# Resources and Relative Prices: A New Puzzle?[1]

PRELIMINARY DRAFT, PLEASE DO NOT CITE

Torfinn Harding
University of Oxford and OxCarre

Radoslaw (Radek) Stefanski
University of Oxford and OxCarre

October 12, 2011

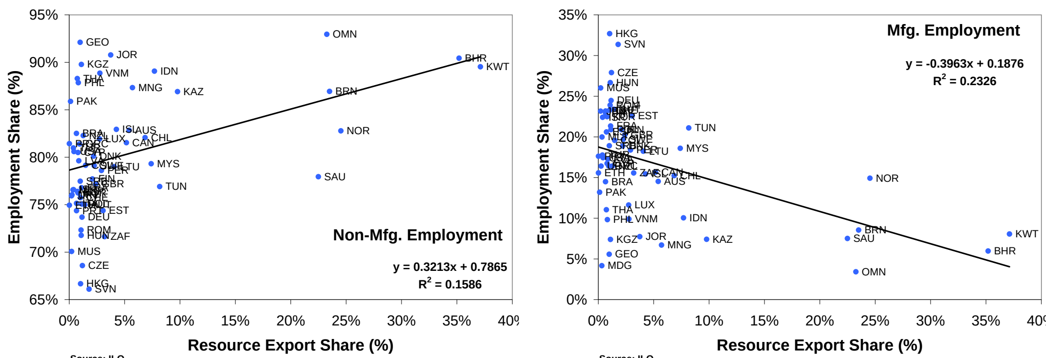
**Abstract**

Standard models of Dutch Disease predict that resource rich regions should experience higher relative prices of non-tradable to tradable products. In this paper we investigate the impact of Dutch Disease triggers like oil exports and foreign aid windfalls on price levels using ICP data, and find no evidence for a positive effect on the relative prices of non-tradable products. Instead, we find a strong and robust negative relationship. We examine whether this stems from a misclassification of traded versus non-traded products in the data, or whether existing models are failing to capture some aspect of the process of de-industrialization.

[1] We would like to thank seminar participants at the University of Oxford and the ETSG conference (Copenhagen) for helpful comments and suggestions. All errors are our own. Emails: torfinn.harding@economics.ox.ac.uk and radek.stefanski@economics.ox.ac.uk

# 1 Introduction

Dutch disease is a process of de-industrialization by which the structure of employment in resource rich countries shifts away from traded sectors to non-traded sectors. The story goes, that natural resource endowments act like a wealth shock resulting in rising demand for both traded and non-traded goods. Whereas traded goods can be imported from abroad, non-traded goods must be produced locally. In order to induce labor to shift from the traded to the non-traded sector (to meet the relatively higher demand for non-traded goods), the relative price of the non-traded sector goods must rise. Models of Dutch Disease thus tend to predict a strong *negative* relationship between relative employment in manufacturing and resource wealth and a strong *positive* relationship between relative prices of non-traded goods and resource wealth. Whilst the first prediction holds in the data, the second prediction and the mechanism driving the first prediction in most models - the rise in non-traded goods prices - appears not to hold.




(a) NM Emp. Shares vs. Resource Export Share (b) M Emp. Shares vs. Resource Export Share

Figure 1: Average Employment shares versus average resource export share for a cross-section of countries, 1980-2006 (Source: ILO, WDI)

As a quick test of this assertion, we take the average export share of natural resources to GDP over the 1980-2006 period as a measure of resource wealth (similarly to Sachs and Warner (2001)). Then, we identifying the manufacturing goods sector with traded goods and the non-resource, non-manufacturing sector with non-traded goods and consider how average relative employment shares in each sector (over the 1980-2006 period) vary with resource wealth across countries (see Appendix for details of data construction). From Figure 1 we see that - indeed - typical resource rich countries devote a smaller proportion of their labor force to the manufacturing sector and a larger proportion of their labor force to the non-manufacturing sector than resource poor countries. This shift of labor, seems to support the Dutch Disease story.

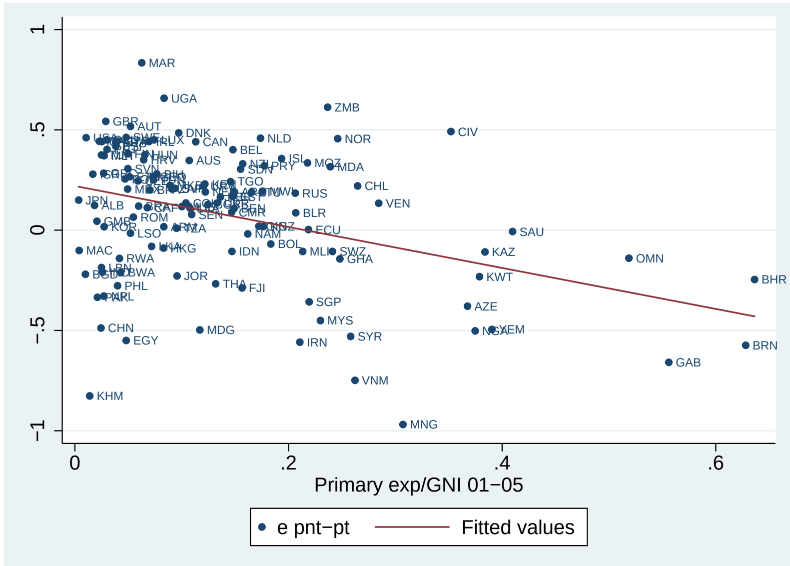



Figure 2: Log price of non-tradables relative to tradables in 2005 versus average resource export share 2001-2005. The relative prices are adjusted for a constant and GDP per capita in constant 2005 PPP prices (Source: ICP, WDI)

Yet, the mechanism that causes the shift of labor in most models - the increase of the price of non-traded goods - seems not to hold. On the contrary, figure 2 indicates that the relative price of non-traded goods falls as gross primary exports as a share of GNI increases.[2] The negative relationship depicted in figure 2 goes against the predictions of standard Dutch Disease models, but turns out to be remarkably robust empirically.

We are thus faced with two possibilities: 1) either regular models of Dutch Disease emphasize an incorrect mechanism driving the reallocation of labor or 2) the aggregate ICP data coupled with the simplicity of our empirical methodology is leading us to draw incorrect conclusions. In what follows, we pursue both paths. First, we examine to what extent regular models of Dutch Disease can generate a reallocation of labor across sectors whilst generating prices that - to the observer - appear to decline with resource wealth. Second, we tighten our empirical analysis by considering disaggregation, different definitions of tradability, numerous data sets and more sophisticated methods of statistical identification. In this paper we thus investigate whether there is a puzzle between model and data in the resource literature.

[2] Publicly available ICP data for the year 2005, gives price levels of varies categories of goods across countries relative to the United States. The relative price in Figure 2 is the residual from a regression with the difference between the log price of non-traded and traded goods as the dependent variable, and a constant and GDP per capita as independent variables. The ICP sectors are categorized into traded and non-traded by following Hsieh and Klenow (2007).

## 2 Resources, De-industrialization and Prices

In this section, we show how a standard, multi-sector model with trade generates a Dutch Disease story that is consistent with the employment data - higher endowments of natural resources cause labor to reallocate from (traded) manufacturing to (non-traded) non-manufacturing. We also demonstrate that such models predominantly generate this reallocation through changes in prices of (non-traded) non-manufacturing.

**Households** Suppose there is a measure one of identical agents. Furthermore, assume each agent's preferences are given by:

$$\left((c_s + \bar{s})^{\frac{\sigma-1}{\sigma}} + \nu c_m^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $c_s$ is consumption of non-traded (mostly service) goods, $c_m$ is consumption of traded (mostly manufacturing) goods, $\nu$ determines the relative taste for traded goods and $\sigma$ is the elasticity of substitution between goods. We have also included a home production term, $\bar{s}$, in the non-traded sector following Duarte and Restuccia (2007), which is useful later to better capture the changes of non-traded prices with productivity but plays no role in Dutch Disease below.

The representative agent is endowed with a unit of labor, and a unit each of two sector-specific types of capital which he supplies inelastically on the labor and capital markets. The agent is also endowed with a resource tree that provides a stream of $O$ units of natural resources each period. These resources are not directly used by the agent but are sold on the market. The budget constraint of the agent is given by:

$$p_s c_s + c_m \leq w + r_s + r_m + p_o O, \tag{2}$$

where, $p_s$ is the relative price of non-manufacturing goods, $p_o$ is the relative price of the natural resource, $w$ is the wage rate and $r_i$ are sector specific rates of return on capital rental. The traded good is taken as numeraire.

**Production** There is a competitive market in each of the two sectors. The technologies in each sector are given by:

$$Y_s = A_s L_s^{1-\alpha} K_s^{\alpha} \text{ and } Y_m = A_m L_m^{1-\theta} K_m^{\theta} \tag{3}$$

Output in each sector, $Y_s$ ($Y_m$), is produced using labor, $L_s$ ($L_m$), as well as sector-specific capital, $K_s$ ($K_m$) and each sector is characterized by a potentially, sector-specific productivity, $A_s$ ($A_m$).

**Trade** It is assumed that manufacturing goods are traded whilst non-manufacturing goods are non-traded. In order to close the model, we assume a period-by-period balanced budget constraint given by:

$$m - p_o O = 0, \tag{4}$$

where, $m$ is the value of imported manufacturing goods (recall that the traded sector is numeraire). Notice that $p_o$ is the world market price for oil (relative to manufacturing goods). Also notice, that the above specification dictates, that all resources are exported in exchange for manufacturing goods. Furthermore, no resources are used in home country production and no resources are imported from abroad.

**Market Clearing** Market clearing conditions for services, manufacturing, labor and capital are given by:

$$c_m = Y_m + m,\ c_s = Y_s,\ L_m + L_s = 1,\ K_m = 1,\ K_s = 1 \tag{5}$$

**Competitive Equilibrium** For each price of oil, $p_o$, an equilibrium in the above economy consists of a vector of relative prices $\{p_s, w, r_s, r_m\}$ and allocations for agents and firms $\{c_s, c_m, Y_s, Y_m, L_s, L_m\}$ so that labor, capital and output markets clear and trade remains balanced.

**Optimization** Agents take prices as given and choose the optimal quantities of manufacturing and non-manufacturing goods to consume. The problem for an agent is to maximize (1) subject to (2). The optimal demands are:

$$c_s = \frac{(w + r_s + r_m + p_o O - p_s^{\sigma} \bar{s} \nu^{\sigma})}{p_s + \nu^{\sigma} p_s^{\sigma}} \text{ and } c_m = \frac{\nu^{\sigma} p_s^{\sigma} (w + r_s + r_m + p_o O + p_s^{\sigma} \bar{s} \nu^{\sigma})}{p_s + \nu^{\sigma} p_s^{\sigma}}. \tag{6}$$

Firms then set prices to maximize profits:

$$p_s = \frac{A_m}{A_s} \frac{(1-\theta)}{(1-\alpha)} \frac{L_s^{\alpha}}{(1-L_s)^{\theta}},\ w = \frac{A_m (1-\theta)}{(1-L_s)^{\theta}},\ r_s = \alpha A_s L_s^{1-\alpha},\ r_m = \theta A_m (1-L_s)^{1-\theta}. \tag{7}$$

Employment is then pinned down by the following equation:

$$\nu (A_m (1-L_s)^{1-\theta_m} + poO)^{-\frac{1}{\sigma}} A_m (1-\theta_m)(1-L_s)^{-\theta_m} = (A_s L_s^{1-\theta_s} + \bar{s})^{-\frac{1}{\sigma}} A_s (1-\theta_s) L_s^{-\theta_s} \tag{8}$$

**Dutch Disease and Relative Prices** For $0 \leq \alpha, \theta < 1$, by the implicit function theorem, this equation implies that $\frac{dL_s}{dp_o O} > 0$ - a higher value of endowment of natural resources, results in a higher employment in the non-traded sector. Notice also, from equation 7, that (also using the implicit function theorem), $\frac{dp_s}{dL_s} > 0$. Thus, the shift of labor from the traded to the non-traded sector is accompanied by an increase in the price of non-traded goods. At best, if the share of capital is assumed to be zero in both sectors i.e. $\alpha = \theta = 0$, then $\frac{dp_s}{dL_s} = 0$. With a flat labor supply curve, prices do not have to increase for labor to reallocate. Thus, in this simple framework, the reallocation of labor is associated with a non-decreasing nature of the non-traded goods price.

## 2.1 The simple model and the ICP data

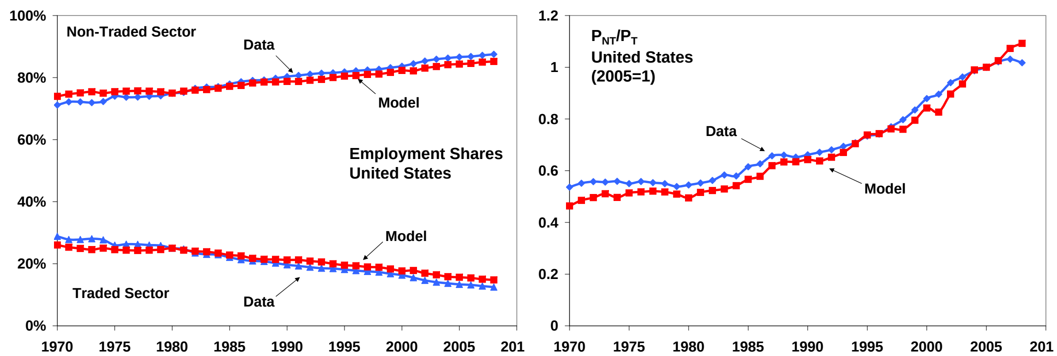
In the section we see how well the simplest version of the model does in explaining the ICP employment and price data between resource rich and resource poor countries. Central to our understanding of relative prices of non-tradables between any two countries or over time within countries, is the Harrod-Balassa-Samuelson effect (HBS). This is an observation that as a country grows richer, its consumer price levels tend to systematically rise. One explanation for this effect is that prices of non-tradables will increase more than prices of tradables in rich countries since productivity growth in the tradable sector is higher than in the non-tradable sector. This mechanism has been investigated and confirmed to be the most important driver of cross country price differences by Hsieh and Klenow (2007) and many others. Furthermore, changes in relative sectoral productivity also tend to be associated with labor reallocation across sectors as argued by Duarte and Restuccia (2007) and others. If traded and non-traded goods are gross complements in consumption so that consumers like goods in relatively fixed proportions, labor will shift to the faster growing sector in order to maintain relatively fixed proportions of goods.

Our approach in this section is to calibrate the above model to US time series data and reproduce the HBS effect. As sectoral productivity in countries changes, the model will predict changes in relative prices and sectoral employment. Given the parameters from this calibration, we then take the model to the cross country data and investigate the additional impact of endowments of natural resources.

**Calibration** To give the model the best chance of matching the cross country price data (which our preliminary analysis suggests is declining with natural resource wealth), we assume that there is no capital in the model so that $\theta_s = \theta_m = 0$. In this case the solution of the model at each point in time simplifies to:

$$p_s = \frac{A_m}{A_s} \text{ and } L_s = \frac{(1 + \frac{p_o O}{A_m})x - \frac{\bar{s}}{A_s}}{1 + x}, \tag{9}$$

where $x = \left(\frac{A_m}{A_s}\right)^{1-\sigma} \nu^{-\sigma}$. Prices in the model will thus only depend on changes in relative sectoral productivity and will be independent of natural resources. In terms of employment, three factors drive reallocation of labor across sectors: the endowments of natural resources,



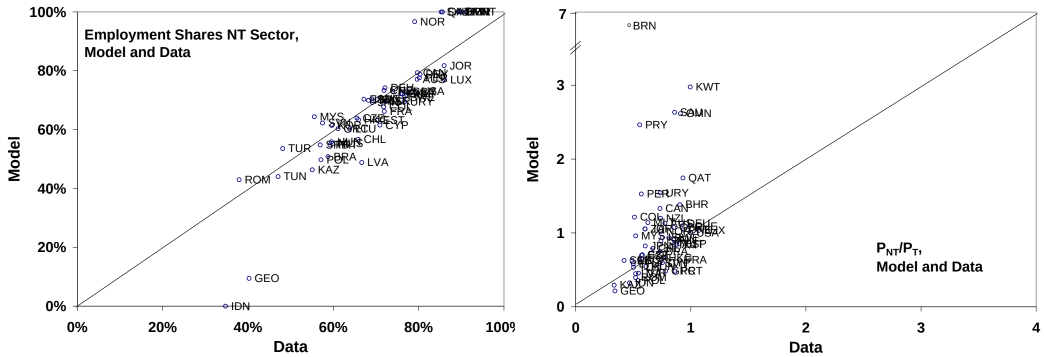

(a) Sectoral Employment Shares in the US - data and model

(b) Relative price of non traded goods in the US - data and model

Figure 3: US Comparison: Model and Data

described above and two additional channels as in Duarte and Restuccia (2007). First, there is the non-homotheticity in the service sector, $\bar{s}$. Increases in non-traded sector productivity result in $\frac{\bar{s}}{A_s}$ decreasing which translates to a higher $L_s$. Second, if productivity in the traded sector is systematically increasing at a faster rate than in the non-traded sector (so that $\frac{A_m}{A_s}$ is increasing) and $\sigma < 1$ (so that traded and non-traded goods are gross complements), labor will also shift to the non-traded sector. We will use these non-resource labor reallocation mechanisms to infer parameters that will influence the reallocation of labor when oil is present. In particular we set US exports of natural resources to be zero, $p_oO = 0$ and choose $\sigma = 0.33$ to match annualized GDP growth rates in the data following Duarte and Restuccia (2007). Finally we choose $\bar{s} = 0.3$ and $\nu = 0.0074$ to match employment shares in the non-traded sector between 1970 and 2005. The model's predictions for relative prices and sectoral employment shares are shown in Figures 4(a) and 4(b).

**Endowments of Natural Resources** Given the above parameters we investigate how well the model does in predicting cross-country price and employment data. In particular, for each country we choose $p_oO$ to match average exports of natural resources over the 1970-2005 period and set sectoral productivity parameters $A_s$ and $A_m$ to match that observed in the data. For details of data construction, see Stefanski and Kuralbayeva (2011). We expect the model to either fit both price and employment data well or neither data set, since both quantities are - to a large extent - driven by changes in relative sectoral productivity. Figure 4 shows the results of the model and the data. Despite our expectations, we find that the cross-country employment data fits quite well, but that cross country price data does not fit the model well. The most noticeable outliers are Brunei, Kuwait, Saudi Arabia, Oman, Paraguay, Bahrain and Canada -




(a) Cross country sectoral employment - data and model

(b) Cross country relative prices - data and model

Figure 4: Cross Country comparisons: Model and Data

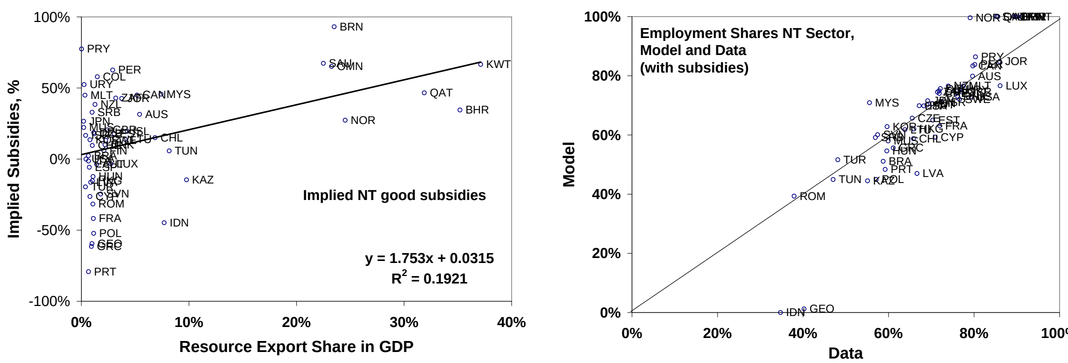
all resource rich countries. Thus, even though we have switched off the channel through which endowments of natural resources are usually taken to influence prices (different capital shares across sectors) - we nonetheless see the model systematically over predicting prices of non-traded goods in resource rich countries. Allowing for capital in the model, and thus allowing for endowments of natural resources to influence prices, would result in even higher predicted prices of non-traded goods and an hence an even larger failure of the model to match prices.

The above analysis raises an interesting question. How do we reconcile observed sectoral productivity differences in resource rich countries with observed non-traded employment and non-traded prices?

## 2.2 Possible Reasons For Model Failure

**Subsidies** One of the problems with the ICP price data is that these are consumption prices, and thus include any subsidies or taxes that the government may impose on purchased goods. The predictions of the model however, are for producer prices. As such, in this section we perform an exercise where we seek to pin down the necessary magnitude of subsidies in order to match observed price data. In particular, we ask the question: “How large would non-traded sector good subsidies have to be, in order to explain observed data”. In order to answer this question, we modify the consumers budget constraint equation so that it now contains a subsidy, $\tau$ on non-traded goods:

$$p_s(1-\tau)c_s + c_m \leq w + r_s + r_m + p_o O + T, \tag{10}$$




(a) Implied non-traded good subsidies

(b) Non-traded employment shares with subsidies

Figure 5: The impact of subsidies.

where $T$ is a lump sum tax to pay for the subsidy. We also assume that the government's budget constraint holds at each point in time:

$$p_s \tau c_s = T. \tag{11}$$

The solution to this problem is then given by equations 6-8 with $\nu$ replaced nu $\tilde{\nu}$, where $\tilde{\nu} = (1-\tau)\nu$. Thus, the subsidy effectively works by making consumers "prefer" non-traded goods more. Figure 5(a) shows the implied subsidies. Notice, that these need to be increasing with resource wealth to account for the price facts. Furthermore, they seem to be implausibly large. For example, the implied subsidy in Canada is 45%, in Australia it is 31% and in Brunei it is 93%. We take these implausibly high figures to mean, that whilst subsidies can explain some part of the lower prices, they are not the entire story.

**Increasing Returns to Scale** One way to break the above relationship is to assume increasing returns to scale (because of, for instance, learning by doing) in the non-traded sector. Thus suppose, for instance, that $A_s = \bar{A}_s L_s^{\gamma}$, where $\gamma \geq 0$. If $\gamma > 0$ there is learning-by doing, which we assume is external to firms that generate it. Then, in a competitive equilibrium, the implied price of non-traded goods is given by:

$$p_s = \frac{A_m}{\bar{A}_s L_s^{\gamma}} \frac{(1-\theta)}{(1-\alpha)} \frac{L_s^{\alpha}}{(1-L_s)^{\theta}}. \tag{12}$$

From this, $\frac{dp_s}{dL_s} < 0$ if and only if $L_s < \frac{\gamma - \theta_s}{\gamma + \theta_m - \theta_s}$. Thus, in the simplest case, if $\theta_s = \theta_m = 0$ and $\gamma > 0$, $\frac{dp_s}{dL_s} < 0$ and since $\frac{dL_s}{dp_o O} > 0$ (since the remainder of the competitive equilibrium problem remains unchanged), it can also be true that $\frac{dp_s}{dp_o O} < 0$.

This however, has the counterfactual implication that labor productivity rises in non-traded goods as labor reallocates towards the non-traded sector (see KS 2010).

**Elastic Labor Supply** So far we have been assuming that supply of labor is perfectly inelastic. Suppose now, instead, that each worker (independent of which sector he works in) supplies $h$ hours of labor, so that total hours available are given by:

$$L_s h + L_m h = h. \tag{13}$$

Suppose also that firms now purchase hours of labor, instead of hiring employees, so that the non-traded goods firm problem is given by:

$$\max p_s Y_s - w(L_s h) - r_s K_s \text{ s.t. } Y_s = A_s (L_s h)^{1-\theta_s} K_s^{\theta_s} \tag{14}$$

and

$$\max Y_m - w(L_m h) - r_m K_m \text{ s.t. } Y_m = A_m (L_m h)^{1-\theta_m} K_m^{\theta_m}. \tag{15}$$

These relationships imply the following non-traded prices:

$$p_s = h^{\theta_s - \theta_m} \frac{1-\theta_m}{1-\theta_s} \frac{Y_m/L_m}{Y_s/L_s}. \tag{16}$$

If the number of hours worked remains unchanged between resource rich and resource poor countries (so that $h$ is constant), then the previous model can do good job of approximating price changes. If, on the other hand, hours worked are lower in resource rich countries compared to resource poor countries (as they are in the data), then the previous model may miss price changes and this model suggests that we may be mis-measuring productivity data. In particular, if hours worked fall with resource wealth, and $\theta_s > \theta_m$, then the model may be able to account for price declines in resource rich countries.

**Consumption Smoothing** If we assume that both capital stocks can be accumulated, then an anticipated oil shock can result in prices of non-traded goods falling before the shock hits, as consumers try to smooth consumption over time. Since consumers are anticipating higher income in the future, they will run down current capital stocks. This will result in the capital labor ratio declining and so an overall increase in the price of capital relative to labor in the run up to the oil shock. The price of the good that uses capital more intensively (traded goods) will thus increase by more than the price of the sector that uses capital less intensively (non-traded goods). Thus, the price of non-traded goods in the run up to the oil shock will fall.

# 3 Econometric Approach and Data

Our concern is the relationship between relative price of non-tradable goods and various measures of resource abundance across countries. Close to our econometric approach is Hsieh and Klenow

(2007), who are concerned with the relationship between GDP per capita and the price level of different product categories across countries. Our simple starting point is cross country regressions with relative prices as the dependent variable. We estimate the following equation:

$$\log p_{s,i} - \log p_{t,i} = \alpha + \beta RA_i + \gamma \log GDPpc_i + e_i. \tag{17}$$

The dependent variable is the log ratio of the price of non-tradables ($p_{s,i}$) to tradables ($p_{t,1}$). The logarithm of GDP per capita, $\log GDPpc$, controls for the HBS-effect. Resource abundance, $RA_i$, for which we will use several different measures, is our variable of interest.

# 4 Stylized Facts: Relative Prices Across Countries

In this section we aim at establishing that the negative relationship between the relative price of non-tradable goods and resource abundance seen in figure 2 is a robust pattern in the data. We explore the relationship between relative prices and different measures of resource wealth: primary export share in GDP, fuel export share in GDP and net primary export share in GDP. We find that the relationship holds for all three measures of resource wealth and that it is the most accentuated for fuel exports.

Further we look at an alternative sector classification, namely public versus privately produced goods and services. Finally we open up the non-traded and traded categories and run regressions at the sector level. The results do all support the existence of the puzzle.

## 4.1 Non-traded versus Traded Goods

We start out with a sector-classification which resembles the classification in the theory; non-traded versus traded goods. The first three columns of the top panel of table 1 present our baseline result. The first thing to note is that the coefficient on GDP per capita is positive and significant on the relative price of non-tradable goods. Thus our findings are consistent with the HBS: the non-tradable price is relatively higher than the tradable price in rich countries. In addition to HBS, there should be a Dutch Disease effect on relative prices according to the model outlined above. Windfall revenue from resource exports will induce a reallocation from the sector producing tradable goods to the sector producing non-tradable goods. This shift of resources is in the model associated with an increase in the price of non-tradable goods. However, the coefficients on the windfall measures in Table 1 are negative and significant for non-tradable goods - whether the measure of resource wealth, is primary export share, fuel export share or net export share. In terms of magnitudes the coefficients imply that a one percentage point increase in windfalls of GNI reduces the relative price of non-tradables with 1.0 and 1.3 percent in the case of total primary exports and fuel, respectively.

We also present regressions of the price level of tradables as the dependent variable. This completes the picture of what is driving the variation in the relative price. We find no effect of resource abundance (first three columns of the bottom panel of table 1), indicating that the puzzle is driven by lower non-tradable prices and not higher tradable prices.

However, we do find a positive and significant coefficient on GDP per capita on the tradable price. This is perhaps surprising, given that the tradable price should be determined at the international market. Nevertheless, our findings are consistent with the HBS, since it seems that non-tradable prices seem to rise even more with GDP per capita.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ |
| | E/GNI | FE/GNI | NE/GDP | (A+E)/GDP | A/GDP |
| Res. Ab. | -1.029*** | -1.321*** | -1.077*** | -0.798** | 1.312** |
| | (0.218) | (0.158) | (0.250) | (0.305) | (0.661) |
| logGDPpc | 0.179*** | 0.201*** | 0.197*** | 0.166*** | 0.229*** |
| | (0.022) | (0.020) | (0.025) | (0.025) | (0.036) |
| Constant | -2.010*** | -2.265*** | -2.281*** | -1.979*** | -2.641*** |
| | (0.209) | (0.193) | (0.237) | (0.236) | (0.348) |
| Obs. | 122 | 122 | 114 | 114 | 114 |
| $R^2$ | 0.446 | 0.493 | 0.428 | 0.395 | 0.355 |
| | $P_T$ | $P_T$ | $P_T$ | $P_T$ | $P_T$ |
| | E/GNI | FE/GNI | NE/GDP | (A+E)/GDP | A/GDP |
| Res. Ab. | -0.097 | -0.242 | -0.036 | 0.185 | 2.328*** |
| | (0.171) | (0.182) | (0.256) | (0.238) | (0.660) |
| logGDPpc | 0.198*** | 0.202*** | 0.198*** | 0.202*** | 0.279*** |
| | (0.017) | (0.017) | (0.020) | (0.021) | (0.030) |
| Constant | -2.102*** | -2.137*** | -2.118*** | -2.162*** | -2.925*** |
| | (0.151) | (0.152) | (0.183) | (0.200) | (0.296) |
| Obs. | 122 | 122 | 114 | 114 | 114 |
| $R^2$ | 0.486 | 0.491 | 0.426 | 0.429 | 0.488 |

*** p<0.01, ** p<0.05, * p<0.1

Table 1: The impact of resource abundance on relative price of non-tradables and on price levels of tradables. Each column represents a different measure of resource abundance: (1) Primary Exports relative to GNI; (2) Fuel Exports relative to GNI; (3) Primary Net Exports relative to GDP; (4) Aid and Primary Exports relative to GDP; (5) Aid relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)

**Foreign Aid** The negative relationship found between relative prices of non-tradables and resource windfalls seem to be specific to resource wealth and does not hold for foreign aid; an alternative windfall of foreign exchange. In columns (4) of table 1 we add aid to the net resource export measure. The negative and significant coefficient for the relative price of non-traded goods still turns up, however the effect is weaker. Column (5) of table 1 indicates why. Aid turns out to be positively associated with the relative prices of non-tradables, and aid represents therefore the first sign we have found of a Dutch disease type of effect on the relative price. Understanding how aid and resource exports might affect an economy differently could bring us closer to understanding our apparent puzzle.

## 4.2 Private versus Public goods

One possibility is that the low relative prices of non-traded goods in resource exporters is mainly driven by low prices of public goods, that occur due to subsidies and other government price interventions. In table 2, we divide the traded and non-traded good categories into private (top panel) and government provided (bottom panel) goods , and see how various measures of resource abundance effect the relative prices of non-traded goods. The results are similar to those before: all measures of resource wealth have a negative coefficient and most are highly statistically significant. The exception is private provided non-tradable goods, when the measure is the primary export share. This suggests, that government policies may be playing some role in the outcome, but that other factors are at play too. As before, the impact of aid on the price of non-tradable goods follows the predictions of the standard Dutch Disease story, again suggesting that natural resource endowments may be playing some different role than other sources of foreign currency. Finally, in the Appendix we show that controlling for foreign savings and migration, we obtain very similar results.

## 4.3 Prices at the Sector Level

As a first cut on the data, the US can be viewed as a typical resource poor country.[3] We could thus reasonably expect that - controlling for income, another important factor influencing prices across countries - resource rich countries have higher prices of non-traded goods. Table 3 demonstrates that this is not the case. The table shows how prices of various categories of goods relative to those in the US change with resource wealth (controlling for average levels of income). On average, resource rich countries tend to be cheaper than the US. Resource wealth seems to have a positive impact only on one price level - housing. The impact of resource wealth on other, presumably non-tradable goods categories, like Transport, Communication, Recreation and culture, Education, Restaurants and hotels as well as Construction - are all either negative and very statistically significant or they are statistically insignificant. Another

[3] Whilst the US does indeed posses a large *quantity* of resources, its economy is also very large. Thus, relative to the size of it's output, the US is resource poor. The average export share of natural resources to GDP in the US over the 1980-2006, for example, was only 0.4%.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | $P^p_{NT}/P_T$ | $P^p_{NT}/P_T$ | $P^p_{NT}/P_T$ | $P^p_{NT}/P_T$ | $P^p_{NT}/P_T$ |
| | E/GNI | FE/GNI | NE/GDP | (A+E)/GDP | A/GDP |
| Res. Ab. | -0.49 | -0.970*** | -1.035*** | -0.682 | 2.200*** |
| | (0.430) | (0.392) | (0.562) | (0.519) | (1.246) |
| logGDPpc | 0.003 | 0.019 | 0.03 | 0.002 | 0.094*** |
| | (0.033) | (0.031) | (0.033) | (0.037) | (0.051) |
| Constant | -0.01 | -0.162 | -0.303 | -0.034 | -0.975*** |
| | (0.332) | (0.306) | (0.315) | (0.359) | (0.497) |
| Obs. | 122 | 122 | 114 | 114 | 114 |
| $R^2$ | 0.018 | 0.061 | 0.067 | 0.035 | 0.042 |
| | $P^g_{NT}/P_T$ | $P^g_{NT}/P_T$ | $P^g_{NT}/P_T$ | $P^g_{NT}/P_T$ | $P^g_{NT}/P_T$ |
| | E/GNI | FE/GNI | NE/GDP | (A+E)/GDP | A/GDP |
| Res. Ab. | -1.013*** | -1.269*** | -0.872*** | -0.566 | 1.710*** |
| | (0.297) | (0.265) | (0.361) | (0.393) | (0.849) |
| logGDPpc | 0.258*** | 0.279*** | 0.280*** | 0.257*** | 0.329*** |
| | (0.027) | (0.025) | (0.030) | (0.030) | (0.038) |
| Constant | -3.018*** | -3.266*** | -3.341*** | -3.117*** | -3.858*** |
| | (0.256) | (0.237) | (0.285) | (0.278) | (0.369) |
| Obs. | 122 | 122 | 114 | 114 | 114 |
| $R^2$ | 0.525 | 0.549 | 0.506 | 0.486 | 0.487 |

*** p<0.01, ** p<0.05, * p<0.1

Table 2: The impact of resource abundance on relative price of non-tradables, disaggregated into private (top panel) and government (bottom pannel) expenditures. Each column represents a different measure of resource abundance: (1) Primary Exports relative to GNI; (2) Fuel Exports relative to GNI; (3) Primary Net Exports relative to GDP; (4) Aid and Primary Exports relative to GDP; (5) Aid relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)

interesting feature of the data is that price levels of - presumably traded goods - like Food and non-alcoholic beverages, Alcoholic beverages and tobacco, Clothing and footwear, Furniture, Households equipment and maintenance, Misc. goods and services as well as Machinery and equip. also appear to be lower in resource rich countries than in resource poor countries.

# 5 What Can Explain the Apparent Puzzle?

Could there be omitted factors that can explain the puzzling econometric findings documented up to now? In this section we test whether the puzzle disappears if we control for factors that can affect the demand or the supply side in a way that is counteracting a Dutch Disease effect.

| $P^i/P^{US}$ | nrExpSh | gdp | Cons. | Obs. | $R^2$ |
|---|---|---|---|---|---|
| 1 GDP | -0.763*** | 0.019*** | 0.400*** | 111 | 0.698 |
| 11 Actual indiv. cons. | -0.521** | 0.020*** | 0.381*** | 111 | 0.717 |
| 1101 Food and non-alcoholic bev. | -0.739** | 0.016*** | 0.706*** | 111 | 0.429 |
| 1102 Alcoholic bev. and tobacco | -0.694* | 0.021*** | 0.473*** | 111 | 0.446 |
| 1103 Clothing and footwear | -0.746*** | 0.017*** | 0.679*** | 111 | 0.497 |
| 1104 Housing, water, elec., gas, fuels | 0.960*** | 0.023*** | 0.210*** | 111 | 0.633 |
| 1105 Furn., HH equip. and maint. | -0.888*** | 0.017*** | 0.576*** | 111 | 0.649 |
| 1106 Health | -0.621*** | 0.017*** | 0.144*** | 111 | 0.702 |
| 1107 Transport | -1.593*** | 0.021*** | 0.834*** | 111 | 0.468 |
| 1108 Communication | 0.355 | 0.003 | 0.786*** | 111 | 0.034 |
| 1109 Recreation and culture | -0.399 | 0.015*** | 0.619*** | 111 | 0.444 |
| 1110 Education | -0.637*** | 0.019*** | 0.080*** | 108 | 0.78 |
| 1111 Restaurants and hotels | -0.095 | 0.022*** | 0.684*** | 109 | 0.494 |
| 1112 Misc. goods and services | -0.841*** | 0.020*** | 0.391*** | 111 | 0.672 |
| 14 Collective cons. exp. by govt. | -1.054*** | 0.024*** | 0.191*** | 111 | 0.74 |
| 15 Gross fixed capital form. | -1.062*** | 0.015*** | 0.594*** | 111 | 0.493 |
| 1501 Machinery and equip. | -0.488** | 0.002** | 1.100*** | 105 | 0.067 |
| 1502 Construction | -1.290*** | 0.020*** | 0.359*** | 105 | 0.538 |
| 1503 Other products | -0.482* | 0.016*** | 0.651*** | 100 | 0.503 |

*** p<0.01, ** p<0.05, * p<0.1

Table 3: The impact of resource wealth (nrExpSh) on relative sectoral prices. (Source: ICP, WDI)

**External Saving** The former section brought attention to a potential role of international saving. Of course, if a resource exporter chooses to save all its windfalls, little is likely to change in its economy. Parking revenues abroad is for example Norway's main mean to avoid that its booming oil and gas revenues lead to Dutch Disease. Excluded international saving could therefore lead to omitted variable bias in our estimations. In Table 4 we include non-resource net exports as a share of GDP (in the first three columns) as a measure of the non-resource saving of the economy. If the resource exporter saves nothing of the resource windfalls, the non-resource net-exports would be equal to the resource net exports in absolute value. I.e., the resource exporter would increase its imports or decrease its exports exactly corresponding to the foreign exchange windfall from the resource exports. As an alternative measure of foreign saving we include the total current account as a share of GDP in the last three columns of 4. The tables shows that our apparent puzzle is robust to these measure of international saving. We also include prices of tradables in the bottom panel for completeness.

**Migration** The reason for the positive effect on the non-tradable relative price of a foreign exchange windfall in the model is that there is an upward sloping supply curve. Anything

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ |
| | E/GNI | FE/GNI | NE/GDP | E/GNI | FE/GNI | NE/GDP |
| Res. Ab. | -0.984*** | -1.444*** | -0.979*** | -0.926*** | -1.194*** | -1.006*** |
| | (0.269) | (0.254) | (0.292) | (0.221) | (0.165) | (0.219) |
| (X-M)/GDP | 0.101 | -0.222 | -0.086 | | | |
| | (0.308) | (0.315) | (0.274) | | | |
| CA/GDP | | | | -1.134** | -0.776* | -0.802 |
| | | | | (0.440) | (0.428) | (0.492) |
| logGDPpc | 0.175*** | 0.211*** | 0.162*** | 0.207*** | 0.218*** | 0.212*** |
| | (0.025) | (0.025) | (0.024) | (0.023) | (0.021) | (0.023) |
| Constant | -1.978*** | -2.358*** | -1.949*** | -2.296*** | -2.439*** | -2.439*** |
| | (0.233) | (0.232) | (0.231) | (0.226) | (0.206) | (0.216) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.447 | 0.496 | 0.429 | 0.477 | 0.506 | 0.478 |
| | $P_T$ | $P_T$ | $P_T$ | $P_T$ | $P_T$ | $P_T$ |
| | E/GNI | FE/GNI | NE/GDP | E/GNI | FE/GNI | NE/GDP |
| Res. Ab. | -0.079 | -0.293 | 0.337 | -0.114 | -0.293 | 0.006 |
| | (0.217) | (0.236) | (0.268) | (0.176) | (0.194) | (0.217) |
| (X-M)/GDP | 0.04 | -0.091 | 0.333 | | | |
| | (0.239) | (0.240) | (0.270) | | | |
| CA/GDP | | | | 0.184 | 0.315 | 0.137 |
| | | | | (0.285) | (0.295) | (0.301) |
| logGDPpc | 0.196*** | 0.206*** | 0.192*** | 0.193*** | 0.195*** | 0.194*** |
| | (0.019) | (0.021) | (0.018) | (0.018) | (0.018) | (0.018) |
| Constant | -2.089*** | -2.175*** | -2.069*** | -2.056*** | -2.066*** | -2.081*** |
| | (0.176) | (0.193) | (0.169) | (0.168) | (0.167) | (0.169) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.486 | 0.491 | 0.493 | 0.487 | 0.493 | 0.485 |

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: The impact of resource abundance on relative price of non-tradables and on price levels of tradables controlling for foreign saving. Two measures of foreign savings are used: Share of net non-resource exports in GDP (columns 1-3) and Share of Current account balance in GDP (columns 4-6). Each column represents a different measure of resource abundance: (columns 1 and 4) Primary Exports relative to GNI; (columns 2 and 5) Fuel Exports relative to GNI; (columns 3 and 6) Primary Net Exports relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)

that will make the economy's supply curve flatter would therefore be expected to decrease the Dutch Disease effect on prices. Although it would be hard to imagine that the supply curve is falling, and hence a negative effect on prices, we should control for factors that might affect the steepness of the supply curve. The size of the labor force is a potential bottleneck affecting the steepness of the supply curve. Immigration can reduce this bottleneck and immigration may therefore be correlated with the relative price of non-tradable. At the same time, immigration may also be correlated with resource abundance, as is casually observed in the Middle East. Since immigration may satisfy the two characteristics of an omitted variable, we control for immigration as a share of total population in the first three columns of table 5. Since there is great cross-country variation in the share of the population that is relevant for the labor market, we therefore also include the immigration stock as a share of the labor force in the last three columns of table 5. The negative relationship between the relative price of non-tradables and windfalls still holds.

# 6 Concluding Remarks

We have outlined standard Dutch-Disease theory and showed how it predicts non-tradable prices to be high relative to tradable prices in countries receiving foreign exchange windfalls. The theory is well established and has been a workhorse to understand the effects of natural resource exports over the last three decades. When we estimated cross country regressions to explain relative prices of non-tradables, we found that resource exporters appear to have relatively low prices on non-tradables; the opposite patterns of what the theory predicts. To understand exactly why this is the case, is the aim of this ongoing project.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ | $P_{NT}/P_T$ |
| | E/GNI | FE/GNI | NE/GDP | E/GNI | FE/GNI | NE/GDP |
| Res. Abund, | -1.058*** | -1.367*** | -1.135*** | -1.042*** | -1.346*** | -1.128*** |
| | (0.245) | (0.186) | (0.185) | (0.240) | (0.180) | (0.178) |
| Migr/Pop | 0.12 | 0.192 | -0.051 | | | |
| | (0.337) | (0.336) | (0.285) | | | |
| Migr/LF | | | | 0.037 | 0.07 | -0.068 |
| | | | | (0.194) | (0.200) | (0.161) |
| logGDPpc | 0.175*** | 0.195*** | 0.196*** | 0.177*** | 0.197*** | 0.198*** |
| | (0.025) | (0.023) | (0.024) | (0.025) | (0.023) | (0.024) |
| Constant | -1.980*** | -2.226*** | -2.270*** | -1.995*** | -2.241*** | -2.283*** |
| | (0.231) | (0.205) | (0.217) | (0.230) | (0.206) | (0.218) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.447 | 0.494 | 0.464 | 0.447 | 0.494 | 0.464 |
| | $P_T$ | $P_T$ | $P_T$ | $P_T$ | $P_T$ | $P_T$ |
| | E/GNI | FE/GNI | NE/GDP | E/GNI | FE/GNI | NE/GDP |
| Res. Abund, | -0.111 | -0.274 | 0.034 | -0.096 | -0.254 | 0.039 |
| | (0.182) | (0.199) | (0.222) | (0.180) | (0.196) | (0.216) |
| Migr/Pop | 0.057 | 0.133 | -0.026 | | | |
| | (0.265) | (0.270) | (0.288) | | | |
| Migr/LF | | | | -0.003 | 0.035 | -0.04 |
| | | | | (0.156) | (0.156) | (0.167) |
| logGDPpc | 0.196*** | 0.198*** | 0.198*** | 0.198*** | 0.200*** | 0.199*** |
| | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) |
| Constant | -2.087*** | -2.110*** | -2.117*** | -2.103*** | -2.125*** | -2.125*** |
| | (0.183) | (0.178) | (0.178) | (0.183) | (0.177) | (0.178) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.486 | 0.492 | 0.485 | 0.486 | 0.491 | 0.485 |

*** p<0.01, ** p<0.05, * p<0.1

Table 5: The impact of resource abundance on relative price of non-tradables and on price levels of tradables controlling for migration. Two measures of migration are used: Share of migrants in poopulation (columns 1-3) and Share of migrants in the labor force (columns 4-6). Each column represents a different measure of resource abundance: (columns 1 and 4) Primary Exports relative to GNI; (columns 2 and 5) Fuel Exports relative to GNI; (columns 3 and 6) Primary Net Exports relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)

# References

**Duarte, M. and D. Restuccia**, "The Role of the Structural Transformation in Aggregate Productivity," *Manuscrpit*, 2007.

**Hsieh, Chang-Tai and Peter J. Klenow**, "Relative Prices and Relative Prosperity," *American Economic Review*, 2007, *97(3)*, 562585.

**Sachs, Jeffrey D. and Andrew M. Warner**, "The Curse of Natural Resources," *European Economic Review*, 2001, *45*, 827–838.

# 7 Appendix

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | pnt-pt | pnt-pt | pnt-pt | pnt-pt |
| log GDP per capita | 0.122*** | 0.178*** | 0.186*** | 0.181*** |
| | (0.038) | (0.024) | (0.023) | (0.023) |
| Aid/GNI 01-05 | -0.000 | | | |
| | (0.005) | | | |
| Ag raw material exp/GNI 01-05 | | -0.491 | | |
| | | (1.577) | | |
| Food exp/GNI 01-05 | | | 0.778 | |
| | | | (0.727) | |
| Ores and metals exp/GNI 01-05 | | | | 0.143 |
| | | | | (1.328) |
| Constant | -1.751*** | -2.147*** | -2.259*** | -2.177*** |
| | (0.343) | (0.222) | (0.216) | (0.207) |
| Observations | 117 | 127 | 127 | 127 |
| $R^2$ | 0.165 | 0.345 | 0.352 | 0.344 |

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | pntp-pt | pntp-pt | pntp-pt | pntp-pt |
| log GDP per capita | -0.005 | -0.006 | -0.012 | -0.011 |
| | (0.061) | (0.038) | (0.037) | (0.033) |
| Aid/GNI 01-05 | 0.028** | | | |
| | (0.011) | | | |
| Ag raw material exp/GNI 01-05 | | 3.659 | | |
| | | (2.894) | | |
| Food exp/GNI 01-05 | | | 0.944 | |
| | | | (1.145) | |
| Ores and metals exp/GNI 01-05 | | | | 1.960 |
| | | | | (2.385) |
| Constant | -0.111 | -0.023 | 0.033 | 0.032 |
| | (0.573) | (0.372) | (0.371) | (0.318) |
| Observations | 117 | 127 | 127 | 127 |
| $R^2$ | 0.130 | 0.026 | 0.009 | 0.023 |

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | pntg-pt | pntg-pt | pntg-pt | pntg-pt |
| log GDP per capita | 0.195*** | 0.256*** | 0.268*** | 0.261*** |
| | (0.044) | (0.029) | (0.027) | (0.027) |
| Aid/GNI 01-05 | 0.002 | | | |
| | (0.005) | | | |
| Ag raw material exp/GNI 01-05 | | -1.378 | | |
| | | (2.118) | | |
| Food exp/GNI 01-05 | | | 0.746 | |
| | | | (0.815) | |
| Ores and metals exp/GNI 01-05 | | | | -0.202 |
| | | | | (1.447) |
| Constant | -2.760*** | -3.142*** | -3.289*** | -3.192*** |
| | (0.393) | (0.274) | (0.257) | (0.244) |
| Observations | 117 | 127 | 127 | 127 |
| $R^2$ | 0.243 | 0.468 | 0.469 | 0.464 |

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | pt | pt | pt | pt |
| log GDP per capita | 0.150*** | 0.191*** | 0.188*** | 0.187*** |
| | (0.025) | (0.017) | (0.017) | (0.016) |
| Aid/GNI 01-05 | 0.011*** | | | |
| | (0.004) | | | |
| Ag raw material exp/GNI 01-05 | | 1.492 | | |
| | | (0.936) | | |
| Food exp/GNI 01-05 | | | 0.249 | |
| | | | (0.750) | |
| Ores and metals exp/GNI 01-05 | | | | 0.382 |
| | | | | (0.469) |
| Constant | -1.780*** | -2.058*** | -2.019*** | -2.012*** |
| | (0.236) | (0.155) | (0.160) | (0.148) |
| Observations | 117 | 127 | 127 | 127 |
| $R^2$ | 0.171 | 0.445 | 0.438 | 0.439 |

| | (1) $P^p_{NT}/P_T$ E/GNI | (2) $P^p_{NT}/P_T$ FE/GNI | (3) $P^p_{NT}/P_T$ NE/GDP | (4) $P^p_{NT}/P_T$ E/GNI | (5) $P^p_{NT}/P_T$ FE/GNI | (6) $P^p_{NT}/P_T$ NE/GDP |
|---|---|---|---|---|---|---|
| Res. Ab. | -0.406 | -1.110** | -0.717 | -0.42 | -0.905** | -0.756 |
| | (0.476) | (0.455) | (0.467) | (0.443) | (0.422) | (0.460) |
| (X-M)/GDP | 0.189 | -0.251 | -0.121 | | | |
| | (0.391) | (0.371) | (0.337) | | | |
| CA/GDP | | | | -0.773 | -0.395 | -0.42 |
| | | | | (0.575) | (0.620) | (0.647) |
| logGDPpc | -0.004 | 0.03 | -0.007 | 0.022 | 0.028 | 0.023 |
| | (0.036) | (0.035) | (0.037) | (0.039) | (0.037) | (0.038) |
| Constant | 0.049 | -0.268 | 0.048 | -0.205 | -0.251 | -0.251 |
| | (0.355) | (0.339) | (0.358) | (0.399) | (0.369) | (0.374) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.02 | 0.064 | 0.032 | 0.028 | 0.064 | 0.051 |

| | $P^g_{NT}/P_T$ E/GNI | $P^g_{NT}/P_T$ FE/GNI | $P^g_{NT}/P_T$ NE/GDP | $P^g_{NT}/P_T$ E/GNI | $P^g_{NT}/P_T$ FE/GNI | $P^g_{NT}/P_T$ NE/GDP |
|---|---|---|---|---|---|---|
| Res. Ab. | -0.968*** | -1.373*** | -0.696* | -0.919*** | -1.154*** | -0.898*** |
| | (0.339) | (0.336) | (0.409) | (0.301) | (0.284) | (0.314) |
| (X-M)/GDP | 0.102 | -0.187 | 0.116 | | | |
| | (0.344) | (0.353) | (0.355) | | | |
| CA/GDP | | | | -1.038** | -0.701 | -0.777 |
| | | | | (0.482) | (0.490) | (0.561) |
| logGDPpc | 0.254*** | 0.287*** | 0.239*** | 0.284*** | 0.294*** | 0.289*** |
| | (0.030) | (0.029) | (0.030) | (0.028) | (0.027) | (0.028) |
| Constant | -2.986*** | -3.345*** | -2.945*** | -3.280*** | -3.424*** | -3.428*** |
| | (0.279) | (0.276) | (0.281) | (0.278) | (0.257) | (0.264) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.525 | 0.551 | 0.497 | 0.541 | 0.556 | 0.532 |

*** p<0.01, ** p<0.05, * p<0.1

Table 6: The impact of resource abundance on relative price of non-tradables, disaggregated into private (top panel) and government (bottom pannel) expenditures, controlling for foreign saving. Two measures of foreign savings are used: Share of net non-resource exports in GDP (columns 1-3) and Share of Current account balance in GDP (columns 4-6). Each column represents a different measure of resource abundance: (columns 1 and 4) Primary Exports relative to GNI; (columns 2 and 5) Fuel Exports relative to GNI; (columns 3 and 6) Primary Net Exports relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)

| | (1) $P^p_{NT}/P_T$ E/GNI | (2) $P^p_{NT}/P_T$ FE/GNI | (3) $P^p_{NT}/P_T$ NE/GDP | (4) $P^p_{NT}/P_T$ E/GNI | (5) $P^p_{NT}/P_T$ FE/GNI | (6) $P^p_{NT}/P_T$ NE/GDP |
|---|---|---|---|---|---|---|
| Res. Abund, | -0.533 | -1.070** | -0.866** | -0.483 | -1.005** | -0.826* |
| | (0.462) | (0.421) | (0.417) | (0.457) | (0.421) | (0.419) |
| Migr/Pop | 0.173 | 0.411 | 0.212 | | | |
| | (0.580) | (0.570) | (0.517) | | | |
| Migr/LF | | | | -0.018 | 0.098 | -0.008 |
| | | | | (0.312) | (0.320) | (0.284) |
| logGDPpc | -0.003 | 0.007 | 0.007 | 0.003 | 0.014 | 0.014 |
| | (0.041) | (0.038) | (0.038) | (0.039) | (0.037) | (0.037) |
| Constant | 0.034 | -0.08 | -0.114 | -0.017 | -0.129 | -0.16 |
| | (0.385) | (0.343) | (0.347) | (0.375) | (0.339) | (0.342) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.019 | 0.065 | 0.049 | 0.018 | 0.062 | 0.048 |

| | $P^g_{NT}/P_T$ E/GNI | $P^g_{NT}/P_T$ FE/GNI | $P^g_{NT}/P_T$ NE/GDP | $P^g_{NT}/P_T$ E/GNI | $P^g_{NT}/P_T$ FE/GNI | $P^g_{NT}/P_T$ NE/GDP |
|---|---|---|---|---|---|---|
| Res. Abund, | -1.120*** | -1.385*** | -1.068*** | -1.092*** | -1.353*** | -1.051*** |
| | (0.317) | (0.275) | (0.273) | (0.312) | (0.269) | (0.268) |
| Migr/Pop | 0.435 | 0.479 | 0.198 | | | |
| | (0.376) | (0.386) | (0.333) | | | |
| Migr/LF | | | | 0.215 | 0.235 | 0.08 |
| | | | | (0.217) | (0.225) | (0.185) |
| logGDPpc | 0.243*** | 0.265*** | 0.265*** | 0.246*** | 0.267*** | 0.267*** |
| | (0.030) | (0.028) | (0.029) | (0.030) | (0.028) | (0.029) |
| Constant | -2.907*** | -3.170*** | -3.214*** | -2.928*** | -3.187*** | -3.227*** |
| | (0.278) | (0.250) | (0.262) | (0.276) | (0.250) | (0.262) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |
| $R^2$ | 0.529 | 0.555 | 0.524 | 0.528 | 0.553 | 0.524 |

*** p<0.01, ** p<0.05, * p<0.1

Table 7: The impact of resource abundance on relative price of non-tradables, disaggregated into private (top panel) and government (bottom pannel) expenditures, controlling for migration. Two measures of migration are used: Share of migrants in poopulation (columns 1-3) and Share of migrants in the labor force (columns 4-6). Each column represents a different measure of resource abundance: (columns 1 and 4) Primary Exports relative to GNI; (columns 2 and 5) Fuel Exports relative to GNI; (columns 3 and 6) Primary Net Exports relative to GDP. Robust standard errors in parentheses. (Source: ICP, WDI)