).

We add dynamics by estimating an error correction models (with a lagged dependent variable and only contemporaneous first differences of the other variables) of the relationships (13) and (14). 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 – and the exchange rate – may begin to adjust at the date of announcement of the resource discovery, triggering early and rapid structural change

¹⁶ 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. With robust standard errors, this difference was statistically significant at the eight percent level and 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.

(e.g. Arezki et al. 2015). Much of the import response is delayed, coming through only once revenue from the resource discovery is accruing to domestic agents.¹⁷

Figure 1: Speed of adjustment



Note: The graph shows the response in log points to a permanent increase in $\ln R$ of 0.01, based on the estimated models presented in column 1 and 3 in table A8 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).

4. Heterogeneity

4.1 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

¹⁷ 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 (2013) for theory and evidence on the latter. We leave it for future research to identify present value effects in our context.

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 4 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 displacement effect is much larger for manufactures than for food and agriculture, with services intermediate. The elasticity is more than twice as large in manufacturing as in agriculture, and the difference is significant.¹⁸ A high manufacturing elasticity might be expected since manufacturing is relatively ‘footloose’, compared to agriculture’s dependence on land, a sector-specific and non-tradable factor. The absolute changes per \$1 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 \$1 of resource exports, while food and agricultural exports fall by 6c and service exports by 17c.

We have also disaggregated further and estimated effects on exports across 20 3-digit manufacturing sectors (results available on request). The only sector with a significantly positive coefficient on natural resource exports was chemicals, as might be expected given that natural resources are important inputs to this sector. Exports of printing, machinery, and electronic equipment were significantly negatively affected by exports of natural resources.¹⁹

¹⁸ Cross-equation tests confirm statistically significant difference between β_{Xaf} and β_{Xma} ($\chi^2(1) = 7.80$, $p = 0.01$), but not between β_{Xma} and β_{Xsv} ($\chi^2(1) = 1.52$, $p\text{-value} = 0.22$).

¹⁹ Using robust standard errors instead of standard errors clustered at the country-level, the following additional sectors have a significant negative coefficient: textile products, plastics, computers and furniture. Chemicals was still the only sector with a significant positive coefficient. Estimation results available on request from the authors.

Table 4: Product disaggregation

	(1) ln Xaf	(3) ln Xma	(5) ln Xsv	(8) ln Maf	(10) ln Mma	(12) ln Msv
ln R	-0.171 [*] (0.089)	-0.395 ^{***} (0.133)	-0.266 ^{***} (0.061)	0.075 [*] (0.039)	0.088 (0.076)	0.159 ^{***} (0.054)
ln NRGDP	0.010 (0.342)	0.795 ^{**} (0.385)	1.165 ^{***} (0.232)			
ln FMA	0.026 (0.178)	0.239 (0.326)	0.061 (0.157)			
ln GDP				0.771 ^{***} (0.166)	0.985 ^{***} (0.212)	0.694 ^{***} (0.181)
ln FSA				0.027 (0.102)	0.287 ^{**} (0.141)	0.259 ^{**} (0.125)
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: Standard errors clustered at the country-level in parentheses. The exports effect for agriculture and the imports effects for agriculture and manufacturing are significant at the 1%-level when we use robust standard errors. 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.

One determinant of the extent to which an industry is affected is how footloose firms are, this showing up in the theory model of section 2.2 as a high share of trade in sectoral output. Although we do not observe footlooseness directly, a proxy used in the literature is the tradability of output, as measured by trade costs (Ederington et al. 2005). Holmes and Stevens (2014) estimate a measure of transportation cost (TC) for 466 NAICS 1997 industries, and we interact this measure with resource exports in order to explore the cross-industry responses. Results based on 3-digit manufacturing sectors (20 sectors) are given in Table 5. The TC measure in column 1 is the simple average of TC per sector, while column 2 uses a dummy taking one if the simple average of TC is above a threshold value.²⁰ The interaction terms are positive and significant, confirming that lower trade costs – proxying for footlooseness of the

²⁰ The variable we label TC is the constant distance elasticity, $\eta^{\log-\log}$, estimated by Holmes and Stevens (forthcoming). Following Allcott and Keniston (2014), we take 0.8 as threshold of ‘highly tradable goods’.

sector – are associated with a larger negative effect of resources on non-resource exports, as suggested by theory.²¹

Table 5: Sectoral exports and sectoral tradability

	(1) ln X	(2) ln X
ln R	-0.143* (0.074)	-0.072* (0.039)
ln R x TC sector mean	0.157* (0.095)	
ln R x D = 1 if TC > threshold		0.107* (0.062)
ln NRGDP	0.927*** (0.137)	0.927*** (0.138)
ln FMA	-0.047 (0.096)	-0.047 (0.096)
Constant	-5.845* (3.107)	-6.638** (3.241)
Observations	11317	11317
Countries	40	40
R-sq	0.79	0.79

Note: Log exports (ln X) per 3-digit manufacturing sector as dependent variable. The 3-digit code refers to NAICS 1997 classification. Based on Comtrade data for 1984-2006. Two-way clustered standard errors in parentheses: country-sector and country-year. The coefficients on ln R and its interactions are significant at least at the 5%-level when we use robust standard errors. We run the same Fisher tests reported in the lower part of Table A4 and always reject a unit root in the residuals. We have insufficient number of observations to run the IPS-tests. Country and sector-year FE included.

4.2 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 the country sample split by level of resource dependency and per capita income, and then investigate the role of governance as measured by

²¹ These results are consistent with Alcott and Keniston (2014), who look at the effect of resource booms across U.S. counties. Some of their effects may reflect relocation of economic activity within the U.S., while our estimates are based on national data.

rule of law and control of corruption. We end the section by combining the heterogeneity across different products explored in section 4.1 and the heterogeneity across countries in terms of governance measures.

The left hand side of Table 6 presents the estimates when we split the sample according to resource dependency, defined relative to median net resource exports as a share of GDP over 2000-2006.²² 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 \$1 responses ($b = \beta * Y/R$, penultimate row) are smaller. The main message is that for highly resource dependent economies the trade impact is relatively small, and more of the impact, 64c per \$1 ($= 1 - 0.32 - 0.04$), is borne by other parts of the balance of payments including foreign saving and remittances. This is consistent with the fact 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 \$1 and raising imports by 51c, suggesting dissaving.

The right hand panel of Table 6 divides the sample by per capita income (as classified by the World Bank in 2009). Countries with higher income have a larger export response and smaller import response, both in terms of the elasticity and the per unit effect. For the high income group each \$1 of resource exports reduces other exports by 91c, compared to 47c in the lower group. 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 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 4, 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.

²² See appendix table A2 for a list of the countries.

Table 6: Heterogeneity; income groups and resource dependency

	Resource Dependency				Income Groups			
	Highly dependent		Less dependent		High/ Upper middle		Lower middle/ Low	
	(1) ln X	(4) ln M	(1) ln X	(4) ln M	(5) ln X	(6) ln M	(7) ln X	(8) ln M
ln R	-0.611*** (0.049)	-0.038 (0.040)	-0.150*** (0.039)	0.118*** (0.042)	-0.406*** (0.108)	0.054 (0.069)	-0.283*** (0.060)	0.119*** (0.031)
ln NRGDP	0.958*** (0.292)		0.957*** (0.221)		0.697*** (0.218)		1.293*** (0.427)	
ln FMA	-0.060 (0.126)		0.245* (0.137)		0.194 (0.130)		0.674** (0.334)	
ln GDP		1.056*** (0.080)		0.690*** (0.168)		1.030*** (0.162)		0.482*** (0.122)
ln FSA		0.040 (0.102)		0.262** (0.109)		0.210*** (0.052)		0.203 (0.222)
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: Standard errors clustered at country-level in parentheses. The coefficient on ln R for high/upper middle income is significant at the 10%-level when we use robust standard errors. 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. Income groupings are based on the World Bank's country classification. Results are similar if we divide countries at median GDP per capita (2005, at PPP). 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. Country and year FE included.

The quality of governance is an important aspect of countries' responses to resource wealth.²³ 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 relatively slower growth, and Mehlum et al. (2006) nuanced this finding, showing that only countries with poor institutions suffer this negative effect. In the same spirit, Andersen and Aslaksen (2008) found that the negative effect is present in democratic presidential countries and not in parliamentary countries. More broadly, Acemoglu and co-authors have investigated the relationship between institutions and 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?

²³ See Ross (forthcoming) for a survey of this extensive literature.

To answer this question we interact resource exports with two measures of governance, rule of law and control of corruption;²⁴ a higher score on each measure, the better the governance is held to be. Results are reported in Table 7, 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 exports, meaning that better governance amplifies the negative effect of resource exports on non-resource exports. The lower part of Table 7 quantifies this by evaluating effects at the levels of two specific countries, Chile (CHL) and Ecuador (ECU). Of our 41 countries, Chile ranks as 4 on both indicators, only behind Norway, Canada and Australia; Ecuador has relatively low scores, ranked 27 on rule of law and 32 on control of corruption. The difference in effects is large, with a much larger export displacement effect for Chile than Ecuador (-96c compared to -39c for rule of law), and smaller import effect (about 0c compared to 19c).

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,²⁵ and, as we have seen, manufactures are more susceptible to being crowded out by resources. We investigated further by disaggregating by product type, as in Table 4 (results available on request). We find a negative coefficient on the interaction terms for manufacturing exports indicating that, even within manufactures, better rule of law and better control of corruption increase the sensitivity of manufacturing exports to resource exports.²⁶ Thus, compositional effects at the sector level are part of, but not the whole story. It is possible that compositional effects operate at a finer level of disaggregation, as countries with good governance are more likely to attract more ‘footloose’ industry. It is precisely such industry that is likely to be crowded out by real exchange rate effects.²⁷ Additional factors driving this result might include the positive correlation between trade openness and governance, together with the result from the theory that trade openness increases export displacement. Good governance is also associated with better macro-economic management, and there is evidence that governance mitigates the extent to which resource windfalls crowd out non-resource sector GDP growth (Arezki et al. 2011).

²⁴ Interaction variables are measured in deviations from their sample means, i.e. the coefficient on resource exports is the effect at the mean of the interacted variable. All interaction variables are time-invariant, so the country-fixed effects capture their direct effect and there is no need to include them separately in the regressions. We focus on ‘Rule of Law’ and ‘Control of Corruption’ from the Worldwide Governance Indicators (WGI).

²⁵ 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).

²⁶ Interaction coefficients for exports of the two other categories and for imports were not significant. The coefficient on $\ln R$ was always negative and significant for exports. For imports, it was always positive and often significant.

²⁷ 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 7: Heterogeneity; governance

	(1) ln X	(3) ln X	(6) ln M	(8) ln M
ln R	-0.386*** (0.076)	-0.376*** (0.079)	0.068 (0.055)	0.073 (0.055)
ln R x Rule of Law	-0.147** (0.061)		-0.055 (0.045)	
ln R x Control of Corruption		-0.151** (0.068)		-0.051 (0.045)
ln NRGDP	0.900*** (0.239)	0.872*** (0.235)		
ln FMA	0.192 (0.119)	0.181 (0.119)		
ln GDP			0.898*** (0.140)	0.890*** (0.141)
ln FSA			0.276*** (0.083)	0.267*** (0.080)
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 2000 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 2000 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: Standard errors clustered at the country-level in parentheses. The coefficient on ln R in the import columns (3 and 4) are significant at the 1%-level when we use robust standard errors. 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: “interaction var, ECU, CHL” refers to their value of Rule of Law or Control of Corruption; Y/R 2000, ECU, CHL refers to their ratio of X or M to R in year 2000. “interaction var, min, max” refers to the minimum and maximum values of Rule of Law or Control of Corruption observed in our sample, after normalization around the mean. Country and year FE included.

5. Robustness

5.1 Robustness check I: alternative controls

Our export and import equations are embedded 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, the conclusions of the paper are not sensitive to the choice of control variables. Table A5 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 collinearity problem. For exports, we find that the magnitude varies between -72 and -81 cents reduction per \$1 of resource exports. For imports, the magnitude varies between +19 and +30 cents. In column 1 and 2 of table A6 we exclude year dummies from our baseline model of table 2. The magnitude of the export effect drops from -74 to -57 cents and the import effect increases from +23 to +27 cents. We conclude that our results are stable to alternative sets of controls.

5.2 Robustness check II: cross-sectional dependence

An issue receiving considerable attention in the econometric literature on dynamic panels using macroeconomic data is cross sectional dependence.²⁸ Unobserved common shocks across countries may lead to correlation in the error-terms and biased and inefficient estimates (Pesaran

²⁸ See Eberhardt and Teal (2011) for a discussion.

2006). Our inclusion of year fixed effects helps, as they control for cross sectional dependence to the extent the impact of common shocks is identical across countries (De Hoyos and Sarafidis 2006). Theory gives guidance on the sources from which remaining cross sectional dependence may arise, empirically 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, which control for global shocks with differential impacts across countries. The results are presented in column 3 and 4 of table A6 and the messages of this paper are robust to accounting for cross-sectional dependence.

5.3 Robustness check III: alternative samples

In Table 6, we split our sample of 41 countries according to resource dependency and income level. In Table A7, we instead expand the sample by defining it based on countries gross exports of natural resources a share of GDP. Inclusion of countries with more than five percent of GDP as gross resource exports gives us 47 countries in total, 2.5% gross natural resource exports of GDP gives 65 countries, 1% gives 90 countries and more than zero percent gives 114 countries. The upper panel presents the estimates for non-resource exports and the lower for non-resource imports. The effect of natural resource exports on non-resource exports is always negative and significant at least at the five percent level, while the effect on non-resource imports is positive in all cases and significant at least at the ten percent level for the three largest samples. For \$1 of resource exports, non-resource export falls by between 74c and 109c and non-resource imports increase by between 13c and 69c. Interestingly, the change in exports is always larger than the change in imports in dollar terms and we conclude that expanding the sample does not alter the main message of this paper. Note, however, the tendency towards negative savings out of \$1 extra resource exports as the sample gets larger.

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 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 displace non-resource exports, at a rate of around 75c to a \$1 of resource exports, while drawing in imports at around 25c per \$1. These estimates imply very little response in savings (foreign asset accumulation), although this varies across countries. Export displacement is particularly severe for footloose manufactures, precisely those sectors that many resource rich developing economies want to diversify into. 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 exports of manufactures, rather than agriculture and food or services. Thus, on average, each \$1 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.

Overall, our results point to the challenge that resource rich economies face in diversifying their exports. This is a widely expressed goal, yet our results point to the fact that – on average – exports in the sectors that countries wish to grow are displaced by resource exports. These findings are valuable to policy makers in resource rich countries who need to know how their non-resource trade is likely to be affected by resource exports and, in formulating diversification strategies, to know which sectors are more or less vulnerable to the adverse effects of natural resource abundance.

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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_n and u , as a function of R . The

effect of variation in R can be found by totally differentiating and rearranging to give $\frac{du}{dR} = \frac{1}{e}$,

$$\frac{dp_n}{dR} = \frac{1}{(r_{nn} - e_{nn})} \cdot \frac{e_n}{e} > 0. \quad \text{Non-resource exports are } X = r_x - e_x u \text{ and imports } M = r_m - e_m u.$$

Totally differentiating and using expressions for the change in p_n and u ,

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

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 (8) – (11) implicitly define the variables E_1, n_1, p_1 , and G_1 . We linearise around the equilibrium where $R_1 = 0$, denoting the share of exports in tradable production by $\varsigma \equiv X_1 / n_1 p_1$. Units are chosen such that $L_1 = 1, n_1 = \mu$, and hence $E_1 = \mu p_1$ (eqn. 8). Noting that $R_1 = 0$ implies that $X_1 = M_1$, eqns (6) and (7) are $\varsigma = p_1^{-\sigma} FMA_1 = G_1^{\sigma-1} FSA_1$. At this equilibrium p_1 , and G_1 satisfy (10) and (11) which both reduce to $1 = \mu(p_1 / G_1)^{1-\sigma} + \varsigma$. Evaluating differentials at these values of endogenous variables gives the following equations for the non-resource exports displaced by resource exports, $-dX_1 / dR_1$, and the change in the real exchange rate, dp_1 / dR_1 :

$$\frac{-dX_1}{dR_1} = \frac{\sigma[1 - \zeta\mu] + \zeta - 1}{\sigma[2 - \zeta] + \zeta - 1} \geq 0, \quad \frac{dp_1}{dR_1} = \frac{(1 - \zeta)[1 - \zeta(1 - \mu)]}{\mu\zeta[\sigma(2 - \zeta) + \zeta - 1]} > 0.$$

An increase in R_1 has a larger impact on X_1 than on M_1 if $-dX_1/dR_1 > 1/2$, i.e. if

$\zeta[1 + \sigma(1 - 2\mu)] > 1$. Providing $\mu < 1/2$, this is satisfied for large enough ζ, σ .

Appendix 3: Data

Data on GDP (*GDP*) and aggregate trade are from World Development Indicators (WDI).²⁹ Trade measures are exports and imports of goods and services (BoP), resource exports and imports covering fuel, metals and ores (R is defined as gross resource exports); 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 analogously. 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 sector-specific exports are from Comtrade.³⁰ They cover 1984-2006 and are aggregated from SITC 4 digit product classification to NAICS 1997 3-digit classification.³¹

Data on bilateral non-resource exports used in the gravity estimation are also from Comtrade. 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.³²

The Comtrade data and the trade data from WDI are in our analysis measured in 2000 USD, i.e. their original current USD values are deflated 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 GDP variables are from WDI. *GDP* is also measured in 2000 USD.

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).³³ The data are in 2005 USD.

²⁹ See: <http://publications.worldbank.org/WDI/>

³⁰ See: <http://wits.worldbank.org/wits/> and appendix 4 for details.

³¹ For the concordance, see: <http://www.nber.org/lipsey/sitc22naics97/>

³² See: <http://www.cepii.fr/anglaisgraph/bdd/distances.htm>

³³ See: <http://unstats.un.org/unsd/snaama/dnlList.asp>

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."³⁴

As a measure of transportation cost we use the log-log estimates presented by Holmes and Stevens (forthcoming). We aggregate to NAICS 1997 3-digit and 4 digit sectors by taking the simple average across all products within sectors. Figure ABLA gives an impression of the variation of transportation costs across product at the 4 digit level per 3-digit sector.

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	13.55	1.70	6.52	16.65
Island dummy	0.10	0.29	0	1
1 if landlocked	0.13	0.33	0	1
RNET/GDP (2000-2006)	14.04	13.21	1.45	45.30
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 (B&B)*	-0.07	3.45	-11.51	13.97
Observations	706			

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

³⁴ 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

$$x_{ij} = s_i t_{ij} m_j, \quad i \neq j. \quad (\text{A12})$$

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

$$X_i = s_i \sum_{j \neq i} t_{ij} m_j, \quad M_i = m_i \sum_{j \neq i} t_{ij} s_j. \quad (\text{A13})$$

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 (A13). 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, colony status, common language, contiguity) for the between country frictions, t . We use non-resource trade and obtain estimates of foreign market access and foreign supplier access,

$$FMA_i = \sum_{j \neq i} t_{ij} m_j, \quad FSA_i = \sum_{j \neq i} t_{ij} s_j. \quad (\text{A14})$$

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 (A12) 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	
In 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 of our components of t 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.

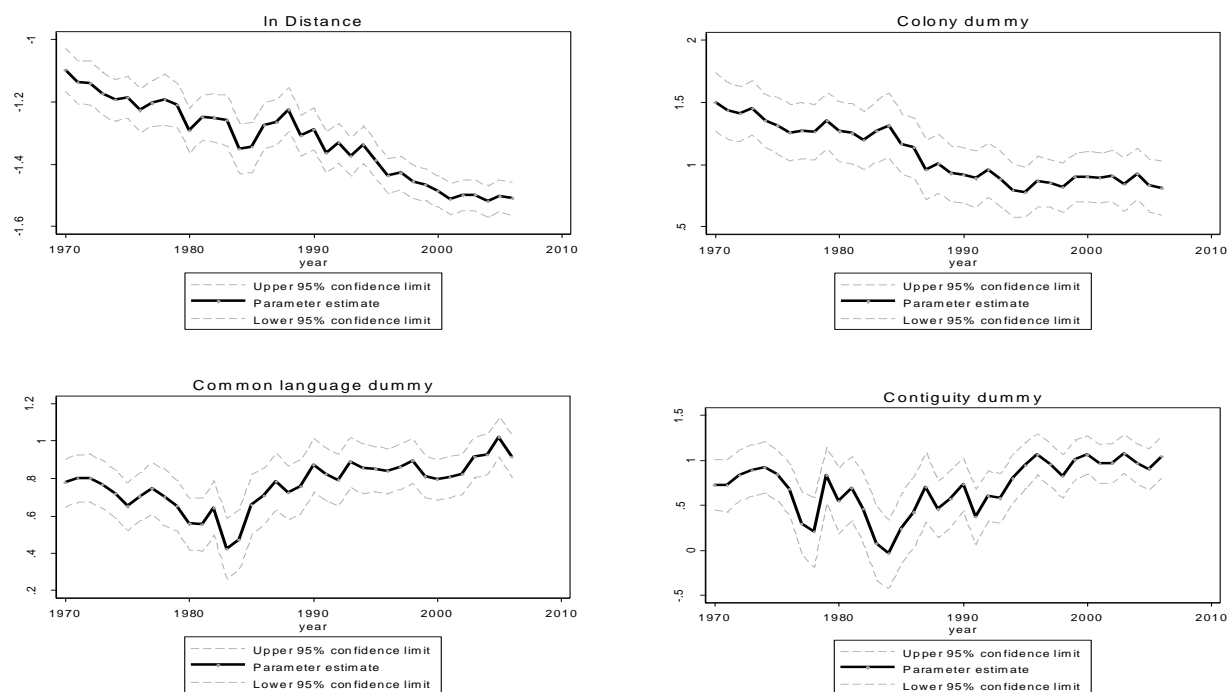
Figure A2: Estimated gravity coefficients and corresponding std. errors

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

As an instrument for resource exports we use a price index based on country and year specific commodity price shocks constructed by Bazzi and Blattman (B&B, 2014). The shocks are calculated as (Bazzi and Blattman, 2014, p. 6): “the annual difference in each country’s log commodity export price index. Each country’s price index is a geometric average of all commodity export prices weighted by lagged export shares.” They use “US dollar denominated prices from international markets.” We choose to use the version of their shock that gives the largest F-statistic in our first stage: the version leaves out 10% top potential price makers and makes no adjustments for the share of resource exports in GDP (this is as their “standard” measure, but the price index is not multiplied with the share of resource exports in GDP). We sum these shocks across time per country to get the price indexes, which are the relevant measures for our long-run estimates. Note that our country fixed effects capture the level of the indexes. When we use robust standard errors, the measure we chose has a F-statistic in the first stage of 34 and 41 in the exports and imports equations, respectively. The results with standard errors clustered at the country-level are presented in Table 3 in the main text.

Appendix 6: Further 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 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 panel-data unit root 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. As is well known 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 (2013) for a recent application of these dynamic panel data procedures.

Table A5 – A7 are discussed in section 5 of the main text.

Table A4: Cointegration tests

	(1) ln X	(4) ln M
ln R	-0.343*** (0.093)	0.085 (0.056)
ln NRGDP	0.835*** (0.239)	
ln FMA	0.197 (0.129)	
ln GDP		0.878*** (0.133)
ln FSA		0.261*** (0.074)
Observations	706	706
Countries	41	41
R-sq	0.71	0.78
$b = \beta * Y/R$	-0.74	0.23
Y/R	2.17	2.73
IPS Z-t-tilde-bar (0 lag)	-5.17	-1.94
p-value	.	.
IPS W-t-bar (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-sq. P (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

Note: Standard errors clustered at the country-level 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 Fisher type tests allow for country-specific autoregressive parameters. "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: Robustness with respect to alternative controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln X	ln X	ln X	ln X	ln M	ln M	ln M	ln M
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
ln R	-0.333*** (0.099)	-0.335*** (0.098)	-0.374*** (0.100)	-0.364*** (0.104)	0.084 (0.060)	0.068 (0.051)	0.095** (0.047)	0.110** (0.054)
ln NRGDP	0.888*** (0.235)	0.779*** (0.261)					0.854*** (0.151)	0.799*** (0.161)
ln GDP			1.038*** (0.248)	0.999*** (0.280)	1.033*** (0.194)	0.941*** (0.131)		
ln FSA		0.200 (0.135)		0.150 (0.120)				0.270*** (0.090)
ln FMA			0.192* (0.106)			0.354*** (0.121)	0.344*** (0.133)	
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: Standard errors clustered at the country-level in parentheses. The coefficients on ln R in column 5-8 are significant at the 1%-level when we use robust standard errors. 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 A6: Excluding year dummies and the pooled common correlated effects estimator (CCEP)

	Excluding year dummies		CCEP	
	(1)	(2)	(3)	(4)
	ln X	ln M	ln X	ln M
ln R	-0.263*** (0.088)	0.099** (0.044)	-0.302*** (0.086)	0.046 (0.053)
ln NRGDP	1.178*** (0.180)		0.632** (0.274)	
ln FMA	0.398*** (0.081)		0.290*** (0.106)	
ln GDP		0.586*** (0.115)		1.286*** (0.151)
ln FSA		0.305*** (0.062)		0.235** (0.100)
Observations	706	706	706	706
Countries	41	41	41	41
R-sq	0.64	0.72	0.83	0.91
$b = \beta * Y/R$	-0.57	0.27	-0.66	0.13
Y/R	2.17	2.73	2.17	2.73

Note: Standard errors clustered at the country-level in parentheses. The coefficients on $\ln R$ in column 2 and 4 are significant at the 1%- and 5%-level, respectively, when we use robust standard errors. 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 two for the imports equation when year FE are excluded. Country FE included in all columns. Year FE included in column 3 and 4. 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 controls for global shocks with potentially heterogeneous impacts across countries.

Table A7: Robustness to larger samples: defined as countries with gross exports of resources larger than a given percentage of GDP 2000-2006

% gross res. exp.	5%	2.5%	1%	0%	
	(1)	(2)	(3)	(4)	(5)
	ln X	ln X	ln X	ln X	ln X
ln R	-0.343*** (0.093)	-0.370*** (0.092)	-0.230*** (0.084)	-0.151** (0.071)	-0.106** (0.053)
ln NRGDP	0.835*** (0.239)	1.290*** (0.173)	0.915*** (0.192)	1.088*** (0.137)	1.099*** (0.123)
ln FMA	0.197 (0.129)	-0.017 (0.055)	0.090 (0.082)	0.052 (0.052)	0.061 (0.046)
Observations	706	763	1101	1712	2193
Countries	41	47	65	90	114
R-sq	0.32	0.72	0.71	0.75	0.77
$b = \beta * X/R$	-0.74	-0.92	-0.75	-1.09	-1.05
Y/R	2.17	2.50	3.24	7.19	9.87

% gross res. exp.	5%	2.5%	1%	0%	
	(6)	(7)	(8)	(9)	(10)
	ln M	ln M	ln M	ln M	ln M
ln R	0.085 (0.056)	0.047 (0.046)	0.082* (0.042)	0.098** (0.040)	0.057** (0.029)
ln GDP	0.878*** (0.133)	1.039*** (0.136)	0.809*** (0.148)	0.862*** (0.121)	0.935*** (0.118)
ln FSA	0.261*** (0.074)	0.135*** (0.044)	0.150** (0.063)	0.078 (0.054)	0.071 (0.051)
Observations	706	763	1101	1712	2193
Countries	41	47	65	90	114
R-sq	0.40	0.81	0.77	0.79	0.80
$b = \beta * M/R$	0.23	0.13	0.29	0.69	0.54
Y/R	2.73	2.87	3.58	7.01	9.47

Note: Standard errors clustered at the country-level. Upper panel for exports, lower panel for imports. Column repeats the results based on our standard sample, which is based on net resource exports being larger than 1% of GDP on average over 2000-2006. The other columns based on gross resource exports (R) as a percentage of GDP being larger than the indicated figure. The list of added countries is available on request from the authors.