UNIVERSITAT DE BARCELONA

Essays on the Venezuelan economy

Miguel Ángel Santos

PhD in Economics

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PhD student:

Miguel Ángel Santos

Advisor:

Xavier Raurich

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To Constantino, my inexhaustible source of inspiration, from whom I robbed many precious hours needed to write this.

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Introduction[1]

If mistakes are the portals of discovery, as James Joyce said, then it is hard to think of a more fertile soil than Venezuela.[2] Fifteen years into the twenty-first century, Venezuela displays the same income per capita as it had in 1955. In other words, it has endured sixty years of stagnation, where the country managed to elude its portentous luck in the natural resource lottery. The long calvary is divided in two very distinct periods. Gross domestic product (GDP) per capita expanded 34.5% in the twenty-seven years between 1950 and 1977 (1.1% per year), and then collapsed 21.4% (-0.63% per year) over the following thirty-eight years (1977-2015). One of the most spectacular cases of economic progress turned into a colossal growth failure.

Although GDP per capita peaked in 1977, total factor productivity started to fall early in the seventies. Overall, there have been four and a half decades of sustained decay in productivity. This period has been sprinkled with massive oil bonanzas, including the Arab embargo after the Yom Kippur war of 1973, the Iranian revolution in 1979, the Gulf War in 1990-1991, and the prolonged windfall of 2004-2013. In spite of that, the economy stagnated throughout most of these years, hinting that oil proceeds may have fueled a mixture of import-based consumption boom (later to be reversed) and capital flight. As prosperity gradually vanished in the late seventies, policy-makers have resorted to ever more unorthodox economic policies, plaguing the economy with a myriad of price, interest, and exchange controls that have rendered the system of relative prices useless and resulted in poor allocation of fading resources.

All these features make Venezuela a potentially prolific field of study for certain branches of the economic literature. It is a stagnant economy, subject to large, frequent, volatile, and exogenous shocks coming from swings in oil prices.

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[1] Unless indicated in the corresponding footnotes, all the bibliographical references made here are to be found in the references listed at the end of each chapter.

[2] "A man of genius makes no mistakes. His errors are volitional and are the portals of discovery." The original quote appears in Chapter 9 of *Ulysses* (1922). It is pronounced by Stephen Dedalus, a character that has often been recognized as a harsher version of Joyce himself in his early twenties.

It is also one of the most heavily intervened economies in the world, with long spells of tight capital and exchange controls, and it is at the same time a large exporter of capital. Finally, Venezuela is an extreme case of Dutch disease that has seen how oil production per capita fall by 74.4% in the last fifty years and yet has failed to develop any other source of foreign currency. This thesis is aimed at extracting some lessons from the Venezuelan growth failure and its intricate relationship with oil. The three self-contained chapters are aimed at making significant contributions to different strains of the economic literature devoted to understanding the nature of oil shocks, financial repression as a spur for capital flight, and the impacts of Dutch disease in patterns of non-resource specialization.

In Chapter 1, forthcoming in the *Latin American Journal of Economics*,[3] I have calibrated a real business cycle (RBC) model as originally presented by Kydland and Prescott (1982) and Long and Plosser (1983)[4], to the Venezuelan economy. I argue that the particular features of the Venezuelan economy do resemble some of the fundamentals needed for RBC models to be able to replicate movements and co-movements of real variables along the cycle. First, due to its stagnation, Venezuela is one of the few developing countries where the study of cycles may actually be more interesting than the analysis of growth drivers. Second, in order to approximate movements and co-movements of historical data, RBC models need to be fed with large, persistent and volatile technological shocks. As it turns out, the Venezuelan economy is indeed impacted by exogenous shocks by means of oil prices. The oil sector of the economy is an enclave that represents 30% of GDP and 1.1% of employment while providing 85% of exports. Third, the particularities of Venezuela are well-suited to one of the most common critiques made to RBC models: RBC-simulated real wages are far too pro-cyclical relative to those observed in real data. As widely reported by the World Bank and a number of studies (see Alayon et.al. 2002), throughout Venezuela has had very rigid and distorted labor laws,

[3] Formerly *Cuadernos de Economía*, published by Instituto de Economía of Pontificia Universidad Católica de Chile.
[4] All bibliographical references quoted here are to be found in the list of references at the end of each corresponding chapter.

with high relative firing costs, widespread minimum salary, and, more recently, forbidden dismissal below certain wage levels. Within that framework, the market response to shocks in demand has been to adjust real salaries by means of large swings in inflation. Accordingly, the cyclical component of wages is much more volatile and (positively) correlated with output than in the United States.

This chapter contributes to the literature of RBC models in three different ways. First, although there have been papers using RBC to assess the impact of oil shocks in oil-importing countries (Kilian, 2006), to my knowledge this is the first attempt at using them to understand cycles in an oil-exporting country. Second, this is a rare case where a calibration of the standard version of the original RBC model yields simulated movements and co-movements that are aligned with observed cycle statistics. Interestingly, it does not happen to be an OECD country where most of the free-market premises of RBC models hold, but rather a heavily intervened economy with a large number of market failures and unsteady political and institutional framework. At last, we have documented that very rigid labor markets within the context of a repressed economy might result in highly volatile real salaries by means of large swings in inflation over the cycle, much more so than those real salaries observed in countries with presumably more elastic labor and capital mobility.

In Chapter 2, co-authored with Carmen Reinhart and published in *Emerging Markets Finance and Trade*[5], we present a framework for analyzing financial repression, inflation surprises, and *seigniorage*, and we explore their connections to balance of payments crises. We apply the framework to Venezuela over the thirty years spanning from 1984 to 2013. The Venezuelan experience in this period is unique because it encompasses various financial crises, debt restructuring, cycles of financial and capital account liberalization and policy reversals, multiple exchange rate arrangements, and booms and busts in terms of trade. We offer an encompassing view of external vulnerability

[5] Reinhart, C. & Santos, M. A. (2016): From Financial Repression to External Distress: The Case of Venezuela. *Emerging Markets Finance and Trade*, 52:1–30.

beyond sovereign default or restructuring that takes into account the private sector as reflected in capital flight (or repatriation). We associate our measures of financial repression and others suggested earlier in the literature (Geovanini and de Melo, 1993), with different indicators of capital flight. In particular, we introduce a more comprehensive indicator of capital flight to account for the over-invoicing of imports, which tends to be rampant in periods of exchange controls.

This chapter makes a number of contributions to the literature of financial repression, capital flight, and mis-invoicing of foreign trade transactions. We have made a contribution to the literature on financial repression by modifying the financial repression framework introduced by Reinhart and Sbrancia (2015). Our proposed framework allows for differentiation between domestic and foreign debt issuance and incorporates the possibility of financing the fiscal deficit via exchange-rate devaluation. We also introduce a new measure of capital flight that incorporates the over-invoicing of imports. In particular, we take the difference between the sum of all imports declared by Venezuelan customs (as reported in the UN COMTRADE database with corrections from Hausmann et. al., 2011[6]) and total imports declared by the Central Bank in the balance of payments. We also suggest two different ways of validating if over-invoicing of imports as calculated thereby is significantly higher in periods of exchange rate control. A *vertical validation* test measures capital flight as being significantly higher in years of exchange control (relative to free market years) within the country. A *horizontal validation* test constructs, for every year, the world´s distribution of the quotient between imports reported by the Central Bank and UN Comtrade-based imports. We then test if the Venezuela quotient is significantly higher than the world distribution in years of exchange controls. Finally, we associate our broader measure of capital flight with our estimation of financial repression. We find capital flight to be higher in years of exchange control precisely because a lack of access to foreign exchange creates a captive

[6] Hausmann, R., Hidalgo, C., Bustos, S., Coscia, M., Chung, S., Jimenez, J., Simoes, A., and Yildirim, M. (2011). *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. Cambridge, MA.

market for financial repression, which is amplified by the adoption of interest rate ceilings.

In Chapter 3, which I have co-authored with Dany Bahar, we have performed a thorough cross-country analysis to test the impacts of high shares of natural resources in a number of indices of non-resource export concentration. Moreover, we have assembled a country-product-year database, appending different product characteristics (differentiation, capital intensity, skill intensity), in order to find which non-resource products are the most likely victims of Dutch disease and which are most likely to thrive, and the implications of these specialization patterns.

This paper contributes to the literature of Dutch disease and non-resource export concentration at two different levels. The literature of Dutch disease is extensive when it comes to documenting the negative impacts of natural resource exports on non-resource tradable goods as an aggregate. Little has been said on the impact of natural resource exports on non-resource export concentration, either from a country perspective or at the product level. At the country level, to the extent of our knowledge, this is the first attempt to link Dutch disease and non-resource export concentration. We have done that using different indices of non-resource export concentration, time periods, definitions of natural resource (and non-resource) exports; while controlling for GDP per capita and exchange rate regime. At the product level, there has not been any attempt to identify which product characteristics are more likely to thrive within the non-resource export basket of resource rich countries. Once we show that high shares of natural resources are associated with lower diversification on the non-resource export basket of countries, we look inside the latter in an effort to determine which products are likely to gain share and which ones are likely to lose ground, depending on three different product characteristics: product differentiation (Rauch, 1999), capital intensity (Becker, Gray and Marvakov, 2013), and skill-intensity (Nunn, 2007). In order to test for impacts of homogenous and differentiated products at different levels of technological sophistication, we have relied on discrete classification found in Lall (2000).

Chapter 1

The Right Fit for the Wrong Reasons: Real Business Cycle in an Oil-Dependent Economy

1.1 Introduction

The theory of business cycles studies the causes leading to and consequences resulting from recurrent expansions and contractions in aggregate economic activity. The idea that a few equations can have the power to replicate means, volatilities, relative volatilities, auto-correlations, and cross-correlations observed in time series of real macroeconomic data is very appealing and has motivated a significant number of authors since the seminal contributions of Kydland and Prescott (1982) and Long and Plosser (1983). Real business cycle theory assumes that these periodic fluctuations are caused primarily by real factors. It has become ever less ambitious; nowadays it does not aspire to explain why business cycles exist, but rather to assess and interpret the movements and co-movements of real variables along the cycle.

Most of the empirical evidence for or against RBC models is focused on OECD countries: These are supposed to be fully functioning market economies with appropriate institutional and policy settings. Our purpose here is somewhat the opposite. We set ourselves to study how an RBC model would fare in explaining historical data moments for Venezuela, which throughout the sample period (1950-2008) has been one of most heavily government-intervened economies, one with a large number of market failures and an unsteady political and institutional framework. There have been many papers using RBC models to assess the impacts of oil shocks in oil-importing countries (i.e. Kilian, 2006), but to our knowledge this is the first attempt at using them to understand the cycles in an oil-exporting country. Our interest has been spurred by a number of economic reasons.

The use of Solow residuals as a proxy for exogenous technology shocks has been a permanent source of criticism for RBC models. The reason for this is that in order to approximate movements and co-movements of historical data, the RBC needs to be fed with large, persistent, and volatile technological shocks. This is unappealing, as emphasized by Summers (1986), since to simulate a recession you would need an implausible degree and frequency of technological regress (negative exogenous technology shocks).

As it turns out, the Venezuelan economy is indeed affected by large, frequent, volatile and exogenous shocks: oil prices. The oil sector of the economy is an enclave that represents an average of 30% of gross domestic product (GDP)[7] and 1.1% of employment while providing 85% of exports. As the country does not have a stabilization fund and fiscal policy is highly pro-cyclical, oil shocks are transmitted and even amplified to the rest of the (non-oil) economy (see Hausmann, Talvi and Perotti, 1996; Erbil, 2011), becoming the driving force behind the business cycle. As exogenous oil shocks are normally not matched by corresponding variations in capital or labor, they tend to be gathered in the Solow residuals (Finn, 1995).

A second critique made to RBC models has to do with simulated real wages being far too pro-cyclical relative to those observed in real data. King and Rebelo (2000), using quarterly data for the United States for 1947-1996, report that the simulated standard deviation of employment relative to output is roughly half of the observed (0.99 in actual data as compared to simulated 0.48).[8] On the other hand, the simulated standard deviation of real wages relative to output is substantially larger than the observed one (0.38 in real data as compared to the simulated 0.54). That is to say that, in contrast to observed time series, the RBC model has an internal mechanism of adjustment in the labor market that relies less on quantities (workers) and more on prices (real wages).

[7] Measured at 2007 constant prices.
[8] This has also been stressed by Sims (2012).

The Venezuelan labor market has particular features that make it appealing from an RBC perspective. As widely reported by the World Bank[9] and a number of studies (see for instance Alayon et.al. 2002), Venezuela has historically had one of the most rigid and distorted labor laws in the world, with high relative firing costs, widespread minimum salary, and, more recently, forbidden dismissal below certain salary levels.[10] Within that framework, the market response to shocks in demand has been to adjust real salaries by means of large swings in inflation. Accordingly, the cyclical component of wages is much more volatile and (positively) correlated with output than in the United States. The flip side of that coin is that, as quantitative labor restrictions prevent the number of workers from adjusting to shocks, employment tends to be much less volatile and correlated with output (less pro-cyclical) than in the United States. As both features (high real wage volatility and low employment volatility) run along the patterns of RBC-simulated time series, the model is able to provide a better match for real historical data, at least from a labor market standpoint.

The paper is organized as follows: Section 1.2 provides a complete growth accounting exercise for Venezuela and the benchmark case of the United States for the period 1950-2008. Within Venezuela, we have worked out Solow residuals and derived productivity shocks for both the economy as a whole and for a reduced economy consisting only of the non-oil sector. In section 1.3, stylized facts of real business cycle data are presented for both countries (including Venezuela's non-oil sector). Section 1.4 introduces the standard RBC model and derives its equilibrium conditions. Section 1.5 is devoted to calibration. I have relied on Venezuela's Central Bank statistics and Baptista (2011) to calibrate an RBC model for the non-oil sector of the Venezuelan economy, which is then fed by exogenous shocks coming from the oil sector. In section 1.6, relevant statistics coming out of the simulation are presented, and in section 1.7 I analyze the potential sources of differences in the performance of

[9] See www.doingbusness.org

[10] See Presidential Decree 639, published in Official Gazette 40.310, extending the labor immobility law proclaimed in 2003, yet for another year (2014).

the RBC model for both economies. Conclusions and policy recommendations are presented in section 1.8.

1.2 Growth Accounting

In order to identify the productivity shocks that will be later input into the RBC model, I have calculated Solow residuals from a standard growth accounting exercise. A Cobb-Douglas aggregate production function has been assumed:

$$y_t = a_t k_t^{\alpha} n_t^{(1-\alpha)}, \tag{1.1}$$

where y_t stands for aggregate output, k_t for net non-residential capital stock, n_t for labor input, and α is the capital share of output. Taking logs on both sides and clearing out technology(a_t) leads to:

$$\ln a_t = \ln y_t - \propto \ln k_t - (1-\propto) \ln n_t \tag{1.2}$$

All of the data for Venezuela have been taken from the Venezuelan Central Bank and Baptista (2011). Capital stocks have been built using the perpetual inventory method. The average capital share of output used is 43.2% (average for the period 1950-2008), which is not far from the 40% that Gollin (2002) estimates for Venezuela in his seminal paper on income shares for Latin America. In the case of the United States, data for gross domestic product (GDP) and non-residential capital stock were obtained from the Bureau of Economic Analysis (BEA), whereas data for the labor input comes from the Federal Reserve Bank of St. Louis. The capital share of output used was 0.33, as elsewhere in the literature (see for example Gertler and Karadi, 2011; Sims, 2012; Gertler and Kyiotaki, 2012).

Over the sample period (1950-2008), the income gap between Venezuela and United States widened considerably. Assuming that both countries started at the same place, by 2008 Venezuela's income per capita would have been just 44.1% of that of the United States, as reported in Figure 1.[11]

[11] The Venezuelan income per capita by 1950 was estimated by Bello, Blyde and Restuccia (2011) to be 66% that of the United States. Taking into account that it widened 56% over the next fifty-eight years, yields a Venezuelan income per capita of 29% relative to that of the

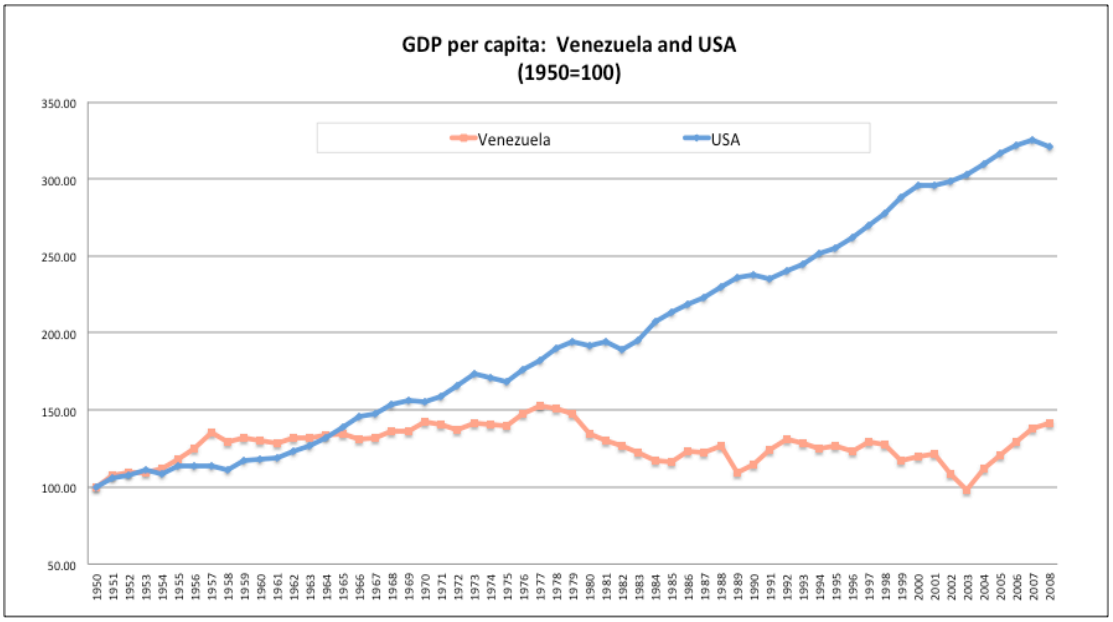

Figure 1: GDP per Capita: Venezuela and USA (1950=100)

We can differentiate two distinct periods in the evolution of Venezuelan GDP. While GDP per capita expanded 1.1% per year (34.5% in total) in the twenty-seven years between 1950-1977, it collapsed by -0.24% per year (7.2% in total) on the following thirty-one years (1977-2008). One of the most spectacular cases of economic growth turned into a colossal growth failure.

A growth accounting exercise helps to identify the sources behind the dismal differences in growth performance in these periods. We have done this exercise using workers, total hours, and hours per worker as a proxy for labor input.[12] While these methods portray growth evolution from different

United States by 2008. This is a figure consistent with the one reported by Penn World Tables (26%) and the World Bank (28%) for 2008.

[12] Data for average hours per worker has been obtained from the University of Groningen, Growth and Development Center Conference Board, Total Economy Database at http://ggdc.net.

perspectives, they yield very similar average total factor productivity and almost identical total factor productivity shocks.[13]

As we can see from Figure 2, total factor productivity accounts for most of the income gap between the United States and Venezuela. Assuming again that both countries started at same level, by 2008 the difference in income based solely in differential total factor productivity would have been 48%. These results are in line with those reported for both countries by Cole, Ohanian, Riascos and Schmitz (2005) in their study of Latin America; and also with those estimated by Calcavanti, de Abreu and Veloso (2012).

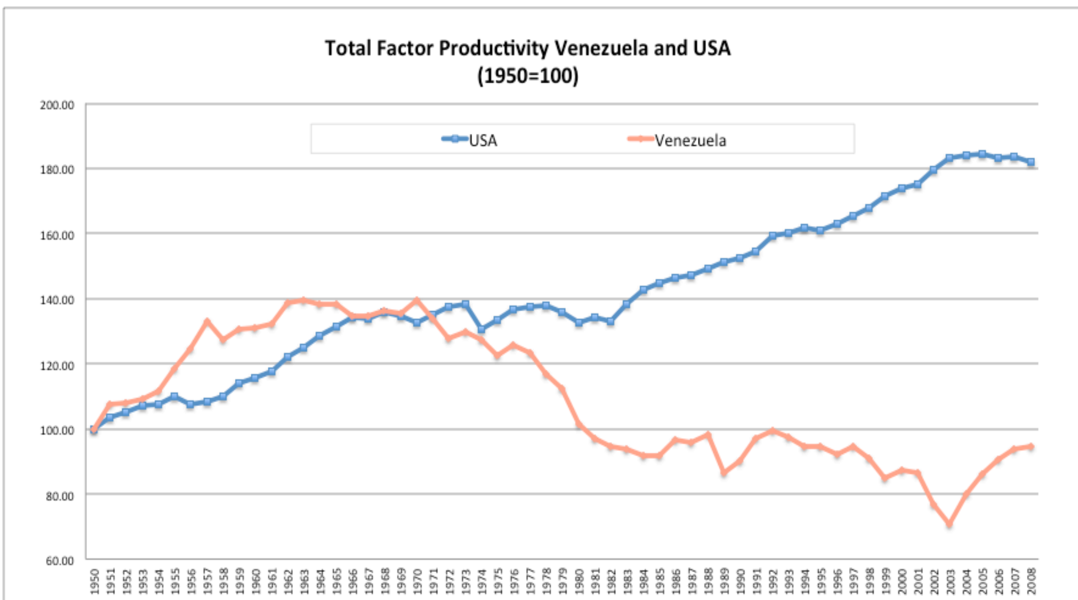

Figure 2: Total Factor Productivity Venezuela and USA (1950=100)

We can see that while Venezuelan GDP per capita peaks in 1977, its total factor productivity reached its crest seven years earlier, around 1970. From there onwards, growth per capita was driven by a large increase in the stock of capital per worker. Those seven years were characterized by a large investment boom

[13] This in turn is a consequence of the similarities observed in the decline of hours per worked in both countries over the period 1950-2008.

that did not derive its returns from productivity but rather from a number of market distortions prevalent at the time (appreciated exchange rate, guaranteed demand coming from the oil boom, low tax rates).

Table 1 below contains growth accounting results in total and per hour worked for both countries, divided into the sub-periods mentioned above. We can see that from 1950-1977 the contribution of total factor productivity in Venezuela was lower than in the United States (0.84% vs. 1.21%). Figure 2 provides clues indicating that factor productivity was very similar in both countries over the first twenty years of the sub-sample; the difference originating over last seven years of that period.

Table 1

GROWTH ACCOUNTING PER HOUR
(averages per year)

	VENEZUELA		USA	
	1950-2008		**1950-2008**	
	Growth Rate/hr	Contribution to Growth/hr	Growth Rate/hr	Contribution to Growth/hr
Gross Domestc Product per hour	0.43%	0.43%	1.62%	1.62%
Non-Res Capital Stock per hour	0.96%	0.42%	1.72%	0.57%
Total Factor Productivity		**0.02%**		**1.05%**
	1950-1977		**1950-1977**	
	Growth Rate/hr	Contribution to Growth/hr	Growth Rate/hr	Contribution to Growth/hr
Gross Domestc Product per hour	1.99%	1.99%	1.92%	1.92%
Non-Res Capital Stock per hour	2.67%	1.16%	2.14%	0.71%
Total Factor Productivity		**0.84%**		**1.21%**
	1977-2008		**1977-2008**	
	Growth Rate/hr	Contribution to Growth/hr	Growth Rate/hr	Contribution to Growth/hr
Gross Domestc Product per hour	-0.92%	-0.92%	1.37%	1.37%
Non-Res Capital Stock per hour	-0.53%	-0.23%	1.36%	0.45%
Total Factor Productivity		**-0.69%**		**0.92%**

For the second sub-period (1977-2008), the contribution of total factor productivity per hour was not only lower than that of the United States, but significantly negative (-0.69%). Such a loss, coupled with a fall on the stock of non-residential capital per hour worked (-0.23%), led to an average rate of growth of -0.92%. In these thirty-one years Venezuela lost 24.9% of its income per unit of labor. Table 1 also provides evidence pointing towards poor total factor productivity being the driving force behind the income gap reported in Figure 1. These results are consistent with those of Bosworth and Collins (2008) and Loayza, Fajnzylber, and Calderon (2005).

The distinction between these periods is important because they roughly correspond to two different institutional arrangements relating to the exploitation of oil. Between 1950 and 1970 oil extraction was run by private companies, which were awarded concessions over oil fields and heavily taxed. Within this context, the government launched a massive program of investment in public infrastructure and electricity plants that spurred growth and eased productivity in the manufacturing sector. The Yom Kippur war in 1973 and the subsequent oil embargo imposed by Arab countries on the United States had a positive impact on oil prices, feeding the greed of Venezuelan authorities and paving the way for the nationalization of the industry, which was completed in 1976. From then on, the government moved beyond the development of public infrastructure to massive intervention in the economy, gradually supplanting the market in the allocation of oil windfall within the context of state-capitalism policies.

Oil vs. Non-oil

Using Venezuelan Central Bank statistics and the revised dataset provided by Baptista (2011) we have disentangled the differences in factor contribution and total factor productivity for the oil and non-oil sectors. The results reported on Table 2 have been calculated using a slight variation on the accounting methodology used in Hayashi and Prescott (2002): Growth per worker has been decomposed into the contribution of non-residential capital per worker and average hours per worker (total factor productivities remain the same).

Table 2

GROWTH ACCOUNTING PER WORKER
(average per year)

VENEZUELA

OIL GDP

1950-2008	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	0.17%	0.17%
Non-Residential Capital Stock	1.94%	1.70%
Labor input (hours per worker)	-0.21%	-0.03%
Total Factor Productivity		**-1.50%**

1950-1977	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	4.04%	4.04%
Non-Residential Capital Stock	3.20%	2.80%
Labor input (hours per worker)	-0.35%	-0.04%
Total Factor Productivity		**1.28%**

1977-2008	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	-3.19%	-3.19%
Non-Residential Capital Stock	0.85%	0.74%
Labor input (hours per worker)	-0.09%	-0.01%
Total Factor Productivity		**-3.92%**

NON-OIL GDP

1950-2008	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	1.19%	1.19%
Non-Residential Capital Stock	1.13%	0.38%
Labor input (hours per worker)	-0.21%	-0.14%
Total Factor Productivity		**0.94%**

1950-1977	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	3.36%	3.36%
Non-Residential Capital Stock	3.47%	1.17%
Labor input (hours per worker)	-0.35%	-0.23%
Total Factor Productivity		**2.41%**

1977-2008	Growth Rate	Contribution to Growth
Gross Domestic Product per worker	-0.70%	-0.70%
Non-Residential Capital Stock	-0.91%	-0.31%
Labor input (hours per worker)	-0.09%	-0.06%
Total Factor Productivity		**-0.34%**

The differences are startling. The non-oil sector of the economy exhibits an annual average positive total factor productivity of 0.94% throughout the sample, in stark contrast to the -1.50% exhibited by the oil sector.

Within the period of steep decline in Venezuela's income (1977-2008), the non-oil sector experienced a loss in GDP per worker of 0.70% per year (19.6% in total). Over the same period, output per worker in the oil industry fell an annual average of 3.19% (a total decline of 63% throughout the period), a likely outcome of investing more money into the same developments to fight off field depletion. Differences in TFPs are presented in Figure 3.

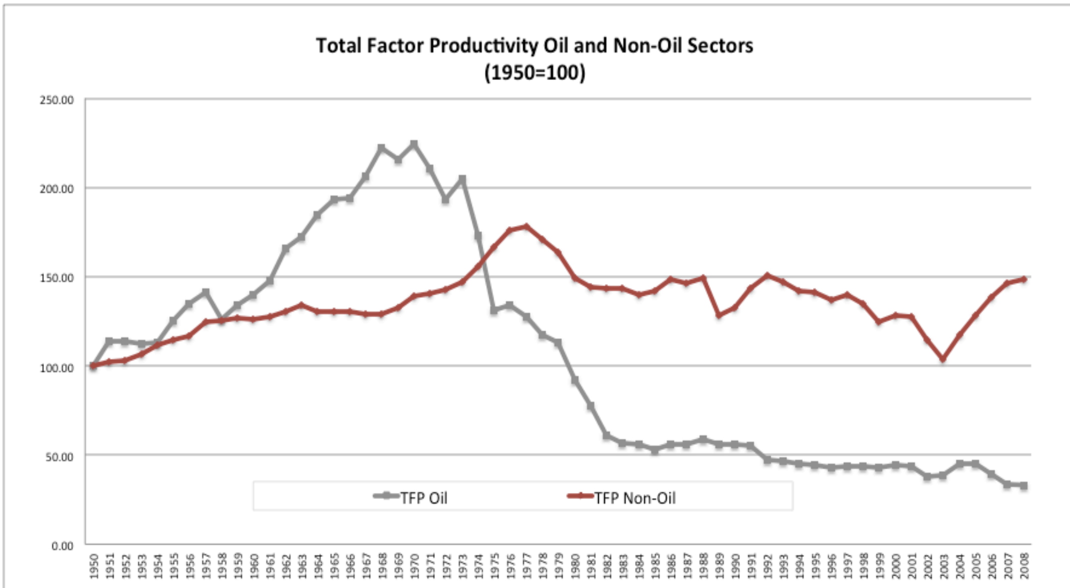

Figure 3: Total Factor Productivity Oil and Non-Oil Sectors (1950=100)

Some authors (Arreaza and Dorta, 2004; Baptista, 2004; Agnani and Iza, 2008) have analyzed TFPs in the Venezuelan oil and non-oil sector, and concluded that the latter is chiefly responsible for the country´s growth failure. Looking at the results reported in Table 2, one is tempted to differ. First, the average annual contribution of TFP for the whole sample period (1950-2008) turns out to be positive (0.94%) for the non-oil sector and negative (-1.50) for the oil sector. Second, cumulative decline in TFP over the growth-collapse period (1977-2008) totals 10% in the non-oil sector, as compared to 71% in the oil sector. Moreover, the loss of output per worker in the non-oil sector (-0.70%) was driven in roughly equal proportions by a decrease in the stock of non-residential capital per worker (0.31%) and a decrease in total factor productivity (-0.36%); whereas the fall of output per worker in the oil sector (-3.19% per year) occurred in spite of an increase in capital per worker (0.74%), neatly driven by a large decrease in TFPs (-3.19%).

In any case, the fact that the oil sector is an enclave with little forward or backward linkages to the rest of the economy does merit a differential treatment. Oil provides an average of 85% of exports throughout the sample while representing a mere 1.1% of employment. It does not respond to free-market dynamics. Since 1976, the industry has been managed by the public sector in and its output has been highly restricted by the decisions of OPEC.[14] Therefore, any attempt to understand the business cycles in Venezuela will likely benefit from adjusting the calibration to the non-oil economy, fed by oil-driven exogenous shocks.

1.3. Stylized Facts of the Venezuelan Business Cycle

We have calculated a number of relevant business cycle statistics for Venezuela and the benchmark case of the United States using HP-filtered annual series for the period 1950-2008.[15] [16] All series are expressed in logs (with the exception of the rental rate) and in real terms. The purpose is to get acquainted with the particularities of the business cycle in Venezuela, while providing a benchmark to gauge the effectiveness of RBC model in replicating actual data. The calibration for the latter follows the same guidelines and yields similar results obtained by King and Rebelo (2000) for 1948-1997 using quarterly data.

Venezuela

Most of the data used come from the national accounts of the Venezuelan Central Bank and Baptista (2011). The only statistic from a different source is average hours per worker, which was taken from the Total Economy Database of the University of Groningen. As Venezuela lacks a fully functioning and representative stock market, estimates for the annual rental rate have been obtained by dividing the share of output going to capital into the stock of non-residential capital. This ex-post indicator has at least two shortcomings that have been pointed out in the literature. First, given that the rental rate is determined ex-ante, this approach does not incorporate the effects of expectations (Stock

[14] Organization of Petroleum Exporting Countries.
[15] I stick to the convention of using parameter $\lambda = 100$ for annual data.
[16] I have used the Baxter-King filter as an alternative. The results do not differ significantly from those reported here using the Hodrick-Prescott filter.

and Watson, 1998). Second, using the capital's share of output results in implausibly high returns on physical capital (Bergoing et.al. 2002). We may neglect the latter, since our interest here does not involve levels but rather cyclical variations. As for the former, it is not so much a matter of convenience but rather one of availability. Results are reported in Table 3.

.

Table 3
Real Business Cycle Statistics for the Venezuelan Economy

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	5.08	1.00	0.53	1.00
Consumption	5.88	1.16	0.66	0.76
Investment	18.73	3.69	0.59	0.82
Employment	1.98	0.39	0.50	0.44
Labor Productivity	4.57	0.90	0.57	0.92
Real Wages	5.91	1.16	0.58	0.69
Real Rental Rate	1.32	0.26	0.44	0.50
TFP	4.36	0.86	0.53	0.93

The first and second columns contain absolute and relative volatilities, with the volatility of the cyclical component of output being the reference variable. The volatility of TFP shocks (standard deviation 4.36) is amplified at the levels of investment (18.73), real wages (5.91), consumption (5.88), output (5.08), and labor productivity (4.57). In contrast, cyclical variations on the rental rate (1.32) and most notably, employment (1.98) are significantly lower and do not amplify TFP shocks.

Most of the remaining figures on Table 3 are reasonable (i.e. investment much more volatile than output, rental rates much less), so we will focus on two noteworthy and exceptional facts. Having consumption be more volatile than output (relative standard deviation 1.16) goes against all economic rationality. One would expect that had consumers decided not to smooth consumption at all (either for undesirability, lack of financial depth, or a combination), the worst scenario possible would be having consumption and equally volatile. But it is hard to imagine why rational agents would have their consumption fluctuating more than output. We will get back to this when we analyze non-oil statistics later on.

The second interesting feature lies in the labor markets. The rigidities that prevent the market from adjusting to shocks via quantities (high relative firing costs, widespread minimum salary, and forbidden dismissal below certain salary levels) have driven employment volatility well below that of output (0.39); whilst real salaries display a large relative volatility (1.16). That is to say that extreme restrictions within the labor market have put the burden of adjustment on real salaries, as opposed to quantities, a feature that mirrors well the internal adjustment dynamics of RBC models.

Annual time-series do not display a high degree of persistence as measured by first order autocorrelations (third column). TFP shocks (0.53) do propagate at the consumption (0.66), investment (0.59), real wages (0.58) and labor productivity (0.57) levels; but not when it comes to output (0.53), employment (0.50) and rental rate (0.44).

Finally, most of the time series analyzed tend to move together with the cyclical component of output, as portrayed by the cross-correlations in Column 4. All variables exhibit pro-cyclical behavior as they all tend to correlate positively with output, although at different levels of intensity. Labor productivity seems to move together with TFP shocks, both being highly correlated with output (0.92 and 0.93 respectively). This is also the case forf investment (0.82), consumption (0.76), and real wages (0.69). The only variables without significant correlation to output are the rental rate of capital (0.50) and employment (0.44).

Venezuela Non-Oil

In order to evaluate the cyclical impact of oil shocks in the non-oil economy, we have carved out differentiated business cycle statistics using HP-filtered data. The main interest here lies in analyzing the cyclical variations of the non-oil sector of the economy given the fact that oil output is governed by factors different from market forces. Data for oil and non-oil output, investment, salaries, employment, and real wages have been obtained from national accounts and Baptista (2011). TFPs have been derived following the standard procedure, using the capital share of output reported by Baptista (2011) in the absence of oil rents (33.9%). Rental rates were estimated as non-oil capital share of output divided into non-oil non-residential capital stock.

In order to replicate Table 3 for the non-oil economy we have made three assumptions. First, average hours per worker are assumed to be similar in both sectors (since The University of Groningen does not report average hours worked per sector). Second, all oil net investment is assumed to be non-residential (neither Baptista nor the Central Bank report differentiated residential investment). Third, consumption per unit of labor has been estimated using total consumption. I believe these assumptions are plausible if we take into account that we are not dealing here with levels but rather with cyclical variations of HP-filtered data.

Real business cycle statistics estimated in such a way will portray a non-resource-abundant economy subject to oil-driven TFP shocks. Such an economy is much more likely to be resembled by RBC theory. Results are reported in Table 4.

Table 4
Real Business Cycle Statistics for the Venezuelan Non-Oil Economy

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	5.96	1.00	0.63	1.00
Consumption	5.88	0.99	0.66	0.78
Investment	19.37	3.25	0.51	0.78
Employment	1.99	0.33	0.50	0.36
Labor Productivity	5.55	0.93	0.68	0.94
Real Wages	6.20	1.04	0.57	0.78
Real Rental Rate	1.49	0.25	0.47	0.70
TFP	5.29	0.89	0.64	0.96

The standard deviation is higher for all the variables selected, with the notable exception of employment, which remained unchanged (1.98 for the economy as a whole, 1.99 for the non-oil sector)[17]. This seems to reinforce the fact that stringent labor legislation affects both sectors alike. Relative volatilities are also quite similar, but a noteworthy feature shows up in the non-oil economy. The cyclical component of consumption is now lower than that of output. Although the figure is still high (0.99) and points to little or no smoothing consumption within the non-oil sector, the reduction turns out to be significant (down from 1.16 to 0.99).

One possible explanation is that total GDP is a composite of a highly volatile non-oil output and a relatively steady oil production. Such an economy is subject to shocks coming from large cyclical swings in oil prices, which impact the demand-side of the non-oil economy (as gathered by the Solow residuals) but are squeezed out of the system without exerting much of a multiplying effect (i.e. via capital flight).

Looking at auto-correlations (column three on Table 4) we can notice that persistence and propagation within the non-oil sector are weaker than in the case for the whole economy. TFP shocks (0.64) only propagate at the level of labor productivity (0.68) and consumption (0.66). All non-oil variables turn out to be

[17] The standard deviation of consumption is identical, as I used the same aggregate measure per unit of labor.

pro-cyclical (column four) with coefficients very similar to those reported in Table 3.

United States

We have calculated a similar set of real business cycle statistics for the benchmark case of the United States. As in the case of Venezuela, all series are expressed in logs (with the exception of the rental rate) and in real terms. All time series have been obtained from the Federal Reserve Bank of Saint Louis and have been expressed either in constant 2009 US dollars (output, consumption, investment) or in 2009-based real indexes (total hours, wages). Total hours and wages have been approximated by total hours in the non-farm business sector, as reported also by the Federal Reserve Bank of Saint Louis. I have run the calculations using different index years for the same labor aggregates calculated by the Bureau of Labor Statistics and found no significant difference in the set of selected second moments. The rental rate comes from the annual deflated return of the S&P500 index. Summary statistics for the selected real business cycle variables are reported on Table 5.

Table 5
Real Business Cycle Statistics for the United States
(Cyclical variations in real returns using S&P500 as a proxy for rental rate)

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	2.04	1.00	0.48	1.00
Consumption	1.74	0.86	0.58	0.82
Investment	6.21	3.05	0.55	0.77
Employment	2.28	1.12	0.50	0.86
Labor Productivity	1.18	0.58	0.59	0.07
Real Wages	1.24	0.41	0.57	0.25
Real Rental Rate	16.52	8.12	-0.16	-0.25
TFP	1.57	0.77	0.54	0.57

A comparison between standard deviation statistics provides some preliminary insights. Output, consumption, investment, labor productivity and TFPs, unsurprisingly, display a much lower volatility that ranges between a third and a half of that registered in Venezuela for the same aggregates. In the labor market, however, the differences are striking. The average volatility of employment in the United States is 1.2 times that of Venezuela, while real wages is just 0.2. The large volatility displayed by the rental rate can be attributed to the indicator used (a cyclical component of real S&P500 returns)[18]. We shall get back to this later. By comparing standard deviations in column one of Table 5 we can also verify that TFP shocks (1.57) amplify to output (2.04), consumption (1.74), investment (6.21), employment (2.28) and rental rate (16.52), except for labor productivity (1.18) and real wages (1.24).

All relative volatilities, autocorrelations and cross-correlations are aligned with those obtained by King and Rebelo (2000) using quarterly data for the period 1947-1996. The cyclical component of consumption is less volatile than output (0.86), whilst investment turns out to be three times as volatile as output (3.05). Employment comes out as more volatile than output (1.12), as opposed to labor productivity (0.58) and wages (0.41).

All auto-correlations are on the order of 0.45-0.60, with the sole exception of rental rate, whose cyclical component displays negative auto-correlation (-0.16)[19]. TFP shock propagation is weak, with all the correlations in the vicinity of the one registered by TFP shocks (0.54). Most of the variables are pro-cyclical, with employment (0.86), consumption (0.82), investment (0.77) and TFP shocks (0.57) being the ones most correlated with output. Real wages (0.25) and labor productivity (0.08) display low correlations to output, with the latter very close to being acyclic.

[18] King and Rebelo (2000) use the rental rate provided by Stock and Watson (1998), who created a real rental rate based on vector auto-regressive (VAR) inflation expectations.

[19] As expected, the autocorrelation orders are lower than those reported by King-Rebelo (2000) using quarterly data.

The counter-cyclicality of rental rate of capital (-0.25) in the United States has already been mentioned in the literature and remains a puzzle nowadays, in spite of the numerous efforts to reconcile this with the theory of business cycles (see Kydland and Prescott, 1990; Cooley, 1995; Mertens, 2005; Di Cecio, 2005; and Mertens, 2010). Using the cyclical component of S&P500 returns as a proxy results in a highly volatile and negatively auto-correlated rental rate, two unlikely features of the marginal product of capital we are trying to mirror. In order to ease the comparisons between cycle moments in these two countries we have re-estimated Table 5 using a proxy for the rental rate obtained in a similar way to Venezuela::capital share of output divided into the stock of non-residential capital. As can be seen in Table 6, such a procedure results in rental rates that co-move along with output, similar to Venezuela, although the correlation is lower (0.25 vs. 0.70).

Table 6
Real Business Cycle Statistics for the United States
(Rental rate as capital share of output into stock of non-residential capital)

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	2.04	1.00	0.48	1.00
Consumption	1.74	0.86	0.58	0.82
Investment	6.21	3.05	0.55	0.77
Employment	2.28	1.12	0.50	0.86
Labor Productivity	1.18	0.58	0.59	0.07
Real Wages	1.24	0.41	0.57	0.25
Real Rental Rate	0.48	0.24	0.54	0.67
TFP	1.57	0.77	0.54	0.57

1. 4. Standard RBC Model

In this section we outline the formulation and equilibrium conditions of a standard frictionless RBC model.

Preferences, Endowment and Technology

There are only two representative agents: households and firms. Households consume, save (by investing in capital and renting it to firms) and supply labor. Firms produce only one good by combining capital and labor.
The economy is populated by a large number of identical and infinitely lived agents who maximize expected utility given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \tag{1.3}$$

where β denotes the discount factor, c_t is consumption and l_t represents leisure. We assume the standard properties of the utility function hold: utility is increasing in both arguments, jointly concave in consumption and leisure, and satisfies the Inada conditions.

Endowments

Individuals' main endowment is time, which can be split into hours of work (n_t) and leisure (l_t). For simplicity, the total amount of time is normalized to one, which yields the following time constraint:

$$l_t = 1 - n_t \tag{1.4}$$

Given that for simplicity we are using the most rudimentary version of the neoclassical model (closed economy, no government), all output must be either consumed or invested domestically, as formalized by the aggregate resource constraint:

$$y_t = c_t + i_t \tag{1.5}$$

Technology

The standard unit of output is produced by a large number of identical firms. The representative firm combines capital and labor inputs with constant returns to scale (CRS), according to a standard Cobb-Douglas function:

$$y_t = a_t k_t^{\propto} n_t^{(1-\propto)}, \tag{1.6}$$

where a_t is a random total factor productivity shock whose law of motion follows a mean-zero AR(1) process, in logs:

$$ln\, a_t = \rho\, ln\, a_{t-1} + \varepsilon_t \quad , \tag{1.7}$$

for $\varepsilon_t \sim i.i.d.\ N\ (0,\sigma_\varepsilon^2)$. Also, we assume the standard properties of the production function, i.e. production is increasing and concave on both factors. The law of motion of capital stock is then:

$$k_{t+1} = (1 - \delta)\, k_t + i_t, \tag{1.8}$$

where δ denotes the annual depreciation rate.

Based on this formulation, general equilibrium conditions can be computed. The representative household maximizes utility over consumption and leisure subject to his budget constraints, and the representative firm maximizes profits. By equalizing supply and demand for capital and labor we obtain our market clearing prices w_t (real wages) and R_t (real rental rate of capital).

A representative firm decides how much capital and labor to employ by solving:

$$\max_{k_t,\, n_t} \quad a_t k_t^{\alpha} n_t^{1-\alpha} - R_t k_t - w_t n_t \tag{1.9}$$

This optimization problem yields real wage and rental rate equations:

$$w_t = (1-\alpha) a_t\, k_t^{\alpha} n_t^{-\alpha}, \tag{1.10}$$

and

$$R_t = \alpha\, a_t\, k_t^{\alpha-1} n_t^{1-\alpha} \tag{1.11}$$

Given the functional form $u\ (c_t, n_t) = ln\ c_t + \theta\, ln\ (1-n_t)$, the representative household decides how much to consume and supply labor by solving

$$\max_{\{c_t,n_t\}_{t=0}^{\infty}} \quad E_0 \sum_{t=0}^{\infty} \beta^t [\ln c_t + \theta \ln(1-n_t)], \tag{1.12}$$

subject to

$$k_{t+1} = (1\text{-}\delta)k_t + w_t n_t + R_t k_t - c_t \tag{1.13}$$

Equilibrium in this model can be described by a system of non-linear stochastic difference equations and some auxiliary equations:

$$\frac{1}{c_t} = \beta^t E_t \left\{ \frac{1}{c_{t+1}} [\alpha \cdot a_{t+1}\, k_{t+1}^{\alpha-1} n_{t+1}^{1-\alpha} + (11\delta)] \right\} \tag{1.14}$$

$$\frac{\theta}{1-n_t} = \frac{1}{c_t}(1-\alpha)a_t k_t^{\alpha} n_t^{-\alpha} \tag{1.15}$$

$$k_{t+1} = a_t k_t^{\alpha} n_t^{1-\alpha} - c_t + (11\delta)k_t \tag{1.16}$$

$$ln\, a_t = \rho\, ln\, a_{t-1} + \varepsilon_t \tag{1.17}$$

$$y_t = a_t k_t^{\alpha} n_t^{1-\alpha} \tag{1.18}$$

$$y_t = c_t + i_t \tag{1.19}$$

$$w_t = (1-\alpha)a_t k_t^{\alpha} n_t^{-\alpha} \tag{1.20}$$

$$R_t = \alpha a_t k_t^{\alpha-1} n_t^{1-\alpha} \tag{1.21}$$

1. 5. Calibration

We have calibrated the model's parameters for the Venezuelan economy (as a whole and for the non-oil sector) and the United States. In most cases the proxies for parameters come from observed long-term features of the time-series we are modeling. Only in a couple of cases have I relied on highly conventional parameters widely used in RBC theory for the United States.

The *discount factor* β was calibrated using the Euler equation for a risk-free bond:

$$\frac{1}{c_t} = \beta E_t \frac{1}{c_{t+1}}(1 + r_{t+1}),$$

which, when evaluated in steady state,[20] implies:

$$\beta = \frac{1}{1+r} \tag{1.22}$$

[20] Variables without time subscripts denote steady state levels.

β has been calibrated so that the steady state interest rate coincides with average return to capital. For the case of Venezuela, we have used average real returns on capital for the economy as a whole (*r* = 13.98% per year*)* and the non-oil sector (*r* = 9.02%*)* as reported in Baptista (2011), which results in β=0.8773 and β=0.9173. For the United States, following the convention of the literature (see Lucas, 1980; Kydland and Prescott, 1982; Long and Plosser, 1983; King and Rebelo, 2000), we computed average real returns on the Standard and Poor 500 Equity Index over the analyzed period (1950-2008); which resulted in *r* = 6.27%/*year*, and β=0.9401.

The *average depreciation rate* was derived from historical time series data on depreciation expense and capital stock provided by Baptista (2011), resulting in 4.61% per year. Given that there are no records on depreciation by sectors, we have assumed that capital depreciates at the same pace in the oil and non-oil sectors. For the United States, we have performed a similar calculation using the data provided by the Federal Reserve Bank of Saint Luois, resulting in yearly depreciation of 5.67%. The latter figure is closed to the one used by Levy (1992, δ= 5.2%), Stokey and Rebelo (1995, δ= 6.0%), and Nadiri and Prucha (1996, δ= 5.9%).

We have used the same *capital share on total output* for the economy as a whole (∝=0.432) and for the non-oil sector in particular (∝=0.339) that applied in our growth accounting exercise. The latter is reported by Baptista (2011) as the rate of return on capital excluding oil rents. Baptista (2011) estimates this time series following a methodology introduced by Baptista and Mommer (1989), consisting of using the rate of return on capital on the non-oil sector of the economy to calculate the rate of return on capital without the oil sector (the difference being oil rents). For the United States, I relied on a parameter (∝=0.333) widely used elsewhere in the literature.

We calibrated the *utility parameter of leisure (θ)* solving the Euler Equation for the steady state capital-labor ratio:

$$\frac{k}{n} = \left(\frac{\alpha}{\frac{1}{\beta}-(1-\delta)}\right)^{\frac{1}{(1-\alpha)}}, \qquad (1.23)$$

where we can plug calibrated values for α, *β*, and δ to calculate the steady state capital-labor ratios. From here, we just need to solve the law of motion of capital for the steady state consumption per worker:

$$\frac{c}{n} = \left(\frac{k}{n}\right)^{\alpha} - \delta\frac{k}{n} \tag{1.24}$$

Then, we solve the first order condition for labor supply and obtain another expression for consumption per worker:

$$\frac{c}{n} = \frac{1}{\theta}\frac{1-n}{n}\,(1\text{-}\alpha)\,\left(\frac{k}{n}\right)^{\alpha} \tag{1.25}$$

Equating (24) to (25) leads to:

$$\left(\frac{k}{n}\right)^{\alpha} - \delta\frac{k}{n} = \frac{1}{\theta}\frac{1-n}{n}\,(1\text{-}\alpha)\,\left(\frac{k}{n}\right)^{\alpha}, \tag{1.26}$$

and solving for θ (taking n as given) we obtain:

$$\theta = \frac{\frac{1-n}{n}(1-\alpha)}{1-\delta\left(\frac{k}{n}\right)^{(1-\alpha)}} \tag{1.27}$$

We have estimated θ so that *n* matches the long-run average time devoted to work, as reported by the Total Economy Database of the University of Groningen for the United States (21.4%) and Venezuela (22.6%). In order not to have different parameters for leisure between Venezuela and the non-oil sector of its economy, we have used *n=0.2258* for the non-oil sector and the standard *n=0.20* for Venezuela as a whole. This exercise results in θ=2.90 for the United States and θ=2.68 for both Venezuela and the non-oil sector of the economy. In any case, the results reported below are not contingent on these assumptions, as changes of θ within the [2,4] range do not produce any significant impacts on RBC simulations (see King and Rebelo, 2000).

Finally, we calibrated *parameters associated to TFP* by using evidence from inside the model. Since this model implicitly assumes that a linear, deterministic trend drives the observed data, we de-trended the TFP series by regressing:

$$\ln\widehat{a_t} = \emptyset_0 + \emptyset_1 t_t + u_t \tag{1.28}$$

Then we use the estimated residuals $\hat{u}t$ as a measure of de-trended TFP series and estimate an AR(1) process:

$$\hat{u} = \rho \hat{u}_{t-1} + e_t \quad , \qquad (1.29)$$

where $\hat{p}$ and $\hat{t}$ may be taken as proxies for the autocorrelation coefficient of technology and standard deviation of the innovations of Solow residuals. This yields a calibration of $\hat{p}$ =0.9098 for Venezuela, $\hat{p}$ =0.9197 for the non-oil sector, and $\hat{p}$ =0.8966 for the United States. The associated standard deviations are σ_e =0.0454 for Venezuela, σ_e =0.0476 for the non-oil sector, and σ_e =0.0161 for the United States.

According to these estimations, the persistence of TFP shocks is similar in both countries, but Venezuela turns out to be three times as volatile as the United States. That is precisely one of the shortcomings of the RBC models calibrated for the United States: Shocks are persistent, but they do not exhibit enough volatility as to explain the business cycle (Summers, 1986). That is where the Venezuelan case, with oil shocks gathered on Solow residuals impacting the non-oil economy, may be a better candidate for RBC predicaments. Table 7 summarizes the result from calibration.

Table 7
Calibrated Parameters of the Baseline Model

Parameter	Description	Venezuela	Venezuela Non-oil	United States
β	Discount Factor	0.8773	0.9173	0.9400
α	Capital Share of Output	0.4325	0.3389	0.3333
δ	Annual Depreciation Rate	0.0761	0.0761	0.0567
θ	Utility Parameter of Leisure	2.6784	2.6827	2.9041
ρ	Autocorrelation Solow Residuals	0.9098	0.9197	0.8966
σ	Standard Deviation of Innovations of Solow Residuals	0.0454	0.0476	0.0161

1. 6. RBC-simulated Business Cycle Statistics

One way to assess the capacity of the RBC time series to mirror the actual behavior of the economy during the business cycle is to contrast relevant second moments for simulated and real data. Table 8 below contains standard deviations (absolute and relative), autocorrelations, and cross-correlations with output for a number of real variables as derived from a RBC standard model calibrated for the Venezuelan economy. We can gather successes and failures by comparing these statistics with those reported on Table 3 for actual data.

Although the model's output is more volatile than the actual experience (8.22 vs. 5.08), the RBC simulated series does remarkably well in predicting relative volatilities. The model captures the fact that investment is more volatile than output, with simulated relative standard deviation (3.20) coming out relatively close to observed values (3.69). Similar accuracy is registered on relative volatilities of employment (0.34 vs. 0.39), labor productivity (0.77 vs. 0.90), real rental rate (0.19 vs. 0.26) and productivity shocks (0.76 vs. 0.86). As has been anticipated, the model results on smoothed consumption series that are less volatile than output (0.71), a fact that does not match the awkward feature of real data (1.16). Also, real wages are predicted to be less volatile than output (0.76), when in fact they exhibit a higher relative volatility (1.16). Modeled volatility of TFP shocks (5.87) is amplified by real wages and labor productivity (6.25), output (8.22) and investment (26.32), a fact that matches the actual data, where in addition they are also amplified by consumption.

As reported in the literature (see Kydland and Prescott 1982 and 1990; King, Plosser and Rebelo, 1998; King and Rebelo, 2000), the RBC-simulated time series tend to be more persistent than actual values. The order of autocorrelations goes from 0.64-0.87 in the model, in contrast to 0.44-0.66 in real data. As an immediate consequence, propagation is also weaker, with observed TFP auto-correlation (0.53) being slightly below that of productivity (0.57), real wage (0.58), and investment (0.59), when in the model it propagates to all real variables with the sole exception of the rental rate.

RBC rightly predicts all real variables to be highly pro-cyclical. The degree of co-movement with output varies, with predicted cross-correlations for investment (0.89 modeled vs. 0.82 observed), labor productivity (0.96 vs. 0.92) and TFP shocks (0.98 vs. 0.92) being more accurate than those obtained for consumption (0.93 vs. 0.76), real wages (0.96 vs. 0.69), employment (0.79 vs. 0.44) and rental rates (0.77 vs. 0.50).

Table 8
Venezuela: Real Business Cycle Statistics from Basic RBC model

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	8.22	1.00	0.76	1.00
Consumption	5.86	0.71	0.87	0.93
Investment	26.32	3.20	0.65	0.89
Employment	2.78	0.34	0.64	0.79
Labor Productivity	6.25	0.76	0.85	0.96
Real Wages	6.25	0.76	0.85	0.96
Real Rental Rate	1.60	0.19	0.64	0.77
TFP	5.87	0.71	0.70	0.98

From this battery of real business cycle statistics, we can see that a basic RBC model, one portraying a closed economy without government, produces a surprisingly good account of Venezuela´s cyclical economic activity. The fit becomes even better if we calibrate the model for the non-oil sector of the economy and contrast its predictions accordingly. Table 9 below reports the outcomes of this exercise, which must be compared to Table 4.

Table 9
Non-Oil Venezuela: Real Business Cycle Statistics from basic RBC model

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	8.57	1.00	0.74	1.00
Consumption	5.92	0.69	0.85	0.94
Investment	27.32	3.19	0.64	0.91
Employment	2.81	0.33	0.63	0.83
Labor Productivity	6.43	0.75	0.82	0.97
Real Wages	6.43	0.75	0.82	0.97
Real Rental Rate	1.33	0.16	0.63	0.74
TFP	6.17	0.72	0.70	0.99

The approximation for the non-oil economy retains all the positive correspondences reported above while improving on certain areas. As expected, the calibration yields output and its components to be more volatile in the non-oil economy, a fact that matches the actual data (with the exception of consumption, where I have made no distinction between total and non-oil).

As consumption is slightly less volatile than non-oil output (0.99), it better resembles the RBC-simulated relative volatility (0.69). Granted, the simulated value is still lower than the one observed, but this is not an exclusive problem of Venezuela but rather a common feature widely observed in other countries' calibrations (see section 7 for the benchmark case of the United States). Also, the rank of relative volatilities produced by this approximation closely matches that observed in real variables such as investment (3.19 vs. 3.25), employment (0.33 vs. 0.33); and does well on labor productivity (0.82 vs. 0.93), real wages (0.82 vs. 1.04), TFP shocks (0.70 vs. 0.89) and even rental rate (0.15 vs. 0.25).

1.7. A Rationale for Differential RBC Performance: Venezuela vs. the Benchmark Case of the United States

We can contrast the performance of the RBC model in describing the behavior of the Venezuelan economy during the business cycles with the benchmark case of the United States. It is noteworthy that we are opposing one of the most heavily intervened oil-dependent economies in the world with the quintessential fully functioning market, the subject of most of literature empirical applications and adaptations of real business cycle models. To this purpose we have calibrated a basic RBC model for the United States economy and gathered significant statistics in Table 10, which we shall compare to the statistics derived from real data as reported in tables 5 and 6.

Table 10
United States: Real Business Cycle Statistics from Basic RBC model

	Standard Deviation	Relative Standard Deviation	Autocorrelations	Cross-Correlation with Output
Output	3.03	1.00	0.72	1.00
Consumption	1.76	0.58	0.85	0.90
Investment	11.50	3.80	0.65	0.94
Employment	1.28	0.42	0.64	0.89
Labor Productivity	1.99	0.66	0.81	0.95
Real Wages	1.99	0.66	0.81	0.95
Real Rental Rate	0.36	0.12	0.65	0.79
TFP	2.07	0.68	0.69	1.00

As in the case of Venezuela, modeled output volatility (3.03) is higher than that observed in real data (2.04). The model captures the fact that investment tends to be more volatile than output (3.80 modeled vs. 3.05 observed). Consumption turns out to be less volatile than output, but the difference between predicted and observed values (0.58 vs. 0.86) is not far from the gap observed in the case of non-oil Venezuela (0.69 vs. 0.99). Persistence and propagation appear stronger in simulated series than in actual data, as well as co-movements with output.

For comparison purposes, given that Venezuela has no representative stock market from which to derive rental rates of capital, we prepared Table 6 for the United States. There, we used the same statistic as a proxy that we used in Venezuela, namely a rate derived from the share of capital in GDP divided into the net stock of non-residential capital. The statistics for the latter are closer to the predictions of the model, either in relative standard deviation (0.12 vs. 0.24), autocorrelation (0.65 vs. 0.54) or cross-correlations with output (0.79 vs. 0.72). More important, the rental rate proxy comes out to be pro-cyclical, just as predicted by the RBC model. The puzzle remains, however, on why stock returns (as reported in Table 5) or other expectations-based estimates of the actual rental rate (see Stock and Watson, 1996) come out as anti-cyclical when the ex-post returns on capital as derived from national accounts are consistently pro-cyclical.

The most striking differences are to be found in the behavior of labor markets. In the case of the United States, the model predicts a relative standard deviation of unemployment (0.42) that is a third of the value observed in real data (1.12). To the contrary, the model predicts a relative volatility of wages (0.66) much higher than the one observed (0.41)[21]. One could conjecture that as actual real wages are not as flexible as presumed in the RBC model, the bulk of the adjustment to shocks falls upon quantities (workers).

The opposite happens to be true in Venezuela. Given large restrictions to labor mobility in the form of extremely high firing costs and outright restrictions to outplacements, the bulk of the adjustment to exogenous shocks falls upon prices (real salaries), as opposed to quantities (workers). Simulated relative volatility of employment, either in general (0.34) or non-oil (0.33), almost matches observed values in either case (0.39 and 0.33 respectively). Employers

[21] Some authors have noticed this shortcoming and suggested alternative ways to circumvent it, including by incorporating contracts between firms and workers that allow for wage smoothing (Gomme and Greenwood, 1995).

simply do not venture into hiring workers in a boom, because they are aware that it will be either impossible or very expensive to fire them in a recession.

This translates into a highly pro-cyclical real wage, which turns out to be more volatile than presumed in the model, displaying a relative volatility of 1.16 in general and 1.04 in the non-oil economy. This is in stark contrast with those registered for simulated time series in either case (0.77 and 0.73). The main factor behind the large volatility displayed by real wages is a highly volatile and unpredictable rate of inflation. Figure 4 below contains the cyclical components of the time series for inflation and the log average nominal wages. Although the business cycles have become more pronounced since 1970, the swings in the cyclical component of inflation have not only out weighted but also preceded those in the average nominal wage, inducing a large volatility in cyclical real wages.

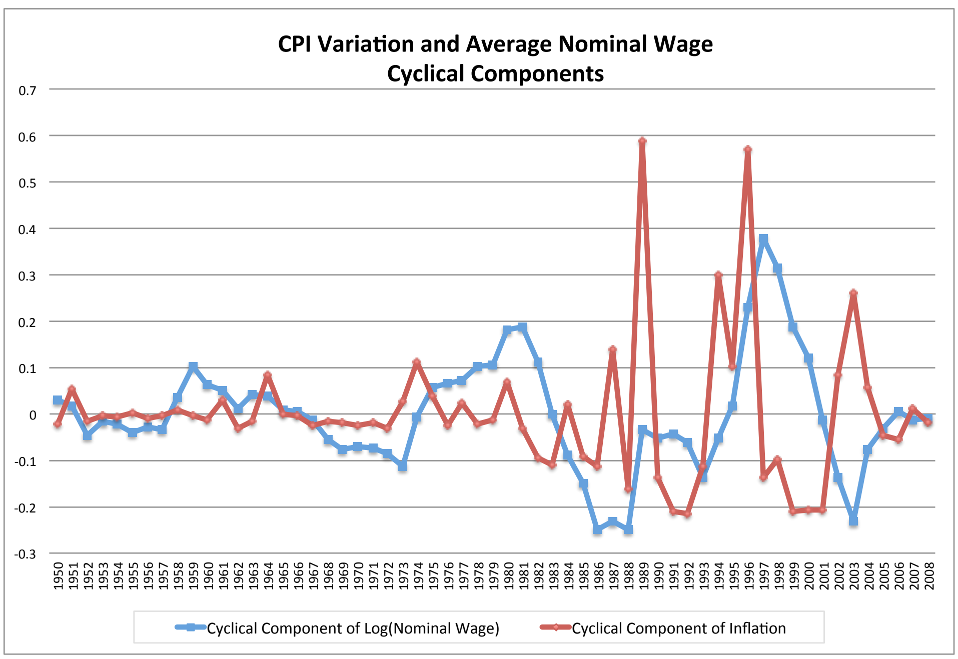

Figure 4: CPI Variation and Average Nominal Wage Cyclical Components

Large differences in the behavior or real wages registered in Venezuela and the United States do mirror the differences in labor productivity. In Figure

5, we report on the actual cyclical behavior of real wages and output over 1950-2008. The correlation in Venezuela is relatively high, both in general (69.1%) and in the non-oil sector (78.1%). In the United States, to the contrary, observed real wages are much less pro-cyclical, displaying a low correlation with output (24.8%). The disparities between both labor markets in terms of labor productivity are even more salient. As reported in Figure 6, labor productivity displays an almost perfect correlation with cyclical output in Venezuela, either in general (92.1%) or in the non-oil sector (94.3%); whereas in the United States there is barely any correspondence (6.7%). Fully flexible real wages and pro-cyclical labor productivity, intrinsic to the mechanics of adjustment of the standard RBC model, are better resembled by the Venezuelan labor market and thereby explain the better fit.

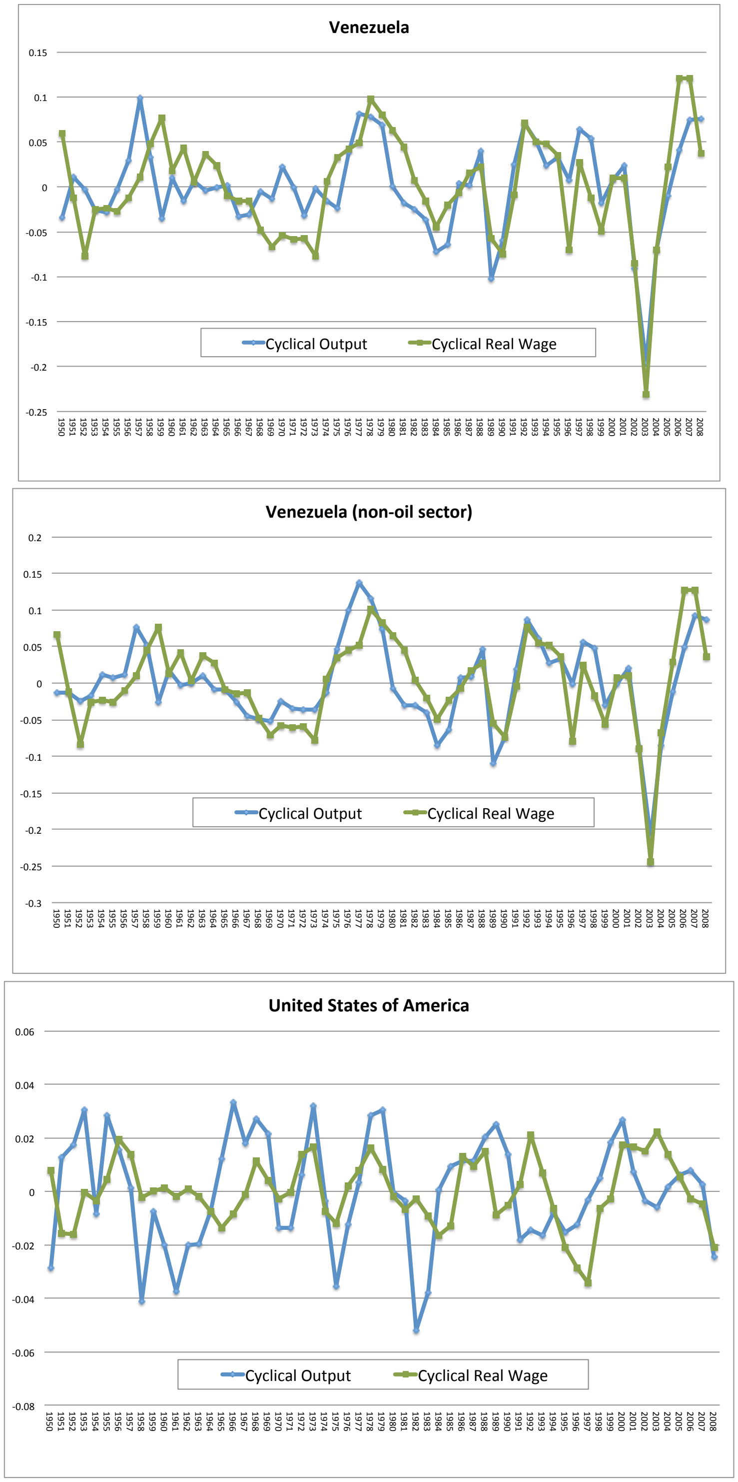

Figure 5: Cyclical Output and Real Wages

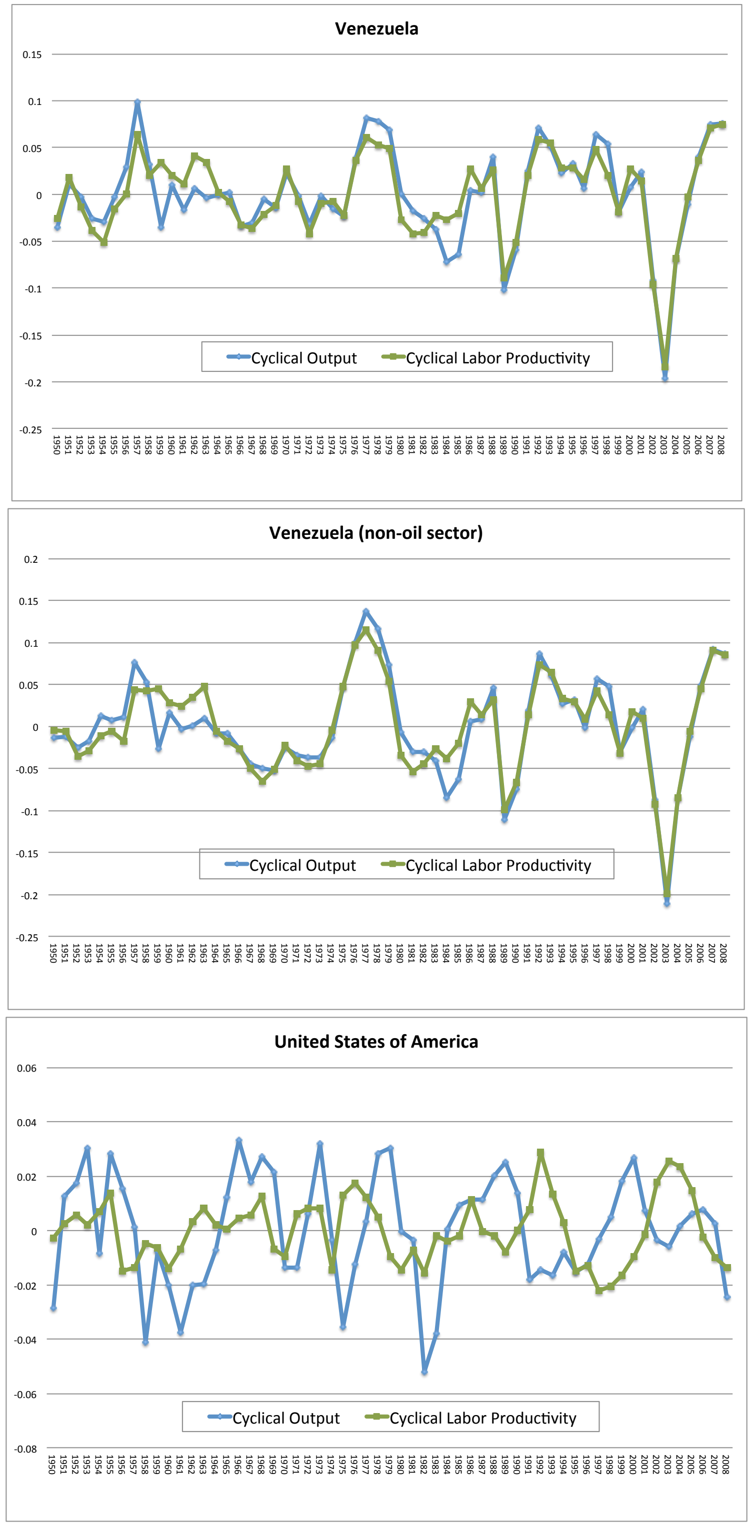

Figure 6: Cyclical Output and Labor Productivity

1. 8. Conclusions

We have calibrated a standard version of the RBC model to Venezuela and contrasted the accuracy of its predictions to those obtained for the benchmark case of the United States. In spite of being a heavily intervened economy, Venezuela has some particular features that make it appealing from an RBC standpoint. First, growth per capita has remained stagnant over the previous forty years, an unfortunate fact that in turn makes business cycle fluctuations more relevant. Second, the country is subject to large, frequent and highly volatile exogenous shocks in the form of oil prices. Third, Venezuela has some of the most rigid labor legislation in the world, an arrangement that places all the burden of adjustment to those shocks on real wages.

As it turns out, the calibration of an RBC for Venezuela preserves much of the success registered in the literature for the United States, and performs significantly better on labor markets. Given that oil output does not respond to market forces but is rather decided within the context of a cartel (OPEC), we have also calibrated a standard RBC for the non-oil sector of the economy, which is in turn compared to stylized business cycle facts carved out from national statistics for that sector. The fit is even better in the latter case, as consumption turns out to be slightly less volatile than non-oil output. Applying an old free-market framework to a heavily intervened oil-dependent economy provides new insights into both the theory and the country.

From a RBC standpoint, it is surprising that such a strong labor market restrictions are needed to match the predictions of the model. Venezuela is a country where dismissal costs are prohibitive, minimum nominal wage is widespread, and firing employees is forbidden below certain salary thresholds. And yet, predicted relative volatilities of employment almost exactly match those observed in actual data, either in general or for the non-oil economy. The flip side is real wages that are extremely volatile and highly pro-cyclical, in stark contrast to the sluggishness and lack of correlation with output that real wages exhibit in the United States.

The results reported here reinforce the so-called interest rate puzzle. Whilst ex-post indicators of returns to capital derived from national accounts do behave pro-cyclically, as predicted by the RBC model, proxies derived from real returns on stock indexes remain anti-cyclical.

For Venezuela, the implications of this paper are far reaching. Protecting jobs by introducing legislation that hinders adjustment in quantities only translates into highly volatile real wages. The net welfare effect of such a policy choice–protecting jobs at the expense of utterly unpredictable real wages–may end up being negative for workers, in particular as liquidity constraints, the only other mean of smoothing out consumption, are all too pervasive in developing countries.

Bibliography

[1] Agnani, B, and Iza, A. (2008). Growth in an oil abundant economy: The case of Venezuela. The Papers 08/18, Department of Economic Theory and Economic History of the University of Granada.

[2] Alayon, A., Daza, A., Carballo, C., Marquez, V. (2002). El costo de la regulacion laboral y de las decisiones judiciales en Venezuela. Edicion UCAB-Conapri, Caracas.

[3] Arreaza, A., and Dorta, M. (2004). Sources of Macroeconomic Fluctuations in Venezuela. Serie de Documentos de Trabajo, BCV, 56.

[4] Baptista, A. And Mommer, B. (1989), Renta petrolera y distribución factorial del ingreso, Instituto Latinoamericano de Investigaciones Sociales (ILDIS), Friedrich Ebert Stiftung, Caracas.

[5] Baptista, A. (2004). El relevo del capitalismo rentístico. Fundación POLAR.

[6] Baptista, A. (2011). Bases cuantitativas de la economía venezolana: 1930-2008. Fundación POLAR.

[7] Bello, O., Blyde, J., and Restuccia, D. (2011). Venezuela's growth experience, *Latin American Journal of Economics*, *48*(2), 199-226.

[8] Bergoing, R. et.al. (2002). A Decade Lost and Found: Mexico and Chile in the 1980s. *Review of Economic Dynamics, 5*(1), 166-205.

[9] Bosworth, B. and Collins, S. (2008). The empirics of growth: An update, Brookings Papers on Economic Activity 2, 113-179.

[10] Calcavanti, P., de Abreu Pessoa, S., Veloso, F. (2012). On the evolution of TFP in Latin America, Fundacao Getulio Vargas, Instituto Brasilero de Economia (IBRE).

[11] Cole, H., Ohanian, A., Riascos, A., Schmitz Jr., J.A. (2005). Latin America in the rearview mirror, *Journal of Monetary Economics, 52*: 69-107.

[12] Cooley, T., (1995). Frontiers of BC Research. Thomas Cooley, Editor. 1995.

[13] Di Cecio, R. (2005). Comovement: It is not a puzzle. Working Paper 2005-035B http://research.stlouisfed.org/wp/2005/2005-035.pdf Federal Reserve Bank of Saint Louis.

[14] Erbil, N. (2011), Is Fiscal Policy Pro-cyclical in Developing Oil Producing Countries?. IMF Working Paper WP/11/171.

[15] Finn, M.G. (1995). Variance properties of Solow's productivity residual and their cyclical implications. *Journal of Economic Dynamics and Control, 19*, Issues 5–7, July–September, 1249–1281.

[16] Friedman, M. (1957). A Theory of the Consumption Function, Princeton University Press, Princeton, N.J.

[17] Gertler, Mark & Karadi, Peter, (2011). A model of unconventional monetary policy, *Journal of Monetary Economics, Elsevier, 58*(1), 17-34. Gertler, Mark, and Nobuhiro Kyiotaki (2011). Financial Intermediation and Credit Policy in Business Cycle Analysis. In *Handbook of Monetary Economics*, Vol. 3, ed. Benjamin Friedman and Michael Woodford.

[18] Gollin, D. (2002). Getting income shares right, *Journal of Political Economy, 110*(2): 458-464.

[19] Gomme, P., and Greenwood, J. (1995). On the cyclical allocation of risk, *Journal of Economic Dynamics and Control, 19*: 91-124.

[20] Hayashi, F., and Prescott,, E. (2002). The 1990s in Japan: A lost decade. *Review of Economic Dynamics, 5*(1), January, 206-235.

[21] Hausmann, Ricardo, Talvi, E., Gavin and M., Perotti, R. (1996). Managing Fiscal Policy in Latin America and the Caribbean: Volatility, Pro-cyclicality, and Limited Creditworthiness; Inter-American Development Bank Papers. Inter-American Development Bank Working Paper-326.

[22] Kilian, L. (2006). Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. CEPR Discussion Paper no. 5994.

[23] King, R., Plosser, C., and Rebelo, S. (1988). Production, growth, and business cycles: I. The basic neoclassical model. *Journal of Monetary Economics, 21*, 195-232.

[24] King, R., Rebelo, S. (2000). Resuscitating real business cycles, NBER Working Paper No. 7534, February, NBER Program EFG.

[25] Kydland, F., and Prescott, E. (1982). Time to build and aggregate fluctuations. *Econometrica, 50*, 1345-1370.

[26] Kydland, F., and Prescott, E. (1990). Business cycles: Real facts and a monetary myth, *Federal Reserve Bank of Minneapolis Quarterly Review, 14*, 3-18.

[27] Levy, D. (1994). Capital Stock Depreciation, Tax Rules, and Composition of Aggregate Investment. Journal of Economic and Social Measurement.

[28] Loayza, N., Fajnzylber, P., and Calderon, C. (2005). *Economic growth in Latin America and the Caribbean: Stylized facts, explanations and forecasts*, Washington DC: The World Bank.

[29] Long, J., and Plosser, C. (1988). Real business cycles. *Journal of Political Economy, 91*. 39-69.

[30] Lucas, R. (1980). Methods and Problems in Business Cycle Theory. *Journal of Money Credit and Banking, 12*, 696-715.

[31] Mertens, E. (2005). The Output-Interest Rates Puzzle Conditional on Technology and Monetary Shocks, Study Center Gerzensee and University of Lausanne October.

[32] Mertens, E. (2010). Structural Shocks and the Comovements Between Output and Interest Rates. Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C. 2010-21.

[33] Nadiri, I. & I. Prucha (1996). Estimation of the Depreciation Rate of Physical and R&D Capital in the U.S. Total Manufacturing Sector. *Economic Inquiry 34*, 43-56.

[34] Sims, E. (2012). Lecture notes on Graduate Macro Theory II: Stylized Business Cycle Facts and the Quantitative Performance of the RBC Model. University of Notre Dame.
http://www.nd.edu/~esims1/grad_macro_12.html

[35] Stock, J. and Watson, M (1996). Business Cycle Fluctuations in U.S. Macroeconomic Time Series, in J. Tailor and M. Woodford (eds.) *Handbook of Macroeconomics*, North-Holland.

[36] Stokey, N. and Rebelo, S., (1995). Growth Effects of Flat-Rate Taxes. *Journal of Political Economy, 103*, 519-550.

[37] Summers, L. (1986). Some skeptical observations on real business cycle theory. Federal Reserve Bank of Minneapolis, Quarterly Report, Fall 1985, Chapter 5.

Chapter 2

From Financial Repression to External Distress: The Case of Venezuela *

2.1 Introduction

The literature on sovereign default has identified the widespread prevalence of "debt intolerance:" when developing nations experience serious debt servicing difficulties, even to the point of default, at external debt-to-GDP ratios that are substantially below the levels routinely recorded for advanced economies.[22] Reinhart and Rogoff (2009 and 2011) posit that the omission or underestimation of domestic liabilities in debt-sustainability calculations helps to explain sovereign external default and restructurings at "seemingly low" levels of external debt.[23] The problem is that time series on domestic-currency

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[22] See Reinhart, Rogoff, and Savastano (2003) for a discussion of the concept of debt intolerance and an application to a broad array of emerging markets and Bannister and Barrot (2011) for further applications.

[23] Besides the presence of "hidden" domestic liabilities, there are other explanations for the debt intolerance phenomenon. Reinhart, Rogoff, and Savastano (2003) emphasize the role of reputation and a history of serial default (countries with a recurring history of adverse credit events cannot digest even what are widely considered as moderate levels of external debt). Catão and Kapur (2006) highlight the role played by macroeconomic volatility in explaining debt intolerance. While volatility increases the need for international borrowing to help smooth domestic consumption, the ability to borrow is constrained by the higher default risk that volatility engenders. Kraay and Nehru (2006) emphasize the role of institutions while Mendoza and Oviedo (2006) argue that the volatility of revenues makes continuous debt servicing more challenging.

liabilities (public or private) are hard to come by and, until recently, the theoretical literature on domestic debt was comparatively sparse.[24] As a consequence, the connection between domestic debt burdens, financial crises, and external sovereign defaults remains understudied. In this paper, we investigate some of these links in the case of Venezuela from 1984-2013.

The Venezuelan experience is unique because it encompasses multiple financial crises, debt restructuring, cycles of financial and capital account liberalization and policy reversals, alternative exchange rate arrangements and booms and busts in the country's terms of trade over a thirty-year span. We offer an encompassing view of external vulnerability beyond sovereign default or restructuring that takes into account the private sector as reflected in capital flight (or repatriation).

In any event, financial repression accounts for public revenues similar to those of OECD economies, in spite of the latter having much higher domestic debt-to-GDP ratios. This is because the financial repression "tax rate" is consistently higher than in advanced economies.[25] Furthermore, the financial repression tax rate is higher still in years of exchange controls and legislated interest rate ceilings. In line with an earlier literature on capital controls, our comprehensive measures of capital flight document a link between domestic disequilibrium and a weakening of the net foreign asset position via private capital flight. These results matter because, in our view, they are not unique to Venezuela.

The paper proceeds as follows: Section 2.2 describes economic and financial developments in Venezuela to provide a quantitative narrative of the

[24] Reinhart and Rogoff (2009) provided long dated time series on domestic and external public debt; Abbas, et.al (2010) and Barrot (2015) have recently expanded this line of research. Also, recent theoretical work has begun to focus on the nexus between domestic debt, sovereign default and, in some instances, inflation (see for instance, Aguiar, 2013, et.al. D'Erasmo and Mendoza, 2013, and Hur, Kondo and Perri, 2013).

[25] Reinhart and Sbrancia (2010 and 2015) arrive at a similar conclusion for inflation-prone Argentina but not for India or South Africa, the other two developing countries in their predominantly advanced-economy sample.

evolution of domestic and external debt while sketching the current system of multiple exchange rates and widespread capital controls. In Section 2.3, we analyze the mechanisms of financial repression used by the Venezuelan government to default on or tax the holders of domestic debt obligations (the haircut). The parallels with negotiated haircuts on external debt, as extensively documented in Cruces and Trebesch (2013), are discussed. We next describe variations of two different basic methodologies proposed in the literature to estimate the financial repression tax. The first of these approaches follows Reinhart and Sbrancia (2011 and 2015) and decomposes the ex-post real returns on domestic debt into the unexpected inflation and ex-ante financial repression components. The second approach measures the financial repression tax (or haircut) by comparing the "market-determined" yield on foreign debt with ex-ante and ex-post returns on domestic financial instruments, as in Giovanini and De Melo, (1993).[26] Section 2.4 presents the estimates for the Venezuela case. While financial repression helps to "liquidate" the existing stock of domestic debt, we also show that it tends to accelerate leakages on the capital account in the form of capital flight (the topic of Section 2.5), weakening the net foreign asset position. We complement the traditional measure of capital flight with an estimate of the over-invoicing of imports, which accelerates markedly in periods of exchange controls. The final section discusses to what extent the results are representative of a broader experience.

2.2 Economic Setting: Debt, Exchange Rates, and Capital Mobility

Despite soaring oil prices from 2006 to 2013, the net consolidated external debt of Venezuela rose from US $26.9 to US $104.3 billion. The central government, however, only accounted for roughly a fifth of that. The difference, US $60.9 billion (78%), owed to standard practices of the Bolivarian revolution,

[26] Other measures of the financial repression tax have been suggested by Easterly (1989) and Easterly and Schmidt Hebbel, (1994); see also background material to Reinhart and Sbrancia (2015) for a discussion of this literature.

and was issued by state owned enterprises and the relatively new *Fondo Comun China-Venezuela* (FCCV). The FCCV is a special-purpose vehicle that allows Venezuela to withdraw from a rolling line of credit at the Chinese Development Bank in exchange for future shipments of oil. [27]

Domestic debt in local currency also climbed, rising from 36.298 million bolivares (VEF) in 2006 to 420.502 million in 2013.[28] The nominal increase of 1,060% (an average annual rate of 42%) was partially offset by an accumulated price increase of 528% (or an average annual rate of 30%), reducing the cumulative increase in real domestic debt to about 85% (or 9% per annum).

During much of this period, the combination of exchange controls and interest ceilings created a captive domestic audience for domestic government debt despite markedly negative real ex post interest rates. The significant losses imposed on domestic bondholders escalated over time, owing to accelerating inflation.

The existence of multiple exchange rates over prolonged periods of time makes it difficult to estimate precise debt burdens. For instance, during 2013, the average parallel exchange rate premium peaked at 478%, while debt-to-GDP ratios calculated at market rates were about 3.9 times higher than those calculated on the basis of the official rate. Total public debt, calculated at a moderate 40% of GDP on the basis of the official rate (Figure 7), is transformed to a public debt burden of about 150% of GDP in parallel market rates are used to convert the existing stock of external debt (Figure 8). As Venezuela has undergone three extended periods of exchange controls spanning 18 of the previous 28 years, we can revisit previous episodes to roughly assess where debt-to-GDP ratios stabilized once the exchange rate was unified.[29]

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[27] The latter escapes the scrutiny of the National Assembly, is shielded from any formal mechanism of accountability, and is not included in the official external debt statistics, as reported by the World Bank.
[28] VEF refers to the new currency unit introduced by the Venezuelan Central Bank on January 1st, 2008 (*bolívar fuerte* or strong bolívar), equivalent to 1,000 bolívares.
[29] See chronology in Appendix I.

In 1988, the debt-to-GDP ratio at the parallel market rate was approximately double the comparable calculation based on the official exchange rate (100.3% vs. 58.1%). Once the system of financial controls was dismantled in the process of economic reform of 1989 (*El Gran Viraje*), debt-to-GDP ratios stabilized around 68.2%, closer to the estimate calculated using the official exchange rate pre-liberalization. Figure 9, which traces the evolution of external debt evaluated at both official and parallel rates, illustrates this point. Of course, these developments unfolded during a period when the economic outlook for the region was on the mend as the debt crisis that engulfed Latin America during most of the 1980s was coming to a closure, culminating with the Brady Plan debt restructuring agreements at the beginning of the 1990s.[30] A similar post-unification pattern was observed in 1996, when a new attempt at stabilizing the economy (*Agenda Venezuela*) unified the exchange rate.

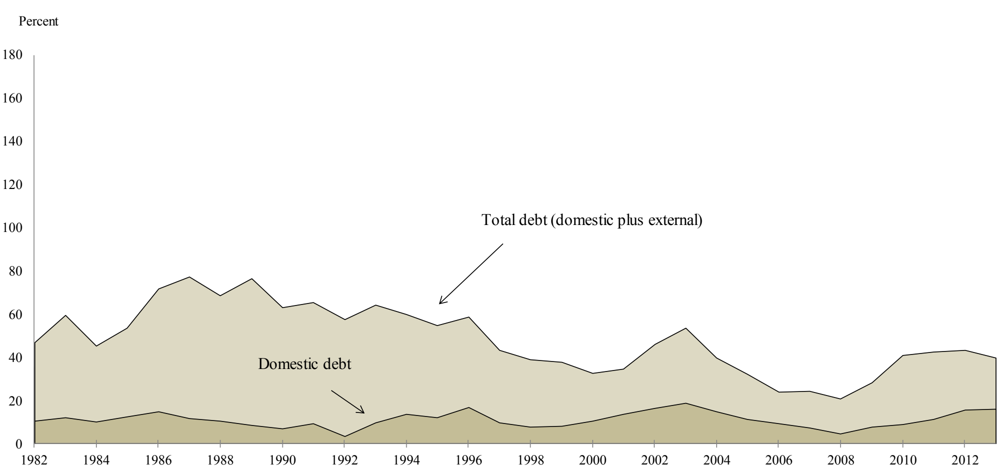

Figure 7: Consolidated Public Debt and its Composition at the Official Exchange Rate: Venezuela, 1982-2013

Sources: International Monetary Fund, *International Financial Statistics* and *World Economic Outlook* Jeanne and Guscina (2006), Ministerio de Finanzas, and Reinhart and Rogoff (2009).

[30] Cline (1989 and 1995) provides a comprehensive analysis of these events.

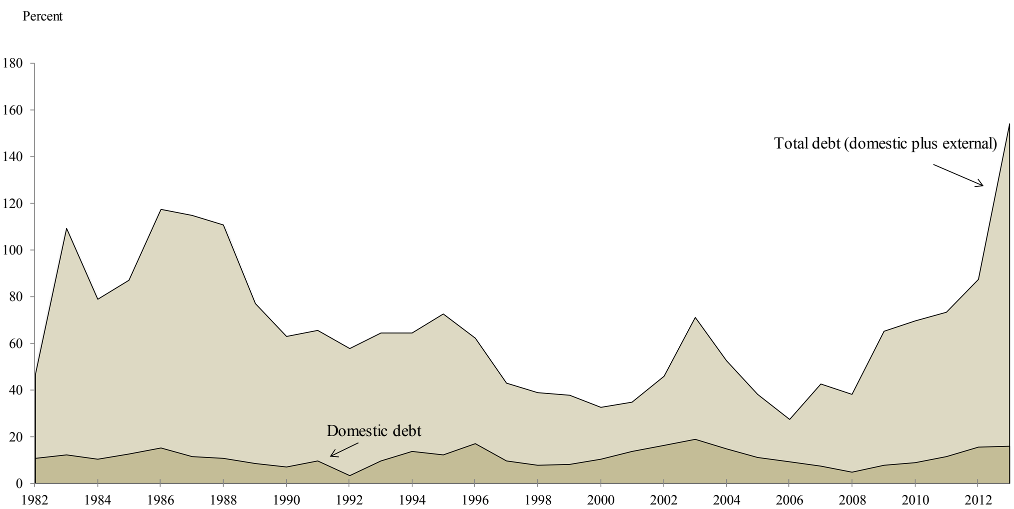

Figure 8: Consolidated Public Debt and its Composition at the Parallel Market Exchange Rate: Venezuela, 1982-2013

Sources: International Monetary Fund, *International Financial Statistics* and *World Economic Outlook* Jeanne and Guscina (2006) and Ministerio de Finanzas, and Reinhart and Rogoff (2009), and Thompson Reuters.

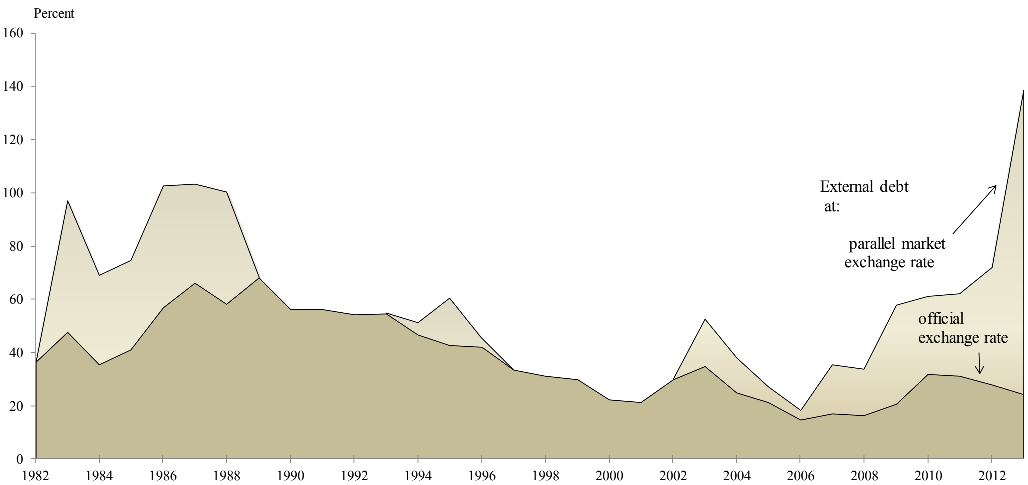

Figure 9: Consolidated External Public Debt at the Official and Parallel Exchange Rates: Venezuela, 1982-2013

Sources: International Monetary Fund, *International Financial Statistics* and *World Economic Outlook* Jeanne and Guscina (2006) and Ministerio de Finanzas, Reinhart and Rogoff (2009), and Thompson Reuters.

Notes: The intervals where the official and parallel market measures coincide, indicate the episodes of financial and capital account liberalization (subsequently reversed), where the rates were unified.

Table 11 summarizes the drivers behind the fall on the foreign debt-to-GDP ratio calculated at the parallel exchange rate. In 1989, foreign debt-to-GDP ratios fell 31.7 percentage points from 100.3% to 68.2%, mostly driven by a spike in inflation (84.5%), which was well above the depreciation registered in the average parallel market rate (15.6%). In 1996, the picture looks somewhat different. Foreign debt-to-GDP ratios fell by 24.5 percentage points (from 60.5% to 45.7%), driven primarily by a net amortization of foreign debt (9.8%), and an inflation rate (99.9%) that was somewhat larger than the depreciation registered in the average parallel exchange rate (79.9%).

Table 11
Episodes of exchange rate unification, Venezuela 1982-2013

	Foreign Debt	Parallel Exchange Rate *	General Price Index	Gross Domestic Product	Foreign debt-to-GDP at parallel rate
1989	2.04	15.78	84.46	-8.60	-31.70
1996	-9.76	79.87	99.88	-0.20	-24.54

* Change in average parallel exchange between the unification year and the prior year.
Average parallel exchange rate considers parallel rate up to the unification month, and then the unified official exchange rate

Sources: Ministerio de Finanzas, Banco Central de Venezuela, and Thompson Reuters.

These stylized facts seem to suggest that prices during the period of controls respond to something close to an average between the official and parallel exchange rates.[31] As exchange rate controls have been accompanied with price controls, the price level embedded in the nominal GDP does not fully reflect the marginal (parallel) exchange rate. Surely, there is a great deal of uncertainty on the part of domestic importers and producers about the rate at which they will be able to get their next allotment of foreign currency, but that uncertainty cannot always be transferred to prices, either because of the existence of price controls, "maximum profit margins," or demand-driven considerations.

In such circumstances, debt-to-GDP ratios calculated at parallel market rates are an upper bound, as the average marginal exchange rate is used to convert foreign debt into domestic currency (or alternatively, nominal GDP and domestic debt into foreign currency), but nominal GDP has not yet incorporated the full price effects implicit on that rate. Once the unification

[31] Reinhart and Rogoff (2004) examine this issue for 153 countries over 1946-1998 for which they have monthly parallel exchange market data. They conclude the parallel rate is a better predictor of future inflation but also note in the background material that based on their estimates of the over-invoicing of imports and under-invoicing of exports there is considerable cross-country variation.

takes place, often coupled with the elimination of price ceilings, inflation takes off and nominal GDP jumps, stabilizing the debt-to-GDP ratio at a level much closer to the one previously calculated at the official exchange rate. Thus, it all depends on the share of economic activity connected to the official rate. For example, according to Barclays (2014), in 2013 the average exchange rate was 16.0 VEF per dollar, which is somewhere in between the official rates (6.3 and 11.4) and the average parallel market rate (35.0). At that rate, total debt-to-GDP is 78%, which is closer to the lower bound at the official rate (40%) than to the upper bound estimated at the average parallel market rate (154.3%).

2.3 Measuring the Financial Repression Tax: Conceptual Approaches

Financial repression imposes a tax or haircut on domestic debt.[32] The haircut is a default, but de facto rather than de jure, as the terms of the underlying debt contracts are not violated. The tax is enforced through the combination of exchange controls creating a captive audience for the domestic public sector debt and inflation running above nominal interest rate ceilings. As a result, negative ex-post real interest rates are an imposed loss on domestic bondholders—hence, the analogy to the haircuts on external debt that arise in the context of restructuring agreements.[33] Unlike the settlement process of external debts, however, creditors have little or no say in the magnitude of the haircut. Since domestic banks and pension funds are the usual buyers of the government debt, these losses are transferred to depositors in the form of even lower negative real interest rates on deposits, which operate as an effective tax on savings. Unfunded liabilities in the pension system can quickly accumulate if the haircut is significant and there is little or no scope to make up for these losses by holding alternative assets, as purchases of foreign assets are often curtailed or prohibited altogether. In what follows, we use two different approaches to assess the magnitude of the financial repression tax. The first of these is a modified version

[32] Usually refers to the fact that the interest rate ceilings that usually accompany financial repression need not a priori be binding.

[33] See Cruces and Trebesch (2013).

of Reinhart and Sbrancia (2015), which introduced a theoretical differentiation between the effects of unexpected inflation and those of ex-ante financial repression; i.e. domestic nominal interest rates below expected inflation.

The second approach is based on Giovanini and De Melo (1993), who compare "effective interest rates" on external debt to the potentially repressed "effective interest rates on domestic debt." This is a natural exercise for emerging markets (the focus of their analysis) for the period that they consider (1974-1987), as emerging market governments funded themselves through both domestic and external borrowing (in varying degrees), as documented by Reinhart and Rogoff (2011). The market-determined interest rate on external debt is a logical benchmark under such circumstances. However, as noted by Reinhart and Sbrancia (2015), there are two compelling reasons why this approach is neither feasible nor desirable for broader application. First, most emerging markets had little or no external debt during the heyday of the financial repression era during Bretton Woods (1945-1973); the depression of the 1930s and the subsequent World War had all but eradicated global debt markets. Second, some countries (such as the United States and the Netherlands) do not have and have not had external debt.[34] All government debts are issued under domestic law and in the domestic currency, irrespective of whether the holders of the debt are domestic pension funds or foreign central banks.

Unexpected Inflation, Ex-Ante Financial Repression and Seigniorage

Modifying Reinhart and Sbrancia (2015), we introduce foreign debt (in addition to domestic debt) into the government's budget constraint.[35] The approach departs from the consolidated public budget in real terms, differentiating between cash outlays and inflows:

[34] Apart from a trivial amount of Carter-bonds in the 1970s, the US debt is domestic, whether it is held by residents or nonresidents.

[35] Note that this is the consolidated budget constraint for the government, which is obtained by combining the budget constraints of the fiscal and monetary authorities. This budget constraint makes explicit the link between monetary and fiscal policy.

$$g_t + \frac{1+i_{t-1}}{1+\pi_t} b_{t-1} + \frac{1+i^*_{t-1}}{1+\pi^*_t} e_t b^*_{t-1} = \tau_t + b_t + e_t b^*_t + \left(h_t - \frac{h_{t-1}}{1+\pi_t}\right) \qquad (2.1)$$

On the left-hand side we have total cash outflows:

Real government expenditure (g_t)

Real debt service on domestic debt $\left(\frac{1+i_{t-1}}{1+\pi_t} b_{t-1}\right)$

Real debt service on foreign debt, $\left(\frac{1+i^*_{t-1}}{1+\pi^*_t} b^*_{t-1}\right)$ and the real exchange rate (e_t)

Note that the ex-post real interest rate for domestic debt and foreign debt is a function of the ex-ante nominal interest rate $(i_{t-1}\ and\ i^*_{t-1})$ and realized inflation $(\pi_t\ and\ \pi^*_t)$ respectively.

On the right-hand side of (2.1) are the three sources of financing: Taxes (τ_t); new financing via issuance of domestic (b_t), and foreign (b^*_t) debt; and seigniorage (h_t denotes base money).

A note on taxes: one can also connect the government's fiscal position to external developments by assuming that a fraction of total tax revenues (τ_t), arises from interest earnings on the stock of reserves held by the central bank, as in Velasco (1987) among others.

Let i^F_{t-1} be the interest rate that would be levied on domestic debt in the absence of financial repression, and π^e_t the expected rate of domestic inflation in period *t*. By adding and subtracting $\left[\left(\frac{1+i_{t-1}+(i^F_t - i_{t-1})}{1+\pi^e_t}\right) b_{t-1}\right]$ from the left hand side of (2.1) and we arrive at:

$$g_t + (1+r^F_t)b_{t-1} + (1+r^*_t)e_t b^*_{t-1} - (1+t^A_t)\frac{(\pi_t - \pi^e_t)}{(1+\pi_t)} b_{t-1}$$
$$- \frac{i^F_{t-1} - i_{t-1}}{1+\pi^e_t} b_{t-1} = \tau_t + b_t + e_t b^*_t + \left(h_t - \frac{h_{t-1}}{1+\pi_t}\right)$$

where:

$$(1+r^F_t) = \frac{1+i^F_{t-1}}{1+\pi^e_t},$$

the ex-ante real return on domestic debt in absence of financial repression,

$$(1+r^*_t) = \frac{1+i^*_{t-1}}{1+\pi^*_t},$$

the real return on foreign debt, and

$$(1 + r_t^A) = \frac{1+i_{t-1}}{1+\pi_t^e}$$

is the ex-ante real return on domestic debt.

We can now rearrange the consolidated real public budget as:

$$(g_t - \tau_t) + r_t^f b_{t-1} + r_t^* e_t b_{t-1}^* + \Delta b_t + e_t \Delta b_t^* = (1 + r_t^A)\frac{(\pi_t - \pi_t^e)}{(1+\pi_t)} b_{t-1} + \frac{i_{t-1}^F - i_{t-1}}{1+\pi_t^e} b_{t-1} + \left(h_t - \frac{h_{t-1}}{1+\pi_t}\right) \quad (2.2)$$

The left hand side shows financing needs without either financial repression or seigniorage. The components are the primary fiscal balance $(g_t - \tau_t)$, real interest rate payments on domestic debt in the absence of financial repression $\left(r_t^f b_{t-1}\right)$, real interest payments on foreign debt in domestic currency $(r_t^* e_t b_{t-1}^*)$, and the net increase in domestic (Δb_t) and foreign debt $(e_t \Delta b_t^*)$.

On the right hand side we break down the financing, distinguishing between: Unanticipated inflation $(1 + r_t^A)\frac{(\pi_t - \pi_t^e)}{(1+\pi_t)} b_{t-1}$, ex-ante financial repression arising from differences between free market and realized domestic interest rates $\left(\frac{i_{t-1}^F - i_{t-1}}{1+\pi_t^e} b_{t-1}\right)$, and seigniorage $\left(h_t - \frac{h_{t-1}}{1+\pi_t}\right)$. Seigniorage and its corresponding inflation tax are applied to holdings of high-powered money, while the tax base for financial repression are holdings of government bonds. Moreover, inflation is not a prerequisite for financial repression nor are interest rate ceilings required to impose inflationary taxes. That is not to say there are no complementarities between financial repression and inflation taxes. Indeed, given interest rate ceilings and within certain non-hyperinflationary limits, both sources of financing are positively related to the rate of inflation. However, from a conceptual standpoint, it is important to differentiate between these components: As financial liberalization takes place, the inflation-tax need not disappear; it will most likely hold while fiscal financing from financial repression vanishes and the market interest rates and the interest rates on government debt converge increase.

As also stressed in Reinhart and Sbrancia (2015), it is important to distinguish between the effects of inflation surprises and ex-ante financial repression. The former results from agents' failure to forecast inflation accurately while the latter responds to expected financial repression effects, (i.e. even if economic agents are able to forecast inflation accurately, interest-rate ceilings below expected inflation still force real losses on their holdings of domestic bonds).[36]

The modification to Reinhart and Sbrancia (2015) allows us to examine the intersection between domestic debt, financial repression, and external developments. First, it connects the failure to refinance foreign debt with the need to resort either to financial repression or seigniorage (for a given level of government spending and taxes). Second, it incorporates the effects of real depreciation as a financing mechanism, which usually translates into higher real money balances (printing more domestic currency in exchange for unit of dollar exports). Lastly, if government tax revenues are linked to the stock of international reserves, it becomes evident that capital flight (which is associated with a lower level of international reserves than otherwise would prevail) would, other things equal, produce larger financing needs. These needs, to the extent that they are not compensated by other forms of explicit taxation (consumption, income, etc), lead to a greater reliance on the financial repression or inflationary taxes.

Domestic and Foreign Cost of Borrowing

The second approach to measuring financial repression is based on the difference between the domestic and foreign cost of borrowing (as in Giovanini and de Melo, 1991). Foreign yields reflect free-market risk perception. Assuming that domestic and foreign bonds are perfect substitutes, we can estimate the fiscal effects of financial repression by calculating domestic debt service at yields demanded by international market on foreign bonds. Of course, this approach assumes that there are no transaction costs, no risk differentials

[36] It may be also the case that in periods of financial repression the government may have a higher potential to "surprise" via unexpected inflation. This owes to the fact that prices do not fully adjust to supply and demand forces, but rather (at least partially) follow controlled "official price lists" that are adjusted sporadically.

between domestic and foreign bonds, and that taxes levied on domestic and foreign debt instruments are similar.

2.4 Measuring the financial repression tax: The Venezuelan case

In this section we present empirical estimates of the financial repression tax for Venezuela from the 1980s through 2013 along the lines described in Section 2.3.

Unexpected Inflation, Ex-Ante Financial Repression and Seigniorage: Estimates

We reconstructed the right hand side of equation (2.2) for Venezuela for 1984-2013. Given the large changes observed from year to year in the stock of domestic debt and the fact that the maturities of these instruments are rather short, we have used the average stock of domestic debt as the basis for these calculations.[37] In order to pin down the first and second components of the right hand side of the equation, we relied on two assumptions. The first relates to the construction of a time series for expected inflation, while the second one is a conjecture about the nominal interest rate that would have prevailed in the domestic market in the absence of financial repression. Given the lack of survey data on expected inflation for most of the period in question, we modeled expected inflation using a "naïve" random walk inflation forecast.[38]

[37] Reinhart and Sbrancia (2010 and 2015) calculated the effective interest rate as a weighted average based on the actual year-by-year composition of the debt.

[38] We have also estimated expected inflation using an ARIMA model for the period 1957-2013. We have reported the "naïve" random walk forecast because a) the Venezuelan economy has gone through large structural changes over these fifty-six years, and therefore parameter instability might be a relevant source of bias, and b) results do not vary significantly, except for the inflation surprise component (Appendix II replicates Table 12 using ARIMA forecasts).

No less challenging than constructing a time series for inflation expectations is the question of the "free-market counterfactual." In order to make a proxy for the largely unobserved free-market nominal domestic interest rates over 1984-2013, we separated the years of financial repression (20 out of 30) from those where free-market conditions prevailed (10). To arrive at these groupings, every year that begun with price, interest rate, and exchange controls is considered among the former, including the two years where significant reform programs aimed at liberalizing the economy were introduced. There is reason to believe that this is a plausible strategy as both the *El Gran Viraje* (1989) and the *Agenda Venezuela* (1996) policy packages caught the general public largely by surprise, resulting (ex-post) in significant "haircuts" on bond holders and fiscal savings derived from unexpected inflation and financial repression.

Over the ten years of comparatively free financial market conditions (1990-1993 and 1997-2002), average nominal interest rates on domestic government bonds were 1.10 times the inflation rate on average, in contrast with 0.71 on the twenty years of financial repression. As a very rough approximation, we assume that during the financial repression years, nominal interest rates on domestic bonds would have yielded 1.10 times the rate of inflation.[39] The resulting estimates can be treated as a lower-bound estimate for the financial repression tax, given that controls are typically imposed on years of economic instability (with the attendant expropriation risk), where it is plausible to expect that a higher premium over inflation would have been demanded by domestic bondholders.

The results of this exercise are reported in Table 12, where financial repression years are shaded. At an aggregate level, it is noteworthy that unidentified financial needs (the right-hand side of equation 2.2) averaged 5.1% of GDP over the thirty-years studied. Periods of financial repression and price controls exhibit significantly higher unidentified financing needs (6.3%) than

[39] In terms of real ex-post interest rates, these ratios imply a real rate very close to zero during the financial liberalization spells and a real rate average of -8.6% during the financial repression eras.

otherwise (2.8%). Fiscal savings derived from inflation surprises (0.5% of GDP) were positive and significantly higher than those registered in free-market years (-0.5%), indicating that governments had more capacity to surprise economic agents in periods of financial repression. Ex-ante financial repression contributed 1.3% of GDP in years of financial repression, significantly higher than the -0.03% registered for free-market years. These estimates support the basic intuition that no one would buy government debt at an anticipated negative yield unless they were forced to do so.[40] Liquidation years, defined as years where real average yield on government bonds is negative, somewhat overlap with financial repression, but are not unheard of during free market periods. [41]

The sheer size of fiscal revenues (savings) generated via ex-ante financial repression is significant, given that the ratio of domestic debt-to-GDP averaged only 11% over the sample (11.7% over the years of controls). Reinhart and Sbrancia (2015) have documented fiscal revenues in the range of 2-3% of GDP coming from financial repression in the United States and the United Kingdom, but one must take into account that domestic debt-to-GDP ratios in any year in these countries is anywhere between four and eight times larger than Venezuela's. The scenario described here is more in line with Reinhart and Sbrancia's findings from chronic-inflation Argentina. It takes more financial repression (markedly bigger haircuts to bondholders) to generate fiscal revenues/savings in Venezuela, given that the relative size of its domestic debt is smaller and shrinking.

Consider for example the years 1989, 1996 and 2013, where fiscal revenues via ex-ante financial repression totaled 4.4%, 3.9%, and 4.7% of GDP, respectively. Given that domestic debt-to-GDP ratios were relatively low, in order to achieve those savings, the tax rate (haircut) had to be substantive. As can be seen from Figure 4, real interest rates on government bonds in those years were negative to the tune of 37.7%, 23.3% and 25.2%.

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[40] It must be remembered that risk characteristics aside, within such a small, illiquid market, these bonds do not support a "liquidity premium" that would make them viable instruments to hold even at anticipated negative real interest rates.
[41] Reinhart and Sbrancia (2015).

Out of the three components of inflationary/repression financing shown in Table 12, seigniorage is by far the largest, representing on average 4.0% of GDP per year. As with the preceding discussion on domestic debt, the real action is not coming from the size of the monetary base but from the very high inflation tax. Governments tended to resort more to printing money for generating fiscal revenues in times of repression (4.34%) than in free-market periods (3.36%); the difference being statistically significant at a 10% level. In any case, deficit monetization is significant and pervasive across the board. This points out to a chronic disequilibrium within the Venezuelan fiscal accounts, most likely related to: a) the temptation of obtaining more domestic currency in exchange for oil exports by means of devaluation, and b) large real exchange rate volatility.

Table 12
Unanticipated Inflation, Financial Repression and Seigniorage: Venezuela, 1984-2013

	Unanticipated Inflation Effect		Ex-ante Financial Repression Effect		Seigniorage		Total financing
	VEF Million	% GDP	VEF Million	% GDP	VEF Million	% GDP	% GDP
1984	2	0.5			3	0.6	
1985	-0	-0.0	0	-0.0	12	2.6	2.5
1986	0	0.0	0	-0.1	9	1.9	1.9
1987	10	1.4	13	1.8	21	3.1	6.3
1988	1	0.1	14	1.6	27	3.1	4.7
1989	29	1.9	67	4.4	48	3.2	9.5
1990	-28	-1.2	23	1.0	106	4.6	4.4
1991	-9	-0.3	32	1.0	205	6.8	7.5
1992	-4	-0.1	23	0.5	131	3.2	3.6
1993	16	0.3	37	0.7	146	2.7	3.6
1994	122	1.4	217	2.5	436	5.0	8.9
1995	-8	-0.1	220	1.6	436	3.2	4.7
1996	630	2.1	1,136	3.9	1,239	4.2	10.2
1997	-1,108	-2.6	39	0.1	1,888	4.5	2.0
1998	-343	-0.7	-252	-0.5	1,504	3.0	1.8
1999	-458	-0.8	17	0.0	1,902	3.2	2.5
2000	-435	-0.5	-1,574	-2.0	1,566	2.0	-0.6
2001	-344	-0.4	-1,507	-1.7	1,332	1.5	-0.6
2002	1,291	1.2	481	0.4	2,410	2.2	3.9
2003	1,600	1.2	2,120	1.6	5,400	4.0	6.8
2004	-2,846	-1.3	-3,748	-1.8	7,065	3.3	0.2
2005	-1,337	-0.4	-4,456	-1.5	8,633	2.8	0.9
2006	757	0.2	927	0.2	25,067	6.4	6.8
2007	1,538	0.3	3,678	0.7	27,608	5.6	6.6
2008	2,212	0.3	7,565	1.1	35,119	5.2	6.6
2009	-1,069	-0.2	6,939	1.0	32,561	4.6	5.4
2010	-394	-0.0	9,009	0.9	46,711	4.6	5.4
2011	-173	-0.0	16,789	1.2	76,315	5.6	6.8
2012	-12,103	-0.7	10,245	0.6	124,277	7.6	7.5
2013	76,303	2.9	124,826	4.7	272,982	10.2	17.8
Averages							
All years		0.15		0.83		4.01	5.10
Controls		0.48 ***		1.29 **		4.34 *	6.30 ***
Free market		-0.52		-0.03		3.36	2.82

Sources: Venezuelan Central Bank, Ministerio de Finanzas, International Monetary Fund, *International Financial Statistics* and *World Economic Outlook.*

Notes: Asterisks (*), (**), (***) denote significance at the 10%, 5%, and 1% level, respectively. Years of capital controls/financial repression are shaded.

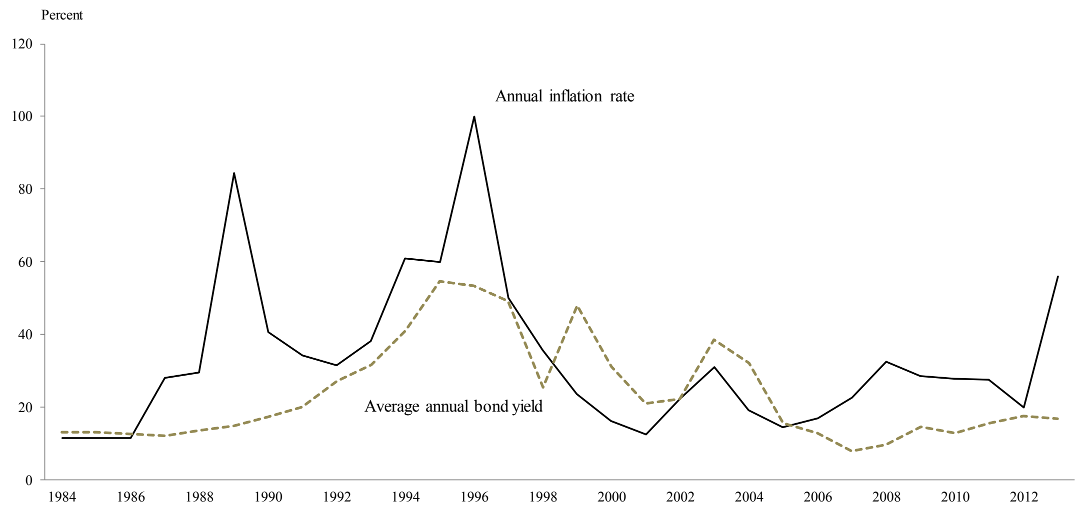

Figure 10: Average Nominal Domestic Bond Yield and Inflation: Venezuela, 1984-2013

Sources: International Monetary Fund, International Financial Statistics and World Economic Outlook and Venezuelan Central Bank.

Domestic and Foreign Cost of Borrowing: The Estimates

These estimates of various forms of inflation/repression financing involve making strong assumptions about expectations and "normal" levels of real interest rates. We also pursue the alternative approximation to the financial repression tax suggested by Giovanini and de Melo (1993). They used an ex-post measure consisting of effective interest rate payments plus arrears divided into the average outstanding stock of both domestic and foreign debt. From there, they proceed to calculate the financial repression tax by computing the differential between foreign borrowing cost (translated into domestic currency) and domestic borrowing cost, times the average stock of domestic debt.

While this approach is viable from an accounting standpoint, it misses some important sources of differentials that influence borrowing costs from an economic perspective other than interest rate payments. In particular, it ignores the fact that large swings in prices of sovereign debt help to adjust for the difference between the coupon rate of foreign debt and the yield demanded by international markets. The fact that these price adjustments do not occur in most domestic debt markets of developing countries, as the marketability of domestic debt instruments tends to be limited, is yet another feature of financial repression.

We chose the Merrill Lynch maturity-adjusted index of sovereign yield on Venezuelan foreign debt (GDVE)[42] as a proxy for foreign borrowing cost. The only limitation is that the GDVE is available from 1991 onwards, since Venezuelan foreign debt did not float on international markets until the Brady bond exchange occurring that year. For domestic debt yields, we have taken the effective weighted average yields on domestic public bonds reported by the International Monetary Fund (IMF)[43]. Using GDVE yields in US dollars, and the realized loss of value in domestic currency vis-à-vis the dollar, we calculated equilibrium domestic interest rates for domestic public debt instruments for every year. We performed two sets of calculations, using average devaluation in the official market and average depreciation of the parallel exchange market in years of exchange controls. Equilibrium rates calculated thereby have been subtracted from domestic public bonds, and multiplied by the average stock of domestic debt.

Figure 11 below presents the dollar returns on foreign and domestic debt calculated at the average official exchange rate for the twenty-three years spanning from 1991 to 2013. The patterns mirror the peculiarities of the exchange rate policy adopted by Venezuela: Periods of fixed exchange rate regimes (2003-2013) or dirty floating within bands (1994-1995 and 1999-2002), both largely lagging inflation; followed by large devaluations leading to deep dives in the dollar return on domestic government bonds. At the official exchange rate the picture is not so startling, as fifteen years (65%) present positive dollar returns, albeit only half of them are above the yield of foreign debt instruments. The problem is that these calculated returns are hard to realize,

[42] Bloomberg (2014).
[43] Effective weighted average yield on national public debt bonds traded in the Caracas Stock Exchange; from January 1999, weighted average yield on national public debt.

as access to dollars at the official exchange rate is far from guaranteed, and most of the time barred for capital account transactions.

A more realistic approach to dollar returns on domestic debt instrument is presented on Figure 12, which uses average depreciation of the domestic currency in the parallel exchange rate market. There are eleven years (48%) of positive dollar returns on domestic debt instruments; only six of those have yields that are higher than those demanded by international markets. Average returns on control years are highly negative (-10.2%), and in particular 2013, where someone investing in a basket of domestic bonds at the beginning of the year would have seen 63.3% of the dollar value of his/her investment sunk by year end.

In order to calculate government savings or the financial repression tax, we calculated the difference between equilibrium domestic borrowing cost as described above, and average yield on domestic public debt outstanding, times the average stock of domestic debt on the year. Results are reported in Table 3 (using official exchange rate) and 4 (parallel market rates). Average fiscal revenues from financial repression range come out at 1.6% of GDP at the official rate. Financial repression years are somewhat higher than free market years (2.1% vs. 0.8%), although the difference is not significant. If measured at average parallel market exchange rates, financial repression, on average, generated savings of 3.4% of GDP, with the average on years of financial repression (5.2% of GDP) significantly higher than free-market years (0.7%).

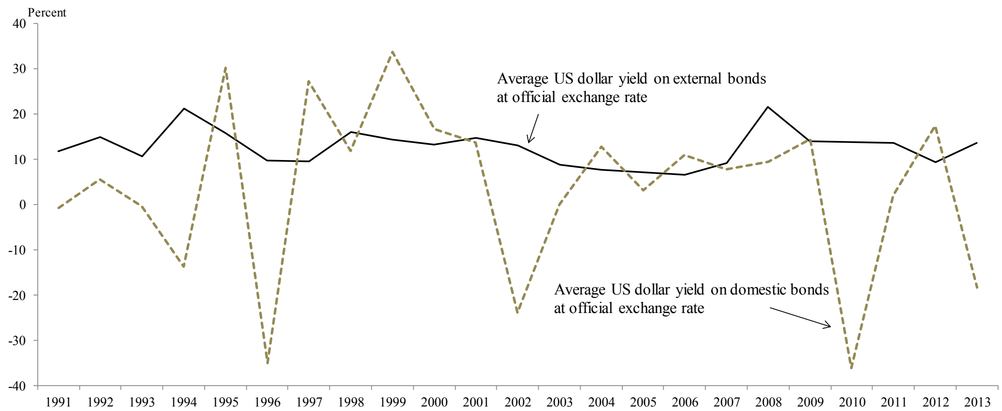

Figure 11: Average U.S. Dollar Yields on External and Domestic Debt at the Official Exchange Rate: Venezuela, 1991-2013

Sources: Bank of America, Merryl Lynch, Bloomberg, and International Monetary Fund, International Financial Statistics.

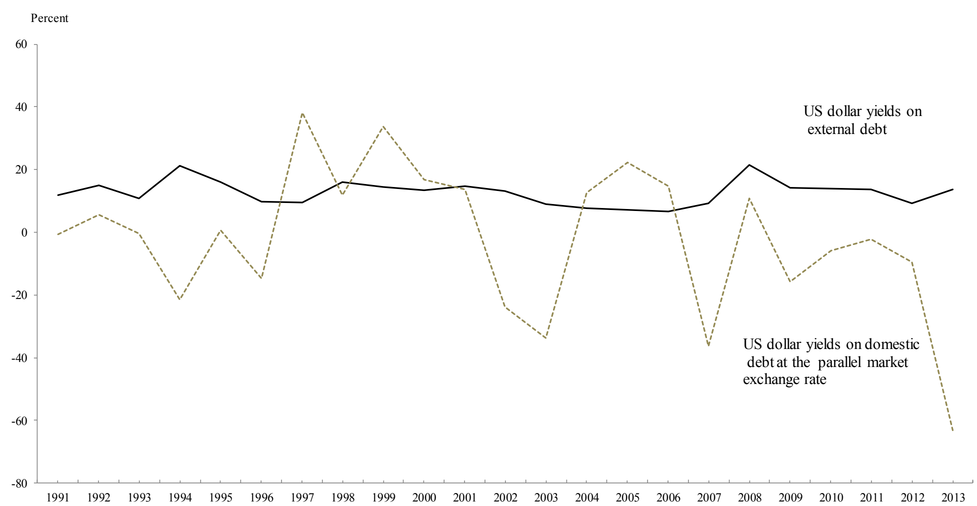

Figure 12: Average U.S. Dollar Yields on External and Domestic Debt at the Parallel Exchange Rate: Venezuela, 1981-2013

Sources: Bank of America, Merrill Lynch, Bloomberg, and International Monetary Fund, International Financial Statistics.

2013 stands out as extraordinary due to the accelerated depreciation of domestic currency in the parallel market. Given that the average dollar price in VEF increased 217.9% and that average dollar yield of foreign debt was 13.8%, equilibrium domestic returns on domestic government bonds would have been 244.8%. This figure is in stark contrast to realized yields (16.8%), leading to haircuts from financial repression equivalent to no less than 31% of GDP.

Tables 13 and 14 also show how parallel market rate estimates of financial repression tend to precede those at the official exchange rate. Take for example the three years of exchange controls ranging from 1994 to 1996. The parallel market rate was legal, exhibiting a premium over the official exchange rate of 9.9% (1994) and 42.3% (1995). As the official exchange rate lagged both inflation and the parallel exchange rate, estimates on financial repression at the official rate result in lower fiscal revenues for 1994 (5.6% of GDP vs. 7.5%) and 1995 (-1.8% vs. 2.5%). In 1996 the official price of the dollar increased well beyond the parallel market rate (135.99% vs. 79.87%), driving our estimates of public revenues from financial repression at the official exchange twice above those registered at the parallel rate (11.81% of GDP vs. 4.93%).

Table 13
Financial Repression at the Official Exchange Rate, 1991-2013

	Merryl Lynch Ave Yield (US$)	Change in price of U.S. Dollar (official)	Equilibrium Yield Domestic	Equilibrium Domestic Yield - Average Government Yield	Financial Repression	
					VEF Million	% GDP
1986						
1987						
1988						
1989						
1990						
1991	11.88	20.83	35.19	15.13	33	1.09
1992	15.00	20.43	38.49	11.35	24	0.57
1993	10.71	32.04	46.18	14.52	48	0.88
1994	21.33	63.36	98.19	57.16	486	5.60
1995	15.98	18.78	37.76	-16.97	-240	-1.76
1996	9.83	135.99	159.18	105.80	3,476	11.81
1997	9.58	17.07	28.29	-20.80	-930	-2.22
1998	16.01	12.07	30.01	4.60	180	0.36
1999	14.38	10.62	26.52	-21.36	-908	-1.53
2000	13.31	12.26	27.20	-3.92	-254	-0.32
2001	14.71	6.43	22.09	1.06	107	0.12
2002	13.08	60.43	81.42	59.30	8,728	8.09
2003	8.89	38.56	50.88	12.37	2,648	1.97
2004	7.72	17.21	26.26	-5.89	-1,665	-0.78
2005	7.13	12.00	19.98	4.41	1,430	0.47
2006	6.57	1.81	8.50	-4.43	-1,550	-0.39
2007	9.14	0.00	9.14	1.33	481	0.10
2008	21.56	0.00	21.56	12.01	3,994	0.59
2009	14.13	0.00	14.13	-0.34	-144	-0.02
2010	13.88	76.28	100.75	87.91	63,073	6.20
2011	13.73	13.17	28.71	13.18	16,105	1.19
2012	9.38	0.00	9.38	-8.12	-16,610	-1.01
2013	13.76	42.99	62.66	45.90	155,102	5.82
					Averages	
					All years	1.60
					Controls	2.13
					Free market	0.78

Table 14
Financial Repression at the Parallel Exchange Rate

	Merryl Lynch Ave Yield (US$)	Change in price of U.S. Dollar (parallel)	Equilibrium Yield Domestic	Equilibrium Domestic Yield - Average Government Yield	Financial Repression VEF Million	Financial Repression % GDP
1986						
1987						
1988						
1989						
1990						
1991	11.879	20.83	35.19	15.13	33	1.09
1992	15.002	20.43	38.49	11.35	24	0.57
1993	10.712	32.04	46.18	14.52	48	0.88
1994	21.327	79.50	117.78	76.75	652	7.52
1995	15.979	53.78	78.35	23.62	335	2.45
1996	9.827	79.87	97.55	44.17	1,451	4.93
1997	9.581	7.97	18.31	-30.78	-1,376	-3.28
1998	16.009	12.07	30.01	4.60	180	0.36
1999	14.375	10.62	26.52	-21.36	-908	-1.53
2000	13.309	12.26	27.20	-3.92	-254	-0.32
2001	14.713	6.43	22.09	1.06	107	0.12
2002	13.084	60.43	81.42	59.30	8,728	8.09
2003	8.887	109.35	127.96	89.45	19,153	14.27
2004	7.721	17.38	26.44	-5.71	-1,614	-0.76
2005	7.126	-5.45	1.29	-14.28	-4,634	-1.52
2006	6.565	-1.59	4.87	-8.06	-2,818	-0.72
2007	9.142	69.51	85.01	77.20	27,878	5.64
2008	21.558	-1.07	20.26	10.71	3,561	0.53
2009	14.127	35.86	55.05	40.58	16,986	2.40
2010	13.883	19.96	36.61	23.77	17,057	1.68
2011	13.726	18.22	34.44	18.91	23,115	1.70
2012	9.375	29.96	42.15	24.66	50,472	3.08
2013	13.758	217.85	261.58	244.82	827,209	31.03
					Averages	
					All years	3.40
					Controls	5.16 *
					Free market	0.66

Notes: One asterisk (*) denotes significance at 10% level. Years of capital controls/financial repression are shaded.

Something similar occurred during the period 2005-2010. Between March 2005 and December 2009, in spite of cumulative inflation of 165.1%, the official exchange rate remained fixed at 2.15 bolivars (VEF) per dollar. Throughout that period, the parallel exchange rate premium went from 32.5% to 175.8%, resulting in a cumulative fiscal savings in 2005-2009 from financial repression at the parallel market rate (6.3% of GDP) nine times higher than that obtained at the official exchange rate (0.74%). In 2010 there was a two-step exchange adjustment between January and February totaling a devaluation of 50%. As a consequence, in 2010 fiscal savings from financial repression resulted at 6.2% of GDP at the official exchange rate, as opposed to 1.7% at the parallel market rate. In general, as the parallel market rate maintains a significant premium throughout the whole exchange control period (see Figure 13), fiscal savings coming from financial repression are much higher at that rate than at the official exchange rate. Noteworthy when interpreting these results is the fact that domestic debt during this period averaged a modest 11.3% of GDP.

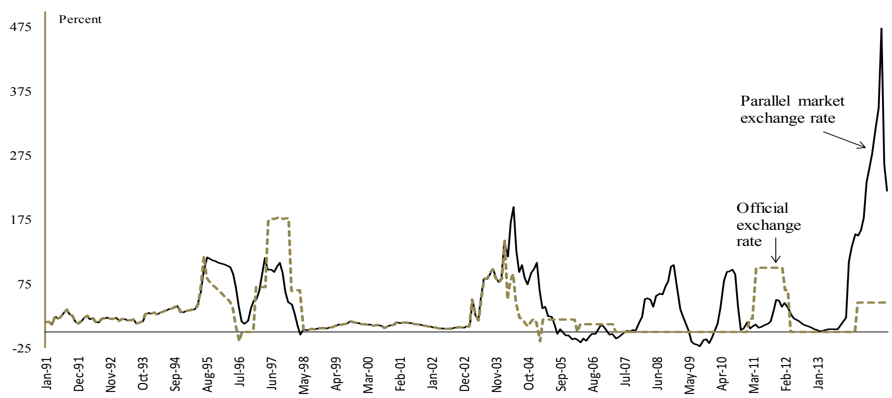

Figure 13: Official and Parallel Market Exchange Rates: January 1991-December 2013 (12-Month Percent Change)

Sources: International Monetary Fund, International Financial Statistics and Thompson Reuters.

Summary

Two general insights emerge from the preceding analysis. First, regardless of the methodology, government savings (the financial repression tax) are greatest during periods of interest-rate ceilings, exchange and price controls, and come close to zero when none of these restrictions prevail. The estimates are especially substantive in light of the fact that Venezuela's domestic debt-to-GDP ratios are relatively small. Second, large misalignments across our different indicators for financial repression within the same year mirror either misalignments between domestic interest rates, exchange rates, and inflation; and/or large differences in the real exchange rate at the official and parallel markets (most of the time domestic currency is highly overvalued in the official market, and highly undervalued in the parallel market). As these are pervasive throughout the sample, one can only conclude that calling years without controls "free-market years" in Venezuela may be a euphemism, helpful from a conceptual standpoint and yet inaccurate. After decades of heavy government intervention and widespread regulation going well beyond outright controls, the capacity for resource-allocation of the relative price system may be seriously impaired—not to mention that reforms may not be credible.

2.5 From Financial Repression to External Distress

Extreme forms of financial repression and high inflation can be expected to influence a countries' external balance. Emphasizing the experience during the debt crisis in developing countries of the 1980s, Dooley (1988), among others, argued that heavily depressed returns on domestic investments fuel a flight towards safety in the form of foreign assets, impairing the external balance. Makinen and Woodward (1990) stressed that, depending on the existence of exchange controls, financial repression and the inflation tax could either be substitutes or complements. Without exchange controls, high inflation stimulates capital flight, currency substitution, and leads to a contraction in the demand for domestic currency (and domestic currency-denominated assets that are imperfectly indexed), eroding the basis for financial repression (this is the substitutes case). By the same token, exchange controls create a captive market for assets subject to the financial repression tax (haircut), which can lead authorities to rely on higher inflation tax financing than would have otherwise prevailed (the case of complements). In this section, we investigate whether, in spite of substantial transaction costs and large penalty risks, financial repression induces capital flight in years where exchange controls prevail.

Measuring Capital Flight

In order to estimate capital flight, we relied on two sets of calculations. The first of these was popular in the literature on capital flight of the 1980s (see, for instance, Diaz-Alejandro 1984 and 1985, and Rodriguez, 1987). It basically adds to the stock of international reserves at the beginning of the year, the current account balance, direct investment, portfolio investment, and the net variation in public assets abroad; and subtracts the ending stock of international reserves. It is the equivalent of calculating what would have been the balance of international reserves in the absence of changes in the net variation of private assets abroad and errors and omissions, and then contrasting that with the actual change in international reserves.

A second measure of capital flight quantifies the over-invoicing of imports that is commonplace in periods of exchange controls and large parallel market premiums. Exporters, of course, will have incentives to mis-invoice in the opposite direction, understating their true proceeds.[44] In order to approximate the amount of leakages in external accounts arising from this practice, we contrast the level of imports, as reported by the Venezuelan Central Bank, with total imports declared by the Venezuelan customs (the authoritative source is the United Nations Commodity Trade Statistics Database, UN Comtrade). In principle, there is no reason to expect persistent systematic differences or that the gap between the two sources would be higher in years of exchange controls.

We also constructed the comparable measure of mis-invoicing for all the other countries in the UN Comtrade Database, and tested for each year whether the error recorded for Venezuela is significantly different from the average error for the rest of the world.[45] These exercises is informative on two different dimensions: a) in the time-series dimension, we are comparing mis-invoicing practices in the years of exchange controls with other years within Venezuela, and b) on a cross-section basis, we compare the Venezuelan estimate with the estimates of mis-invoicing for all other countries. Because the cross-section comparison is done on a year-by-year basis, however, we can also determine whether the observed differences between Venezuela and everyone else was significantly greater in years of exchange controls. Finally, we constructed a broader measure of capital flight that combines the mis-invoicing estimates with the balance of payments measure of capital flight. As with the individual

[44] In the case of Venezuela, government-controlled oil exports dominate. As such, this limits the scope for understating exports.

[45] We estimate the quotient to perform this test to correct for the fact that larger economies would register larger absolute errors than smaller ones.

components, we test whether is composite is significantly higher in years of exchange controls.

The Estimates

We calculated estimates of capital flight on the basis of the balance of payments statistics published by the Central Bank of Venezuela for 1984 to 2013. As noted, for our measure of over-invoicing of imports, we relied on the UN Comtrade database as well.[46] To quantify capital account leakages in the context of multiple exchange rates, we present a range of estimates involving both official and parallel market exchange rates. We report the estimates as a percentage of GDP, in constant dollars, and as a percentage of total exports. In the case of the over-invoicing of imports, we also report the estimates as a percentage of imports.

As shown in Table 15, capital flight has been a chronic feature in the Venezuelan economy, representing on average of 4.7% of GDP at the official exchange rate and 7.2% of GDP at the parallel market exchange rate, while siphoning away 17.2% of total exports. While we lack a counterfactual (we do not observe what capital flight may have been in the absence of controls), it would appear exchange controls have not been particularly adept at stemming the exodus.

By none of our measures capital flight turned out to be lower in years where exchange controls were in place. Moreover, when measured as percent of GDP at the average parallel market, rate capital flight turned out to be significantly higher in years of controls (8.2% vs. 5.2%). However, it is not possible to conclude on the basis of this analysis whether controls exacerbated capital flight, or deteriorating economic fundamentals led to both tighter controls and capital flight. The endogeneity of capital controls is recognized in much of the literature (see Drazen and Bartolini, 1997a and 1997b, Cardoso and Goldfajn, 1998, and Reinhart and Rogoff, 2004).

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[46] We have used the second revision of the Standard International Trade Code statistics (SITC-R2), available up to 2011 at the moment of writing.

As to the actual means through which capital flight takes place even in the context of strict exchange control regimes, two practices can be identified in the case of Venezuela. The first arises from the government's practice of issuing dollar-denominated debt targeting domestic citizens using domestic currency. The so-called *bolivar-dollar* bonds of the previous decade were an attempt by the Venezuelan government to avoid issuing debt in international markets, while at the same time benefiting from the large exchange premiums on the domestic parallel exchange market. Domestic agents, to whom these bonds were allocated in a fairly opaque and discretionary process, would then sell them at a discount in the international market, at an implicit exchange rate that was "overvalued" relative to the parallel exchange rate. It can almost be characterized as a government-sponsored capital flight. The second means of capital flight is standard fare worldwide: over-invoicing of imports, as already described.

Over-invoicing of imports turns out to be significantly higher in periods of financial repression across all the measures at standard significance levels (Table 16).[47] As noted earlier, these results are to be interpreted with care, as the tests are silent on causation. Furthermore, the fact that over-invoicing also occurs in periods of free market (where a priori there would not be any incentive to do so) seems to point out to a consistent positive bias in our estimator, but does not explain why it results consistently higher in periods of exchange controls.

[47] As a percentage of GDP at official rate (2.6% vs. 1.8%), at parallel exchange rate (4.3% vs. 1.8%), constant 2011 dollars (4,564 vs. 2,050), as a percentage of exports (9.4% vs. 7.1%,), and percentage of imports (15.5% vs. 10.7%).

Table 15
Capital Flight Estimates, 1984-2013

	% GDP (at official exchange rate)	% GDP (at parallel exchange rate)	Constant 2013 US$ Million	% of Exports
1983	5.5	11.3	6,908	19.0
1984	3.5	6.8	4,850	13.6
1985	1.7	3.1	2,263	7.2
1986	1.6	2.9	1,532	8.3
1987	-1.0	-1.6	-840	-3.9
1988	-2.7	-4.7	-2,414	-12.0
1989	7.1	7.2	5,291	21.4
1990	6.3	6.3	5,466	17.3
1991	4.6	4.6	4,264	16.4
1992	1.7	1.7	1,691	7.2
1993	-1.5	-1.5	-1,488	-6.2
1994	5.7	6.2	5,266	20.4
1995	4.4	6.2	5,267	17.7
1996	3.5	3.8	3,728	10.4
1997	6.7	6.7	8,507	24.3
1998	6.7	6.7	8,869	34.7
1999	4.2	4.2	5,783	19.6
2000	5.2	5.2	8,381	18.2
2001	7.7	7.7	12,685	35.3
2002	10.6	10.6	12,967	36.7
2003	4.5	6.8	4,893	13.9
2004	7.8	11.8	11,019	22.2
2005	8.2	10.4	14,217	21.1
2006	4.0	5.0	8,698	11.2
2007	7.8	16.3	20,369	25.6
2008	6.5	13.5	22,801	21.6
2009	7.1	20.1	25,366	40.8
2010	7.5	14.5	21,536	30.8
2011	6.1	12.2	19,890	20.8
2012	3.1	8.1	12,148	12.3
2013	2.0	11.4	8,612	9.7
Averages				
All years	4.7	7.2	8,720.6	17.2
Controls	4.5	8.2 *	9,590.5	15.8
Free market	5.2	5.2	6,712.5	20.3

Sources: Banco Central de Venezuela, International Monetary Fund, International Financial Statistics, Thomson Reuters.

Notes: An asterisk (*) denotes significance at the 10% level. Years of capital controls/financial repression are shaded.

Table 16
Capital Flight through Import Over-Invoicing, 1984-2011

	Over-invoicing of imports				
	% GDP (at official rate)	% GDP (at parallel rate)	Constant 2011 US$ Million	% of Exports	% of Imports
1984 ***	2.0	3.8	2,629	7.6	16.7
1985 ***	1.5	2.7	1,936	6.4	12.1
1986 ***	2.7	4.8	2,469	13.8	15.0
1987 ***	3.2	5.0	2,502	11.9	14.0
1988 ***	3.7	6.5	3,240	16.6	13.8
1989 ***	2.6	2.6	1,888	7.9	14.0
1990 **	1.6	1.6	1,382	4.5	11.6
1991 -	2.3	2.3	2,039	8.1	11.9
1992 **	2.5	2.5	2,487	10.9	12.0
1993 -	2.3	2.3	2,176	9.4	12.0
1994 ***	2.1	2.4	1,936	7.8	14.7
1995 ***	2.6	3.7	3,012	10.5	16.6
1996 ***	1.5	1.6	1,566	4.5	10.8
1997 *	1.9	1.9	2,304	6.8	11.8
1998 ***	1.9	1.9	2,451	9.9	11.5
1999 -	0.7	0.7	904	3.2	5.0
2000 -	1.5	1.5	2,348	5.3	10.5
2001 -	1.7	1.7	2,652	7.6	10.6
2002 -	1.5	1.5	1,761	5.2	10.3
2003 -	1.2	1.7	1,205	3.5	9.2
2004 -	1.9	2.9	2,632	5.5	12.7
2005 -	1.7	2.1	2,791	4.3	9.9
2006 ***	5.1	6.3	10,775	14.4	28.0
2007 ***	6.7	14.1	17,034	22.1	32.8
2008 -	1.1	2.3	3,811	3.7	6.9
2009 -	1.0	2.9	3,595	6.0	8.4
2010 ***	2.6	5.0	7,228	10.7	18.2
2011 ***	3.8	7.5	11,900	12.8	25.4
Averages					
All years	2.3	3.4	3,666.1	8.6	13.8
Controls	2.6 **	4.3 ***	4,563.8 **	9.4 *	15.5 **
Free market	1.8	1.8	2,050.4	7.1	10.7

Sources: Banco Central de Venezuela, International Monetary Fund, International Financial Statistics, Thomson Reuters, and United Nations UN Comtrade Database.

Notes: Asterisks (*), (**), (***) denote significance at the 10%, 5%, and 1% level, respectively. Years of capital controls/financial repression are shaded. Asterisks appear next to the years where Venezuela's estimates of mis-invoicing significantly differed from those estimated for the rest of the countries included in the UN Comtrade Database.

We also examined whether Venezuela´s estimates of this method of capital flight are significantly higher than the world mean. Asterisks appear next to the years in Table 16 where Venezuela's estimates of mis-invoicing significantly differed from those estimated for the rest of the countries included in the UN Comtrade Database for each of those years. The year-by-year frequency distributions highlighting Venezuela's relative position are presented in Appendix III. Out of the eighteen years in our sample (1984-2011) where Venezuela had exchange rate controls, in thirteen (72%) the mis-invoicing estimate was significantly higher than the world average, in all cases at the 1% significance level. In four out of the ten (40%) years where exchange controls did not prevail the Venezuelan error turned out to be significantly higher than the world´s average.

Lastly, we calculated a broad measure of capital flight, adding to the balance of payments measure our estimates on over-invoicing of imports. Results are reported in Appendix IV for the various measures, while Figure 14 highlights the composite capital flight measure as a percent of GDP at the parallel market exchange rate as well as its trend over the sample. Perhaps the most salient feature of Figure 8 is that it reveals consistently large leakages that average around 10% of GDP over the full sample but increasing markedly in the past 10 years, as the trend highlights.

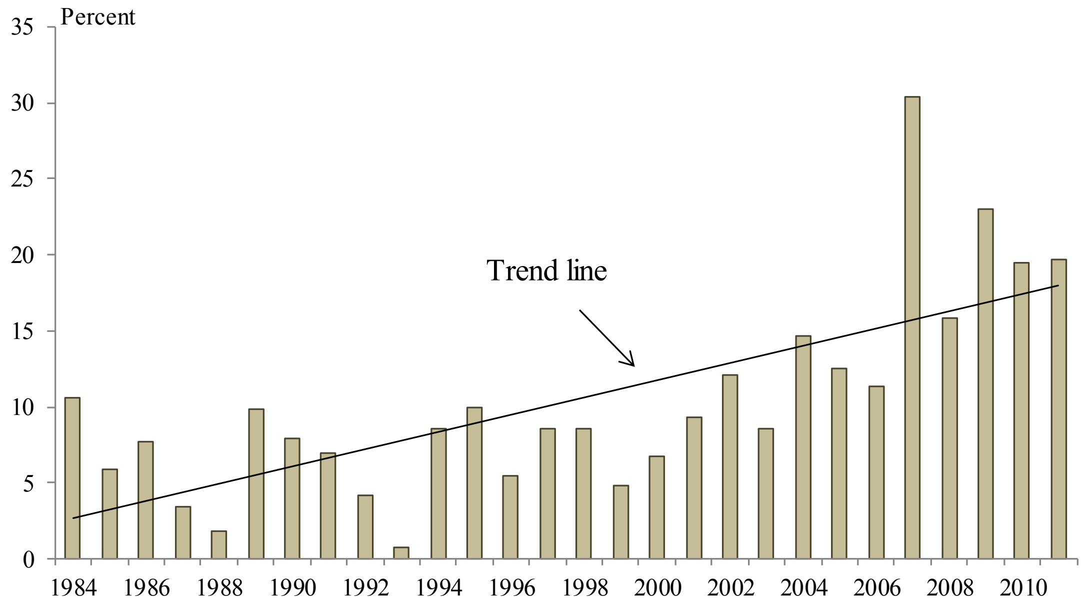


Figure 14: Composite Capital Flight Measure as a Percent of GDP at the Parallel Market Exchange Rate and its Trend: 1984-2011

Sources: Banco Central de Venezuela, International Monetary Fund, International Financial Statistics, Thomson Reuters, and United Nations UN Comtrade Database.

2.6 Conclusions

Excepting two short-lived liberalization episodes, the financial system in Venezuela since the early 1980s has been characterized by a wide array of exchange controls and interest rate ceilings coupled with a heavy reliance by the government on inflationary finance. The result has been consistently negative real interest rates on domestic government bonds and bank deposits. The "haircut" on depositors and bondholders via negative ex post real interest has, on several occasions, exceeded 30% on an annual basis.[48] We find evidence suggesting a systematic link between significant distortions in the domestic financial system and a weakening of external accounts via capital flight. The nature of the domestic-external interaction can give rise to self-reinforcing

[48] The cumulative calculation would be much higher. Thus, the magnitude of the haircut on domestic debt is at par with some of the highest calculated during episodes of external debt restructuring, as shown in Cruces and Trebesch (2013).

vicious circles. A chronically high inflation tax arising from deficit monetization coupled with financial repression spurs capital flight and weakens the country's external position. Capital flight, in turn, weakens the government's revenue base inducing greater reliance on inflation/financial repression taxes. This connection between large haircuts on domestic debt and a weakening in the balance of payments can also help explain why emerging markets sovereign defaults often occur at seemingly low levels of external debt, even when domestic debt levels are modest, as is the case of Venezuela.[49]

Severe and/or chronic financial repression can help explain the dearth, limited nature, or disappearance of domestic debt markets contributing to the "original sin" problem in many emerging markets.[50] While there are other definitions, Eichengreen and Hausmann (1999) described original sin as a situation "in which the domestic currency cannot be used to borrow abroad or to borrow long term even domestically." Pursuing this line of reasoning, one could infer that the ability of many emerging governments to tilt their financing inwards in recent years is connected to the trends towards more liberalized domestic financial markets and lower inflation rates-trends that have, thus far, eluded Venezuela.

[49] Reinhart, Rogoff, and Savastano (2003) show that more than 1/2 of the post-1970 defaults on external debt, occurred at debt-to-GDP levels that would have satisfied the Maastricht criteria of 60% (for public debt).
[50] Reinhart and Rogoff (2009 and 2011) present evidence that in several emerging markets (Venezuela was not among these) domestic debt played a bigger role prior to the widespread rise in inflation during the 1970s.

Bibliography

[1] Abbas, A., B. Nazim, E. G. Asmaa, and M. A. Horton. (2010). A historical public debt database. IMF Working Paper 10/245.

[2] Aguiar, M., M. Amador, E. Farhi, and G. Gopinath. (2013). Crisis and commitment: Inflation credibility and the vulnerability to sovereign debt crises. Mimeograph, Cambridge, MA: Harvard University.

[3] Banco Central de Venezuela. Annual series on monetary base, foreign public debt, and consumer price index variations. Accessed Mar. 15, 2014 www.bcv.org.ve

[6] Barclays, B. (2014). Venezuela: SICAD II: Good start but still some uncertainty on its future. May 25th 2014.

[7] Barrot, D. (2015). The debt of nations. Mimeograph, Barcelona: Barcelona Graduate School of Economics.

[8] Bartolini, L., and A. Drazen. (1997). When liberal policies reflect external shocks, what do we learn? *Journal of International Economics 42*(3–4), 249–73. doi:10.1016/S0022-1996(96)01468-7.

[9] Bartolini, L., and A. Drazen. (1997). Capital-account liberalization as a signal. *American Economic Review 8*(1), 138–54.

[10] Bloomberg, L. P. (2014). Series of Merrill Lynch maturity-adjusted index of sovereign yield on Venezuelan foreign debt (GDVE) 1991–2013. Retrieved from Bloomberg database (accessed March 20, 2014).

[11] Cardoso, E., and Goldfajn, I. (1998). Capital flows to Brazil: The endogeneity of capital controls. IMF Staff Papers 45: 161–202. Washington, DC: International Monetary Fund.

[12] Catão, L., and S. Kapur. (2006). Volatility and the debt-intolerance paradox. IMF Staff Papers 53(2): 195–218. Washington, DC: International Monetary Fund.

[13] Cline, W. (1989). The Baker plan and Brady reformulation: An evaluation. In I. Husain and I. Diwan, eds. Dealing with the debt crisis: A World Bank symposium, Washington, DC: World Bank

[14] Cline, W. (1995). *International debt reexamined*. Washington, DC: Institute for International Economics.

[15] Cruces, J. J., and C. Trebesch. (2013). Sovereign defaults: The price of haircuts. *American Economic Journal: Macroeconomics 5*(3), 85–117.

[16] D'Erasmo, P., and E. G. Mendoza. (2013). Distributional incentives in an equilibrium model of domestic sovereign default. NBER Working Paper 19477, September. Cambridge, MA: National Bureau of Economic Research.

[17] Diaz-Alejandro, C. (1985). Good-bye financial repression, hello financial crash. *Journal of Development Economics 19 (1–2*), 1– 24. doi:10.1016/0304-3878(85)90036-7.
[18] Diaz-Alejandro, C. F. (1984). Latin American debt: I don't think we are in Kansas anymore. Brookings Papers on Economic Activity 15 (2): 335–403.
[19] Dooley, M. P. (1988). Capital flight: a response to differences in financial risks. Staff Papers-International Monetary Fund 35 (3): 422–36.
[20] Easterly, William R. (1989). Fiscal Adjustment and Deficit Financing During the Debt Crisis. In I. Husain and I. Diwan, eds., *Dealing with the Debt Crisis*, 91-113. Washington DC: The World Bank.
[21] Easterly, W., and K. Schmidt-Hebbel. (1994). Fiscal adjustment and macroeconomic performance: a synthesis. In *Public Sector Deficits and Macroeconomic Performance*, eds. W. Easterly, C. A. Rodríguez, and K. Schmidt-Hebbel, 15–78. New York: Oxford University Press.
[23] Easterly, W. R. (1989). Fiscal adjustment and deficit financing during the debt crisis. In *Dealing with the debt crisis*, eds. I. Husain and I. Diwan, 91–113. Washington, DC: The World Bank.
[23] Eichengreen, B., and R. Hausmann. (1999). Exchange rates and financial fragility. New Challenges for Monetary Policy. Proceedings of a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 27, 329–68.
[24] Giovannini, A., and M., de Melo. (1993). Government revenue from financial repression. *American Economic Review 83*(4). 953–63.
[25] Guscina, A., and M. O. Jeanne. (2006). Government debt in emerging market countries: A new data set. International Monetary Fund Working Paper No. 6-98. Washington, DC: International Monetary Fund.
[26] Hur, S., I. Kondo, and F. Perri. (2013). Inflation, debt, and default. mimeograph, Pittsburgh: University of Pittsburgh.
[27] Kraay, A., and V. Nehru. (2006). When is external debt sustainable? The World Bank Economic Review 20(3), 341–65. doi:10.1093/wber/lhl006.
[28] Makinen, G. E., and G. T. Woodward. (1990). Funding crises in the aftermath of the great war. In *Capital markets and public debt management*, eds. R. Dornbusch and M. Draghi. Cambridge, UK: Cambridge University Press.
[29] Mendoza, E. G., and P. Marcelo Oviedo. (2006). Fiscal policy and macroeconomic uncertainty in developing countries: The tale of the

tormented insurer. NBER Working Paper No. 12586, October. New York: National Bureau of Economic Research.
[28] Ministerio del Poder Popular de Economía y Finanzas. Series of total stock of domestic public debt. http://www.mefbp.gob.ve/ (accessed March 30, 2014).
[29] Reinhart, C. M., and M. Belen Sbrancia. (2010). The liquidation of government debt. NBER Working Paper 16893, March. New York: National Bureau of Economic Research.
[30] Reinhart, C. M., and K. Rogoff. (2009). *This time is different: Eight centuries of financial folly*. Princeton: Princeton University Press.
[31] Reinhart, C. M., and K. Rogoff. (2011). The forgotten history of domestic debt. *Economic Journal 121*(552), 319–50. doi:10.1111/j.1468-0297.2011.02426.x.
[32] Reinhart, C. M., K. Rogoff, and M. Savastano. (2003). Debt intolerance. Brookings Papers on Economic Activity 34(1), 1–74. doi:10.1353/eca.2003.0018.
[33] Reinhart, C. M., and M. Belen Sbrancia. (2010). The Liquidation of Government Debt, NBER Working Paper 16893, March, Cambridge, MA.
[34] Reinhart, C. M., and M. Belen Sbrancia. (2015). The liquidation of government debt. *Economic Policy 30* (82), 291–333. doi:10.1093/epolic/eiv003.
[35] Reinhart, C. M., and K. Rogoff. (2004). The modern history of exchange rate arrangements: A reinterpretation. *Journal of Economics 119*(1), 1–48.
[36] Rodriguez, M. A. (1987). Consequences of capital flight for Latin American debtor countries. In *Capital flight and third world debt*, eds. D. Lessard, and J. Williamson, 129–44. Washington, DC: Institute for International Economics.
[37] United Nations. (2011). UN Comtrade Database. http://comtrade.un.org/
[38] Velasco, A. (1987). Financial crises and balance of payments crisis: A simple model of the southern cone experience. *Journal of Development Economics 27*(1–2), 263–83. doi:10.1016/0304-3878(87)90018

Appendix I

Chronology of Exchange Rate Arrangements in Venezuela

Date	Classification: Primary/Secondary/Tertiary	Comments
August 1934–July 23, 1941	Peg to US dollar	Foreign exchange controls introduced
July 23, 1941–July 1, 1976	Peg to US dollar/ Multiple exchange rates	
July 1, 1976–February 28, 1983	Peg to US dollar/ Dual Market	Up until late 1982 free market premia is in single digits.
February 28, 1983–November 1986	Managed floating/Parallel market/ Multiple exchange rates	Officially linked to the US dollar. In July 1983 parallel market premia rose to 319%.
December 1986–March 13, 1989	Freely falling/Managed floating/ Multiple exchange rates	Parallel market premia are consistently above 100%.
March 13, 1989–March 1990	Freely falling/Managed floating	
April 1990–September 1992	Managed floating	
October 1992–May 4, 1994	Freely falling/Managed floating	
May 4, 1994–April 22, 1996	Freely falling/Dual market/De facto crawling band around US dollar	+/- 5% band. Parallel market premium jumped to 100% on November 1995.
April 22, 1996–July 8, 1996	Freely falling/De facto crawling band around US Dollar	+/- 5% band.
July 8, 1996–July 1997	Pre announced crawling band around US dollar/Freely falling	Official band is +/- 7.5%, de facto band is +/-2%. Parallel market premium declines to single digits during this period.
August 1997–January 2003	Pre announced crawling band around US dollar	Official band is +/- 7.5%, de facto band is +/-2%.
February 2003-June 2015	Peg to US dollar/parallel market	The Bolivar was replaced with the Bolivar Fuerte in March 2007.

Notes: reference currency is the US dollar.

The Fine Details of Exchange Rate Arrangements, 2003-2015	
Date	**Description**
02/2003	Exchange rate control imposed, official rate set at 1.60 VEF per dollar.
02/2004	Exchange control. Official rate devalued to 1.92 VEF per dollar.
03/2005	Exchange control. Official rate devalued to 2.15 VEF per dollar.
01/2010	Exchange control. Dual exchange system is adopted, comprising two official rates (VEF 2.15 and 2.60 per dollar).
12/2010	Exchange control. Official exchanges rates are unified at VEF 4.30 per dollar.
02/2013	Exchange control. Official exchange rate devalued from 4.30 to 6.30 VEF per dollar.
07/2013	Exchange control. Official exchange rate remains at 6.30 VEF per dollar for certain sectors, and an auction official markets (SICAD I) is announced for certain import codes and other foreign exchange rate transactions. (Although the decree was published on February and a first “pilot” auction was carried out in March, the auctions did not occur regularly until July)
03/2014	Exchange control. Official exchange rate remains at 6.30; SICAD I auctions remain (ranging from 11-12 VEF per dollar), but some transactions are moved to a second auction is created (SICAD II).
12/2015	Exchange control. Official exchange rate remains at 6.30; SICAD I auctions remain (ranging from 11-12 VEF per dollar), but SICAD II auctions are eliminated (ranging 48-52 VEF per dollar); a new auction market is created (SIMADI) opening at 185 VEF per dollar.

Appendix II

Unanticipated Inflation, Financial Repression and Seigniorage: Venezuela, 1984-2013; (using ARIMA 1,1,0 to estimate expected inflation)

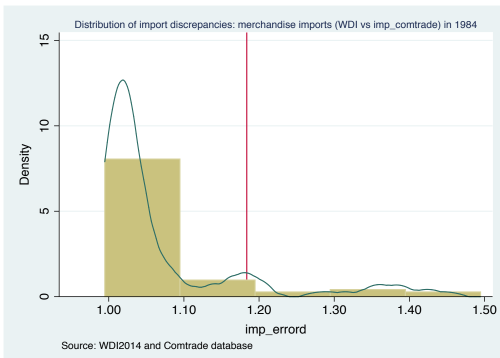
	Unanticipated Inflation Effect		Ex-ante Financial Repression Effect		Seigniorage		Total financing
	VEF Million	% GDP	VEF Million	% GDP	VEF Million	% GDP	% GDP
1984	3	0.7			3	0.6	
1985	-2	-0.4	0	-0.0	12	2.6	2.1
1986	0	0.0	0	-0.1	9	1.9	1.9
1987	10	1.4	13	1.8	21	3.1	6.3
1988	-7	-0.8	12	1.4	27	3.1	3.6
1989	28	1.9	66	4.4	48	3.2	9.4
1990	-50	-2.2	17	0.8	106	4.6	3.2
1991	37	1.2	39	1.3	205	6.8	9.3
1992	3	0.1	23	0.6	131	3.2	3.8
1993	22	0.4	38	0.7	146	2.7	3.8
1994	88	1.0	209	2.4	436	5.0	8.4
1995	-166	-1.2	194	1.4	436	3.2	3.4
1996	644	2.2	1,141	3.9	1,239	4.2	10.3
1997	-1,660	-4.0	32	0.1	1,888	4.5	0.6
1998	513	1.0	-318	-0.6	1,504	3.0	3.4
1999	-67	-0.1	19	0.0	1,902	3.2	3.1
2000	111	0.1	-1,699	-2.1	1,566	2.0	-0.0
2001	195	0.2	-1,584	-1.8	1,332	1.5	-0.1
2002	1,713	1.6	493	0.5	2,410	2.2	4.3
2003	-2	-0.0	1,980	1.5	5,400	4.0	5.5
2004	-4,384	-2.1	-3,546	-1.7	7,065	3.3	-0.4
2005	1,188	0.4	-4,814	-1.6	8,633	2.8	1.6
2006	1,943	0.5	959	0.2	25,067	6.4	7.1
2007	945	0.2	3,612	0.7	27,608	5.6	6.5
2008	1,093	0.2	7,281	1.1	35,119	5.2	6.4
2009	-3,270	-0.5	6,517	0.9	32,561	4.6	5.1
2010	1,111	0.1	9,224	0.9	46,711	4.6	5.6
2011	388	0.0	16,874	1.2	76,315	5.6	6.9
2012	-11,864	-0.7	10,258	0.6	124,277	7.6	7.5
2013	93,349	3.5	131,293	4.9	272,982	10.2	18.7
Averages							
All years		0.16		0.81		4.19	5.08
Controls		0.32		1.27 ***		4.34 *	6.10 **
Free market		-0.16		-0.07		3.36	3.14

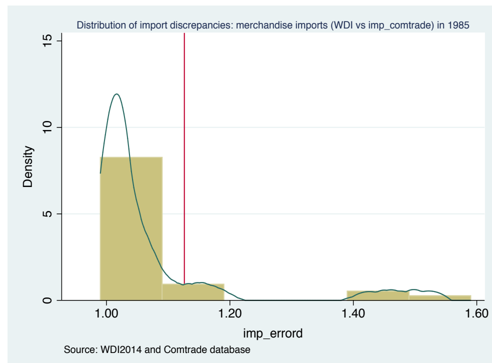
Sources: Venezuelan Central Bank

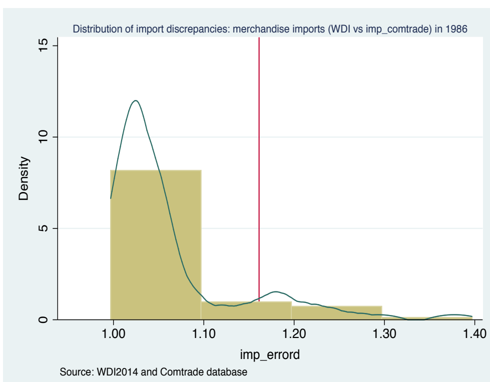
Notes: Asterisks (*), (**), (***) denote significance at the 10%, 5%, and 1% level, respectively. Years of capital controls/financial repression are shaded.

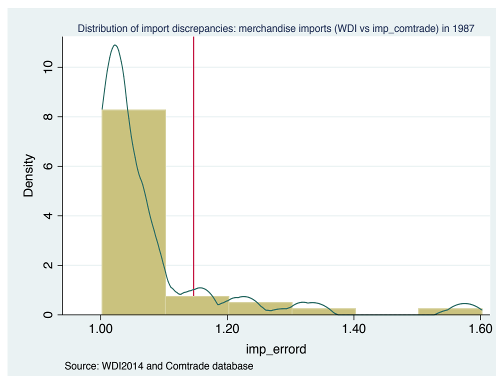
Appendix III

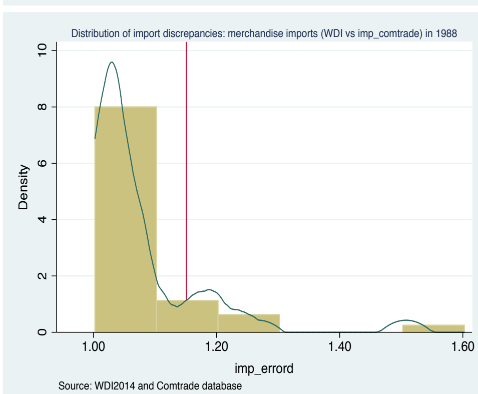
Frequency Distribution (1984-1989) of the Ratio of Central Bank´s Reported Imports (World Development Indicators) and the Sum of Imports Reported by Customs (UN Comtrade Database).

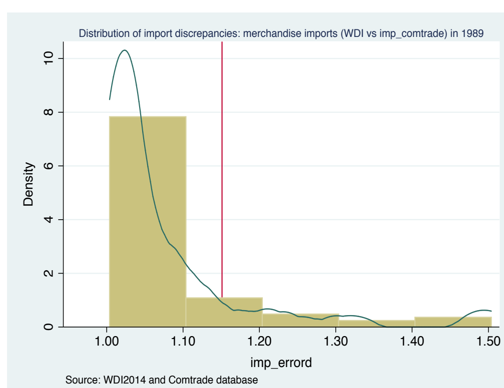






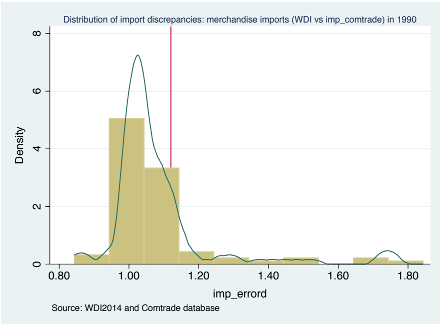


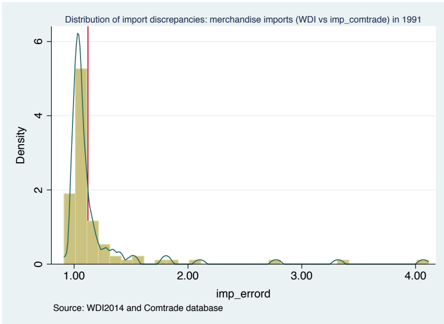


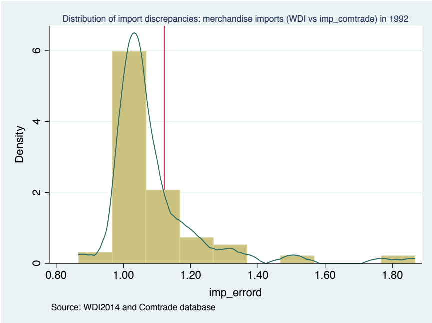


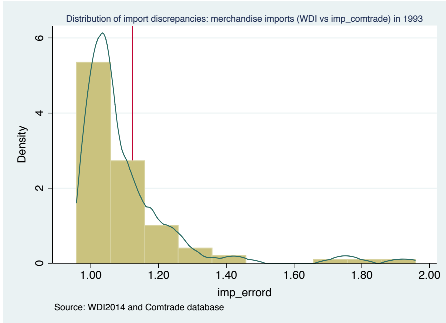
Appendix III (continued)

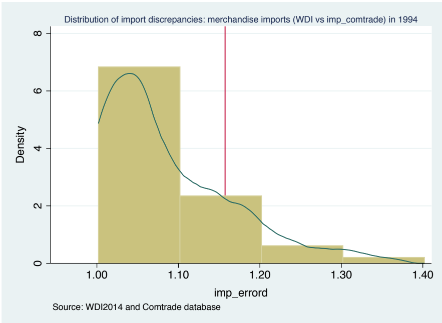
Frequency Distribution (1990-1995) of the Ratio of Central Bank´s Reported Imports (World Development Indicators) and the Sum of Imports Reported by Customs (UN Comtrade Database)

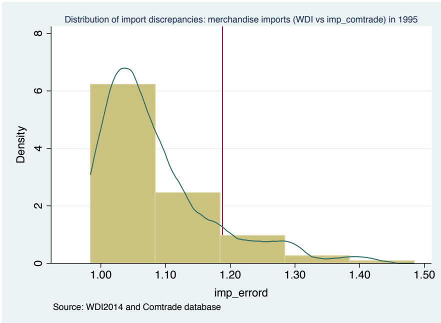






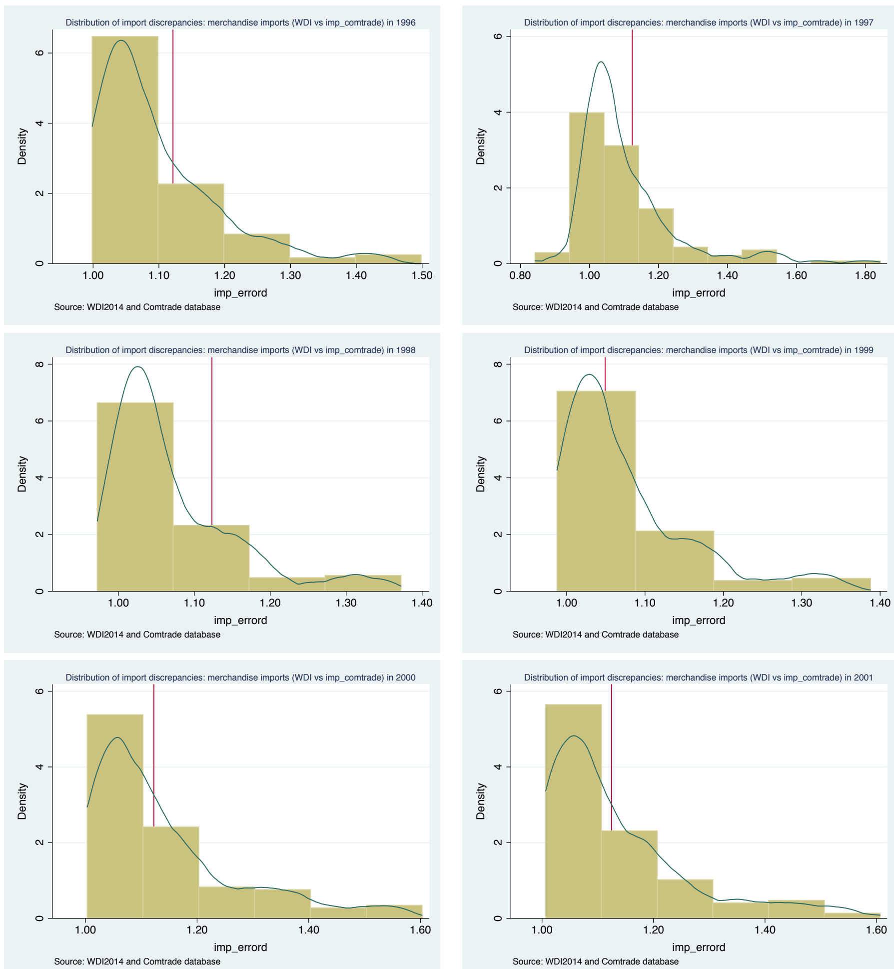






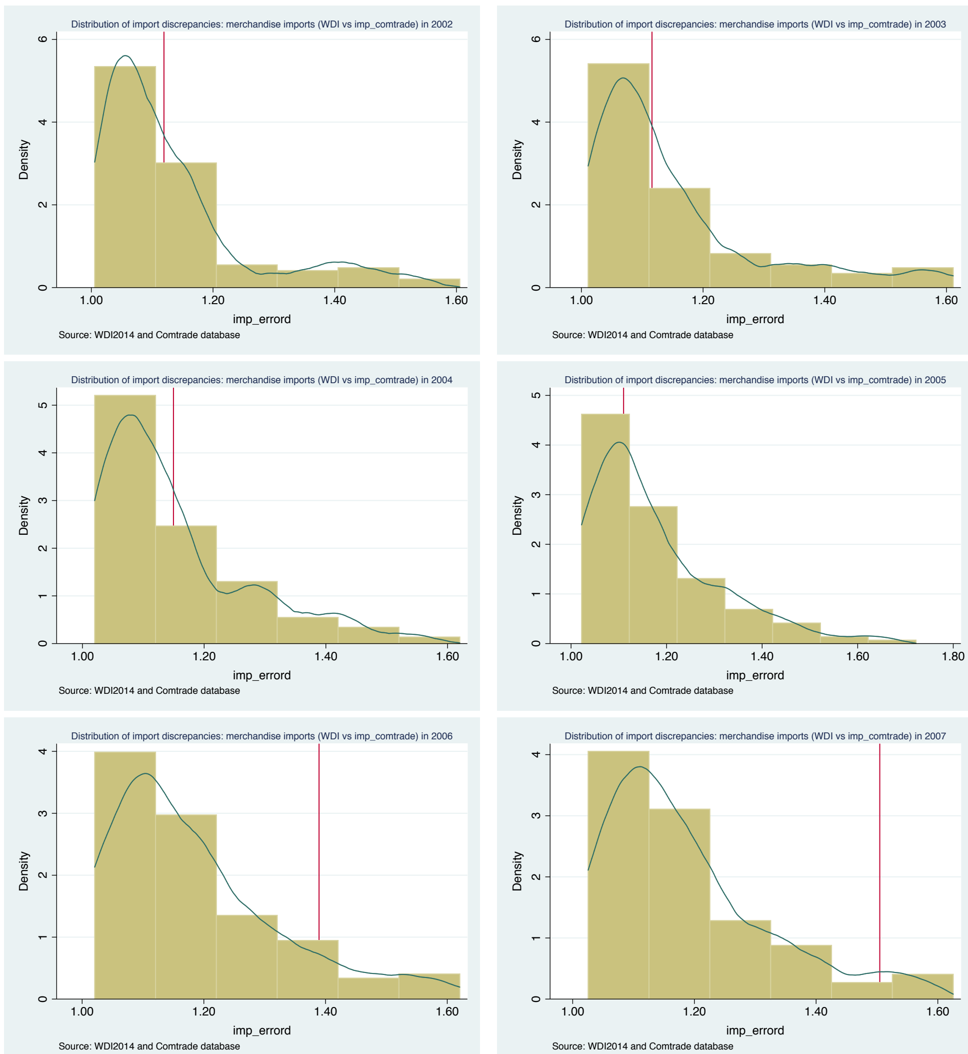
Appendix III (continued)

Frequency Distribution (1996-2001) of the Ratio of Central Bank´s Reported Imports (World Development Indicators) and the Sum of Imports Reported by Customs (UN Comtrade Database).



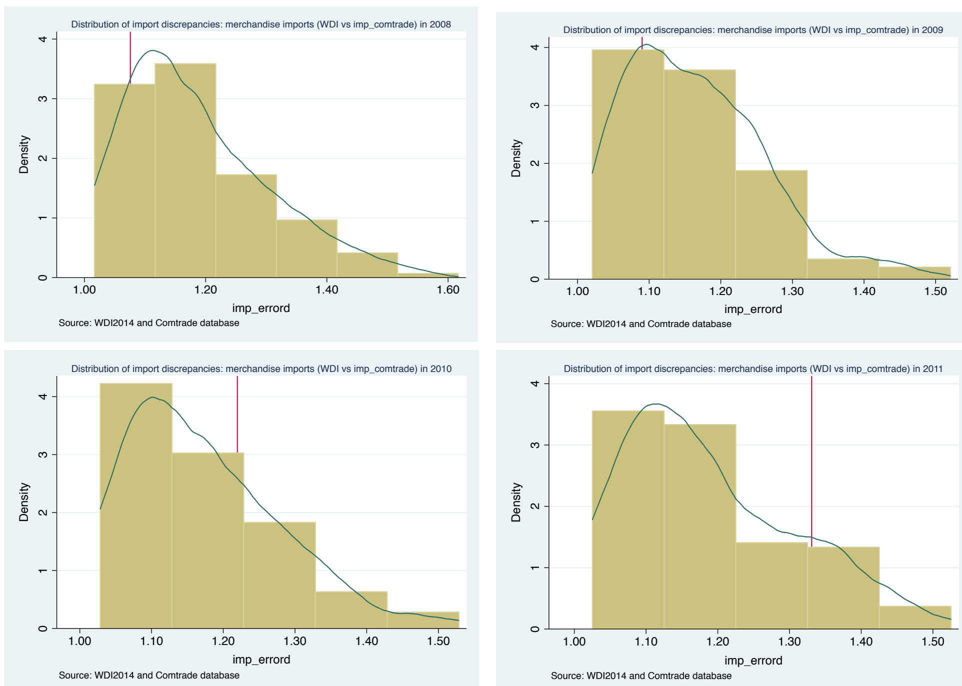
Appendix III (continued)

Frequency Distribution (2002-2007) of the Ratio of Central Bank´s Reported Imports (World Development Indicators) and the Sum of Imports Reported by Customs (UN Comtrade Database).



Appendix III (continued)

Frequency Distribution (2008-2011) of the Ratio of Central Bank´s Reported Imports (World Development Indicators) and the Sum of Imports Reported by Customs (UN Comtrade Database)



Appendix IV

A Broad Measure of Capital Flight: Venezuela, 1984-2011

	Capital Flight	Over-Invoicing of Imports	Broad Capital Flight				
	US$ Million	US$ Million	US$ Million	% GDP -at Official rate	% GDP - at Parallel rate	Constant 2011 US$ Million	% of Exports
1984	2,162	1,210	3,372	5.4	10.6	7,325.3	21.2
1985	1,028	908	1,936	3.2	5.8	4,127.3	13.6
1986	709	1,180	1,889	4.3	7.7	3,952.0	22.1
1987	-403	1,240	837	2.2	3.4	1,688.6	8.0
1988	-1,205	1,670	465	1.0	1.8	902.0	4.6
1989	2,768	1,020	3,788	9.8	9.8	7,011.7	29.3
1990	3,014	787	3,801	7.9	7.9	6,675.3	21.8
1991	2,450	1,210	3,660	6.9	6.9	6,168.6	24.5
1992	1,001	1,520	2,521	4.2	4.2	4,125.2	18.0
1993	-907	1,370	463	0.8	0.8	735.6	3.2
1994	3,293	1,250	4,543	7.8	8.6	7,034.4	28.2
1995	3,386	2,000	5,386	7.0	9.9	8,112.6	28.2
1996	2,466	1,070	3,536	5.0	5.4	5,175.9	14.9
1997	5,757	1,610	7,367	8.6	8.6	10,541.3	31.1
1998	6,098	1,740	7,838	8.6	8.6	11,038.6	44.6
1999	4,083	659	4,742	4.8	4.8	6,503.7	22.8
2000	6,118	1,770	7,888	6.7	6.7	10,464.1	23.5
2001	9,403	2,030	11,433	9.3	9.3	14,935.1	42.9
2002	9,841	1,380	11,221	12.1	12.1	14,317.8	41.9
2003	3,783	962	4,745	5.7	8.6	5,942.9	17.4
2004	8,797	2,170	10,967	9.7	14.7	13,302.5	27.6
2005	11,738	2,380	14,118	9.8	12.5	16,558.8	25.3
2006	7,364	9,420	16,784	9.2	11.3	19,197.9	25.6
2007	17,948	15,500	33,448	14.5	30.4	36,758.5	47.8
2008	20,569	3,550	24,119	7.7	15.8	25,890.7	25.4
2009	23,505	3,440	26,945	8.2	23.0	28,158.1	46.8
2010	20,255	7,020	27,275	10.2	19.5	28,082.9	41.5
2011	19,261	11,900	31,161	9.8	19.7	31,161.0	33.6
			Averages				
			All years	7.16	10.31	11,996.0	26.3
			Controls	7.25	12.15 **	13,910.4 *	25.6
			Free market	6.99	6.99	8,550.5	27.4

Sources: Banco Central de Venezuela, International Monetary Fund, International Financial Statistics, Thomson Reuters, and United Nations UN Comtrade Database.

Notes: Asterisks (*), (**), (***) denote significance at the 10%, 5%, and 1% level, respectively. Years of capital controls/financial repression are shaded. Asterisks appear next to the years where Venezuela's estimates of mis-invoicing significantly differed from those estimated for the rest of the countries included in the UN Comtrade Database.

Chapter 3

On the Impacts of Natural Resources on Export Concentration[*]

3.1 Introduction

Firms specialize and countries diversify. The literature on Dutch disease is extensive when it comes to documenting the negative impacts of natural resource exports on non-resource tradables as an aggregate (Sachs and Warner, 1995; Mikesell, 1997; Auty, 1998; de Ferranti et. al, 2002; Gylfason, 2004). Little has been said on the impact of natural resources on non-resource export concentration. And yet, different branches of the economic literature have documented the beneficial impacts of export diversification on various grounds (Imbs and Wacziarg, 2003; Klinger and Lederman, 2004 and 2005; Hausmann, Hwang and Rodrik, 2005; Hidalgo et. al., 2007; Koren and Tenreyro, 2007; Cadot, Carriere, and Strauss-Kahn, 2011; and Hausmann and Hidalgo, 2011). This study lies at the junction of these two strands of the economic literature as it explores and documents non-resource export basket concentration in countries prone to suffer from Dutch disease, from a cross-country perspective and at the product level.

Our research can be framed within the early economic literature studying Dutch disease, a condition likely to show up in resource abundant countries. Seminal works by Neary (1982) and Corden (1984) documented the existence of two different channels spreading the disease. There is a *resource movement effect*, whereby the boom increases profitability in the resource sector, raising

[*]Written by Dany Bahar and Miguel Angel Santos. The authors would like to thank Ricardo Hausmann, Dani Rodrik, Sebastian Bustos and Xavier Raurich for useful comments and suggestions, as well as to participants in different seminars of the Center for International Development at Harvard University and Universidad de Barcelona. The usual disclaimers apply. Corresponding author: miguel_santos@hks.harvard.edu

its demand for labor at the initial wage rate. Thus, equilibrium wages go up, both non-tradable and non-resource tradable sectors release labor to the resource sector, which in turn tends to diminish output on the former. There is also a *spending effect*: The boom raises the economy´s real income and fuels aggregate demand. As a result, the relative price of non-tradable goods raises with respect to tradables (whose prices are set in international markets), resulting in a real currency appreciation that hampers further non-resource output. While the net impact of both effects for the service sector is ambiguous, the manufacturing sector is unequivocally squeezed.

We begin our empirical exercise by estimating the impacts of the share of natural resources in the export baskets of countries on a number of non-resource export concentration indices: the Gini coefficient, the Herfindahl-Hirschman index, the Theil index, and the number of active export products[51]. The use of the Theil index allows us to explore whether the concentration is occurring more at the extensive margin (numbers of products exported) or the intensive margin (changes in the relative size of already existing products). We use multiple indices to ensure that our findings are not dependent on the particular way in which export concentration is measured.

We find a consistent and significant positive relationship between the share of natural resources in exports and non-resource export concentration, which is robust to using alternative definitions of natural resources, different time periods and concentration indexes. Countries more prone to suffer from Dutch disease tend to have more concentrated non-resource export baskets. We also find that most of the impact on the Theil index is due to changes in the relative size of existing products (the intensive margin or Theil within). This is true for both OECD and non-OECD countries, although in the latter the negative coefficient of the Theil between (reduction in the number of non-resource products exported) is much larger. Our results are robust to the inclusion of multiple controls, including exchange rate regimes.[52] While fixed exchange rate

[51] Appendix I contains a description of all the concentration indicators used and their corresponding formulas.

[52] Early theoretical models suggested that fixed exchange rate regimes coupled with effective sterilization could help in protecting the non-resource sector during resource booms (Corden and Neary, 1982). More recent studies report that remittances may have the same Dutch disease

regimes have no influence in developing economies, in OECD countries they seem to help in cushioning the negative impacts of Dutch disease on non-resource export concentration.

Once we have documented that high shares of natural resources are associated with higher non-resource export concentration, we dig deeper into the non-resource export basket of countries in search for product characteristics that might help in explaining differential performance. Although the literature on Dutch disease emphasizes its negative impacts on the non-resource tradable sector as a whole, it seems unlikely that these effects would be identically distributed. To the contrary, the transmission channels described above raise important questions as to which particular type of goods might be more likely to suffer from Dutch disease than others.

If currency overvaluation is the main channel of Dutch disease, then those industries importing capital might be marginally better than those relying purely on domestic (labor) costs. By the same token, if the natural resource industry crowds out skilled labor from the rest of the economy, one would expect non-resource sectors relying on unskilled labor to be relatively less affected than those relying on skilled workers. At last, one could argue that the overall increase in costs to the non-resource tradable sector (by both resource movement and overvaluation effect) might be better weathered by an industry facing the more inelastic demand curves that are characteristic of more differentiated goods (Erkel-Rousse and Mirza, 2002; Broda and Weinstein 2004). But one could also claim that differentiated goods tend to be more skill intensive and require potentially sizeable training costs (Besedes and Pruza, 2004), which would make them more vulnerable to real exchange rate appreciation.

In order to be able to evaluate these hypotheses from an empirical standpoint, we use export data at the country-product-year level, appending indicators of skill and capital intensity at the product level using data from NBER's productivity dataset as well as Rauch (1999) definitions of homogenous

impacts as natural resource booms, and that symptoms are aggravated by fixed exchange rate regimes (Lartey, Mandelman and Acosta, 2012).

vs. differentiated goods. In total, we consider more than 600 different non-natural resource products for over 100 countries and 25 years.

Our findings are several. In countries more likely to suffer from Dutch disease, non-resource homogeneous goods tend to have larger shares within the non-resource export basket, as opposed to differentiated goods. These results are not only driven by resource-based products; they are robust to including as natural resources all resource-dependent and resource-based products. In order to deepen our understanding, we have incorporated the degree of technological sophistication of each product in the analysis (Lall, 2000). We find that homogeneous goods make for a larger share of the non-resource export basket in resource-rich countries the lower their technological sophistication. For differentiated goods the pattern is reversed: They tend to have larger shares of the non-resource export basket, the higher they are in the technology scale.

We have also found significant evidence indicating that capital intensive goods tend to have larger shares of the non-resource export basket the higher the share of natural resources in exports. This result is more robust in developing economies, which tend to rely more on imported capital and therefore benefit from currency appreciation archetypal of Dutch disease. Finally, we find weak evidence indicating that skill-intensive goods are more likely to lose ground when the share of natural resources in the exports is high.

The paper is organized as follows: Section 3.2 presents the data and provides some stylized facts on different measures of export concentration and our indicators of product differentiation, capital intensity, and skill-intensity at the product level. Section 3.3 contains our regressions at the country level, suggesting a positive relationship between larger shares of natural resources in exports and our different measures of non-resource export concentration. In Section 3.4, we look into the non-resource export basket in search of product characteristics that might determine who are the particular winners and losers of Dutch disease. Conclusions and policy implications are presented in Section 3.5.

3.2 Data and Stylized Facts

The main source of data for this paper is world export data, which comes from the UN COMTRADE database with corrections made by Hausmann et al. (2011). It includes exports from all countries classified using the Standard Industry Trade Classification (Revision 2) at the four-digit level over the period 1985-2010. In order to classify products as resource or non-resource, we rely on the definitions of Primary Products provided by Lall (2000).[53] When testing for the impacts of natural resources on non-resource export baskets we control for income per capita, as derived from the World Development Indicators database of the World Bank.

Our analysis at the country-year level includes 114 countries and 26 years. All Former Soviet Union countries have been excluded, as they have no data prior to 1990 and unreliable trade statistics up to 1995 (Bahar et. al., 2014). Table 17 provides a summary of descriptive statistics for variables at the country level, in separate panels comprising all country-years in our sample (Panel 1.1), Non-OECD (Panel 1.2), and OECD countries (Panel 1.3). While natural resources represent on average 50.8% of non-OECD export baskets throughout the period 1985-2010, they accounted for 21.5% of OECD exports. At the same time, OECD countries tend to have less concentrated non-resource export baskets, and their statistics are less dispersed than those of non-OECD countries. The differences are glaring: OECD countries have an average Gini coefficient on their non-resource export basket 15% lower, HHI index 86% lower, Theil index 53% lower; and export on average 53% more items than their non-OECD counterparts.

[53] See Appendix II for a list of all three-digit categories considered as primary products. Our results are robust to expanding the definition of natural resources to all resource-based products described there.

Table 17
Summary Statistics at the Country-Level (1985-2010)

Variable	Observations *	Mean	Standard Deviation	Minimum	Maximum
Panel 1.1 All countries					
Non-Resource Export Concentration Indexes					
Gini Coefficient	2,868	0.9006	0.0844	0.6576	0.9981
Herfindahl-Hirschman Index (HHI)	2,868	0.1435	0.1931	0.0067	0.9786
Theil Index	2,868	2.8853	1.3019	0.8803	6.3364
Theil Within	2,868	2.4764	0.9829	0.6663	5.3641
Theil Between	2,868	0.4089	0.4933	0.0000	2.7613
(Ln)products	2,868	6.0188	0.4914	3.6889	6.4265
Control Variables					
Natural Resources (% of exports)	2,868	0.4276	0.2928	0.0223	0.9940
Fixed Exchange Rate Dummy	2,868	0.6520	0.4764	0.0000	1.0000
Panel 1.2 Non-OECD countries					
Non-Resource Export Concentration Indexes					
Gini Coefficient	2,085	0.9392	0.0543	0.7635	0.9981
Herfindahl-Hirschman Index (HHI)	2,085	0.1872	0.2099	0.0114	0.9786
Theil Index	2,085	3.3682	1.1840	1.2535	6.3364
Theil Within	2,085	2.8155	0.9146	0.6663	5.3641
Theil Between	2,085	0.5528	0.5085	0.0016	2.7613
(Ln)products	2,085	5.8754	0.5064	3.6889	6.4249
Control Variables					
Natural Resources (% of exports)	2,085	0.5076	0.2891	0.0373	0.9940
Fixed Exchange Rate Dummy	2,085	0.6460	0.4783	0.0000	1.0000
Panel 1.3 OECD countries					
Non-Resource Export Concentration Indexes					
Gini Coefficient	783	0.7980	0.0610	0.6576	0.9609
Herfindahl-Hirschman Index (HHI)	783	0.0269	0.0229	0.0067	0.2147
Theil Index	783	1.5993	0.4478	0.8803	3.5479
Theil Within	783	1.5736	0.4362	0.8590	3.4946
Theil Between	783	0.0257	0.0294	0.0000	0.3681
(Ln)products	783	6.4008	0.0293	6.0591	6.4265
Control Variables					
Natural Resources (% of exports)	783	0.2145	0.1703	0.0223	0.7503
Fixed Exchange Rate Dummy	783	0.6679	0.4713	0.0000	1.0000

* Observations are country-years.
Sources: UN COMTRADE database, SITC categorization at the four-digit level (revision 2) with corrections by Hausmann et. al. (2011); World Development Indicators; Ilzetzki, Reinhart and Rogoff (2010). Authors´ own calculations.

To test for the impact of the share of natural resources on non-resource export concentration we have relied on four measures of export concentration widely used in the literature (Imbs and Wacziarg, 2003; Koren and Tenreyro, 2007; Cadot, Carriere, and Strauss-Kahn, 2011): the Gini coefficient, the Herfindahl-Hirschman index (HHI), the Theil index and the log-number of non-resource product exported with value above zero.[54] The four panels in Figure 15 plot the relationship between these four indicators of non-resource export concentration against the share of natural resources in exports of the countries in the sample for year 2010. [55] We can see there is a consistent positive relationship between the share of natural resources in the export basket and concentration of non-resource exports. [56]

[54] See Appendix I for details on the formulas and construction of these indexes.

[55] The slope in the case of the fourth indicator (log of the number of non-resource export products existing in each country) is negative, indicating that as the share of natural resources in the exports increases, the number of non-resource products exported decrease (concentration goes up).

[56] To prepare the charts in Figure 15 we have excluded all countries where natural resources represent less than 5% of total exports. The analysis that follows have not been truncated in any way.

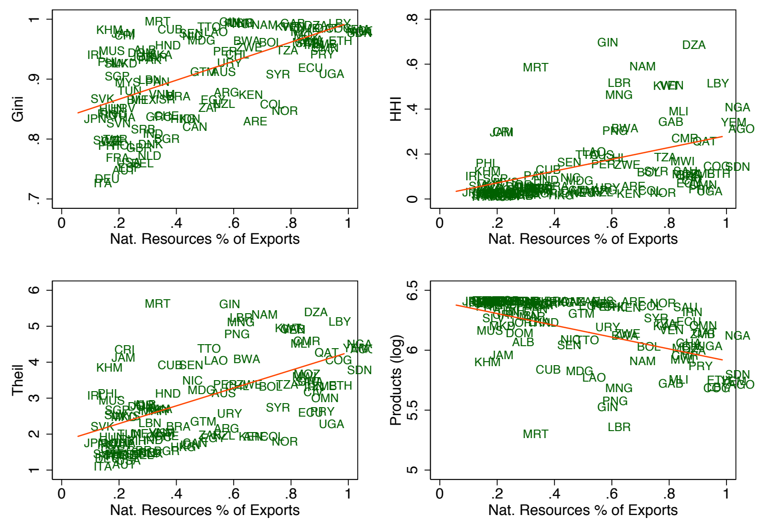


Figure 15: Non-Resource Export Concentration and Share of Natural Resources in Exports

Source: UN COMTRADE database, SITC categorization at the four-digit level (revision 2), with corrections by Hausmann et. al (2011). Authors' own calculations.

In addition, following Imbs and Wacziarg (2003), we estimated the non-parametric relationship between each of these concentration measures and natural resources as a share of total exports for all countries and years in the sample. The results, shown in Figure 16, suggest that it is reasonable to assume a linear relationship between the share of natural resources in the export basket and all of our four concentration measures.

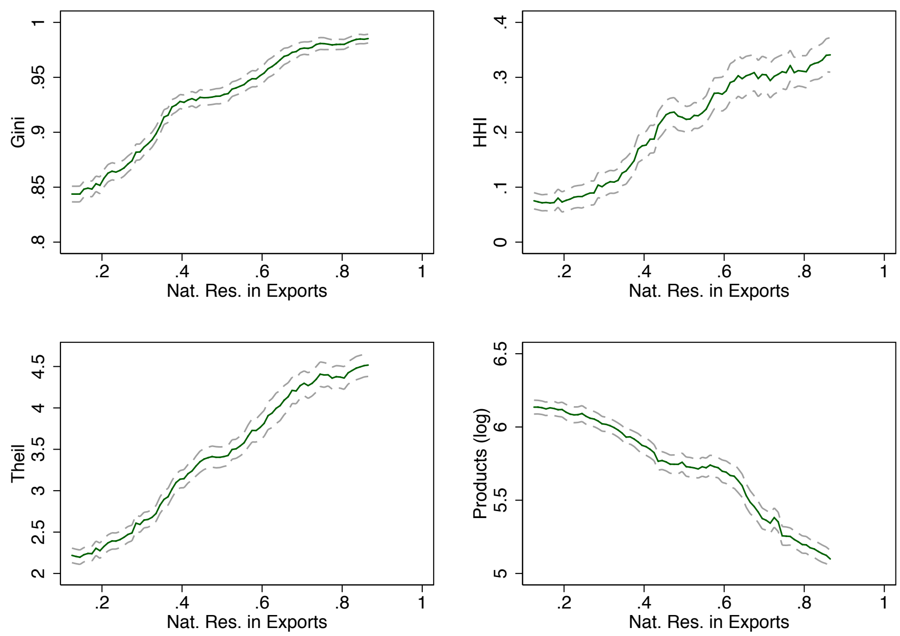


Figure 16: Non-Parametric Relation Between Non Resource Export Concentration and Share Of Natural Resources Exports

Source: UN COMTRADE database, SITC categorization at the four-digit level (revision 2), with corrections by Hausmann et. al. (2011). Authors´ own calculations.

Our analysis at the country-product-year level includes data for 617 non-resource export products, in 114 countries and 26 years. To assess the impacts of natural resources on the concentration of the non-resource export basket at the product level we constructed different indexes of product characteristics and appended them to the same trade dataset described above:

- *Product differentiation*: Our indicator of product differentiation is derived from Rauch (1999). According to this source, all traded goods are classified into three categories: goods traded in organized markets or world exchanges, goods that have a referenced price, and differentiated goods. The classification broadly captures the economic notion of substitutability. Products sold in organized markets are unambiguously homogeneous and highly substitutable: granted some standards of quality, consumers neither know nor care about their origin. Referenced products are not traded in organized markets, but have their prices listed in industry guides and trade journals. These goods may have some unique attributes, but are also substitutable. All other goods are considered differentiated goods.

- *Capital intensity*: Our measure of capital intensity has been taken from the NBER productivity dataset (Becker, Gray and Marvakov, 2013), and correspond to the share of capital in the total value added of the industry manufacturing that product.

- *Skill intensity*: Following Nunn (2007), our measure of skill intensity is the share of non-production workers on total workers, which we have calculated based on the NBER productivity dataset (Becker, Gray and Marvakov, 2013).

Table 18 presents summary statistics on each product characteristic and the corresponding correlation matrix. All indicators range from zero to one, with capital and skill intensity being continuous variables, and product differentiation being a dummy. Note that skill intensity is negatively correlated with capital intensity (-0.549) and positively correlated with product differentiation (0.371); whereas capital intensity is negatively correlated with product differentiation.[57]

Table 18
Summary Statistics of Product Characteristics

					Correlation matrix		
Characteristic	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Differentiation**	**Capital**	**Skill**
Product differentiation	0.5514	0.4973	0.0000	1.0000	1.0000		
Capital intensity	0.7462	0.1101	0.3808	0.9339	-0.5490	1.0000	
Skill intensity	0.3882	0.1023	0.1513	0.7713	0.3706	-0.3447	1.0000

[57] Correlations involving product differentiation shall be taken with care as it is a dummy variable.

3.3. Natural Resource Exports and Non-Resource Export Diversification: The Evidence

Our baseline specification for estimating the relationship between natural resource exports and non-resource export concentration indexes takes the following form:

$$CI_{it} = \propto + \beta Nat.Res_{it} + \delta LnGDPPC_{it} + f_t + u_{it} \qquad (3.1)$$

where in each case the dependent variable is one of the non-resource export concentration indexes described above (CI), computed for country i in period t. The specification includes in the right hand side our variable of interest, the percentage of natural resources in the export basket of countries ($Nat.Res._{it}$), as well as income per capita ($LnGDP_{it}$). Controlling for income per capita allows us to account for the fact that as countries grow richer they tend to be more diversified (Imbs and Wacziarg, 2003; Hausmann, Hwang and Rodrik, 2005; Hidalgo et. al., 2007; Koren and Tenreyro, 2007; Cadot, Carriere, and Strauss-Kahn, 2011). We also include a full set of time (year) dummies (f_t).

Given that yearly changes in the share of natural resources in the export basket of a single country are relatively small, we refrain from adding country fixed effects to the specification. As 89.1% of the total variance of the share of natural resources in exports comes from differences between countries, our reported effects are the mirror of cross-country variations, as opposed to within country variation. [58] This in turn has important implications for our findings: we are not exploiting particular episodes of resource booms, but rather contrasting countries that are more likely to suffer from Dutch disease given their larger exposure to natural resources.

The estimations for specification (1) are reported in Table 19 for all countries, and in Table 20 separately for developing (non-OECD, Panel 1) and

[58] A standard variance decomposition analysis reported in Appendix III shows that only 10.9% of the total variation registered in the share of natural resources on export baskets comes from the within component (differences within countries).

OECD countries (Panel 2). Our primary interest is in the value of the coefficient β. In both tables and all cases, it is positive and highly significant, indicating a positive relationship between the share of natural resources in exports and the concentration of the non-resource export basket for the average country. The economic significance of the estimator is also remarkable: countries with 15 percentage points (pp) in the share of total natural resources exports above average (roughly half standard deviation) tend to have non-resource export concentration Gini coefficient 0.016 points higher. A similar exercise shows that countries with 15pp above average in the share of natural resources in total exports tend to have a higher HHI by 0.032 points, a higher Theil by 0.27 points and 6,6% less items on their non-resource export basket.

As Table 20 indicates, these results are predominantly driven by non-OECD countries. The relationship between natural resources and the degree of concentration of the non-resource export basket is weaker in the case of OECD economies, with coefficients that have the expected sign but lower levels of significance (Gini, Theil and open lines), or non-significance at all (HHI).

Taking advantage of the decomposition properties of the Theil index, we have also analyzed the within and between components of changes in the non-resource export concentration associated to changes in the share of natural resource on the export basket of countries. Figure 17 plots the predicted Theil index as a function of natural resources in the export basket of the average country, based on the results reported on Table 19 There we can see how changes in the relative size of already existing products is the predominant driver of concentration as measured by the Theil index.

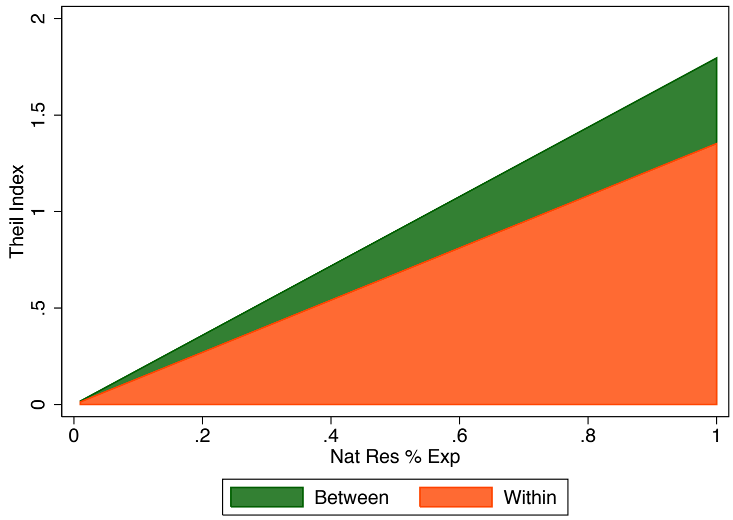


Figure 17: Predicted Between and Within Component of Theil Index

The degree of this phenomenon varies depending on the type of country. In non-OECD economies, as reported on Panel I in Table 20, two-thirds of the change in the Theil index of concentration is associated with changes in the relative size of products within the non-resource export basket (within component, 1.0254), whilst one-third is associated with changes in the number of non-resource products exported (between component, 0.4602).[59] In the case of OECD economies (Panel II on Table 20), natural resources explain mostly changes in concentration as driven by the within component.

[59] These estimates are robust to running these regressions using five-year intervals, thus making sure that our standard errors are artificially low (Appendix IV). They are also robust to including within our list of natural resources (and correspondingly excluding from non-resource export basket) agro-industrial and resource-based products described in Appendix I. These calculations are available from the authors upon request.

Table 19

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket

	All Countries (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1085***	0.2188***	1.7957***	0.4435***	1.3522***	-0.4423***
	(5.65)	(3.48)	(5.26)	(4.69)	(4.69)	(-4.69)
Log GDP PC	-0.0324***	-0.0295	-0.3888***	-0.1807***	-0.2080**	0.1802***
	(-6.51)	(-1.53)	(-4.05)	(-7.61)	(-2.63)	(7.62)
Constant	1.1478***	0.3145	5.6259***	1.8073***	3.8186***	4.6248***
	(23.74)	(1.59)	(5.8)	(7.19)	(4.86)	(18.47)
Number of observations	2261	2261	2261	2261	2261	2261
R-squared	0.4884	0.1985	0.4079	0.5374	0.3075	0.5378

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Table 20
Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket (Non-OECD Vs. OECD Countries)

	Panel I. Non-OECD Countries (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0674***	0.2089**	1.4856***	0.4602***	1.0254***	-0.4588***
	(3.98)	(3.15)	(4.19)	(4.35)	(3.49)	(-4.35)
Log GDP PC	-0.0129**	-0.0152	-0.1949	-0.1731****	-0.0218	0.1725***
	(-2.94)	(-0.61)	(-1.65)	(-5.96)	(-0.22)	(5.96)
Constant	1.0142***	0.2074	4.2604***	1.7424***	2.5181**	4.6898***
	(24.49)	(0.87)	(3.82)	(6.05)	(2.79)	(16.35)
Number of observations	1622	1622	1622	1622	1622	1622
R-squared	0.2181	0.1043	0.1892	0.4477	0.1229	0.4479

	Panel II. OECD Countries (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1210**	0.0451	0.9023*	0.0452**	0.8571	-0.0451**
	(2.82)	(1.50)	(2.06)	(3.01)	(1.97)	(-3.01)
Log GDP PC	-0.0561**	-0.0112	-0.3368	-0.0264***	-0.3104	0.0264***
	(-2.92)	(-0.98)	(-1.80)	(-4.76)	(-1.68)	(4.76)
Constant	1.3503***	0.1331	4.8797*	0.2840***	4.5958*	6.1430***
	(7.12)	(1.17)	(2.63)	(4.98)	(2.52)	(107.92)
Number of observations	639	639	639	639	639	639
R-squared	0.2815	0.1694	0.2359	0.4512	0.2224	0.4512

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***)

Overall, these results reveal a consistent, significant and positive relationship between the share of natural resources in exports and the concentration of the non-resource export basket. This implies that countries more prone to suffer from Dutch disease – given their high shares of natural resources in their export baskets – typically have less diversified non-resource export baskets.

Fixed Exchange Rate Regimes

There are policy strategies that Central Banks can implement to alleviate the negative impacts of Dutch disease in the non-resource tradable sector, which perhaps countries with more exposure to natural resources would tend to implement. In particular, the early literature on Dutch disease emphasized the role of fixed exchange rate regimes in delaying the real effects of a resource boom (Neary 1982; Corden and Neary, 1982). According to these authors, acquiring foreign exchange and piling up international reserves, combined with effective monetary sterilization, can help to insulate the non-resource sector from the maladies of a resource boom. More recent empirical work based on remittances suggest that they have spending effects that ultimately lead to real exchange rate appreciation, and that these effects are stronger under fixed exchange rate regimes (Kartey, Mandelman and Acosta, 2012).

In any case, it seems advisable to control for the exchange rate regime when estimating the relation between natural resources and non-resource export concentration. In order to do so we rely on the dataset of Ilzetzki, Reinhart and Rogoff (2010). These authors classify exchange rate regimes for 201 countries, over the period 1970-2010[60] on a scale of 1-6, described in detail in Table 21.

[60] Although not all the countries have data for all years.

Table 21
Exchange rate regime scale

Scale	Exchange rate regime
1	No separate legal tender Pre announced peg or currency board arrangement Pre announced horizontal band that is narrower than or equal to +/-2% De facto peg
2	Pre announced crawling peg Pre announced crawling band that is narrower than or equal to +/-2% De factor crawling peg De facto crawling band that is narrower than or equal to +/-2%
3	Pre announced crawling band that is wider than or equal to +/-2% De facto crawling band that is narrower than or equal to +/-5% Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time) Managed floating
4	Freely floating
5	Freely falling
6	Dual market in which parallel market data is missing.

Source: Ilzetzki, Reinhart and Rogoff (2010).

Our fixed exchange dummy for the period studied (1985-2010) has been defined based on categories one to three (zero if other). These cover the more rigid exchange rate regimes, from the purely fixed type to those comprising significant commitment to maintaining the exchange rate within certain tight bands or limits, which at times may even be pre-announced.[61] In order to account for the impacts of fixed exchange rate regimes on non-resource export concentration we have modified specification (3.1) in the following way:

$$CI_{it} = \propto + \beta Nat.Res_{it} + \gamma FER_{it} + \theta Nat.Res._{it} FER_{it} + \delta LnGDPPC_{it} + f_t + u_{it} \quad (3.2)$$

The dependent variable is in each case one of our indexes of non-resource export concentration (CI) for country i in period t. We regress these against the share of natural resources in the export basket ($Nat.Res._{it}$) while controlling for

[61] Our results are robust to defining the fixed exchange rate dummy (FER) as category 1, or an aggregation of categories 1-2 on the Ilzetzki, Reinhart and Rogoff (2010) scale.

fixed exchange rate regimes (FER_{it}), an interaction term between fixed exchange rate regime and the share of natural resources ($Nat.Res._{it}\, FER_{it}$), income per capita ($LnGDP_{it}$), and a full set of time dummies (f_t).

Our results are reported on Table 21 for all countries, and Table 22 for non-OECD countries (Panel I) and OECD countries (Panel II). Our estimates for β using different concentration indexes and measures remain qualitatively unchanged after controlling for fixed exchange rate regimes. In addition, neither the coefficient of the fixed exchange rate dummy (γ) nor the coefficient of the interaction between fixed exchange rates and the share of natural resources on exports (θ) are estimated to be significant, implying that fixed exchange regimes are seemingly uncorrelated with non-resource export concentration. These conclusions somewhat vary when our sample is broken in non-OECD vs. OECD countries.

The estimates for β in the case of non-OECD countries are smaller when compared to the overall sample, but remain significant in three out of four of our baseline specification using different concentration indexes (the only exception being HHI). Interestingly enough, the estimate for θ is negative and significant in panel II of table 23. This might suggest that OECD countries with high shares of natural resources in their export baskets tend to use fixed exchange rate regimes to cushion eventual Dutch disease symptoms. If anything, these results seem to provide some support to the hypothesis that fixed exchange rate regimes, coupled with effective sterilization, may indeed help in lessening the negative impacts of natural resources in non-resource export diversification, although these are not observed in developing countries.[62] For the purpose of our research, what is important is that the negative association we reported between the share of natural resources in total exports and the degree of concentration of the non-resource export basket is robust to controlling for exchange regimes.

[62] These estimates do not change significantly when we use five-year intervals (Appendix V). We have also run the same analysis using five-year and ten-year averages and different definitions of our fixed exchange rate dummy with similar results. These calculations are available from the authors upon request.

Table 22

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share Of Natural Resources in the Export Basket, Controlling for (Fixed) Exchange Rate Regime

	All Countries (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0828***	0.1796*	1.3616**	0.4581***	0.9035*	-0.4566***
	(3.32)	(2.07)	(3.17)	(4.00)	(2.54)	(-4.00)
FER	-0.0169	-0.0134	-0.2337	-0.0287	-0.2049	0.0287
	(-1.08)	(-0.56)	(-1.24)	(-0.56)	(-1.30)	(0.56)
FER*Nat. Res. (% of exports)	0.0388	0.0617	0.6653	-0.0303	0.6956	0.0299
	(1.52)	(0.79)	(1.59)	(-0.25)	(1.96)	(0.24)
Log GDP PC	-0.0326***	-0.0296	-0.3912***	-0.1809***	-0.2102**	0.1804***
	(-6.59)	(-1.54)	(-4.13)	(-7.60)	(-2.72)	(7.61)
Constant	1.1609***	0.3249	5.8069***	1.8296***	3.9773***	4.6024***
	(23.56)	(1.62)	(5.98)	(7.20)	(5.11)	(18.17)
Number of observations	2261	2261	2261	2261	2261	2261
R-squared	0.49	0.20	0.41	0.54	0.32	0.54

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995. (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Table 23

Baseline Panel Regressions Of Non-Resource Export Concentration Indexes And Share Of Natural Resources In The Export Basket, Controlling For (Fixed) Exchange Rate Regime (Non-OECD Vs. OECD Countries)

	Panel I. Non-OECD (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0444*	0.1689	1.0101*	0.4576**	0.5525	-0.4560**
	(2.28)	(1.69)	(2.13)	(3.32)	(1.45)	(-3.32)
FER	-0.0139	-0.0128	-0.2723	-0.0414	-0.2309	0.0414
	(-0.94)	(-0.36)	(-1.08)	(-0.48)	(-1.21)	(0.48)
FER*Nat. Res. (% of exports)	0.0355	0.0631	0.7366	-0.0011	0.7377	0.0008
	(1.70)	(0.70)	(1.57)	(-0.01)	(1.93)	(0.01)
Log GDP PC	-0.0131**	-0.0156	-0.2006	-0.1731***	-0.0274	0.1726***
	(-3.11)	(-0.63)	(-1.74)	(-5.99)	(-0.29)	(5.99)
Constant	1.0258***	0.2198	4.4905***	1.7713***	2.7192**	4.6608***
	(25.98)	(0.90)	(4.06)	(6.11)	(3.07)	(16.13)
Number of observations	1622	1622	1622	1622	1622	1622
R-squared	0.23	0.11	0.20	0.45	0.14	0.45

	Panel II. OECD (1985-2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1457**	0.0831*	1.3770**	0.0352*	1.3418**	-0.0352*
	(3.20)	(2.23)	(2.98)	(2.15)	(2.93)	(-2.15)
FER	0.0041	0.0108	0.1301	0.0028	0.1273	-0.0028
	(0.19)	(1.59)	(0.84)	(0.71)	(0.83)	(-0.71)
FER*Nat. Res. (% of exports)	-0.0488	-0.0613**	-0.8391*	0.0322	-0.8713*	0.0634
	(-0.96)	(-2.88)	(-2.23)	(1.24)	(-2.29)	(0.75)
Log GDP PC	-0.0568**	-0.0117	-0.3438	-0.0256***	-0.3182	0.0256***
	(-2.90)	(-1.03)	(-1.84)	(-4.69)	(-1.73)	(4.69)
Constant	1.3555***	0.1321	4.8773*	0.2730***	4.6044*	6.1540***
	(6.79)	(1.16)	(2.57)	(4.83)	(2.47)	(109.02)
Number of observations	639	639	639	639	639	639
R-squared	0.29	0.23	0.27	0.51	0.26	0.51

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995. (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***)

3.4 Which Products Are Most Likely to Suffer From Dutch Disease?

In the preceding sections we found robust evidence indicating that a larger share of natural resources in the export basket is associated with lower non-resource export diversification, in developing and OECD countries alike. We turn our focus now to changes occurring at the product level within the non-resource export basket. In particular, we are interested in common characteristics of products that help to explain their shares within the non-resource export basket of countries that are more likely to suffer from Dutch disease. To do so we estimate the following specification:

$$shareNR_{jit} = \alpha + \beta Nat.Res_{it}PC_j + f_{jt} + f_{it} + u_{jit} \quad (3.3)$$

where $shareNR_{jit}$ is the share of product j in the non-resource export basket of country i in year t; $Nat.Res_{it}$ is the share of natural resources in the export basket of country i in year t; PC_j is a product-level variable measuring certain product characteristics; f_{jt} are product-year fixed effects and f_{it} are country-year fixed effects. Note that by including country-year fixed effects we control for all factors that vary at the country-year level such as GDP or exchange rate regime; as well as those that are constant across time within countries such as institutions or geography. Also, by including product-year fixed effects we control for global variations at the product level, such as changes in global demand, common technology upgrading, etc.

To focus our exercise, we estimate specification (3.3) for the three different product characteristics described in Section 3.2. Table 24 reports the estimates for the coefficient of interest (β) for the $Nat.Res_{it}PC_j$ interaction using each of the product characteristics. It is this interaction the one that allows us to measure the impact of every product characteristic by levels of shares of resources in exports, on the share of each product in the non-resource basket. As above, we estimate the specification for all countries (column 1), non-OECD (2), and OECD (3).

Table 24
Share of Products in Non-Resource Export Basket, Natural Resources and Product Characteristics

	(1) All countries	(2) Non-OECD	(3) OECD
Differentiation			
Nat. Res. * diff	-0.0040***	-0.0035***	-0.0048***
	(-9.45)	(-6.22)	(-6.22)
Number of observations	1574532	1144665	429867
R-squared	0.1144	0.1358	0.2925
Capital Intensity			
Nat. Res. * kp	0.0100***	0.0138***	0.0091***
	(5.30)	(5.52)	(2.77)
Number of observations	1663440	1209300	454140
R-squared	0.1275	0.1512	0.3033
Skill Intensity			
Nat. Res. * skill	-0.0035**	-0.0012	-0.0032
	(2.01)	(-0.59)	(-0.61)
Number of observations	1663440	1209300	454140
R-squared	0.1271	0.1505	0.3027

a. The number of observations in the regressions involving product differentiation are lower due to the fact that some goods in the original Rauch (1999) database are not identified either as homogeneous or differentiated.
b. Robust t-statistics are in parentheses. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

We begin by looking at the coefficient of the $Nat.Res_{it}PC_j$ interaction in those regression where we included as product characteristics capital and skill intensity. The results reported in Table 24 indicate that goods that are more capital intensive tend to have higher shares (as compared to labor intensive goods) in the non-resource export basket of resource rich countries. These results are stronger in developing countries, which is consistent with the abundant literature reporting that these are precisely the economies more prone to import capital and would therefore benefit from the real exchange rate appreciation archetypal of episodes of Dutch disease (see Lee, 1995; Prasad and Chinn, 2003; Calvo, Leiderman and Reinhart, 2006). On skill intensity, we found no conclusive evidence on its influence in the composition of non-resource export basket at the product level.

Our most thought-provoking results showed up when evaluating how being differentiated vs. homogeneous influences the share of a particular product in the non-resource export basket of resource rich countries. We find that, on average, the shares of differentiated goods seem to be significantly lower the higher the share of natural resources in exports. More specifically, an increase of 15 pp (half standard deviation) in the share of natural resources is associated with a 0.6 percentage points lower share of the average differentiated good within the non-resource export basket. The results are qualitatively the same when we break our sample into non-OECD and OECD countries. How can we interpret these results?

Given that differentiated goods are characterized by lower demand elasticity (Erkel-Rousse and Mirza, 2002; Broda and Weinstein 2004) and higher markups (Feenstra and Hanson, 2004), one would actually expect them to be more resilient to Dutch disease symptoms than homogeneous goods, which face more elastic demand curves. Thus, in countries that are more likely to suffer from Dutch disease, we would expect differentiated products to have a larger share in the non-resource export basket than homogenous goods. On the other hand, differentiated goods tend to be more skill intensive and require larger and potentially sizeable training costs (Besedes and Pruza, 2004). As these domestic inputs occupy a larger share of their cost structure, real exchange rate appreciation characteristic of Dutch disease may have a higher negative impact on differentiated goods, thereby squeezing out their profitability. Our analysis seems to indicate that the latter component counterweighs the former. But before we make such a bold statement we can explore other possible drivers behind our results and dig deeper into product differentiation.

One possible driver of these results could be that there are some homogeneous goods that, while not being considered natural resources, rely on primary products as inputs in their production process. By definition, these goods would tend to occupy a larger share of the non-resource export basket in resource rich countries. Think of meat as an example. Bovine animals and fresh meat are considered primary products; whereas dried, salted, smoked, prepared or preserved meat require some processing and therefore are not. All these are homogenous goods. Whenever the price of meat goes up, it increases the price of its derivate products. Thus, in a country that is highly exposed to Dutch disease, the productive structure might reflect this pattern. Something similar occurs with crude petroleum, a primary commodity from which a number of refined derivatives such a gasoline, oils and other hydrocarbons are obtained. These are all homogenous products, but are not considered natural resources per se.

To test if these quasi-resource products were driving our results, we took one step further and redefined natural resources to a more liberal standard, including all products comprised in Lall (2000) resource-based 1 (agro-based) and resource-based 2 (other) lists; and correspondingly excluding them from the non-resource export basket.[63] Our results are reported on Table 24 A below. Note that there are not significant changes in the sign, size and significance of coefficient β in the panel corresponding to product differentiation, in none of the three columns. This suggests that the negative relationship that we found between the share of differentiated products within the non-resource export basket and the share of natural resources in total exports, was not driven by more homogeneous, non-primary resource-based products.[64]

[63] See Appendix I for a more detail list of primary goods and resource-based products at SITC three-digit level.
[64] Remember that product differentiation is a dummy variable. If the shares of homogeneous, resource-based goods soar during a natural resource boom, it implies that the shares of differentiated goods within that category are falling.

Table 24 A

Share of More Restricted Non-Resource Products of Non-Resource Export Basket, Natural Resources and Product Characteristics

	(1) All countries	(2) Non-OECD	(3) OECD
Differentiation			
Nat. Res. * diff	-0.0042***	-0.0039***	-0.0037***
	(-5.66)	(-4.21)	(-3.10)
Number of observations	1107048	804810	302238
R-squared	0.1108	0.1187	0.364
Capital Intensity			
Nat. Res. * kp	0.0105***	0.0200***	0.0044
	(3.22)	(4.89)	(1.02)
Number of observations	1207428	877785	329643
R-squared	0.1099	0.1185	0.3593
Skill Intensity			
Nat. Res. * skill	0.0000	0.0043	0.0009
	(0.01)	(1.09)	(0.18)
Number of observations	1207428	877785	329643
R-squared	0.1095	0.279	0.3592

a. All resource-based goods described in list 1 (agro-based) and list 2 (other) in Appendix I are now included as natural resource exports and excluded from the non-resource export basket.
b. Number of observations in the regressions involving product differentiation are lower due to the fact that some goods in the original Rauch (1999) database are not identified either as homogeneous or differentiated.
c. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

The range of non-resource products that rely on primary products goes well beyond homogeneous goods. There are also a number of differentiated goods that use natural resources as intermediate inputs. Take for instance glass-derived products, such as drawn and blown glass, or glass in sheets. These are differentiated products that depend on primary products as intermediate inputs. Ideally, we would like to know if the share in the non-resource export basket of homogeneous and differentiated product that use natural resources displays some differential performance in resource rich countries.

Consistent with this idea, we dig deeper in our analysis and examine how does the slope of the coefficient of interest (β) change as differentiated goods increase their value added and move further downstream from natural resources. We use the four broad categories (other than primary or resource products) supplied by Lall (2000), classifying all tradable goods in resource-based goods, low technology, medium technology and high technology.[65] In order to study the differential impact of natural resources on homogeneous and heterogeneous goods at different levels of technology intensity we use the following specification:

$$shareNR_{jit} = \alpha + \beta Nat.Res_{it} diff_j Lall_j + \gamma Nat.Res_{it} Lall_j + f_{jt} + f_{it} + u_{jit} \quad (3.4)$$

Here we resemble specification (3) but only for one product characteristic (product differentiation); incorporating a triple interaction between the share of natural resources in the export basket of country i in year t ($Nat.Res_{it}$), our indicator of product differentiation ($diff_j$); and the category of that product within the Lall technology scale described above ($Lall_j$). The results for our coefficient of interest (β) are reported on Figure 18.[66]

[65] Products classified by Lall as primary products are excluded from the sample of non-resorce products from the beginning of this exercise.
[66] See Appendix VI for the full output of specification (4)

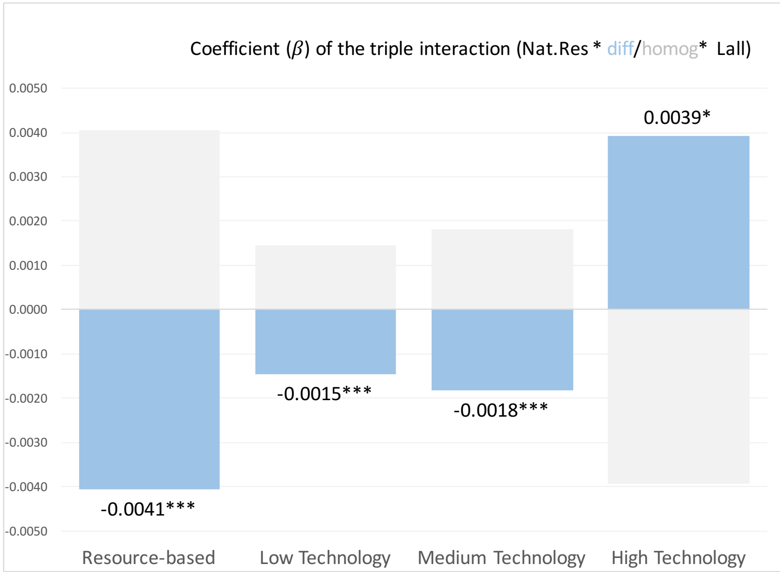


Figure 18: Natural Resources, Technology and Product Differentiation (β)

From figure 18 it is salient that differentiated (homogeneous) goods tend to have a lower (higher) share in the non-resource export basket of resource rich countries, the closer they are in the value chain to natural resources. However, on the other end of the spectrum the pattern reverses. Differentiated goods only display relatively (compared to homogeneous) higher shares within the non-resource export basket of resource rich countries when they belong to the High Technology category. This is consistent with our initial hypothesis: countries more prone to suffer from Dutch disease –given the share of natural resources in their exports- tend to be concentrated around homogenous products, but this concentration is smaller the higher these products are in the value chain. To the best of our knowledge, this is the first time such a result is documented in the literature.

Our analysis with product differentiation yields some subtle results that are not obvious. On the one hand, they confirm previous studies indicating that differentiated goods face more inelastic demand curves. That seems to be the notion underlying the gradual increase of coefficient β depicted in Figure 18: the more sophisticated the technology (the more differentiation, the less dependent on primary resources as intermediate inputs), the less affected differentiated goods are by larger shares of natural resources in the export basket. On the other hand, the negative impacts that higher shares of natural resources have on the cost of non-resource differentiated goods seems to counterweight any benefit derived from more inelastic demand curves for the first three categories of Lall´s (2000) technology scale.

3.5 Conclusions

Using international trade data for 1985-2010 we have analyzed the impacts of high shares of natural resources in total exports over the concentration of the non-resource export basket of countries. We find significant evidence indicating that higher shares of natural resources are associated with lower levels of non-resource export diversification. Our results also suggest that the negative impacts of natural resources on non-resource diversification comes predominantly from changes in the relative size of the products within the non-resource export basket (intensive margin), as opposed to changes in the number of non-resource products exported (extensive margin). In developing countries, where natural resources exhibit on average twice the share of OECD countries, the impacts over the number of non-resource products exported are much stronger. These findings are robust to controlling for GDP per capita, exchange rate regime, and withstand when using alternative definitions of natural resources, different time periods and concentration indexes in our estimation.

We have also analyzed the composition of the non-resource export basket, in search of product characteristics that make them more resilient or more vulnerable in countries probe to suffer from Dutch disease. We find that capital intensive goods tend to have higher shares in the non-resource export baskets of resource rich countries (as opposed to labor intensive goods). The association is stronger in developing countries, which are the ones more likely to import capital and therefore benefit from the real exchange rate appreciation distinctive of Dutch disease.

We also find that homogeneous products that are close to natural resources in the value chain tend to have higher shares /relative to differentiated) within the non-resource export basket of resource rich countries. On the contrary, only differentiated products that use sophisticated technology performed better in relative terms.

Our findings are relevant for a number of reasons. They imply that the order of factors does alter the product: countries where natural resources where found before they were able to develop more sophisticated differentiated goods, will have different growth and diversification trajectories than those where resource discoveries came later. This is consistent with the idea of high-value added, differentiated goods resulting from a process of learning by doing (Krugman, 1987), which takes time and tends to be interrupted by real exchange rate appreciation coming from resource booms. It is also consistent with the notion of inefficient specialization (Matsuyama, 1992), whereby a country tends to specialize in those products more resilient to Dutch disease, which tend to be more homogeneous, less sophisticated from technology standpoint and of lower value added.

If the knowledge required to develop highly differentiated goods that characterize high income countries evolves gradually (as suggested by Hidalgo et. at. 2007, Hausmann and Hidalgo, 2011), another implication is that countries should care to cultivate and nurture low and medium technology differentiated products that we have shown to be vulnerable to Dutch disease. Our results provide a roadmap for identifying these products, and invite further research on the topic of whether industrial policy can be instrumental in spurring them until knowledge has evolved and more sophisticated industries producing differentiated goods are born.

Bibliography

[1] Auty, R. (1998). *Resource abundance and Economic Development: Improving the performance of resource-rich countries*. New York: Oxford University Press.

[2] Bahar, D., Hausmann, R. and Hidalgo, C. (2014). Neighbors and the evolution of the comparative advantage of nations: Evidence of international knowledge diffusion? *Journal of International Economics, 92*(1),. 111–123.

[3] Becker, R., Gray, W., and Marvakov, J. (2013). NBER-CES Manufacturing Industry Database: Technical Notes.

[4] Besedes, T., and Prusa, T. (2004). Surviving the U.S. Import Market: The Role of Product Differentiation. NBER Working Paper No. 10319.

[5] Broda, C., Weistein, D.E. (2004). Globalization and the Gains from Variety. NBER Working Paper No. 10314.

[6] Cadot, O., Carriere, C., and Strauss-Kahn, V. (2011). Export diversification: What´s behind the hump?. The Review of Economics and Statistics, 93, 590–605.

[7] Calvo, G., Leiderman, L., and Reinhart, C. (1996). Inflows of Capital to Developing Countries in the 1990s, The Journal of Economic Perspectives. Vol. 10, No. 2, pp. 123-139.

[8] Corden W.M. (1984). Boom Sector and Dutch Disease Economics: Survey and Consolidation. Oxford Economic Papers 36: 362.

[9] Corden W.M., Neary J.P. (1982). Booming Sector and De-industrialization in a Small Open Economy. The Economic Journal 92 (December): 825–848.

[10] De Ferranti, D., Perry, G., Lederman, D., and Maloney, W. (2002). From natural resources to the knowledge economy. The World Bank.

[11] Erkel-Rousse, H., Mirza, D. (2002). Import Price Elasticities: Reconsidering the Evidence. Canadian Journal of Economics 35, 282–306.

[12] Feenstra, R.C., Hanson, G.H., 2004. Intermediaries in Entrepot Trade: Hong Kong Re-Exports of Chinese Goods. Journal of Economics and Management Strategy 13, 3-35.

[13] Gylfason, T. (2004). Natural resource and economic growth: From dependence to diversification. Center for Economic Policy Research, Discussion Paper 4804.

[14] Ilzetzki, Ethan, Carmen M. Reinhart and Kenneth S. Rogoff (2010) Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?. The London School of Economics and Political Science.
[15] Hausmann, R., Hidalgo, C., Bustos, S., Coscia, M., Chung, S., Jimenez, J., Simoes, A., and Yildirim, M. (2011). The Atlas of Economic Complexity: Mapping Paths to Prosperity. Cambridge, MA.
[16] Hausmann, R. and Hidalgo, C. (2011). The network structure of economic output, Journal of Economic Growth, Springer, vol. 16(4), pp. 309-342.
[17] Hausmann, R., Hwang, J., and Rodrik, D. (2006). What You Export Matters. NBER Working Paper No. 11905.
[18] Hidalgo, C., Klinger, B., Barabási, A., and Hausmann, R. (2007). The Product Space Conditions the Development of Nations. Sience, Vol. 317, Issue 5837, pp. 482-487.
[19] Imbs, J., and Wacziarg, R. (2003). Stages of diversification. American Economic Review, Vol. 3, No. 1.
[20] Koren, M., and Tenreyro, S. (2007). Volatility and development. The Quarterly Journal of Economics (2007) 122 (1): 243-287.
[21] Klinger, B., and Lederman, D. (2004). Discovery and development: An empirical exploration of "new products" (mimeo).
[22] Klinger, B., and Lederman, D. (2005). Diversification, innovation, and imitation off the global technology frontier (mimeo).
[23] Krugman, P. (1987). The Narrow Moving Band, the Dutch disease, and the Competitive Consequences of Mrs. Thatcher. Journal of Development Economics 27 (1-2): 50.
[24] Lall, S. (2000). The Technological Structure and Performance of Developing Countries Manufacturing Exports, 1985-1998. Queen Elizabeth House Working Paper Series QEHWPS44, University of Oxford.
[25] Lartey, E. Mandelman, F., Acosta, P. (2012). Remittances, exchange rate regimes and the Dutch disease: A panel data analysis". Federal Reserve Board of Atlanta, Review of International Economics, Volume 20, Issue 2, pages 377–395, May 2012.
[26] Lee, J. (1995). Capital goods imports and long-run growth. Journal of Development Economics Volume 48, Issue 1, October 1995, Pages 91–110.

[27] Matsuyama, Kiminori (1992) Agricultural Productivity, Comparative Advantage and Economic Growth. Journal of Economic Theory, December.
[28] Mikesell, R. (1997). Explaining the resource curse, with special reference to mineral-exporting countries. Resources Policy, 23(4).
[29] Neary, J. Peter (1982). Real and monetary aspects of the 'Dutch disease'. University College Dublin. School of Economics, 1982-10.
[30] Nun, N. (2007). Relationship-specificity, incomplete contracts, and the pattern of trade. Quaterly Journal of Economics, May 2007.
[31] Prasad, E., and Chinn, M. (2003). Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration. *Journal of International Economics, 59*(1), 47–76.
[32] Rauch, J. E (1999), Networks versus markets in international trade, *Journal of International Economics, 48*(1), 7-35.
[33] Sachs, J., and Warner, A., (1995). Natural resource abundance and economic growth. National Bureau of Economic Research, Working Paper 5398.
[34] Steingress, W. (2015). Specialization Patterns in International Trade, Working papers 542, Banque de France.
[35] Theil, H. (1967). *Economics and information theory*. Amsterdam: North Holland.

Appendix I

Concentration Indices

- *Gini coefficient*: The Gini coefficient is a measure of statistical dispersion commonly used to represent the distribution of income. We use the same formula as Steingress (2015). Let k index a product among N_x products existing in the world economy; R_k be the corresponding export sales revenue of a given country. The export Gini in this country is given by:

$$G = \frac{2}{N_x} \frac{\left(\sum_{k=1}^{n} kR_k\right)}{\sum_{k=1}^{n} R_k} - \frac{N_x + 1}{N_x}$$

  Where export revenues of product k, R_k, are indexed in increasing order, i.e. $R_k < R_{k+1}$, and N_x denotes the total number of exportable products in the world. The Gini coefficient lies between zero (perfect diversification) and one (total concentration).

- *Herfindahl-Hirschman Index (HHI)*: A measure of market concentration commonly used to measure market power of monopolies or oligopolies. It is calculated by summing the square of the share of every product *i* in the non-resource export basket of a country (S_i) within a certain year. The HHI index ranges from zero (perfect diversification) to 10,000 (perfect concentration). We have normalized the HHI so that it ranges between zero and one, using:

$$HHI = \frac{\sum_{i=1}^{N} S_i^2 - \left(\frac{1}{N}\right)}{1 - \left(\frac{1}{N}\right)}$$

  Where *n* is the total number of products of exported by the country.

- *Theil index*: First introduced by Henri Theil (1967), has been applied to a wide array of purposes within social sciences. The Theil index can be calculated as a weighted average of the log difference from the mean export revenue $(\bar{R})$ as defined by the following formula:

$$T = \frac{1}{N} \sum_{k \in N} \frac{R_k}{\bar{R}} \ln\left(\frac{R_k}{\bar{R}}\right)$$

We take advantage of the decomposition properties of the Theil index to broaden our understanding on how much of the impact of Dutch disease on non-resource export concentration is due to changes in the relative size of existing products (within or intensive margin), and how much is due to changes in the number of export products (between or extensive margin). Following Cadot, Carriere, and Strauss-Kahn (2011) we have decomposed the Theil index using the following formulas:

$$T_w = \frac{1}{N_x} \sum_{k \in N_x} \frac{R_k}{\overline{\overline{R_x}}} ln \left(\frac{R_k}{\overline{\overline{R_x}}} \right)$$

$$T_b = \frac{N}{N_x}$$

where N_x denotes the number of exported products and $\overline{R_x}$ represents the mean value of exported products. Our corresponding diversification indexes are then $(1 - T_w)$ and $(1 - T_b)$.

Appendix II

Technological Classification of Exports of Primary Products (SITC 3-Digit, Revision 2)

Annex Table 1: Lall (2000) Technological classification of primary products (SITC 3-digit, revision 2)

PRIMARY PRODUCTS	RESOURCE BASED 1: AGRO-BASED	RESOURCE BASED 2: OTHER
001 LIVE ANIMALS FOR FOOD	002 MEAT DRIED, SALTED, SMOKED	281 IRON ORE, CONCENTRATES
011 MEAT FRESH,CHILLD,FROZEN	014 MEAT PREPARED, PRESERVED, ETC	282 IRON AND STEEL CRAP
022 MILK AND CREAM	023 BUTTER	286 URANIUM, THORIUM ORE, CONC.
025 EGGS,BIRDS,FRESH,PRSRVD	024 CHEESE AND CURD	287 BASED METAL ORES, CONC NES
034 FISH,FRESH,CHILLED,FROZN	035 FISH SALTED, DRIED, SMOKED	288 NONFERRO METALS SCRAP NES
036 SHELL FISH FRESH,FROZEN	037 FISH PREPARED, PRESERVED, ETC	289 PREC METAL ORES, WASTE NES
041 WHEAT ETC UNMILLED	046 WHEAT ETC MEAL OR FLOUR	323 BRIQUETS, COKE, SEMI-COKE
042 RICE	047 OTHER CEREALS, MEAL, FLOWERS	334 PETROLEUM PRODUCTS REFIN
043 BARLEY UNMILLED	048 CEREAL ETC PREPARATIONS	335 RESIDUAL PETROLEUM PROD NES
044 MAIZE UNMILLED	056 VEGETABLES ETC. PREPARED, PRESERVED	411 ANIMAL OILS AND FATS
045 CEREALS NES UNMILLED	058 FRUITS ETC. PREPARED, PRESERVED	511 HYDROCARBONS NES DERIVS
054 VEG ETC FRSH,SMPLY PRSVD	061 SUGAR AND HONEY	514 NITROGEN-FNCTN COMPOUNDS
057 FRUIT,NUTS,FRESH,DRIED	062 SUGAR CANDY NON-CHOCOLATE	515 ORG-INORG COMPOUNDS ETC
071 COFFEE AND SUBSTITUTES	098 EDIBLE PRODUCTS, PREPARED	516 OTHER ORGANIC CHEMICALS
072 COCOA	111 NON-ALCOHOLIC BEVERAGES	522 INORGANIC ELEMENTS, OXIDES, ETC
074 TEA AND MATE	112 ALCOHOLIC BEVERAGES	523 OTHER INORG CHEMICALS ETC
075 SPICES	122 TOBACCO MANUFACTURED	531 SYNT DYE, NAT INDGO, LAKES
081 FEEDING STUFF FOR ANIMLS	233 RUBBER SYNTHETIC	532 DYES NES, TANNING PRODUCTS
091 MARGARINE AND SHORTENING	247 OTHER WOOD ROUGH SQUARED	551 ESSENTIAL OILS, PERFUME, ETC
121 TOBACCO UNMNFCTRD,REFUSE	248 WOOD SHAPES, SLEEPERS	592 STARCH, INULIN, GLUTEN, ETC
211 HIDES,SKINS,EXC FURS,RAW	251 PULP AND WASTE PAPER	661 LIME, CEMENT, BUILDING PRODUCTS
212 FURSKINS,RAW	264 JUTE, OTHER TEXTILES BAST FIBRES	662 CLAY, REFRACTORY BUILDING PREPARED
222 SEEDS FOR'SOFT'FIXED OIL	265 VEGETABLE FIBRES, EXC. COTTON, JUTE	663 MINERAL MANUFACTURES NES
223 SEEDS FOR OTH FIXED OILS	269 WASTE OF TEXTILE FABRICS	664 GLASS
232 NATURAL RUBBER,GUMS	423 FIXED VEGETABLE OILS, SOFT.	667 PEARL, PREC., SEMI-PRECIOUS STONE
244 CORK,NATURAL,RAW,WASTE	424 FIXED VEGETABLE OILS, NON-SOFT.	688 URANIUM, THORIUM, ALLOYS
245 FUEL WOOD NES, CHARCOAL	431 PROCESSED ANIMAL VEGETABLE OIL	689 NON-FER BASE METALS NES
246 PULPWOOD,CHIPS,WOODWASTE	621 MATERIALS OR RUBBER	
261 SILK	625 RUBBER TYRES, TUBES, ETC.	
263 COTTON	628 RUBBER ARTICLES	
268 WOOL(EXC TOPS),ANML HAIR	633 CORK MANUFACTURES	
271 FERTILIZERS,CRUDE	634 VENEERS, PLYWOOD, ETC.	
273 STONE,SAND AND GRAVEL	635 WOOD MANUFACTURES NEST.	
274 SULPHUR,UNRSTD IRN PYRTE	641 PAPER AND PAPERBOARD	
277 NATURAL ABRASIVES NES		
278 OTHER CRUDE MINERALS		
291 CRUDE ANIMAL MTRIALS NES		
292 CRUDE VEG MATERIALS NES		
322 COAL,LIGNITE AND PEAT		
333 CRUDE PETROLEUM		
341 GAS,NATURAL AND MANUFCTD		
681 SILVER,PLATINUM,ETC		
682 COPPER EXC CEMENT COPPER		
683 NICKEL		
684 ALUMINIUM		
685 LEAD		
686 ZINC		
687 TIN		

Appendix III

Natural Resource Exports as a Percentage of Export Basket: Variance Decomposition

Number of obs =	3,239
R-squared =	0.8907

Source	SS	df	MS	F	Prob > F
Between countryid	246.90544	127	1.9441373	199.69	0.0000
Within countryid	30.287484	3,111	0.00973651		
Total	277.19292	3,238	0.08560622		

Intraclass Correlation	Asy. S.E.	[95% Conf. Interval]	
0.88705	0.01304	0.86150	0.91260

Estimated SD of countryid effect	0.27651
Estimated SD within countryid	0.09867
Est. reliability of a countryid mean (evaluated at n=25.30)	0.99499

Appendix IV

Table IV.1.

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket (1985, 1990, 1995, 2005, 2010)

	All Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1119***	0.2362***	1.8932***	0.4634***	1.4298***	-0.4619***
	(5.89)	(3.88)	(5.58)	(4.75)	(5.00)	(-4.76)
Log GDP PC	-0.0311***	-0.0258	-0.3654***	-0.1769***	-0.1885*	0.1763***
	(-6.25)	(-1.39)	(-3.81)	(-7.47)	(-2.38)	(7.48)
Constant	1.1362***	0.2758	5.3943***	1.7728***	3.6215***	4.6592***
	(23.51)	(1.45)	(5.55)	(7.02)	(4.58)	(18.52)
Number of observations	538	538	538	538	538	538
R-squared	0.4841	0.2054	0.4052	0.5153	0.3078	0.5157

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at., 2014). All regressions include time (year) fixed effects.

b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Appendix IV

Table IV.2.

Baseline panel regressions of non-resource export concentration indexes and share of natural resources in the export basket (1985, 1990, 1995, 2005, 2010).

(Non-OECD vs. OECD countries)

	Panel I. Non-OECD Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0684***	0.2242**	1.5515***	0.4732***	1.0783***	-0.4717***
	(4.11)	(3.49)	(4.45)	(4.33)	(3.75)	(-4.33)
Log GDP PC	-0.0114**	-0.0103	-0.1637	-0.1638****	0.0001	0.1633***
	(-2.68)	(-0.44)	(-1.43)	(-5.78)	(0.00)	(5.79)
Constant	1.0025***	0.1604	3.9833***	1.6686***	2.3147**	4.7633***
	(24.62)	(0.71)	(3.65)	(5.86)	(2.61)	(16.80)
Number of observations	387	387	387	387	387	387
R-squared	0.2174	0.1124	0.1896	0.4313	0.1297	0.4315

	Panel II. OECD Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1265**	0.0568	1.0206*	0.0455**	0.9761	-0.0454**
	(2.98)	(1.71)	(2.22)	(3.02)	(2.14)	(-3.02)
Log GDP PC	-0.0571**	-0.0114	-0.3479	-0.0299***	-0.3180	0.0298***
	(-3.00)	(-0.94)	(-1.78)	(-5.17)	(-1.65)	(5.17)
Constant	1.3609***	0.1338	4.9833*	0.3202***	4.6631*	6.1068***
	(7.25)	(1.11)	(2.57)	(5.40)	(2.44)	(103.11)
Number of observations	151	151	151	151	151	151
R-squared	0.2927	0.2010	0.2594	0.5054	0.2455	0.5054

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Appendix V

Table V.1

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket, Controlling For (Fixed) Exchange Rate Regime (1985, 1990, 1995, 2005, 2010)

	All Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0935***	0.2013*	1.5223***	0.4988***	1.0236**	-0.4970***
	(3.63)	(2.30)	(3.55)	(4.11)	(2.99)	(-4.12)
FER	-0.0146	-0.0137	-0.2367	-0.0291	-0.2076	0.0291
	(-0.86)	(-0.54)	(-1.18)	(-0.52)	(-1.25)	(0.52)
FER*Nat. Res. (% of exports)	0.0271	0.0544	0.5584	-0.0646	0.623	0.0641
	(1 .01)	(0.65)	(1.28)	(-0.47)	(1.76)	(0.47)
Log GDP PC	-0.0312***	-0.0259	-0.3673***	-0.1774***	-0.1899*	0.1768***
	(-6.29)	(-1.40)	(-3.85)	(-7.46)	(-2.42)	(7.46)
Constant	1.1474***	0.2856	5.5740***	1.7988***	3.7752***	4.6332***
	(23.14)	(1.48)	(5.69)	(7.15)	(4.75)	(18.48)
Number of observations	538	538	538	538	538	538
R-squared	0.4864	0.2076	0.4088	0.5192	0.3159	0.5196

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at., 2014). All regressions include time (year) fixed effects.

b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Appendix V

Table V.2

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket, Controlling for (Fixed) Exchange Rate Regime (1985, 1990, 1995, 2005, 2010) (Non-OECD Countries)

	Panel I. Non-OECD Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.0469*	0.1837	1.0750*	0.4858**	0.5892	-0.4839**
	(2.44)	(1.84)	(2.29)	(3.41)	(1.64)	(-3.41)
FER	-0.0158	-0.0152	-0.3178	-0.0481	-0.2697	0.0481
	(-1.06)	(-0.41)	(-1.23)	(-0.53)	(-1.39)	(0.53)
FER*Nat. Res. (% of exports)	0.033	0.0642	0.7359	-0.0274	0.7633*	0.0269
	(1.58)	(0.66)	(1.51)	(-0.17)	(2.01)	(0.16)
Log GDP PC	-0.0116**	-0.0105	-0.1677	-0.1645***	-0.0032	0.1640***
	(-2.82)	(-0.45)	(-1.50)	(-5.81)	(-0.03)	(5.81)
Constant	1.0149***	0.1716	4.2291***	1.7083***	2.5208**	4.7236***
	(26.29)	(0.75)	(3.91)	(6.07)	(2.88)	(16.86)
Number of observations	387	387	387	387	387	387
R-squared	0.2245	0.1157	0.1975	0.4352	0.146	0.4354

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995. (Bahar et. at., 2014). All regressions include time (year) fixed effects.
b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***)

Appendix V

Table V.3.

Baseline Panel Regressions of Non-Resource Export Concentration Indexes and Share of Natural Resources in the Export Basket, Controlling for (Fixed) Exchange Rate Regime (1985, 1990, 1995, 2005, 2010)

(OECD Countries)

	Panel II. OECD Countries (1985, 1990, 1995, 2000, 2005, 2010)					
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	Gini	Herfindahl-Hirschman	Theil	Theil between	Theil within	Lines Open (#)
Nat. Res. (% of exports)	0.1809**	0.1253**	1.8861**	0.0330	1.8531**	-0.0330
	(3.37)	(2.83)	(3.48)	(1.64)	(3.46)	(-1.64)
FER	0.0168	0.0187*	0.2538	0.0025	0.2513	-0.0025
	(0.68)	(2.21)	(1.39)	(0.55)	(1.39)	(-0.55)
FER*Nat. Res. (% of exports)	-0.0857	-0.1095**	-1.3703**	0.0241	-1.3944**	-0.024
	(-1.43)	(-3.45)	(-2.89)	(0.99)	(-2.94)	(-0.99)
Log GDP PC	-0.0560**	-0.0101	-0.3307	-0.0298***	-0.3009	0.0297***
	(-2.90)	(-0.92)	(-1.76)	(-4.82)	(-1.63)	-4.82
Constant	1.3377***	0.108	4.6334*	0.3167***	4.3167*	6.1103***
	(6.74)	(0.99)	(2.42)	(4.94)	(2.29)	(95.55)
Number of observations	151	151	151	151	151	151
R-squared	0.3056	0.3148	0.3158	0.5515	0.3069	0.5515

a. The dependent variable is the referenced concentration index calculated on the non-resource export basket of each country. We exclude Former Soviet Union (FSU) countries, as they have no data prior to 1990 and unreliable until 1995 (Bahar et. at. (2014). All regressions include time (year) fixed effects.

b. Robust t-statistics are in parenthesis. Asterisks indicate statistical significance at the 10% (*), 5% (**) or 1% (***).

Appendix VI

Full Results from Specification (4)

HDFE Linear regression	Number of obs = 1,574,532
Absorbing 2 HDFE groups	F(7, 113) = 14.75
Statistics robust to heteroskedasticity	Prob > F = 0.0000
	R-squared = 0.1153
	Adj R-squared = 0.1056
	Within R-sq. = 0.0024
	Number of clusters (countryid) = 114
	Root MSE = 0.0152

(Std. Err. adjusted for 114 clusters in countryid)

Robust sharennrlall	Coef.	Std. Err.	t	P>t	[90% Conf. Interval]	
lallcode_agg#c.natresrpexp#c.diff						
1	0 (empty)					
2	-0.0040603	0.0006375	-6.37	0.000	-0.0051175	-0.0030031
3	-0.0014623	0.0005242	-2.79	0.006	-0.0023316	-0.0005930
4	-0.0018291	0.0004885	-3.74	0.000	-0.0026392	-0.0010190
5	0.0039279	0.0039279	1.90	0.060	0.0005050	0.0073509
lallcode_agg#c.natrespexp						
1	0 (empty)					
2	0.0104223	0.0024493	4.26	0.000	0.0063603	0.0144843
3	0.0057971	0.0023728	2.44	0.016	0.0018620	0.0097323
4	0.0061701	0.0023402	2.64	0.010	0.0022891	0.0100512
5	0 (empty)					

Absorbed degrees of freedom:

Absorbed FE	Num. Coefs. =	Categories -	Redundant
countryyearid	0	2868	2868 *
productyearid	14273	14274	1

* = fixed effect nested within cluster; treated as redundant for DoF computation

Conclusions[67]

In the course of the previous chapters I have presented the results of my investigations into the behavior of the Venezuelan economy over the previous sixty years. They are aimed at making significant contributions in different strands of the economic literature related to the dynamics of resource rich countries: real business cycles, financial repression and capital flight, Dutch disease and patterns of non-resource specialization. Each of these three self-contained chapters have unveiled some relevant lessons that might not be unique to the Venezuelan case, while at the same time they have opened a number of inquiries that motivate further research.

In Chapter 1, we have calibrated a RBC model to the Venezuelan economy. In spite of heavy state intervention, the model is able to replicate observed movements and co-movements of real variables over the cycle more accurately than reported in the literature for more advanced, free-market economies. We argue that this is a consequence of two particular features of Venezuela. First, it is subject to large, persistent, volatile and exogenous technological shocks in the form of oil prices. Second, real salaries display high volatility, which closely mirrors that of output. Venezuela is a country where dismissal costs are prohibitive, minimum nominal wage is widespread, and firing employees is forbidden below certain salary thresholds. And yet, predicted relative volatilities of employment almost exactly match those observed in actual data. The flip side is that Venezuelan real wages are extremely volatile and highly pro-cyclical, in stark contrast to the sluggishness and lack of correlation with output that real wages exhibit in the United States. We have demonstrated that real wage volatility is driven by large swings in inflation, coped with a rigid labor legislation and sticky nominal wages. From an RBC standpoint, it is surprising that such a strong labor market restrictions are needed to match the predictions of the model. It is the expected fit, driven by a totally different set of reasons.

[67] Unless indicated in the corresponding footnotes, all the bibliographical references made here are to be found in the references listed at the end of each chapter.

These results feed further inquiries into some of the underlying mechanisms and their implications. On the former, we have used the original version of RBC and obtained a surprisingly good fit, but the mechanisms of transmission that drive these results have not been formally incorporated into the model. An extension of the RBC integrating a labor market search model (as in Andolfatto and Gomme, 1995; [68]Andolfatto, Gomme and Storer, 1996[69]), taxes, government, and the external sector might be better equipped to account for and test the transmission mechanisms that have been conjectured here. It might also be worth deepening on the implications of our results for social policy. They put emphasis on the need of rigorously evaluating the welfare effects of rigid labor legislation and other policies presumably aimed at protecting workers. As shown here, they might result in large real wage volatility. In the context of developing countries with incomplete financial markets and little other means of smoothing consumption, these policy instruments may have net deleterious consequences on the welfare of those very same workers they are supposed to protect.

In Chapter 2, we propose a new framework to estimate financial repression, and also a broader indicator for capital flight that accounts for the over-invoice of imports. We show that financial repression in Venezuela accounts for public revenues (as a percentage of GDP) similar to those of OECD economies, in spite of the latter having much higher domestic debt-to-GDP ratios. Fiscal revenues coming from financial repression are significantly higher in years of exchange controls and legislated interest rate ceilings. We find evidence suggesting a systematic link between significant distortions in the domestic financial system and a weakening of external accounts via capital flight. The nature of the domestic-external interaction can give rise to self-reinforcing vicious circles. A chronically high inflation tax arising from deficit

[68] Andolfatto, D. & Gomme, P., 1995. Unemployment Insurance, Labor Market Dynamics and Social Welfare," Discussion Papers dp95-09, Department of Economics, Simon Fraser University.

[69] Andolfatto, D. & Gomme, P. & Storer, P., 1996. U.S. Labour Market Policy and the Canada-U.S. Unemployment Rate Gap, Working Papers 9604, University of Waterloo, Department of Economics.

monetization coupled with financial repression spurs capital flight and weakens the country's external position. Capital flight, in turn, weakens the government's revenue base inducing greater reliance on inflation/financial repression taxes. The connection between large haircuts on domestic debt and a weakening in the balance of payments may also help in explaining why emerging markets sovereign defaults often occur at seemingly low levels of external debt.

A natural extension would be to apply the same techniques we have proposed to estimate financial repression and capital flight in Venezuela to a wider set of countries which have also experienced long spells of capital controls and interest rate ceilings. The former provides incentives not only to over-invoice imports but also to under-invoicing exports, which we have omitted in the case of Venezuela, as it does not have any significant export aside from oil (which in turn is exported by a public company). If the link between financial repression and a weakening of the external position via capital flight (including under-invoice of exports and over-invoice of imports) is well established across different countries, it would be interesting to study if its occurrence tends to precede default episodes.

In Chapter 3, we have developed a thorough cross-country study to assess the impacts of natural resources in non-resource export concentration at the country and product level. We report here significant evidence indicating that countries with high shares of natural resources in exports tend to have less diversified non-resource export baskets. At the product level, we find that capital intensive goods tend to have larger shares on the non-resource basket when natural resources are high. These results are more robust in developing countries, which is consistent with the abundant literature reporting that these economies are more prone to import capital and would therefore benefit (relative to labor intensive) from the real exchange rate appreciation archetypal of Dutch disease (Lee, 1995; Prasad and Chinn, 2003; Calvo, Leiderman and Reinhart, 2006). We also find that, for resource rich countries, non-resource homogenous goods tend to make up a larger share of the export basket whereas differentiated goods tend to have smaller shares on average. Yet, for products further away in the value chain, this pattern is reversed. Differentiated goods on the higher end of the technology spectrum are better equipped to cope with Dutch disease and might even thrive (relative to high-tech homogeneous goods) in resource rich countries. The problem is that to get there you may need to gradually accumulate capabilities (Hausmann, Hwang and Rodrik, 2005; Hidalgo et. al., 2007; Hausmann and Hidalgo, 2011), and by killing differentiated industries downstream you make it hard to reach more sophisticated, differentiated industries (consistent with Matsuyama 1992 "improductive specialization", and Krugman 1987 "learning by doing"). At last, we have found some evidence indicating that skill intensive products tend to have lower shares on the non-resource export baskets of resource rich countries. These results are consistent with the story of skill intensive industries suffering more from real exchange rate appreciation due to the higher share of qualified labor in their cost structure. Nevertheless, these are not robust to using alternative definitions of natural resources or breaking the sample in OECD and non-OECD economies.

This paper is the first attempt at analyzing empirically the impacts of Dutch disease at the product level. The mechanisms of transmission in the case of the larger shares of capital intensive goods that we have found in the non-resource export basket of resource rich countries are aligned with previous literature showing that developing countries tend to import capital goods. The mechanisms behind our most important findings are less evident and deserve further research. On the one hand, we have found that homogeneous goods tend to have higher shares within the non-resource export basket in resource rich countries, the closer they are in the value chain to natural resources. This conclusion is intuitive, in particular if we think that there are a number of non-resource products that are closely linked to natural resources and require little additional processing. But our findings are not exclusively driven by these. Our results are robust to including resource-based goods within our aggregate of natural resource exports. For differentiated goods the results somehow reverse: They tend to have higher shares within the non-resource export basket, the more sophisticated they are from a technology standpoint. This strong evidence would benefit from further research using specific empirical strategies for testing potential underlying transmission mechanisms. In particular, there seem to be interesting possibilities in using institutional intensity and contract intensity measures at the product level (Nunn, 2007) interacted with World Bank Governance Indicators at the country level, as weak institutions are documented to be one of the basic diffusion channels for Dutch disease.