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Resource Boom, Manufacturing Bust: The Dutch Disease and Deindustrialization in South America

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Abstract

This thesis looks at the role of the 2003-2013 primary commodity boom in South American deindustrialization. I hypothesize that the boom has led to deindustrialization throughout the region because of the 'Dutch disease,' a process by which a boom in the natural resource sector causes the manufacturing sector to decline due to resource movement between sectors and real exchange rate appreciation. Using a panel dataset of 106 lower-middle and upper-middle income countries from 1995 to 2019, I analyze the extent to which a greater share of primary commodities in a country's export basket has led to (a) lower manufacturing value added and (b) higher real exchange rates, both around the world and specifically South America. I find evidence that the Dutch disease has led to higher real exchange rates in South America, but insufficient evidence that the Dutch disease has led to lower manufacturing value added in the region.

Abstract in Spanish (Resumen en Español)

Esta tesis estudia el papel de la bonanza de productos primas en la desindustrialización de Sudamérica. Planteo como hipótesis que la bonanza ha producido desindustrialización a causa de la 'enfermedad holandesa,' una condición en que una bonanza de un recurso natural hace que el sector manufacturero se deteriora a causa de movimiento de recursos ente sectores y apreciación del tipo de cambio real. Usando un conjunto de datos de panel de 106 países de ingresos medio-bajos y medio-altos de 1995 and 2019, evalúo el grado en que un aumento de la proporción de productos primarios en las exportaciones de un país ha reducido el valor agregado por manufacturas (VAM) y aumentado los tipos de cambio reales (TCR), tanto en todo el mundo como en Sudamérica. Encuentro evidencia de que la enfermedad holandesa ha llevado a

una subida de tipos de cambio reales en Sudamérica, pero no encuentro evidencia suficiente de que la enfermedad holandesa ha llevado a una disminución en valor agregado por manufacturas en la región.

1. Introduction

Two important economic trends have come to characterize South America in the 21st century. The first is that many countries are shifting their economies toward exporting primary commodities, mainly to China and the US. Since the turn of the century, in almost every country in South America, primary commodity exports are rising and manufacturing as a share of GDP is falling more or less steadily (Kim and Lee 2014). Apart from a brief period in the late 1990s, South America has been deindustrializing and reprimarizing since the early 1980s, when the region emerged from its state-led industrialization period (and subsequent debt crisis) and was pushed toward a more liberal economic orthodoxy. The reprimarization trend took off around 2003, when rising demand from China and other emerging markets created a commodity boom that lasted for roughly ten years. Many countries took advantage of it, doubling down on the extraction and exports of fuels, minerals and agricultural products.

The boom did not last, however. Around 2013, demand (and with it, prices) for commodities sharply dropped, causing an economic downturn felt most strongly in countries that relied heavily on windfall gains from commodity exports. This brings us to the second observation: in the years since the commodity boom ended, many South American countries find themselves in a state known as the middle-income trap, where productivity and human capital development are too low to compete in high-tech manufactured goods, but wages are too high to compete internationally in labor-intensive manufactured goods. As a result, economic growth in South America has ground to a virtual halt as the region has been unable to gain a foothold in global value chains.

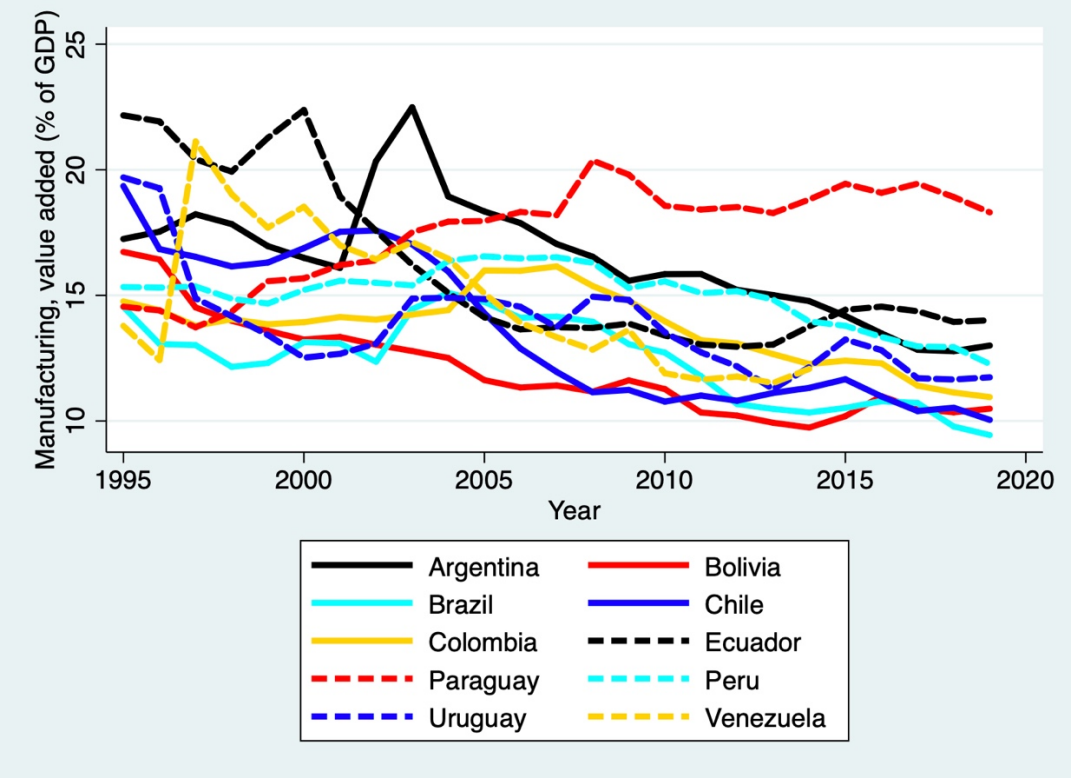
My independent study argues these two phenomena are related, and that the commodity boom created a widespread ‘Dutch disease’ throughout South America. The Dutch disease refers

to a condition in which a price boom in one export causes other exporting industries, namely manufacturing, to struggle due to currency appreciation and the movement of capital and labor toward the booming natural resource sector. I argue some countries were more vulnerable to the disease than others, the most infamous example being Venezuela, however almost all countries in the region followed the same trend.

The Dutch disease is a significant issue because it leads to deindustrialization. Theorical and empirical evidence suggest that in an open economy, manufacturing is a far more reliable vehicle for economic growth than natural resources (Arrow 1962, Matsuyama 1992, Sachs and Warner 2001). This is for a few reasons. Manufacturing tends to have a more complex division of labor, which lead to greater productivity and higher wages. Manufactured goods also have more complex supply chains, which can lead to greater linkages with the rest of the economy. For instance, if an auto manufacturer has a plant in a city, that city is more likely to attract factories that produce car parts like brakes and tires. The city will attract factory workers and engineers. Those engineers and factory workers will spend money at restaurants, buy homes in the area, and otherwise create demand for services. Most important, as these plants grow in size they experience economies of scale – they practice, improve and innovate in a way that makes the factories more productive over time. This is called *Learning-by-doing* and it is a large part of the reason manufacturing is so desirable. Meanwhile, natural resource sectors tend to have weaker linkages to the rest of the economy. They require specific locations (one can't just mine anywhere, only where the minerals are) and involve simpler extractive processes simpler divisions of labor. They are also often enclaves, meaning the capital being used to extract natural resources is often foreign. This limits the value that can be created domestically and the linkages that can be created with the rest of the economy. González et al. (207) demonstrate that in

Colombia, productive quarters in the manufacturing sector are associated with the same outcome in the rest of the economy, whereas productive quarters in mining and oil have the opposite effect. South America has been steadily deindustrializing since the mid 1990s, as shown in figure 1.1:

Figure 1.1: Manufacturing value added (% of GDP) from 1995-2019. Source: Author's calculations based on UN statistics division.



This study analyzes the effect of primary commodity dependence on deindustrialization. I hypothesize that the proportion of primary commodities in a country's export basket will have a negative relationship with manufacturing value added due to the Dutch disease. I also expect to find that this relationship is particularly strong in South America. A variety of factors explain deindustrialization with theoretical and empirical evidence to back them up. One of these

theories is the inverted-U curve theory, which holds that deindustrialization is a natural progression and will almost definitely occur when a country reaches a certain income level.

Deindustrialization may also be a matter of institutions. Industrialization requires investment and when institutions cease to create an investment-friendly environment, deindustrialization ensues. There is also evidence that bilateral trading relationships with China play a significant role. I will discuss in the subsequent chapters how both importing from and exporting to China can be deindustrializing forces. In order to test my hypothesis of the Dutch disease in South America, I control for other deindustrializing forces that could be at play in the region.

I define South America as the ten South American republics: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela. Notably excluded from this list are Suriname, Guyana, and French Guyana, all of whom are located on the South American continent. I exclude these countries because they are more culturally, linguistically, politically and economically tied to the Caribbean region. The World Bank also makes this distinction.

This study is unique in that it focuses exclusively on South America where other studies would focus on Latin America as a whole. Literature on development and recent history in Latin America points to two distinct paths taken by the South and Central American regions in this century. While South American economies have been oriented toward commodities, Central American economies have been more oriented toward lower value-added manufacturing and assembly as well as tourism. Mexico is debatably an exception, deriving a sizeable amount of its economic output from oil, however it will be left out of this study for the sake of consistency (Ocampo 2017).

My empirical model builds upon the work of Kim and Lee (2014), who also use a series of panel regressions to compare deindustrialization in different regions of the world. The authors arrive at the conclusion that the Dutch disease has uniquely affected Latin America. I add to Kim and Lee's work in two ways: First, I test for both *direct deindustrialization* — movement of inputs away from manufacturing and toward natural resources and services and *indirect deindustrialization* — a loss of competitiveness in the manufacturing sector due to real exchange rate appreciation. Second, I break up primary commodities by type in order to compare the severity of Dutch disease effects caused by booms in food, agricultural raw materials, minerals, and fuels.

My study does not look at the Dutch disease from an exclusively economic lens. A variety of historical and political economic factors have led to reprimarization and no analysis is complete without understanding the causes. Chapter 2 identifies the key structural changes that have recently occurred in Latin America, beginning with the debt crises of the 1980s. Reprimarization has stemmed from a combination of region-wide liberalization in the 1980s and 1990s and the China-driven primary commodity boom of 2003-2013. Chapter 2 also explains how different countries in the region have navigated the commodity boom, both politically and economically.

Chapter 3 reviews the relevant literature around the Dutch disease and how it pertains to South America. Sachs and Warner (2001) introduce the concept of the *resource curse*, a universal phenomenon wherein resource-rich countries experience slower economic growth. The resource curse is related to the Dutch disease, but they are two separate concepts. Ocampo (2017) provides a primer on commodity-led development in Latin America. Kim and Lee (2014) show evidence that this commodity-led development has led Latin America to a

deindustrialization path that is distinct from other regions. Chapter also 3 contains two case studies: González et al. (2016) show symptoms of a Dutch disease in Colombia using a time-series regression. Desfrancois (2019) uses a VAR model to predict how an oil boom will lead to Dutch disease symptoms in Ecuador.

Chapter 4 provides a theoretical framework. I use a combination of Matsuyama (1992)'s model of agricultural productivity in a small open economy and Corden and Neary (1982)'s three-sector model to analyze the labor market effects of a resource boom in a small open economy. Chapter 5 provides the methodology for my empirical model and its results. I use a series of lagged panel regressions to measure the effects of primary commodity dependence on both real exchange rate (RER) manufacturing value added (MVA). My results provide evidence of indirect deindustrialization in South America, but insufficient evidence of direct deindustrialization. I find that a greater share of primary commodities in a country's export basket is associated with a higher real exchange rate in South America. I also find that among all middle-income countries, a greater share of primary commodities in the export basket is associated with lower MVA, but I do not find significant evidence that this effect in particularly strong in South America. This is likely due to issues with my dataset.

2. Historic and Political Context

2.1 Introduction

This chapter explores the major historical changes in South America from the 1980s until today that help to explain South America's current middle-income trap. As most of the countries in the region emerged from dictatorship and into democracy, they faced a massive region-wide debt crisis. The remedies to debt and inflation employed by (or imposed upon, depending on who you ask) South American policymakers would fundamentally change the nature of their economies. Over the course of around a decade, the prevailing economic model in South America went from protectionist, state-led industrialization to 'Washington consensus' policies of openness, privatization, and export-led growth. Around the turn of the century, China's entry into the world trade organization (WTO) and subsequent economic growth spurt created a surge in demand for primary materials, which kicked off the ten-year global commodity boom. The commodity boom and a new rising world power marked the beginning of the region's 'post-neoliberal era,' providing a new suite of development strategies widely considered unavailable under the 'Washington consensus.' The strategies employed by countries vary significantly. Bolivia, Ecuador, and Venezuela employed what Jepson (2019) calls an 'extractivist-redistributive' model, doubling down on the export of primary commodities with more state involvement in the extraction and rent distribution processes. Argentina and, to a lesser extent, Brazil employed a 'neo-developmentalist' strategy. Wise (2020) argues this further entrenched the negative effects of natural resource abundance. Finally, Chile and Peru have continued to embrace economic openness with more of an orientation toward China.

Broadly speaking, the shift from the state-led industrialization era to the 'Washington consensus' era laid the groundwork from reprimarization and the proceeding commodity boom turbocharged it. This chapter has two main sections: the first section details the transition away from state-led industrialization and toward liberalization. The second section details the commodity boom and various countries' approaches to it.

2.2 From State-Led Industrialization to the Washington Consensus

Since around the end of the second World War, the dominant economic orthodoxy in Latin America was the inward-looking, state-led industrialization strategy advocated by the UN economic commission for Latin America and the Caribbean (CEPAL). This is commonly referred to as 'import-substitution industrialization,' but as Ocampo (2017) notes, 'state-led industrialization' is the more appropriate term because it involved more than just trade protectionism. "In addition to raising tariffs on imports, governments added many non-tariff barriers (including outright bans) against goods that competed with local production and gave soft loans and subsidies to favored industrial firms" (Reid 2017). Another key feature was "restrictions on foreign direct investment (FDI) in the natural resource and infrastructure sectors if several countries, and the growing role played by state-owned enterprises in these sectors" (Ocampo 2017).

The state-led industrialization model was the beginning of a region-wide export diversification process that would last until the late 1990s. Primary commodities, which dominated the Latin American export basket until the 1960s, came to occupy a shrinking share of Latin American exports. This hardly mattered during the state-led industrialization period, however, since the region largely turned its back on international trade. In 1970, Latin America accounted for just over 4% of international trade (Ocampo 2017). As an alternative to trade,

'*Cepalistas'* argued it was essential to expand the size of the domestic market, which without trade typically involved "wage increases and printing money to cover the subsidies and losses of state-owned companies" (Reid 2017).

Another dominant characteristic of South America in the 1960s and 1970s was military dictatorships, many of which were known for repression and state terrorism. By 1977, only Colombia and Venezuela had democratically elected civilian governments. In the other eight South American republics, some of the military dictatorships started to stray from CEPAL orthodoxy. In Chile and to a lesser extent, Argentina and Uruguay, regimes used their authority to enact more free-market oriented policies, privatizing previously state-owned enterprises and cutting social spending and tariffs. On the other end of the spectrum were Peru's military dictatorship, which nationalized foreign firms in the oil and mining industries, and the Brazilian military regime, which oversaw the creation of hundreds of state-owned firms (Reid 2017).

Many of the military dictatorships of the 1960s and 1970s laid the groundwork for economic liberalization, but only to a certain extent and in certain cases. The structuralist perspective, articulated by O'Donnell (1973), is that 'bureaucratic-authoritarian' dictatorships arose to enforce the dominance of local business leaders and multinational corporations by eliminating modes of popular dissent like trade unions, political parties, and strikes. Chile is the clearest example of this type of regime, but it must be noted that in almost all other cases, military dictatorships held onto at least some CEPAL orthodoxy. Militaries tended to have a vested interest in state-led industrialization, since it provided them with jobs and subsidies. Even Chile retained state control of its copper reserves. Furthermore, Biglaiser (2002) argues that "the appointment of neoliberal economists occurred not because military rulers possessed inherent interest in following market-oriented policies, but because they saw the appointments as a way

to solidify their power." As a result, the market reforms employed by military regimes were far from comprehensive.

South America's 'Washington consensus' period of economic liberalization fully took off in in the 1980s, a decade in which all of the region's military regimes yielded to civilian democracies. A new wave of democracy began with Ecuador in 1979, followed by Peru in 1980, Bolivia in 1982, Argentina in 1983, Uruguay in 1985, Brazil in 1985, and Chile and Paraguay in 1989. Militaries yielded to civilian rule for a variety of political and economic reasons. The first of these was an unfriendly international environment during the 1970s, which saw the fall of military dictatorships in Spain (1973) and Portugal (1976) and later the humanitarian-focused foreign policy of Jimmy Carter (a significant difference from the diplomatic support many of the juntas had previously received from the US). Each military dictatorship also faced significant civilian resistance, which often took the form of massive strikes (Reid 2017). Finally, the most significant economic factor was the Latin American debt crisis of the 1980s. Ahumada (2019) argues the debt crisis was "the critical juncture at which the main features of the region's pattern of insertion [into the global economy] were set." Throughout the 1970s and into the early 1980s, Latin America experienced a flood of foreign capital from a rapidly expanding banking sector concentrated mostly in the US and Europe. The 'core' had a vast supply of liquid financial capital. That financial capital was available to 'periphery' countries at very low interest rates, which created high demand. Loans from the banking sector were broadly considered preferrable to those from international financial institutions (IFIs) like the International Monetary Fund (IMF) and World Bank, which came with strings attached. South American governments, who were looking to preserve the state-led industrialization model, went on a borrowing spree. "[Latin America]'s external debt began to rise exponentially, from around

150% of exports and 15% of GDP in 1975 to 400% of exports and 50% of GDP in 1985" (Ahumada 2019). The debt crisis was triggered by Mexico's 1982 default, which quickly led to debt defaults all across Latin America. This crisis presented an economic challenge that most military governments did not have the will or stamina to deal with. "Rather than risk their professional cohesion, Latin America's armies [with the relative exception of Argentina] sat down with civilian politicians and negotiated a return to their barracks" (Reid 2017).

Ahumada argues Latin American policy makers had three main options to recover from their debt crisis. The first was to go bankrupt, which would have maximized policy autonomy but also would have made it extremely difficult to find new sources of financial capital. The second was "to consolidate an export-turn within the architecture of the import-substitution, as the East Asian countries did" (2019). The third option, which Latin American governments were pressured by their debtors to choose, was to work toward complete repayment through a series of reforms known as 'structural adjustments.' These reforms were a relatively sudden shift toward economic openness, domestic austerity measures, more orthodox macroeconomic policies to control inflation, and privatization of enterprises once owned by the state. Much of these policies were handed down from the US, IMF, and World Bank, who were willing to restructure debts in the region provided countries followed their guidelines.

The upshot of this rapid liberalization was that comparative advantage was more relevant in Latin America than it had been in decades. This carried enormous implications for countries' natural resource sectors, in which maintained their static comparative advantage, and their Manufacturing sectors, which tended to be rendered inefficient from decades of protectionism. This was also the period in which distinct 'northern' and 'southern' patterns emerged within Latin America. Low wages and proximity to the U.S. gives Mexico and Central American

countries a comparative advantage in lower-value-added assembly (*maquila*) while natural resource wealth gives South American countries a comparative advantage in primary commodities. Despite this reinforcement of comparative advantage, South American exports actually diversified through the 'Washington consensus' period. This was mainly due to revitalized regional trade through agreements like MERCOSUR (a trading bloc and customs union that includes Argentina, Brazil, Paraguay, and Uruguay). As Ocampo (2017) points out, intra-regional trade tends to involve far more complex manufactured goods than inter-regional trade

The structural adjustment programs of the Washington consensus period leave behind a complicated legacy. Defenders of structural adjustment like Reid (2017) argue that despite the short-term pain, it was the best available way to deal with the structural issues that Latin America faced. In almost all Latin American countries, Inflation (which had long been chronically higher in Latin America than in the rest of the world) was brought under control and public institutions were markedly improved. The 'lost decade' of the 1980s gave way to seven solid years of region-wide growth and export diversification in the 1990s. All told, Latin America was much better position to whether the late '90s emerging market crisis and to take advantage of the commodity boom to the extent possible. Critics of structural adjustment like Ahumada (2019) argue they were imposed on the peripheral countries of Latin America by core countries (and the international organizations controlled by them) in a one-size-fits-all manner. Privatization and austerity cost thousands their livelihoods and economic security for the benefit of foreign firms and investors. Latin American countries were forced into a core-periphery global free trade regime that entrenched Latin America's comparative advantage in low value-added activities like natural resources and assembly. Both of these pole positions contain some

truth (their accuracy varies on a case-by-case basis), but the debate between them, however consequential, is outside of the scope of this study.

Well within the scope of this study, however, is the fact that after the Washington consensus, South America's productive structure was more prone to change than it had been in decades. "Without the previous protectionist measures, it was market dynamics that determined the areas of higher profitability for private firms, both national and foreign" (Ahumada 2019). Around the turn of the century, as primary commodities became more profitable and manufacturing faced new levels of outside competition, economies in the region shifted accordingly.

2.3 The Commodity Boom and the Rise of China

In the late 1990s, widespread economic hardship and stagnation once again struck Latin America. Russia's 1998 currency devaluation set off a global chain of events that would lead to a worldwide emerging market financial crisis. Foreign capital once again began to flow out of the region and many countries received a new round of structural adjustment. Argentina, Brazil, and Ecuador were hit particularly hard. CEPAL spoke of another 'lost half-decade.' The region did not see sustained growth again until the beginning of the commodity boom in the early 2000s.

China's entry into the WTO in 2001 was extremely consequential for the entire global economy. China's demand for foodstuffs, natural resources, and fuel under constrained supply pushed the price natural resources to record levels. Farmers and mining companies (both private and state owned) made huge investments in expanding output. South America's terms of trade rose rapidly and dramatically, leading to economic growth and increased revenue for South American governments. This new revenue source "loosened the disciplinary power exercised by

IFIs and global capital markets and provided states with a level of policy autonomy that allowed (but did not compel) them to substantively break with neoliberal orthodoxy for the first time in a generation" (Jepson 2020). The decreased leverage of IFIs does not *necessarily* put China at a much better position to influence South American policymaking if it desired to. Bear in mind that "Chinese policy makers face the daunting tasks of having to feed the world's largest domestic population, and to fuel the soon-to-be largest economy in the world" (Wise 2020).

The boom also occurred during a significant inflection point in Latin American politics. the emerging market crisis made neoliberalism increasingly unpopular throughout the region, creating an opportunity for a generation of left-wing leaders, many (but not all) of them populist-nationalists, to come to power. This region-wide shift to the political left became known as the *marea rosa* or 'pink tide.' In South America, pink tide leaders include Argentina's Nestor Kirchner (2003-2007) and Christina Fernández de Kirchner (2007-2015), Bolivia's Evo Morales (2006-2019), Brazil's Luiz Inácio "Lula" da Silva (2003-2011) and Dilma Rousseff (2001-2016), Chile's Ricardo Lagos (2000-2006) and Michelle Bachelet (2006-2010; 2014-2018), Ecuador's Rafael Correa (2007-2017), Paraguay's Fernando Lugo (2008-2012), Peru's Ollanta Humala (2011-2016), Uruguay's Tabaré Vazquez (2005-2010) and José Mujica (2010-2015), and Venezuela's Hugo Chávez (1999-2013). In 2008, debatably the height of the commodity boom, eight of the ten South American republics were governed by the political left (in a broad sense). Since the end of the commodity boom in 2013, South America has returned to relative parity between the political left and right.

A great deal separates the governing styles and policy choices of these leaders — they range from centrist reformers like Lagos to radical populists like Chávez. However, the *mearea rosa* represented, at least in rhetoric, a widespread break from the 'neoliberal' orthodoxy of the

previous two decades. Latin America appeared to be "moving out from under the thumb of the United States, where it was asserted to have forever languished" (Reid 2017). All this is to say that between a rising new world power, a sudden windfall in the form of commodity prices, and a wave of anti-neoliberal political sentiment, South American countries were ripe for a significant structural change.

The most dramatic shifts in policy during the commodity boom were seen in Venezuela, Ecuador, and Bolivia, all three of which followed an 'extractivist-redistributive' model wherein a populist governing coalition used expanded control over natural resource rents to finance increased social spending. This falls under the broader category of resource nationalism In all three extractivist-redistributive cases, the state "took a greater role in extraction, through very much in continued partnership with transnational capital, which was required in order to provide investment and technology. In an era of high commodity prices, transnational extractive firms generally accepted the new terms proposed by governments, if not without protest, and continued to operate profitably in ER states, in spite of the regular and sometimes strident anti-imperialist rhetoric of their governments" (Jepson 2020).

China has become more involved in all three extractivist-redistributive states as a trading partner and as a foreign direct investor. This is especially the case in Ecuador, where China has made a series of multi-billion-dollar oil and infrastructure investments in the latter half of the commodity boom. Some opponents of Ecuador's president Correa accused him of railing against American imperialism while embracing a similarly lopsided relationship with China (Jepson 2020). It should also be noted that all three of these states export commodities with volatile prices. The Venezuelan and Ecuadorian economies are extremely oil-dominant (Venezuela has the largest proven oil reserves in the world) and both countries nationalized their oil resources

long before the commodity boom. In pre-boom Venezuela, the state-owned oil company PDVSA operated with a degree of independence that made it a de-facto private firm. Under Chavez, the Venezuelan executive fought for far greater control over PDVSA and use revenues to finance an array of community-level social programs known as *misiónes.* Bolivia took a similar approach, the success of which proved more durable. Bolivia's main exports are natural gas (nationalized under Morales) and minerals. Commodity revenues in Bolivia went toward, among other things, a conditional cash transfer (CCT) program, a scholarship program for young children, and a national pension system.

The three extractivist-redistributive states saw the largest increases in their terms of trade during the commodity boom (Ocampo 2017). Ecuador and Venezuela have also seen some of the greatest downturns in the years since the boom, since a significant portion of government spending has been tied to commodity revenues. The next chapter of this study presents an empirical analysis by Desfrancois (2019) which shows clear evidence of Dutch disease symptoms in Ecuador. Venezuela, the government that was the most heavily dependent on commodity revenues, has suffered the greatest non-wartime economic collapse in modern history. Bolivia also experiences a downturn after the commodity boom, but it was not as severe. It is worth mentioning that Evo Morales's resource nationalism likely played played a role in the 2019 coup that removed him from power.

Another course, taken by Brazil and Argentina, was the 'neo-developmentalist' route, characterized by "an active industrial policy, focused on directed credit, subsidies, and infrastructural development as well as support for consumption (via, for example, wage increases) in an effort to build the domestic market" (Jepson 2020). This route is theoretically a way to avoid the Dutch disease by actively avoiding overreliance on primary commodities

through industrial policy. Critics of this approach, like Wise (2020), argue that in practice, there was little 'neo' about this approach and it is largely a return to the state-led industrialization policies of the mid-twentieth century. Furthermore, Wise argues that windfall gains from the commodity boom disincentivized institutional reforms that were desperately needed in both countries, creating an 'institutional resource curse.' In Argentina, revenues from soybeans were spent less on developing the domestic market on more on targeted subsidies meant to hold together the Kirchners' political coalition (Wise 2020). To the extent that the Argentine government attempted to boost domestic manufacturing, it did so through typica protectionist methods and anti-dumping complaints against China, to which China quickly retaliated. Also, both the Argentine central bank and national census fabricated economic data to hide inflation and poor growth (Wise 2020).

Brazil had a far more coherent developmentalist policy during this time. During the early years of Lula, Brazil kept in place many of the macroeconomic policies of the Washington consensus while simultaneously looking to boost domestic manufacturing using a combination of subsidies, selective trade protection, and funds from the Brazilian national development bank (BNDES). This was combined with FDI from China, which unlike FDI in Ecuador, was not just for resource extraction. Chinese FDI was also aimed at Brazilian manufacturing in areas like transportation and aerospace (Wise 2020).

Despite the coordinated effort to make its manufactured exports more competitive, the project has largely failed. From 2005 to 2019, Brazil has gone from a trade surplus of $8 billion in manufactured goods to a deficit of $90 billion (Wise 2020). A variety of factors lay behind Brazil's failure in neo-developmentalism. The first was high interest rates, which were put in place during the Washington consensus period to quell inflation. While this succeeded in

keeping inflation under control, it made it more difficult for manufactured exports to compete internationally. This effect was likely augmented by the Dutch disease. The second was the nature of its trading relationship with China. The industrializing effects of Chinese FDI were more than counterbalanced by (a) Chinese demand for Brazilian primary commodities and (b) Chinese manufactured imports displacing Brazilian manufacturing. Wise (2020) attributes as much as 29% of Brazil's manufacturing deficit to Chinese displacement. The final reason was corruption. Brazil's state-owned oil company Petrobras was at the center of *Lava Jato* or 'operation car wash,' the largest-scale corruption scandal in recorded history, which resulted in political turmoil and economic recession. *Lava Jato* essentially consisted of Petrobras being granted kickbacks from a vast network of overvalued contracts to a cartel of construction and engineering companies. As much as a third of Brazil's congress was also on the payroll. In the aftermath of the scandal, Petrobras was forced to halt new projects throughout Brazil and the region, costing hundreds of thousands of jobs. The scandal would result in President Dilma Rousseff's impeachment and Brazil losing its investment-grade credit rating. This is, of course, an oversimplification — all of the details of *Java Jato* would likely require another chapter. The main takeaway, however, is that the experiences of Argentina and Brazil indicate that strong institutions and a lack of corruption are essential to averting the negative effects of resource reliance. For this reason, I account for institutional quality in my empirical section.

A final note about Argentina and Brazil is that both countries' main commodity export to China is soybeans, which are less volatile (meaning they yielded a smaller change in terms of trade) than fuels and minerals. In can be argued that for soybean exporters, the commodity boom has not fully ended. At the beginning of 2020, soybean prices are still well above their pre-boom levels and the recent US-China trade war has made Brazilian and Argentine soy exports far

more competitive. Brazil's current president, Jair Bolsonaro, while politically the polar opposite of *marea rosa* leaders, enjoys strong support from Brazilian agribusiness due to his disregard for environmental protection. During his presidency, large swaths of rainforest in Brazil have been cleared for soybean farming.

A final approach is that taken by Peru, Chile, and to a certain extent, Colombia. None of the three countries have strayed particularly far from the liberal orthodoxy of the 'Washington consensus' regarding free trade. This perhaps because none of the three countries veered particularly far to the political left during the *marea rosa*. All three of these countries have individually singed free trade agreements (FTAs) with the US and Peru and Chile have signed FTAs with China. Both the Sino-Chilean and the Sino-Peruvian FTAs include certain exceptions for the domestic manufacturing and were signed with the goal of "attracting Chinese FDI into efficiency and market-seeking investments as opposed to the current flood of incoming resource-seeking investment…limited to mineral extraction" (Wise 2020). Colombia is harder to categorize cleanly due to its unique situation. Only in 2017 did Colombia's 56-year civil war end, and its decades-long drug war is in many ways still raging. Generally speaking, Colombia has embraced its oil and mining boom as a means to attract (mostly American) FDI in order to finance its large defense budget (Jepson 2020). The next chapter presents a case study that shows Colombia's mining and oil boom has led to Dutch disease symptoms.

2.4 Conclusion

It is difficult understand South America's recent reprimarization and deindustrialization without understanding the other major socio-political shifts that came before it. Both the state-led industrialization period and the commodity boom account for deindustrialization in the region in different ways. When state-led industrialization was the prevailing economic

orthodoxy, traditional manufacturing industries were insulated from international competition. A number of factors, both internal and external, led this orthodoxy to change. The shift toward liberal orthodoxy started with the military dictatorships of the 1970s and 1980s, particularly in the southern cone. It continued through the debt crisis, where IFIs pushed South America toward privatization, austerity, and export-led growth. Although export diversification continued until the late 1990s, the market now had more control than the state in determining the productive structure. South American countries' comparative advantages — and the Dutch disease effects thy entail — became newly relevant. Starting in the early 2000s, a confluence of events — the emergence of China, the surge in commodity prices, and the *marea rosa* — made it clear that both the market and shifting political tides favored primary commodity specialization.

The extent to which countries embraced this strategy varies. Venezuela, Ecuador, Bolivia, and Colombia have used commodity windfalls to finance domestic priorities. This has left all of these countries extremely vulnerable to drops in commodity prices. Argentina and Brazil each attempted to use commodity revenues to finance their own form of developmentalism, but neither of their projects were successful in the long term. Finally, Chile and Peru have more or less stuck with the prevailing wisdom of the 1980s and 1990s, looking to leverage free trade as a means to promote more complex industry and ascend regional and international value chains.

A debate has emerged as to whether South America's deindustrialization has been inevitable. Were there different paths available for South America that would have averted premature deindustrialization? Several authors argue that there was. All of these authors compare Latin America during the 1980s and 1990s to east Asian 'tiger' economies, which

generally had similar starting points. Ahumada (2019) argues that while joining the core-led free trade regime of the 1980s and 1990s, Latin American countries had a severely limited policy space to promote industrialization. He cites the Uruguay round of the General Agreement on Tariffs and Trade (GATT) in 1986, included a 'single undertaking' clause — countries signed on to all of it or none of it. This meant that South American countries were boxed into an intellectual property and investment regime which he argues undermined local manufacturing. Countries couldn't reject these rules without being excluded from the entire global trade regime, a risk no country was willing to take. East Asian countries, he argues, had a wider policy space available and were able to endogenously build their manufacturing sectors using policies that would have been considered protectionism in the Uruguay round.

Palma (2019) presents a similar argument. Both regions liberalized at around the same time. The key difference, he argues, was that East Asian countries generally looked to preserve their manufacturing sectors and make them competitive on the international market, a process he refers to as 'creative transformation.' Latin America, on the other hand, engaged in what he calls 'non-creative destruction.' This attitude was essentially that the region's productive structure at the time of liberalization was "the illegitimate daughter of protectionism and state intervention" and that "the only solution was to destroy it so that something pure would emerge from its ashes" (Palma 2019). He argues a more open industrial policy was possible with the right combination of independence, flexibility, and ideological pragmatism. Instead, he argues, Latin American policy at the time was driven by highly ideological and inflexible neoliberal orthodoxy.

The evidence from Argentina and Brazil, however, suggests that this kind of open industrial policy would have faced several uphill battles, the first of which is institutions. In both

neo-developmentalist countries, major institutions had neither the independence nor the control of corruption to sustain such a project. Institutional quality varies significantly among South American countries, so the effectiveness of neo-developmentalism likely would have varied widely. Even with strong institutions throughout, China may also have presented an overwhelming challenge. China's interest as a trading partner with South America has been mostly limited to primary commodities. With the exception of Brazil, the lion's share of Chinese FDI in the region goes toward extractive industries. Furthermore, we know that the combination of intense Chinese demand for natural resources and the importation of cheaper Chinese manufactured goods created a market that heavily favored primary commodities over manufacturing. In the next chapter, I present evidence from Kim and Lee (2014) that the composition of Latin America's bilateral trade relationship with China has been a deindustrializing force. It's possible that even with the most effective industrial policy, this challenge would have been insurmountable.

The commodity boom has only recently ended (for the soybean exporters of the southern cone, it may not have ended at all). The effects of the aftermath of the boom are currently being studied by economists. South America has broadly experienced deindustrialization that is more premature compared to other regions of the world. I hypothesize that this is due to several 'resource curse' forces that weakened countries' industrial sectors to a point that they could not stem the tide of reprimarization. Some of these forces are political and ideological and depend on the particular instance — in Brazil and Argentina, commodity revenues were a buffer against weak institutions and prevented what could have been a successful industrial policy. In Bolivia, Ecuador, and Venezuela used resource nationalism to advance their social and political agendas, the results of which varied widely. The most common of these forces is the Dutch disease:

through a combination of resource movement away from manufacturing and real exchange rate appreciation due to the commodity boom, manufacturing exports throughout South America have become far less productive. The next three chapters explore this theory through case studies and theoretical and empirical analysis.

3. Literature Review

3.1 Overview

A variety or both theoretical and empirical literature exists on the topic of the Dutch disease. The term was first coined by Baldwin (1977) in *The Economist*. The term referred to the appreciation of the Dutch Guilder after Oil was discovered in the North Sea in the 1960s. The appreciation rendered Dutch non-oil exports uncompetitive and led to rapid deindustrialization. At the time the phrase was introduced, the only explanation offered was an insufficient nominal rate-based analysis. In their seminal paper, Corden and Neary (1982) pointed out that the Dutch disease was due to real exchange rate appreciation. Corden and Neary introduced the three-sector small open economy model that serves as the theoretical basis for this study and several of the articles presented in this chapter. Their theoretical model is essentially as follows: A small, open economy consists of two sectors: one tradeable and one non-tradeable. The tradeable sector is divided into a 'booming' natural resource sector and a 'lagging' manufacturing sector, the prices of which are exogenously determined by world markets. The non-tradeable sector consists of services. Labor (the assumption is that it is perfectly mobile) moves between sectors so as to equalize nominal wages between them. An exogenous price increase, or 'boom,' occurs in the natural resource sector. There are three possible reasons for the boom: an exogenous improvement in extraction technology, a windfall discovery of new reserves and an exogenous rise is world market prices. While the former two may apply in certain cases, my assumption is the third scenario is the scenario which applies to the widespread commodity boom that occurred in South America from 2003 to 2013 (Ocampo

2017). Regardless, the effects of the boom remain the same: a spending effect and a resource movement effect. The spending effect occurs when extra income from the resource boom is spent, either directly by factor owners or indirectly by governments through taxes. Assuming income elasticity of demand for the non-tradeable sector is positive, the price of services will rise relative to the tradeable sectors. Given that the real exchange rate is the ratio between tradeables and non-tradeables, this leads to real exchange rate appreciation. This, in turn, makes manufacturers less competitive in world markets since they are now more expensive with the same level of productivity. Corden and Neary call this *indirect deindustrialization*. The resource movement effect refers to production inputs gravitating toward the more productive natural resource and services sectors (bear in mind that higher productivity implies higher wages) and away from the lagging manufacturing sector. Corden and Neary call this *direct deindustrialization*.

Matsuyama (1992) also provides a theoretical analysis on natural resources and how they relate to deindustrialization. Matsuyama uses a simpler model that only includes agriculture and manufacturing. Matsuyama argues that openness in the main determinant of whether agricultural productivity is positively or negatively related to industrialization. In a closed economy, a more productive agricultural sector means fewer people are required to feed the population of a country and more people are available to work in the more productive manufacturing sector. In an open economy that can import food, however, agriculture and manufacturing compete for the same pool of labor. This means higher productivity in the agricultural sector leads to lower employment in manufacturing. In the next chapter, I extend Matsuyama's framework from agriculture to all natural resources.

The articles reviewed in this chapter present a universal economic problem and its regional manifestation. Sachs and Warner (2001) show empirical evidence for a 'curse of natural resources.' Countries with greater endowments of natural resources are prone to slower GDP growth. Evidence for the resource curse holds up even when controlling for various geographic and political-economic factors that can also cause slow growth. Sachs and Warner argue that in resource-rich economies, more productive activities like manufacturing are 'crowded out' by primary sectors. If the resource curse does indeed exist, Latin America is particularly vulnerable to it. Ocampo (2017), the only article without a regression analysis, broadly explores the role of primary commodities in Latin American economies. His article explores history, the price dynamics of different commodities, and the macroeconomic implications of commodity dependence. Ocampo concludes that commodity dependence has led many Latin American countries to experience Dutch disease effects. Unlike Sachs and Warner, he does not argue these effects are the result of an all-but-inevitable curse but are rather the result of countries failing to fully take advantage of the commodity boom. This is the key difference between the concepts of the Dutch disease and the resource curse: The Dutch disease refers to a solvable economic issue and is discussed mostly in the context of current and future policy. The resource curse is an attempt to explain the past, specifically why resource-rich countries tend to grow slower.

Kim and Lee (2014) empirically compare deindustrialization in Latin America and Southeast Asia. They find that deindustrialization has been stronger in Latin America because of the Dutch disease, as well as the nature and volume of its Trade with China. Finally, González et al. (2016) and Desfrancois (2019) show empirical evidence of the Dutch disease at the national level, presenting case studies of Colombia and Ecuador respectfully.

Behzadan et al. (2017) argue that inequality can drive the Dutch disease. The authors show empirically that "given two otherwise identical countries that differ only in the ownership shares of the natural resource rents, the country with the less equal distribution will have less production of manufacturing goods and less development of learning-by-doing in this sector" (Behzadan et al. 2017). The intuition behind this is fairly simple: wealthier people have a higher propensity to consume services, and the rise in demand for services drives the indirect effects of the Dutch disease. Therefore, a less equal distribution of natural resource rents will lead to a greater demand for services (and as a result, more indirect deindustrialization) than a more equal distribution of rents.

Finally, Torvik (2009) argues that the curse of natural resources is far from inevitable. In fact, there are many countries who seem to have overcome it. Torvik points to a suite of political-economic factors that can explain this: (i) the countries that have 'escaped' the resource curse tend to have higher rates of saving (ii) countries with presidential systems of government tend to be more prone to the resource curse than their parliamentary counterparts (iii) institutional quality has a significant effect on vulnerability to the resource curse because poor property rights and corruption tend to incentivize rent-seeking rather than investment (iv) the type of resource — oil- and mineral-rich countries are more vulnerable to the resource curse than agriculture-exporting countries (Ocampo also demonstrates this) (v) countries with offshore oil tend to avoid the resource curse more effectively than countries with onshore oil, and finally (vi) countries that industrialized earlier fare better than those that industrialized later.

3.2 Sachs and Warner 2001, *The Curse of Natural Resources*

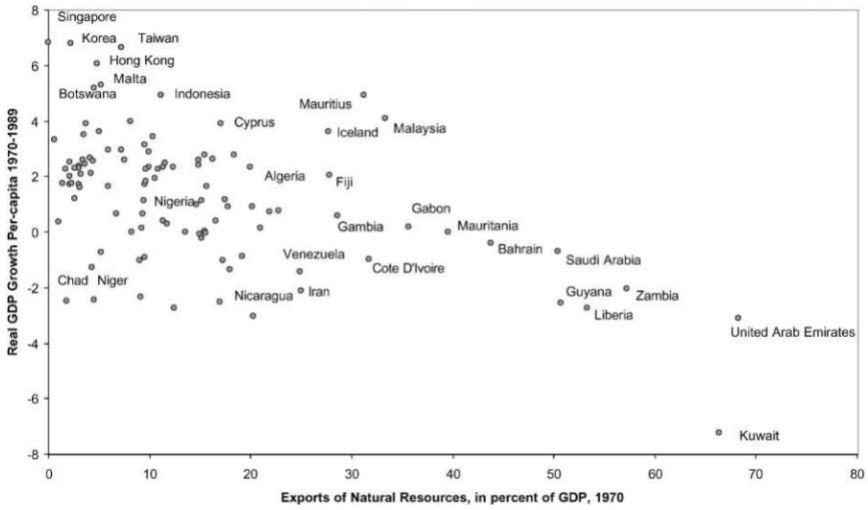
Overview

Sachs and Warner's 2001 article examines the universal trend of slow growth among resource-rich countries. Their thesis is especially pertinent to many countries in South America, many of which are rich in natural resources and have seen their productive structures shift toward the primary sector in the past two decades. Sachs and Warner demonstrate both theoretically and empirically that there is a 'resource curse' that has hindered growth in many middle- and low-income countries. While a number of theories exist regarding the cause of the natural resource curse, the authors argue the most compelling story is the *crowding out* theory. Essentially, reliance on natural resource sectors creates disincentives for export manufacturing and innovation-based activities, which the authors argue are more conducive to growth. When capital and labor inputs go toward the extraction and export of natural resources, those inputs are diverted away from more reliable activities. The crowding out theory is consistent with the notion of a widespread Dutch disease throughout South America, which would suggest that economies which relied more heavily on natural resources during the 2003-2013 price boom are experiencing slower growth today.

Does the curse really exist?

The first piece of evidence for the natural resource curse is based on casual observation. We can observe very little overlap between high-income countries and resource-rich countries. We can say the same for high-growth countries. The scatterplot below shows the relationship between the share of natural resource exports in GDP and real GDP growth between 1970 and 1989.

Figure 3.1: Real GDP Growth and Natural Resource Abundance. Source: Sachs and Warner 2001



A negative relationship easily passes the eye test. Natural resources accounted for less than 10% of exports in all of the highest-growth economies (among them Korea, Malta, and Hong Kong) did. In the lowest-growth economies (Zambia, United Arab Emirates, Liberia), natural resources accounted for more than 50% of exports. There is a clear negative correlation between natural resources as a share of the export basket and growth.

In order to show evidence of a resource curse, the authors had to control for several factors usually outside of countries' control. These regressions are meant to show evidence that the natural resource curse cannot be confused with other factors having to do with geography, climate, or preexisting growth trends. The independent variables include some of the most reliable known predictors of slow growth. Existing theory holds that slow growth is associated with limited access to trade, tropical climate, and prevalence of disease. All regressions include natural resource abundance, the log of GDP per capita in 1970 (to control for preexisting trends), an index for economic openness, and the interaction term between the latter two. Later regressions individually account for percentage of land within 100 kilometers of a coast, distance in kilometers to the nearest coast, percentage of land in geographical tropics, and a

malaria index. The openness index, interaction term between openness and real GDP in 1970, natural resource abundance, and malaria index have statistically significant effects across all regressions. These regressions show that geography, climate, and previous GDP controls do not eliminate the effects of natural resource abundance on growth. This supports the notion that the resource curse observation may be based on reverse causality (natural resource-intensive sectors are the only areas of already slow-growth economies that can thrive).

Before moving on to their theory of what causes the resource curse, the authors point out that the resource curse is a relatively recent phenomenon. Economic historians will point that a large natural resource endowment helped countries like the United States, Sweden and Australia become major economic powers. The authors argue (based on admittedly limited empirical evidence) that these countries relied proportionally less on natural resources and that revolutions in transportation and petroleum technology since the 19_{th} have fundamentally altered the role of natural resource exports in economic growth.

What explains the curse?

After establishing that the natural resource curse is real and isolating it from other effects, the authors move on to the curse's causes. The authors argue the *crowding out* logic is the strongest available hypothesis. This logic holds that there is an opportunity cost for each sector of the economy and that inputs invested into natural resources 'crowd out' inputs which could go into sectors that lead to more reliable growth, namely manufacturing. This is a very similar logic to the model used for this study. The model conceptualizes a dual labor market divided into tradeable and non-tradeable sectors. The tradeable sector consists of manufacturing and natural resource extraction. Labor added to one of these is labor lost in the other, all else equal.

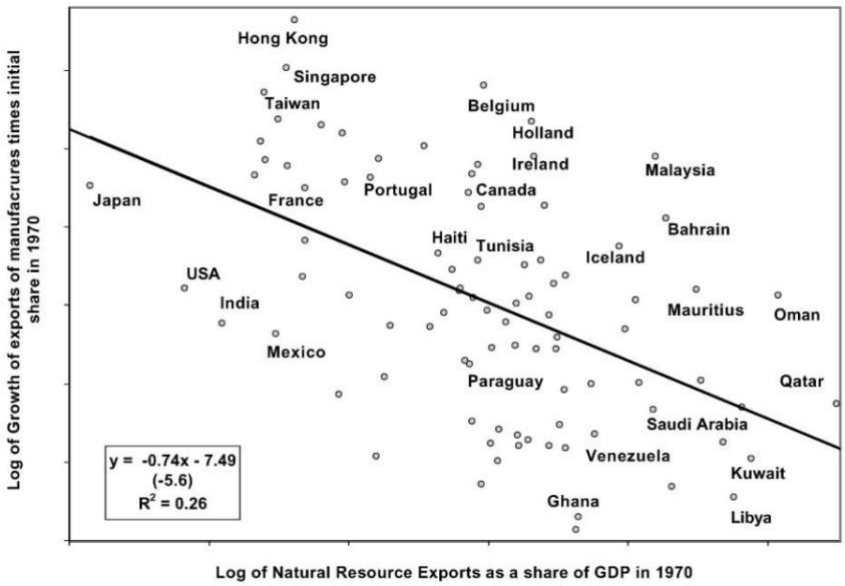
According to the dual economy model, we expect to see an expansion of labor in the natural resource sector during the 'boom' stage of the Dutch disease, borrowing from the labor pools of manufacturing and non-tradeable services. This causes the marginal product of labor, along with wages, to rise. This causes spending effects, which drives up demand, productivity, and wages in the non-tradeable service sector. The authors suggest a similar process, arguing the price of non-tradeable services will be higher in countries that have experienced natural resource booms. In order to prove this, the authors show empirically that countries better endowed with natural resources have higher domestic prices.

The measure domestic price levels through a ratio of two measures of GDP. They measure nominal GDP in US dollars divided by GDP at international prices, both from the year 1979. Mathematically, it can be expressed as:

$$\frac{Nominal\ GDP(US\$)}{Nominal\ GDP\ (World\ Price)} = \frac{(Y * \frac{P}{E})}{(Y * P\$)} \tag{3.1}$$

The authors then use this price ratio as the dependent variable in a regression with the independent variables being log of real GDP in 1979 and natural resource intensity index in 1970. Positive and statistically significant coefficients for both variables indicate that natural resource intensive economies tend to have higher prices. This provides some evidence that businesses in these economies had to compete with higher prices for non-tradeable services. The authors then set out to show empirically that low competitiveness hindered exports in resource-rich economies. They use a scatterplot to demonstrate a clear negative relationship between the log of natural resource exports as a share of GDP in 1970 and the log of manufacturing export growth from 1970 to 1990 times the initial share in 1970, shown below:

Figure 3.2: The Relationship Between Manufacturing Growth in 1970 and Natural Resource Exports in 1970. Source: Sachs and Warner (2001)



The authors point to a number of other factors suggested by previous research which might explain the resource curse. Gylfason (2000) uses a similar intuition to the 'crowding out' hypothesis but argues that education might be the area that is crowded out. The effects of 'crowding out' may also apply to innovation and entrepreneurial activities, both of which can drive growth. If a resource boom creates a high enough wage premium, potential innovators and entrepreneurs will opt to work in the natural resource sector. Other theories on the natural resource curse such as Auty (2000) and Torvik (2009) focus on incentives for governments. High natural resource endowments can incentivize governments to pursue rent-seeking activities rather than promote manufacturing or innovation. Sachs and Warner seem to reject this notion, pointing to evidence that there are no significant differences in such government behavior in resource-rich countries between authoritarian and non-authoritarian systems.

Conclusion

Sachs and Warner's conception of the natural resource curse—and its causes—is very much in line with the theoretical approach to this study. They argue that the opportunity cost of commodity-led development is a more stable development path centered around manufacturing. I argue that this rule applies in general, with a few key differences. Where Sachs and Warner focus on natural resource *endowments*, this study focuses on countries' *dependence* on those endowments. I argue that the extent and nature of that reliance is the root of the premature deindustrialization observed today. This study also focuses on Manufacturing as a share of output where Sachs and Warner focus on GDP growth. Both studies have the same basic intuition — a greater reliance on natural resources crowds out more productive activities, which leads to slower growth. While my study examines deindustrialization where Sachs and Warner measure the result of deindustrialization.

Despite the fact that our two independent variables are different, Sachs and Warner's study offers a set of regressions which are instructive for this study. By controlling for geographic variables in two different ways, the authors are able to more effectively show that natural resource abundance is indeed related to slow growth. First the authors controlled for previous growth as a proxy for all omitted geographical factors. The authors then added several geographical variables to their regression. Either way, they were able to reject their null hypothesis — there is a curse of natural resources and it is not to be confused with geographic factors. Kim and Lee (2014) use similar methods when examining different causes of deindustrialization. The authors are able to demonstrate that the Dutch disease has led to deindustrialization in Latin America, even when controlling for natural progressions and 'China effects.'

3.3 Ocampo 2017, *Commodity-Led Development in Latin America*

Overview

As a region, Latin America has particular reason for concern given Sachs and Warner's analysis of a natural resource curse. In his 2017 article, Jose Antonio Ocampo examines the recent tendency of Latin American economies (particularly is South America) to depend on primary commodities. By recent, I refer to the 2003-2013 Commodity price boom, which Ocampo notes came after a period of export diversification since the 1960s. During this period, Latin American economies tended to "reprimarize", or export proportionally more primary commodities relative to other exports. Ocampo's paper is also interested in the price dynamics of commodities, identifying key super-cycles throughout the 20th century. Ocampo's central argument is that Latin America as a region has not been able to benefit to the full extent possible from commodity specialization. Instead, many countries in the region have experienced Dutch disease effects and have failed to adequately adapt macroeconomic policies to brace for the vulnerabilities generated by commodity cycles.

Ocampo begins with a brief history of the role of commodities in the region's macroeconomic development: Commodity exports have been central to the economic development strategies of most Latin American countries since the 1920s. This tendency was interrupted in the 1960s during a period of largely 'state-led industrialization,' which continued until the 'Washington Consensus' period of the 1980s and 1990s. During the 2003-2013 commodity boom, however, countries in the region began to once again rely on commodities as a greater portion of their export baskets. This boom in prices was not sustained, however, and many South American countries in particular face macroeconomic challenges today in the aftermath of the super-cycle collapse.

Ocampo points out that the role of primary commodities in development and their price dynamics are the subject of contentious debate throughout Latin America. The three main sections in Ocampo's paper (i) provide background information on commodity dependence in the region (ii) examine the dynamics of commodity prices and (iii) evaluate the macroeconomic effects of commodity dependence.

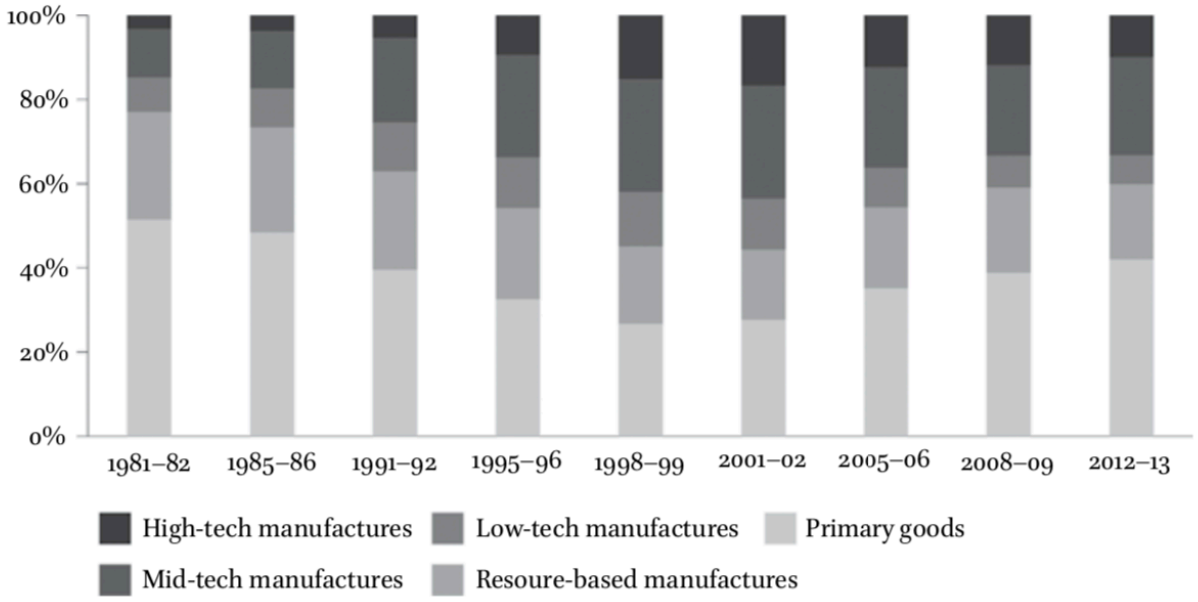
Changing Patterns of Commodity Dependence

Ocampo submits that the state-led industrialization period was brought on by major shocks to primary commodity markets caused by World War II and the Great Depression. He also argues "State-led industrialization" is a more accurate term than the commonly used "import-substitution industrialization", since the era was characterized by much more broad state planning. Commodities were not fully abandoned, however. They still played a large role in the export basket, especially in those of smaller countries in the region, whose industrialization processes were less successful. The state-led industrialization period was characterized by a dramatic reduction of Latin America's role in global exports, reliance on protected domestic markets, and restrictions on foreign direct investment. This led to a growing role for state owned enterprises in the primary commodities sector. Latin America's share in global commodity markets was reduced due to a variety of both internal and external factors, chief among them being the middle east's oil boom and policy that systemically opposed traditional agricultural exports.

In the 1980s and 1990s, the state-led industrialization model came to be replaced by an export-led model. Ocampo identifies three main factors for this change: a major collapse of commodity prices, the Latin American debt crisis, and a widespread period of market reforms beginning in the 1980s. Market liberalization generated a comparative advantage in

commodities for Latin America, but this was counterbalanced by the drop in world commodity prices, leading to an overall diversification of exports throughout the 1980s and 1990s. The share of primary goods in the Latin American export basket reached its lowest point around the turn of the century, facilitated by the introduction of NAFTA and MERCOSUR, which Ocampo argues helped mid- and high- technology exports. The evolution of Latin American exports is shown in figure 3.3:

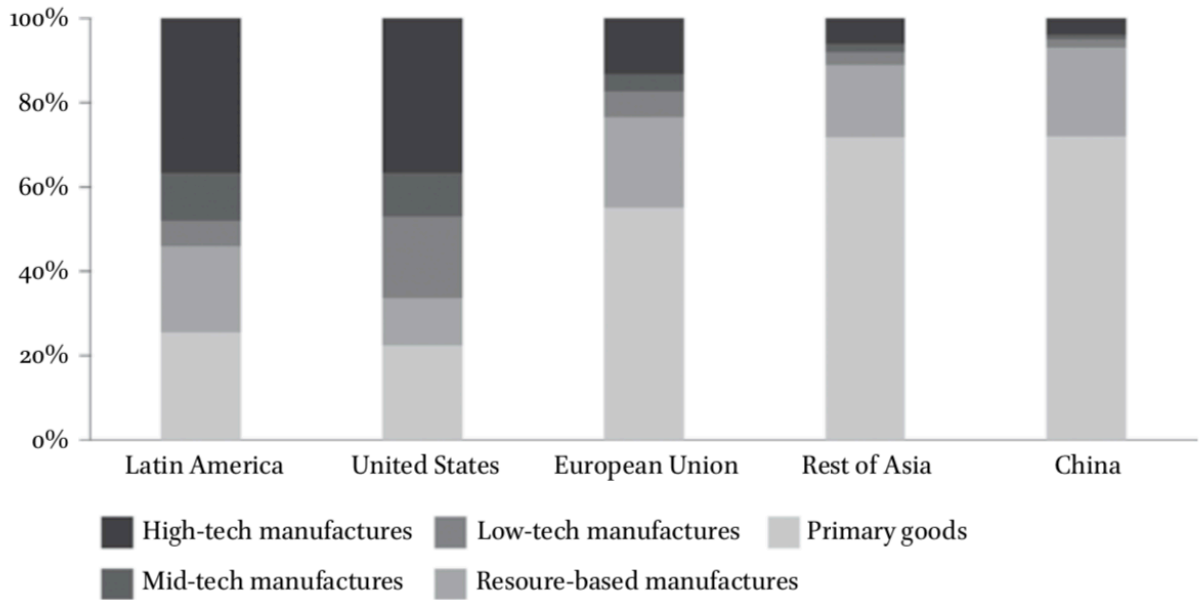
Figure 3.3: Natural Resource and Technological Contents of Latin American Exports over Time. Source: Ocampo (2017).



This export diversification was short-lived, however. Primary goods steadily climbed in their share of the Latin American export basket from the turn of the century on. This reprimarization process was aided by a global boom in commodity prices, owing largely to sharply rising demand from China. When divided by destination, primary commodities dominate the Latin American export basket to China and the rest of Asia, representing well over half of exports as shown in figure 3.4. China also contributed to the reprimarization of Latin

American productive structure through its highly competitive manufacturing imports, which hurt the Latin American manufacturing sector.

Figure 3.4: Latin American Exports in 2013 by Destination. Source: Ocampo (2017).



Ocampo identifies two dominant patterns which have emerged as a result of market reforms in Latin America: the "Northern" pattern relies on manufacturing products destined for the United States using mostly imported parts (it is often more aptly be called *assembly* than *manufacturing*). The "Southern" pattern relies more on primary commodities for trade outside of the region and manufactured goods for trade inside of the region. Ocampo points out that while South America in general can be characterized by commodity specialization, the exact nature of that specialization varies greatly. Andean economies (Venezuela, Colombia, Ecuador, Bolivia, Peru and Chile) rely more on Oil and Minerals, while southern cone economies (Brazil, Argentina, Paraguay and Uruguay) focus on agricultural products. Figure 3.5 broadly breaks down each South American country's natural resource exports and their relative size within the given country's export basket over time:

Table 3.1: South American Primary Commodity Exports over Time, Divided by Country and Classification. Source: Ocampo (2017)

	Fuels			Minerals			Agriculture			Total		
	1995	2003	2013	1995	2003	2013	1995	2003	2013	1995	2003	2013
Argentina	10.3%	17.1%	4.6%	1.7%	3.4%	5.6%	54.1%	50.5%	54.8%	66.2%	71.0%	65.0%
Bolivia	10.9%	33.3%	53.8%	40.1%	16.7%	23.8%	33.4%	33.1%	18.3%	84.3%	83.1%	95.9%
Brazil	0.9%	5.2%	7.4%	11.3%	9.1%	18.1%	33.7%	33.1%	37.4%	45.9%	47.4%	62.9%
Chile	0.2%	2.7%	0.9%	49.5%	42.3%	59.0%	37.2%	36.7%	27.1%	86.9%	81.7%	87.0%
Colombia	27.2%	37.2%	66.8%	6.8%	6.2%	5.1%	36.2%	22.9%	11.4%	70.2%	66.3%	83.3%
Ecuador	35.1%	43.2%	56.5%	2.5%	0.4%	2.7%	54.8%	46.3%	34.5%	92.4%	89.9%	93.8%
Paraguay	2.7%	6.8%	15.4%	0.3%	0.4%	1.4%	80.3%	82.2%	74.4%	83.3%	89.4%	91.2%
Peru	4.9%	7.4%	13.0%	50.2%	53.7%	58.1%	31.3%	22.3%	17.1%	86.4%	83.4%	88.2%
Uruguay	1.0%	1.6%	0.5%	0.9%	1.5%	1.6%	59.1%	63.7%	74.9%	61.0%	66.8%	77.0%
Venezuela	73.6%	78.9%	91.4%	7.5%	5.5%	1.0%	3.2%	1.7%	0.3%	84.2%	86.2%	92.7%

The Dynamics of Commodity Prices

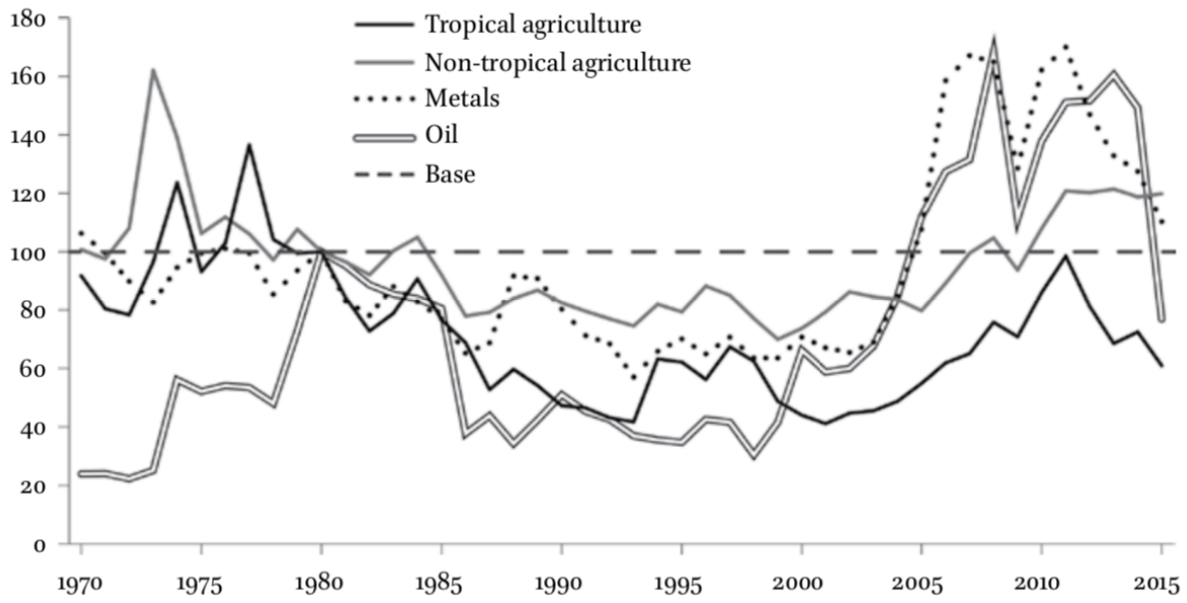
Ocampo introduces the debate around the price dynamics of commodities by introducing the Prebisch-Singer hypothesis, which holds that the prices of manufactured goods rise faster than those of primary commodities. This hypothesis is the subject of some debate and has been disputed. The thesis has regained consideration since 1988, when a World Bank Report found that commodity prices had declined overall during the 20th century (Grilli and Yang 1988).

A handful of methods exist for analyzing commodity price dynamics. The method Ocampo uses is to decompose price dynamics into both long- and short- term trends. Empirically, we see that non-oil commodities experienced a gradual drop throughout the 20th century and picked up again as the century turned. Tropical agricultural goods experienced the most acute drop, followed by non-tropical agriculture and metals. Despite the fact that commodity prices dropped overall, Ocampo is hesitant to fully embrace the Prebisch-Singer hypothesis, arguing that price changes were due to more subtle and specific changes in the

world economy and that the deterioration in price was far from constant. Furthermore, oil prices behaved differently from those of other commodities during most of the 20th century.

Breaking up commodities by type, we see that certain types of commodities are more volatile than others. Oil is the most volatile of the four types of commodities identified, followed by metals, tropical agriculture and non-tropical agriculture. During the 2003-2013 commodity boom, Oil and Metals experienced the strongest positive price shocks, while non-tropical agriculture experienced the weakest. Oil and metals also experienced the greatest drop at the end of the commodity boom starting in 2013, as demonstrated in figure 3.5:

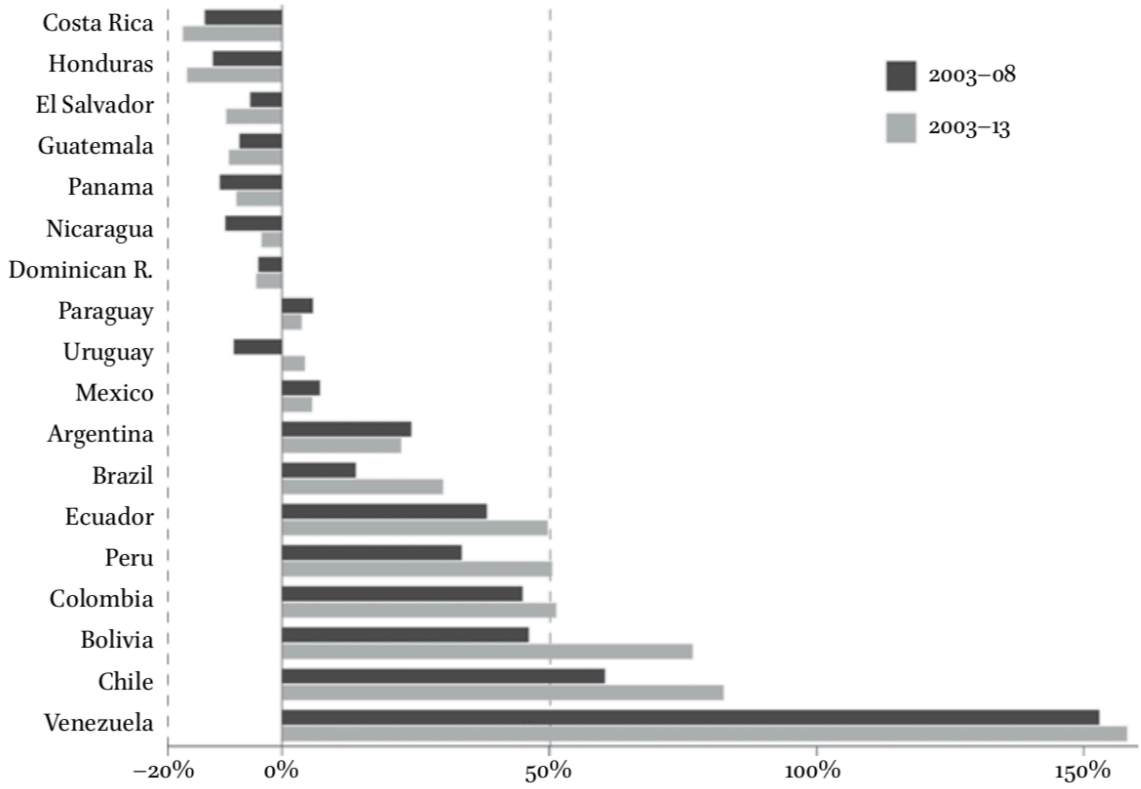
Figure 3.5: Commodity Prices over Time. Source: Ocampo (2017).



When measuring terms of trade during the commodity boom, we can see the effects of resource type on different countries gains and losses. Venezuela, the region's dominant oil producer, experienced by far the most net gain, followed by mineral-rich Chile, Bolivia (Fuel and minerals), Colombia (Fuel and minerals) Peru (minerals), and Ecuador (Fuel and minerals).

More agricultural economies gained (Brazil, Argentina, Uruguay and Paraguay in order), but not as much as their Andean counterparts. These trends are demonstrated in figure 3.6:

Figure 3.6: Terms of Trade Gains and Losses During the 2003-2013 Commodity Boom. Source: Ocampo (2017).



The boom in commodity prices challenged the Prebisch-Singer hypothesis, but Ocampo argues it is worth noting that commodity prices eventually fell again, and the prediction of an overall negative trend may still be intact, especially since super-cycle patterns predict a long period of low prices is approaching.

Macroeconomic Effects of Commodity Dependence

Ocampo divides this section into two subsections. The first deals with basic relationships, which can be divided into short- and long-term effects. The short-term effects of

commodity dependence are largely pro-cyclical. At the most basic level, rises in commodity prices lead to higher incomes, which increases aggregate domestic demand. This is augmented by the procyclical effects of commodity prices on real exchange rates. These effects reverberate around the country's economy to other sectors such as non-tradeable services. The empirical analyses in all of the subsequent articles in this chapter explore these effects. Ocampo notes some countries have put in place countercyclical monetary policies such raising interest rates as commodity output rises and lowering them when it falls.

The longer-term effects of commodity reliance depend on how linked the commodity sectors are with other sectors of the economy. Ocampo associates manufacturing with higher productivity and better long-term growth than commodities. Speaking generally, countries who have engaged in industrialization drives tend to grow more effectively that those who rely on commodities. This school of thought considers commodity specialization in Latin America a missed opportunity and would encourage countries in the region to opt for industrialization.

The opposing view, says Ocampo, is best articulated by Pérez (2010), who argues that there are opportunities in biotechnology, nanotechnology and eco-friendly products which give the region the opportunity to move up the value chain of resource-intensive products. She also points out that the middle-income trap would make large-scale industrialization very difficult, since it would require higher productivity and human capital and maybe even lower wages.

The second subsection addresses the manifestation of macroeconomic dynamics in the region. Shown empirically through trends in aggregate demand, GDP, balance of payments and balance of payments adjusted by the terms of trade, commodity dependence has had strong procyclical spending effects. This applies to increased spending during the commodity boom and a sharp adjustment in the years immediately following it. These effects are most strongly

felt in countries with high fiscal dependence on natural resource revenues, such as Venezuela, Bolivia and Mexico. The extent to which countries have implemented countercyclical macroeconomic policies varies. Chile and Colombia adopted such policies before the end of the commodity boom; however, most countries only adopted such measures after commodity prices had come down.

In terms of GDP, Ocampo demonstrates that the relationship between commodity prices and growth is positive, but stresses that each country has its domestic nuances which either augment or diminish the relationship. Finally, Ocampo measures share of manufacturing in GDP, showing a sharp and mostly steady decline since the 1970s, interrupted only by a brief increase in the 1990s.

Discussion and Conclusion

Ocampo's paper argues that while individual cases vary, Latin America as a whole has lost more than it has gained from commodity-led development. The positive effects of the commodity boom only lasted as long as commodity prices were high. When commodity prices fell, the region experienced several Dutch disease effects, leaving it in a worse position than before, since many countries have prematurely deindustrialized. There are cases of countries instituting counter-cyclical macroeconomic policies, however they prove the exception rather than the rule. Based on Ocampo's findings, it is difficult to dispute that commodity dependence is one of the primary reasons for Latin America's current deindustrialization and middle-income trap.

Ocampo's article explains some of the issues with generalizations about an entire region of the world. Many factors which are crucial to understanding Latin America's premature deindustrialization vary between countries. The type of commodity exported plays a significant

role, which suggest that oil and mineral exporting Andean countries will experience greater deindustrialization than agriculture exporting southern cone countries. Economic factors within countries also determine a great deal. Chile and Colombia were able to institute countercyclical fiscal policies during the commodity boom which could mitigate Dutch disease effects. There is also a wide variance between countries in the prevalence of state-owned firms in natural resource-intensive sectors. The extent to which the government of a country relies on commodity revenues matters great deal. As demonstrated by Gonzalez et al. (2017) and Desfrancois (2019), public spending can be significantly affected by a commodity boom.

Ocampo briefly introduces a debate which must be explored further: where does Latin America go from here? As a whole, the region is in the middle-income trap. Wages are too high to compete in labor intensive manufacturing while productivity is too low to compete in high-tech manufacturing. Ocampo seems to advocate for a region-wide industrialization push comparable to southeast Asia. In other words, Latin American countries who have depended on primary commodities have done so mistakenly and industrialization, or at least diversification of exports, would have been a wiser path to follow. The opposing view, which Ocampo accredits to Pérez (2010), argues that middle-income trap conditions are too strong to industrialize and that the region should focus on finding higher value activities in natural-resource intensive production, where it has a comparative advantage. This points to an alternative view: there is a scenario in which Latin America uses commodities as a vehicle for sustained development, but countries in the region have not properly utilized their comparative advantage.

The next article by Chong-Sup Kim and Seungho Lee (2014) further explores the notion of widespread Dutch disease effects in Latin America. The article empirically shows that Dutch

Disease effects are more responsible for deindustrialization in Latin America than in other regions of the world.

3.4 Kim and Lee 2014, *Different Paths of Deindustrialization: Latin American and Southeast Asian Countries from a Comparative Perspective*

Overview

In their 2014 paper, Kim and Lee consider the phenomenon of deindustrialization from a comparative perspective. As regions, both Latin America and Southeast Asia have experienced deindustrialization. The nature of that deindustrialization, however— its cause, speed and intensity— has varied significantly both between and within regions. The authors consider a variety of causes and evaluate them empirically through an increasingly complex series of regressions. The causes the authors enumerate are the inverted-U relationship between the share of value added by manufacturing and income per capita, the continuous downward slope of the inverted-U curve, the Dutch disease effect, and various 'China effects.' They ultimately find that Latin America has been uniquely subject to the Dutch disease effect due to its reliance on primary commodity exports. They also find the effect of bilateral trade with China is clearest differentiator between the two deindustrialization paths; Southeast Asia has deindustrialized despite the nature of its relationship with China, while Latin America has deindustrialized *because* of it.

The authors stress at multiple points during the paper that they do not intend to make normative claims as to whether deindustrialization is inherently good or bad for economies. This study is more comfortable making such claims due to the positive learning-by-doing effects associated with manufacturing, which will be explored further in the theory section. They instead submit that deindustrialization is a natural phenomenon. It has been observed in many

high-income countries since the 1970s and more recently in low-income countries since the 1990s. They also specify which countries they mean by Latin America (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela) and Southeast Asia (Cambodia, Indonesia, Lao DPR, Malaysia, Philippines, Thailand and Vietnam). For each regression, the authors use a sample of 112 'developing countries' between 1990 and 2012. They also specify their metric for deindustrialization used throughout the paper is share of value added by manufacturing in total GDP.

Literature Review and Theoretical Framework

A variety of causes underly the deindustrialization paths of Latin American and Southeast Asia. Some involve the expected phenomena of the inverted-U relationship mentioned above, which the authors argue effects all countries at some point during their natural economic progressions. The authors draw from a large body of literature on the inverted-U curve. They attribute the observation of the curve to Rowthorn (1994), who argues that deindustrialization is naturally cause by industrial dynamism in 'developed' economies. Once countries reach a certain level of income, manufacturing employment begins to decline. This approach differs from that of Palma (2005), who argues there is a continuously declining relationship between the two variables.

Palma also points to the phenomenon of the Dutch Disease. This phenomenon is less universally applicable, since it only affects countries with high natural resource wealth. These countries tend to experience more pronounced deindustrialization, which is shown empirically in the paper. Resource-rich Latin America began to deindustrialize earlier than Southeast Asia and has seen a more dramatic reduction in manufacturing value added over the period which the

paper observes. Matsuyama (1992) models the Dutch disease through a two-sector economy consisting of manufacturing and agriculture. The opportunity cost of putting inputs into agriculture is a loss of production in manufacturing, which Matsuyama holds is more productive. Sachs and Warner (1995) build upon this model by dividing the economy into three sectors: tradeable natural resources, tradeable manufacturing and non-tradeable services. Higher production in the natural resource sector leads to demand for the non-tradeable service sector, which grows while the manufacturing sector shrinks. Another effect occurs as strong performance in a booming natural resource sector raises the exchange rate to such a degree that it weakens other exports such as manufacturing.

The authors also take into account the emergence of China and its role as a bilateral trading partner as another potential cause for deindustrialization. China's growth and integration into the world economy has significant effects on low- and middle- income countries' productive structure. Since the 1990s, China has both industrialized and grown its consuming class significantly. This has consequences for 'developing' countries having to do with both demand and supply. The authors argue the differences in the two regions' trade relationships with China are a major differentiator between them. Speaking generally, Latin America meets Chinese demand through the export of primary commodities, while Southeast Asia meets this demand by exporting manufactured goods. This implies deindustrialization has been more strongly incentivized in Latin America.

Chinese imports can also be a deindustrializing force, since Chinese manufactured goods can compete with domestically produced manufactured goods. In order to analyze this relationship, however, the composition of trade must be taken into account in addition to its volume. Are China's manufacturing exports high or low technology? Are they final goods for

consumption or intermediate goods that require additional labor? Both of these categorizations carry significant impacts related to deindustrialization. It is entirely possible that Chinese imports may actually be an industrializing force rather than a deindustrializing force. The authors make the case for more literature focusing on these questions.

Empirical Models and Results

The authors estimate a series of regressions to test the effects of the above deindustrialization forces on the share of manufacturing value added as a percentage of GDP (MVA). The authors then compare the results of the regressions, which use the 122-country sample, to empirical data broken down by region. Tables for these regressions are presented in the appendix. The first regression tests the inverted-U curve hypothesis by using GDP (natural log of per capita income) and the square of natural log of per capita income (GDP^2) as independent variables. A one-unit increase (the exact units are unspecified) in the GDP variable is associated with a 16.54 percentage point increase in MVA, while a one-unit increase in GDP^2 is associated with 1.01 percentage point decrease in MVA. The authors interpret this to support the inverted-U relationship hypothesis. The share of manufacturing value added in GDP rises as countries' GDP increases, however begins to decrease at a certain level. The estimate the per capita income level of $3300 to be the level at which manufacturing value added tends to decline. This does not match up with empirical data for Latin America, however. As a region, Latin America began to deindustrialize around the early 1990s and per capita income would not reach the critical point until around the turn of the century, at which point the deindustrialization process had long since started. Table 3.2 shows Latin America's per capita income over time:

Table 3.2: Latin American GDP Per Capita Over Time. Source: Kim and Lee (2014).

1990	1995	2000	2005	2010
1797	2926	3339	3765	6550

A second regression adds to the first by adding dummy variables to different three-year time periods to control for fixed effects. The coefficients for each dummy variable show the relationship manufacturing value added becomes more negative over time. This observation is corroborated by empirical data. From 1990 to 2012 (the time period observed), deindustrialization was observed practically all over the world, as shown in table 3.2:

Table 3.3: Evolution of Manufacturing Value Added as a Percentage of GDP. Source: Kim and Lee (2014).

	1990	1995	2000	2005	2010
World	15.5	15.1	14.0	13.3	12.7
OECD countries	19.9	19.9	18.8	16.8	15.5
Developing countries	16.2	15.5	14.3	14.0	13.3
Latin America	19.8	18.3	18.2	17.2	15.7
Southeast Asia	16.2	17.5	18.2	19.0	17.5

Source: World Bank (2014).

The regression 3 adds PRI, a proxy for dependence on primary commodity exports, to the model. Keeping with the Dutch disease hypothesis, a one unit increase in PRI is associated with a 0.08 percentage point decrease in MVA. The authors argue this at least partially explains why deindustrialization is more pronounced in Latin America than in Southeast Asia. Empirical data shows primary commodity dependence as a percentage of total GDP hovered around 60% from 1990 to 2010 in Latin America, while it hovered around 25% in Southeast Asia during the same time period. Regression 4 adds the interaction terms GDP*PRI and GDP^2*PRI. This increases the PRI coefficient to 0.98 and reduces the coefficient for GDP_2 to -2.06. The authors argue this lowers the per capita income level at which manufacturing value added begins to fall,

further explaining Latin America's earlier deindustrialization. Regression 5 adds regional dummy variables to regression 3 to account for region-based fixed effects, including Central and Eastern Europe, the Middle East and North Africa, and Sub-Saharan Africa. Southeast Asia shows the highest dummy variable coefficient, while the Middle East has the lowest.

The authors then turn their empirical analysis to the China question. Regressions 6 adds the independent variables CHINAIMP (Chinese share in the country's imports) and CHINAEXP (Chinese share of the country's exports), both of which show a negative relationship to manufacturing value added. For 'developing' countries, a greater level of economic interdependence with China since 1990 is associated with greater deindustrialization. Regressions 7, 8, and 9 add some nuance to the 'China effect' hypothesis. Regression 7 includes the independent variable CHINAGL (weighted Grubel-Lloyd index), which serves as an index for intra-industry trade with China. Higher CHINAGL values represent higher levels of intra-industry trade between the given country and China. A one-unit increase in CHINAGL is associated with a 14.12 percentage point increase in MVA. The interaction terms CHINAGL*CHINAIMP and CHINAGL*CHINAEXP, which are added in regressions 8 and 9 respectively, are also strongly positive.

The positive relationship between Grubel-Lloyd index and manufacturing value added implies that bilateral trade with China affects Latin America and Southeast Asia differently. Table 3 shows Southeast Asia's Grubel-Lloyd index with China is far higher than that of Latin America throughout the observed time period, revealing more intra-industry trade with China.

Table 3.4: Evolution of Weighted Grubel-Lloyd Index by Region. Source: Kim and Lee (2014).

	1990	1995	2000	2005	2010
Latin America	0.09	0.10	0.10	0.13	0.10
Southeast Asia	0.28	0.36	0.37	0.32	0.32
Developing countries	0.17	0.12	0.14	0.13	0.12

This difference makes sense when comparing the composition of exports to China by region. Generally, Southeast Asian countries' main exports to China are manufactured goods, machinery, and transport equipment. Meanwhile, Latin American countries' exports to China are overwhelmingly primary commodities, while their imports are overwhelmingly manufactured goods. In other words, trade with China acts as a compliment to manufacturing (or at least a buffer against deindustrialization) for Southeast Asia while it acts as an alternative to manufacturing in Latin America. Tables 3.5 and 3.6 show a selection of Latin American countries' imports from and exports to china, respectfully:

Table 3.5: Selected Latin American Countries' Imports (%) from China over Time. Source: Kim and Lee (2014).

	Chile		Mexico		Paraguay		Peru	
	06	11	06	11	06	11	06	11
Food and live animals	0	1	1	1	0	0	1	1
Beverages and tobacco	0	0	0	0	0	0	0	0
Crude materials except food and fuel	0	0	0	0	0	0	1	1
Mineral fuels, lubricants and related materials	0	0	0	0	0	0	1	0
Animal and vegetable oils and fats	0	0	0	0	0	0	0	0
Chemicals products	4	5	3	4	6	6	9	7
Manufactured goods classified chiefly by material	17	18	10	10	4	8	23	23
Machinery and transport equipment	33	41	69	70	74	62	45	50
Miscellaneous manufactured goods	45	35	15	13	17	24	21	19
Commod. & transacts. Not class. Accord. To kind	0	0	2	2	0	0	0	0

Table 3.6: Selected Latin American Countries' Exports (%) to China over Time. Source: Kim and Lee (2014).

	Argentina		Brazil		Chile		Peru	
	06	11	06	11	06	11	06	11
Food and live animals	3	4	2	4	5	3	21	17
Beverages and tobacco	0	2	1	1	0	0	0	0
Crude materials except food and fuel	44	73	70	75	57	34	69	68
Mineral fuels, lubricants and related materials	26	7	10	11	0	0	4	1
Animal and vegetable oils and fats	19	9	1	2	0	0	0	0
Chemicals products	2	2	3	1	1	1	0	1
Manufactured goods classified chiefly by material	6	2	8	3	36	61	4	12
Machinery and transport equipment	0	0	5	2	0	0	0	0
Miscellaneous manufactured goods	0	0	0	0	0	0	0	0
Commod. & transacts. Not class. Accord. To kind	0	0	0	0	0	0	0	0

Conclusion

In order to observe and comment on structural changes in South America, it is important to isolate regional trends from global trends, which is where this article serves my study. This article identifies two deindustrializing regions of the world and evaluates the factors that the regions have in common and where they differ. The authors find Latin American economies have deindustrialized earlier and more intensely than Southeast Asian economies and that Dutch disease effects are one of the factors which differentiate the two regions. I believe this supports my hypothesis that South American countries that depended more on commodities during the 2003-2013 will experience lower levels of industrialization today.

This paper offers a complement to Ocampo (2017)'s article in which he analyzed commodity dependence on a country-by-country basis throughout Latin America. Kim and Lee's article 'zooms out', comparing entire regions of the world, while Ocampo's article 'zooms in', differentiating between different countries. While it is true that commodity dependence is more of a concern for Latin America than other regions of the world, Ocampo does not identify

the factors that give commodity dependence different implications in Latin America than in other regions of the world. Kim and Lee explore some of these factors—specifically, bilateral trading relationships with China. The authors demonstrate that both the volume and composition of trade with China have a clear effect on both the scale and speed of deindustrialization.

The consequence of Kim and Lee's 'zooming out' is they ignore the specific factors that affect the nature of commodity dependence between Latin American countries, mainly in the types of commodities they export. As Ocampo points out, prices of fuels and minerals are more volatile than those of agricultural products. This can explain the differences in outcomes between, for instance, Colombia and Paraguay. Both countries relied similarly on commodities, however, Colombia relied move heavily on fuels while Paraguay focused primarily on less volatile non-tropical agriculture. As a result, Colombia saw a more pronounced economic upturn during the commodity boom and a more pronounced drop during the post-boom period.

The authors stress at multiple points during the paper that they do not intend to make normative claims as to whether deindustrialization is inherently good or bad for economies. This study is more comfortable making such claims due to the positive learning-by-doing effects associated with manufacturing, which will be explored further in the theory section. They instead submit that deindustrialization is a natural phenomenon. It has been observed in many high-income countries since the 1970s and more recently in low-income countries since the 1990s. The Authors acknowledge, however, that deindustrialization has occurred in Latin America ahead of its 'natural schedule.' I consider this to be cause for concern.

Whatever the opinion on deindustrialization may be, Kim and Lee provide a useful template for a regression analysis testing the theory that the Dutch disease has caused premature deindustrialization. The authors present a comprehensive set of controls that must be employed

in order to distinguish the causes of deindustrialization in different countries. The 'China effects' presented by the authors are especially relevant to the topic at hand. On the supply side, Chinese manufacturers compete with South American manufacturers. On the demand side, a surge of recent Chinese demand has driven South Americas commodity boom and subsequent Dutch disease.

The next two articles present specific case studies of South American countries that are experiencing Dutch disease effects in the wake of the commodity boom.

3.5 González et al. 2016, *The Evolution of Colombian Industry in the Context of the Energy and Mining Boom: Symptoms of the Dutch Disease*

Overview

This article by Mauricio López González, Edwin Esteban Torres Gómez, and Sebastián Giraldo González offers a more specific case study of a South American economy experiencing deindustrialization. The authors evaluate the extent to which Dutch Disease symptoms from Colombia's 2008-2013 mining and energy boom have caused the country's industry to contract. They ultimately fail to reject the hypothesis that the mining and energy boom has had adverse effects on Colombian manufacturing.

Colombia has a long history of primary commodity specialization. For most of the 20th century, Colombia's main specialty was Coffee, which accounted for 63% of the country's exports in 1970 but dropped all the way to 5% in 2011. During this same period, Mining (which mostly consists of oil) rose from 10% of exports to 65%. The growth in mining has been especially strong in the last decade. During the 2008-2013 "mining boom," the sector grew by an average of 9.32% per year. Meanwhile, more recently, the share of manufactured goods in total exports has dropped significantly, from 36% in 2000 to 20% in 2011 (González et. Al

2016). The authors are concerned with the latter trend because of its implications for the greater Colombian economy. The authors point to a robust literature demonstrating that compared to the natural resource sector, the manufacturing sector tends to have greater forward and backward linkages to the rest of the economy and "a more complex division of labor [that] might successfully raise living standards by leading to greater productivity and higher wages" (González et. Al 2016). This study is concerned about deindustrialization in South American countries for similar reasons. I make the assumption that Manufacturing is generally a more productive sector than natural resources because of learning-by-doing.

Theoretical Framework

Like Kim and Lee (2014), and Sachs and Warner (2001), and this study, the authors use the three-sector theoretical framework developed by Caren and Neary (1982) to hypothesize the effects of the mining boom on the manufacturing sector. Their theoretical consists of three 'goods,' two of which are tradeable with prices determined by world markets, and one of which is non-tradeable with its price determined by the domestic market. One of the two tradeable goods is a natural resource, and the other is a manufactured good. Labor is perfectly mobile between sectors.

The authors identify both resource movement (which they call supply side) and spending (demand side) Dutch disease effects. The resource movement effect begins with an exogenous rise in the price of the natural resource, which increases the marginal product of labor in the primary sector. Labor shifts to the primary sector, leading to the underutilization of production factors in manufacturing. The exogenous price increase also creates excess demand, which is met by the non-tradeable sector. Due to increased demand, prices in the non-tradeable sector are

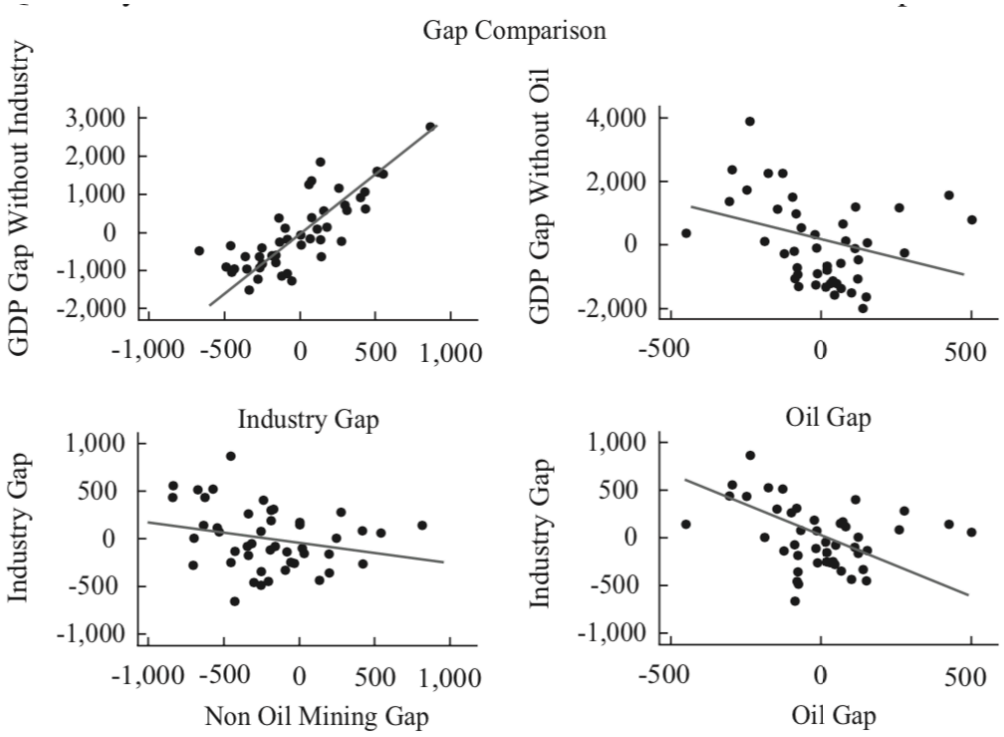
higher, pushing the real exchange rate up. This adversely effects manufactured exports, which are now more expensive and have not experienced any rise in productivity.

On the demand side, the rise in domestic income and consumption due to the commodity boom increases demand for all goods. This demand increases the price of non-tradeable goods and services but not tradeables (recall that their prices are determined by world markets). As a result, labor shifts away from the tradeable sectors and toward the non-tradeable sector, causing non-booming exports to contract.

Methodology

In order to find out whether Colombia's mining boom is related to its deindustrialization, the authors conduct a series of statistical exercises. The first such exercise is a series of scatterplots which map the quarterly output gaps, which represent the difference between actual GDP and the GDP if all domestic labor and capital were used to their full capacity. If the gap is positive, the economy in question is operating below its full potential. The authors use output gaps for GDP without industry, GDP without oil, industrial GPD, oil GDP, and non-oil mining GDP. The results indicate that oil boom quarters (quarters in which the oil gap is positive) tend to be accompanied by negative gaps in the rest of the economy. The opposite is true of industry. A positive relationship between the industry gap and the GDP gap without industry clearly passes the eye test. These two results seem to support the idea that manufacturing has greater forward and backward linkages to the rest of the economy than natural resources. In other words, when mining output in closer to its capacity, output from the rest of the economy is further from its capacity. The scatter plots also indicate that both the oil gap and the non-oil mining gap are negatively related to the industry gap. The scatterplots are shown below:

Figure 3.7: Gap Comparisons. Source: González et al. (2016).



Although the results of the scatterplots seem to support the hypotheses that (a) manufacturing leads to greater overall economic performance than mining and (b) Colombia's mining and energy boom is related to its deindustrialization, however the Authors admit that the results are neither robust nor statistically significant. In order to more accurately analyze the effect of the energy and mining boom on Colombian industry, the authors estimate an OLS regression and a Beta regression. Both regressions have the same variables. The dependent variable is the share of industry in Colombian GDP measured quarterly as *t*. The independent variables, measured quarterly, are the ratio of mining product to GDP minus mining, real exchange rate (RER), the share of manufacturing in total exports, industrial employment renumeration, the trend in the price of crude oil, and the share of public expenditure in GDP.

Results

The results of the OLS regression provides some evidence of the Dutch disease hypothesis. For every one-point increase in the mining/(GDP-mining) ratio, the share of industry in GDP decreases by 0.175 points. The coefficient for RER is negative, but near zero. A one unit increase in the price of crude oil is accompanied by a 0.003-unit decrease in industry share. As expected, the coefficients for manufacturing as a share of exports and industrial employment renumeration are positive. The OLS regression also shows a negative relationship between public expenditure as a share of GDP and industry share. The authors take this to mean public expenditures are higher during oil booms. The results of the Beta regression indicate the same result (the authors stress that we can only interpret the sign of the coefficients): the coefficients for the mining/(GDP-mining) ratio, RER, oil price trends, and public expenditures as a share of GDP were all negative. The coefficients for manufacturing share of exports and industrial employment renumeration were positive. The results are shown below in table 3.7:

Table 3.7: Results of OLS and Beta Regressions. Dependent variable: share of industry in GDP.

Variables	OLS	BETA
Mining/(GDP-Mining)	-0.175*	-1.501*
	(0.080)	(0.869)
RER	-0.000***	-0.001***
	(0.000)	(0.000)
Manufacturing Exports/Total Exports	0.029**	0.240**
	(0.011)	(0.094)
Industrial Employment Remuneration	0.000***	0.003***
	(0.000)	(0.001)
Crude oil (Trend)	-0.000***	-0.003***
	(0.000)	(0.000)
Public Expenditure/GDP	-0.390***	-3.156***
	(0.094)	(0.840)
Constant	0.200***	-1.322***
	(0.017)	(0.175)
ln_phi		11.038***
		(0.258)
Observations	30	30
Wald chi2(6)		437.21***
P -Value		0.000
R-squared	0.937	
Robust standard errors in parentheses		
*** p < 0.01, ** p < 0.05, * p < 0.1		

The results of both regressions indicate that Colombia's deindustrialization is due to Dutch disease symptoms. As the mining sector grows relative to the rest of the economy, industry occupies a smaller role. Presumably, this is due to the movement of production inputs from the manufacturing sector to the natural resource sector that comes from a price boom. Oil price trends are also negatively related with industry share. The negative relationship between RER and industry share also provides some evidence for the demand side of a Dutch disease — as domestic non-tradeables receive excess demand (due to new income from the mining boom),

the ratio of domestic to foreign prices rises, hurting manufacturing exports and causing the sector to contract.

Conclusion

This article demonstrates at the scale of a country what I hope to demonstrate at the scale of a continent. The 'story' of the Colombian economy in the 21st century is indicative of many other South American countries: it has experienced a commodity boom that had negative impacts on its other exports, specifically manufacturing. This has concerning implications for the Colombian economy at large, as it benefits far more from industry than mining. With this in mind, the authors suggest that Colombian policy makers should "manage rents from the booming sectors and redirect them to other tradeable sectors that are more labor intensive" (González et al. 2016).

Unlike other authors, González et al. use a variety of independent variables to demonstrate the presence of a Dutch disease. The authors are able to show that the correlations between industry as a share of GDP and six independent variables all show evidence of a Dutch disease in Colombia. This differs from the empirical approach of other authors presented in this chapter. To demonstrate the impact of the Dutch disease on their dependent variables, Sachs and Warner (2001) use natural resource abundance and Kim and Lee (2014) use their PRI index for primary commodity exports. They then add a series of additional independent variables to control for other sources of slow growth or deindustrialization.

The authors offer evidence that Colombia's Dutch disease effects are felt in real time. For instance, in the same quarter that oil prices are trending up, industry is occupying a smaller share of the Colombian economy. My study suggests that Dutch disease effects are felt over a longer term. Some seven years after the end of the commodity boom, I hypothesize that the

deindustrialization of South American countries is due to Dutch disease effects from commodity dependence *during* the boom. Like González et al. 2016, the next article by Pierre Gilles Fernand Desfrancois 2019 empirically checks for symptoms of the Dutch disease in Ecuador, another oil exporting Andean economy.

3.6 Desfrancois 2019, *Evaluación Empírica de los Síntomas de la Enfermedad Holandesa en la Historia Ecuatoriana Reciente (2007-2017)*

Overview

Like Colombia, Ecuador has reason believe it is prone to experiencing Dutch disease symptoms. Ecuador's main commodity export is also oil, which has the most volatile price of any primary commodity commonly exported from South America (Ocampo 2017). At 8.8 billion barrels, Ecuador has the third highest proven oil reserves in South America, behind only Brazil (15) and Venezuela (298) (Index Mundi 2020). Since it began extracting oil in 1972, Ecuador has experienced two oil 'bonanzas,' the first from 1972 to 1983 and the most recent from 2007-2014. At the peak of the most recent oil boom in 2008, Ecuadorian oil sold for an average of US $117. During the oil boom period, oil accounted for more than half of Ecuadorian exports and a fifth of its GDP growth (Desfrancois 2019). Desfrancois observes that both oil booms had unquestionable effects on the Ecuadorian macroeconomy and productive structure. The first boom produced significant distortions in Ecuador's public spending, fiscal deficit, trade balance and balance of payments. Since 2009, Ecuador's trade balance has become negative due to a reduction in non-oil exports. From 2013 to 2014, oil went from accounting for some more than 30% of government revenues to less than 10% (the majority of Ecuadorian oil is controlled by Petroecuador, a state-owned firm). In 2015, as oil prices sharply dropped, Ecuador entered a period of recession (Desfrancois 2019). Desfrancois hypothesizes that

Ecuador has been experiencing Dutch disease symptoms, and his paper is the first econometric analysis that sets out to show empirical evidence for *symptoms* of a Dutch disease.

Theoretical Framework

Like this study, Kim and Lee (2014), Sachs and Warner (2001), and Gonzalez et al. (2016), Desfrancois uses the familiar three-sector model originally developed by Corden and Neary (1982). A small open economy consists of a tradeable and a non-tradeable sector. The former is divided into a booming natural resource sector and a lagging manufacturing sector. Both act as price takers with prices determined by international markets. The non-tradeable sector consists of services, the prices of which are determined by domestic supply and demand. The price of the booming commodity rises exogenously, and the new income generated from the commodity boom raises the real exchange rate. Desfrancois also points out that commodity booms can lead to a rise in remittances and huge inflows of foreign investment, both of which further lead to real exchange rate appreciation.

Like Gonazalez et al. (2016), Desfrancois argues the Dutch disease causes deindustrialization through a spending effect and a resource movement effect. The spending effect refers to the loss of competitiveness in non-booming (manufacted) exports. This can happen with both fixed and variable exchange rates. If the rate is fixed, the inflow of foreign investment during the commodity boom increases the money supply, which increases aggregate demand. This causes prices to rise throughout the economy, adversely affecting non-booming exports. If the rate is variable, the resource boom causes real exchange rate appreciation, affecting non-booming exports in the same way. The resource movement effect refers to production factors, which in theory are mobile, gravitating toward the booming resource and service sectors and away from manufacturing. Coden and Neary (1982) refer to these effects as

'indirect' and 'direct' deindustrialization, respectively. They will be explored in further detail in the theory section.

There is some existing literature providing to evidence of a Dutch disease throughout Latin America and specifically Ecuador. Acosta (2002) concludes that the Latin American countries richest in natural resources have encountered the most significant challenges in development. On the national level, Naranjo (1995) has found empirical evidence of a spending effect from Ecuador's first oil boom which created an exchange rate lag that favored non-tradable sectors and decreased the production of tradable sectors. Ocampo (2005) analyzed the consequences of the Dutch disease in the Ecuadorian economy, concluding that the gains from the oil sector were not used efficiently and would have been better served developing human capital and other tradeable sectors to reduce Ecuador's dependence on oil.

Methodology

Desfrancois' empirical model in distinct from the other articles presented in this chapter because it uses a Vector Autoregression (VAR) model, a method commonly used for macroeconomic forecasting. The regression analyses presented in this chapter have all used a standard ordinary least squares (OLS) model, which uses one equation to test the impact of multiple independent variables on one dependent variable. Alternatively, a VAR model is a time-series analysis that creates a system of equations in which every endogenous variable in the system have a recursive relationship with every endogenous variable, including itself. For instance, if a fruit vendor who sells apples and oranges used a VAR to estimate apple sales, she would treat apple sales at time *t* as a function of both orange sales at time *t-1* and apple sales at time *t-1*. With enough variables, a VAR model can simulate an entire economy and can be used to forecast how a change in one variable might affect the rest of the economy using a series of

impulse response functions. Desfrancois' model includes one exogenous variable, global oil, and is therefore a VAR-X model. The model includes four endogenous variables: Manufacturing GDP, Commercial GDP, real exchange rate, and public spending. The model uses quarterly data from the Ecuadorian central bank for all endogenous variables and data from West Texas Intermediate (WTI) for oil prices.

Results

Desfrancois' empirical analysis occurs in two stages. The first stage considers the effect of a rise in oil prices on a handful of macroeconomic variables: GDP growth, growth in public spending, and growth in imports. Desfrancois estimates two scenarios, the first in which WTI oil prices remain steady at US $50, the second in which oil prices rise by 5% each quarter. The results of the 8-quarter simulation are shown below:

Table 3.8: The Impact of a 5% Quarterly Increase in Oil Prices on Three Macroeconomic Variables in Ecuador.

Trimestre	Variable					
	Crecimiento del PIB (en %)		Crecimiento del gasto público (en %)		Crecimiento de las importaciones (en %)	
Escenario	Shock petróleo	Sin shock	Shock petróleo	Sin shock	Shock petróleo	Sin shock
Q1	0,92%	0,81%	6,49%	5,68%	3,00%	2,02%
Q2	0,95%	0,79%	4,22%	3,34%	2,74%	1,65%
Q3	0,98%	0,79%	5,84%	4,65%	3,32%	2,06%
Q4	1,02%	0,80%	5,46%	4,05%	3,41%	1,99%
Q5	1,05%	0,80%	6,08%	4,39%	3,71%	2,11%
Q6	1,09%	0,80%	6,20%	4,24%	3,89%	2,09%
Q7	1,13%	0,81%	6,59%	4,33%	4,13%	2,12%
Q8	1,17%	0,81%	6,87%	4,29%	4,35%	2,12%

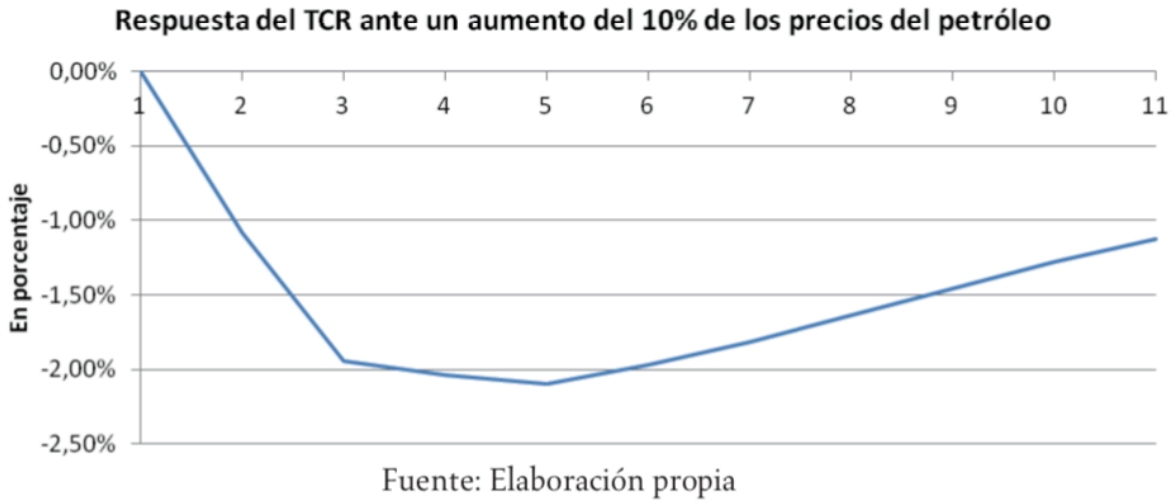
Fuente: Elaboración propia

GDP growth is around .3% greater per quarter with an oil price shock than without. This is to be expected, given the large role of oil in the Ecuadorian economy. Public spending is also consistently higher in the price shock scenario, which is also fairly intuitive given that most

Ecuadorian oil is controlled by a state-owned firm and that oil accounts for a large share of government revenue. Imports are around 2% higher per quarter in the shock scenario, which could be due the income effect of the oil boom.

The second phase of Desfrancois' empirical analysis involves testing for specific symptoms of the Dutch disease. The first such symptom is real exchange rate appreciation. To check for this symptom, Desfrancois uses an impulse response function estimating the effect of a 10% increase in Oil prices on Ecuador's real exchange rate. The model uses all the same variables as the original VAR and includes controls for changes in trade policy. The results are shown below in Figure 2:

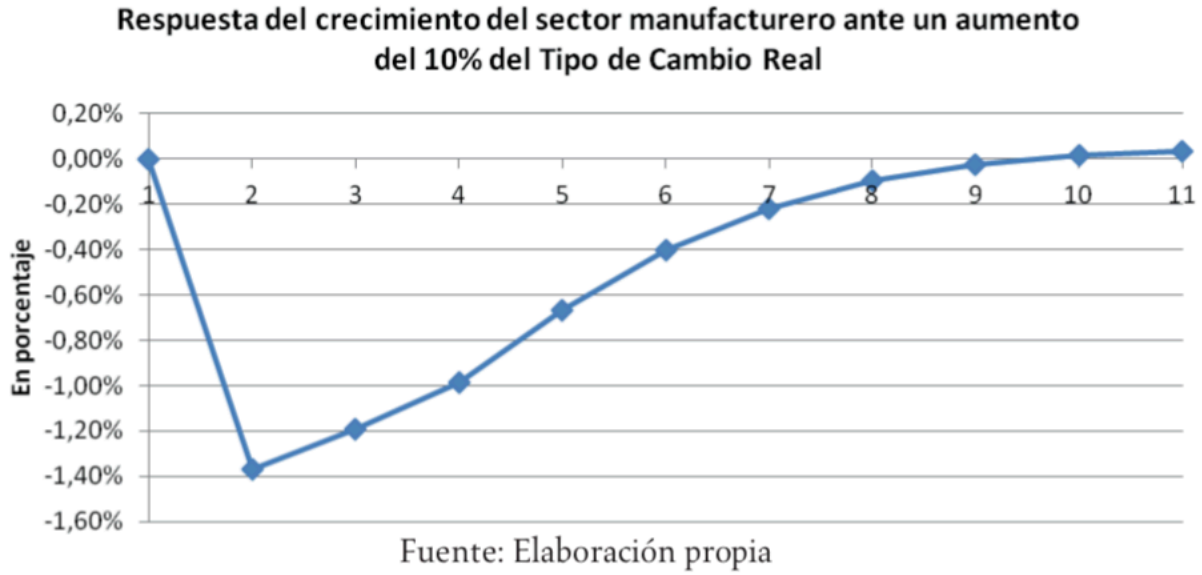
Figure 3.8: Translation: Response of the Real Exchange Rate to a 10% increase in Oil Prices. Source: Desfrancois 2019.



Fuente: Elaboración propia

The empirical model demonstrates that a rise in Oil prices leads to real exchange rate appreciation that is persistent over time, continuing through 10 quarters. The next symptom to test for is the deindustrialization of the manufacturing sector. For this, Desfrancois uses another impulse response function, estimating the effect of a 10% appreciation of the real exchange rate on growth in the manufacturing sector. Figure 3 shows the results:

Figure 3.9: Translation: The Response of Manufacturing Sector Growth to a 10% rise in Real Exchange Rate. Source: Desfrancois 2019.



The empirical model estimates that growth in the manufacturing sector will fall sharply with the sudden real exchange rate appreciation and growth in the sector will be negative for 9 consecutive quarters. The empirical model provides clear evidence of Dutch disease symptoms in Ecuador: A rise in the price of oil leads to appreciation of the real exchange rate, which in turn causes the lagging manufacturing sector to contract. Desfrancois goes on to compare the difference in growth between the manufacturing and commerce sectors given a 10% quarterly increase in the price of oil. Table 2 shows the results:

Table 3.9: The Impact of a 10% Rise in the Price of Oil on Growth in the Manufacturing and Commercial Sectors. Source: Desfrancois 2019.

Trimestre	Crecimiento del PIB comercio (en %)	Crecimiento del PIB manufacturero (en %)
Q1	1,37%	0,93%
Q2	1,07%	0,94%
Q3	1,14%	0,96%
Q4	1,09%	0,97%
Q5	1,13%	1,00%
Q6	1,15%	1,03%
Q7	1,19%	1,07%
Q8	1,23%	1,11%

Given a 10% increase in the Price of Oil, growth in the Manufacturing sector in significantly slower through 8 quarters than in growth in the commercial sector. Desfrancois interprets this trend as a resource movement effect. Because the spending effect has raised prices in the service sector, mobile labor and capital are reallocated toward it.

Desfrancois is also interested in the symptom of 'fiscal laziness,' or an increase in public spending without any changes to the tax distribution. He hypothesizes that during the oil boom, "the high national income generates a similar growth in spending, but there is no evidence of a significant increase in income, that is, it is not accompanied by tax changes or new collection measures" (Desfrancois 2019). To test this hypothesis, Desfrancois uses another VAR model that includes GDP growth rate, trade balance, the size of the non-financial public sector (NFPS), the real exchange rate, and oil prices. He then uses impulse response function to measure the impact of a 10% increase in oil prices. The model finds that such a price increase would cause a contraction of US $430 million on the in the NFPS, all else equal. This effect is also persistent

— the NFPS would stay below original levels for more than 10 quarters. Finally, Desfrancois examines the symptom of trade imbalance, which can be caused by a loss of competitiveness among non-oil exports due to real exchange rate appreciation. In theory, non-oil imports will decrease due to real exchange rate appreciation and imports will increase due to new income from the oil boom. Using the same VAR model, Desfrancois estimates that a 10% increase in the price of oil will lead to a trade balance contraction of US $400 million, which is also persistent through 10 quarters. While the latter two symptoms show evidence of a Dutch disease, they are not directly pertinent to this study.

Conclusion

There is clear evidence of a Dutch disease in Ecuador. A rise in oil prices leads to real exchange rate appreciation, which in turn makes the manufacturing sector less competitive. This provides evidence of both an income effect and a resource movement effect. The two individual case studies I have examined, Ecuador and Colombia, both appear to be suffering the same Dutch disease symptoms from roughly the same oil boom (although Colombia's resource boom also included non-oil mining. This provides some evidence that Dutch disease-related deindustrialization in a region wide trend, but not enough. Colombia and Ecuador are neighbors, and their resource booms were similar. My empirical analysis further explores this trend by examining whether the Dutch disease is truly region wide truly region-wide and applies to other minerals and agricultural products (soybeans from southern cone countries, for instance).

Desfrancois' VAR model has a few unique advantages compared to a standard regression model. The VAR model allows for a more complex set of relationships to be examined, rather than just the relationships between one dependent variable and a given number of independent variables. This presents a more comprehensive model of a country's economy. A

VAR model can also present a sequence of events and relationships that is probably a more accurate picture of the Dutch disease. For instance, González et al.'s regression demonstrated that oil prices and the real exchange rate have negative relationships with industry as a share of GDP. With Desfrancois' VAR model, we are able to observe oil prices' impact on the real exchange rate and then the real exchange's impact on manufacturing. Another advantage is the ability to predict multiple scenarios. Not only are we able to predict the effect of an oil boom on the manufacturing and commercial sectors — we are able to predict a counterfactual scenario where no oil boom occurred.

3.7 Conclusion

Sachs and Warner's paper establishes empirical evidence of a 'resource curse' — economies oriented toward extraction and export of natural resources tend to grow slower. Their theoretical analysis (the only one to come after their empirical analysis) speculates that this is due to the Dutch disease, or as they refer to it, the 'crowding out' thesis. Natural resources crowd out more productive activities like manufacturing and resource booms cause real exchange rate appreciation, making manufacturing less competitive. The 'recourse curse' is especially prevalent in Latin America, specifically South America. Ocampo's article offers a primer on the region's recent history of resource specialization. It is worth noting that Ocampo does not necessarily believe the negative effects of resource specialization are inevitable, however he argues that most Latin American countries have not fully taken advantage of the recent commodity boom and are instead experiencing Dutch disease effects.

Kim and Lee's comparative analysis demonstrates that the Dutch disease has led to more premature and pronounced deindustrialization in Latin America than other regions of the world and that in general, Latin America's trading relationship with China has accelerated these trends.

Finally, González et al. and Desfrancois present two econometric analyses which provide evidence of a Dutch disease in Colombia and Ecuador.

4. Theory

4.1 Background

For much of the 21st century, the productive structure of South America has shifted toward the export-oriented growth. Since a period of dramatic liberalization in the 1980s and 1990s, South American economies have been pushed toward a neoclassical orthodoxy which stresses comparative advantage. These reforms were part of a large-scale push in the region away from the import-substitution model which prevailed in the 1960s and 1970s and toward a more open, export-driven model. It would be impossible to discuss South America's structural shifts without discussing the roles of the United States, IMF and World Bank. In the 1980s, the region experienced a massive debt crisis. Speaking in generalizations, governments were unable to access new credit and many creditors were only willing to renegotiate debt unless governments adhered to IMF and World bank structural adjustment programs, at the center of which was the conditionality trade liberalization.

As economies in South America liberalized, they tended to shift their productive structures toward the primary commodities in which they show a static comparative advantage (Ahumada 2019). For Andean economies, this advantage lies in fuels (the main export of Venezuela, Colombia and Bolivia) and Minerals (the main experts of Chile and Peru). For Southern Cone economies, this advantage lies in agriculture (the main exports of Argentina, Paraguay and Uruguay). Primary commodities in general show more volatile price cycles than other types of exports. From 2003 to 2013, primarily due to a sharp increase in demand from a

growing consuming class mainly in China, commodity prices experienced a nearly 10-year positive price cycle.

The positive effects of the cycle were felt throughout the region. The commodity boom coincided with the *marea rosa*, a leftward shift in Latin American politics which marked the beginning of the regions post-neoliberal era. Many governments were comfortable with a high level of fiscal dependence of primary commodity revenues (referring to the proportion of government revenues coming from primary commodities), as they were able to use windfall gains from natural resource revenues to finance broad social programs. This was especially the case for extractivist-redistributive countries that nationalized the production and exports of natural resources.

Booms in natural resource intensive sectors also tend to create spending effects, which increase demand throughout a given economy, especially in the non-tradeable services sector. Labor gravitated toward the booming commodity sectors and expanding non-tradeable sectors and away from traditional manufacturing. During the commodity boom, South America's tendency toward deindustrialization which began in the 1980s was accelerated due to the Dutch disease effect. The pronounced increase in exports due to the commodity boom led to the appreciation of real exchange rates, which made it harder to export other tradeable goods.

Around 2014, when world prices for natural resources acutely dropped and the commodity boom became a commodity bust, the second stage of the Dutch disease effects began. The windfall gains in the booming sector and the spending effect during the boom stage had led to a rise in overall employment, productivity, and wages. During the bust stage, these effects apply in reverse. Productivity in the natural resource sectors dropped due to falling world prices, resulting in stagnating wages and loss of formal employment. This in turn led to a

decrease in consumption. This decrease in consumption was further augmented in cases where government revenues — and the social spending that came with them — were directly tied to primary commodity revenues. Formal employment is lost, and recovery is difficult due to an underdeveloped manufacturing sector. The result, in the case of South America, has been a large and growing urban informal sector.

In the small open economy model for this study, I make the assumption that productivity in manufacturing is endogenous and grows over time. This is because of learning by doing, the process of habitual self-perfection and micro-innovation unique to manufacturing. Learning by doing occurs far less in the natural resource sector, which is more extractive in nature. For the purpose of this study's theoretical model, learning-by-doing does not happen at all in the natural resource sector. This is the reason the reason manufacturing is considered a more reliable and stable vehicle for economic growth than natural resources in open economies, as demonstrated by Matsuyama (1992) and later by Sachs and Warner (1999). The model below describes the effect of a natural resource boom (and bust) on a small open economy.

4.2 Hypothesis

Central to the middle-income trap issue that many South American countries face is premature deindustrialization. As Ocampo (2017) and Ahumada (2019) point out, manufacturing has steadily taken on a smaller role in almost all South American economies since the start of the commodity boom. I hypothesize that this is due to the direct and indirect deindustrialization that comes as a result of the Dutch Disease, which this chapter attempts to model. This prediction is not only based in theory. Empirical evidence also points to a link between natural resource dependence and premature de-industrialization. Using a sample of low- and middle-income countries around the world, Kim and Lee (2014) observe a negative relationship between

primary commodity dependence and Manufacturing value added in GDP. Sachs and Warner (2001) also observe a negative relationship between Natural Resource wealth and GDP growth. They hypothesize that this is because the natural resource sector "crowds out" the more productive manufacturing sector.

Table 4.1: The Variables and Hypotheses of This Study.

Dependent Variable (A)	**Manufacturing value added as a % of GDP (MVA)**
Dependent Variable (B)	**Real Exchange Rate (RER)**
Independent Variable	**Natural resources as a % of exports (PRI)**
Hypotheses for Dependent Variable (A)	**H_O:** There is no significant relationship between PRI and MVA. **H_A:** There is a significant *negative* relationship between PRI and MVA. **H_O:** The relationship between PRI and MVA is no different in South America than in other regions. **H_A:** The relationship between PRI and MVA is significantly more negative in South America than in other regions.
Hypotheses for Dependent Variable (B)	**H_O:** There is no significant relationship between PRI and RER. **H_A:** There is a significant *positive* relationship between PRI and RER. **H_O:** The relationship between PRI and RER is no different in South America than in other regions of the world. **H_A:** The relationship between PRI and RER is significantly more *positive* in South America than in other regions of the world.

4.3 Two-Sector Theorical Economy

I will begin with a theoretical small open economy with two sectors: a tradeable manufacturing sector M and a tradeable "booming" natural resource sector R. All sectors employ a portion of the total working population $\bar{l}$, which is constant and divided into manufacturing employment l^{M} and natural resource employment l^{R}. Full employment is shown in equation 4.1:

$$\bar{l} = l_t^M + l_t^R \tag{4.1}$$

I assume labor is perfectly mobile between the two sectors. This implies workers have perfect information, are able to switch jobs without barriers, and have no inherent differences in productivity between them. Output X in each sector follows a diminishing returns schedule, demonstrated by F and G in equations 4.2 and 4.3:

$$X_t^M = M_t F(l_t^M), \qquad F(0) = 0, F' > 0, F'' < 0 \tag{4.2}$$

$$X_t^R = RG(l_t^R), \qquad G(0) = 0, G' > 0, G'' < 0 \tag{4.3}$$

The productivity of the natural resource sector R is treated as exogenous. Productivity of the natural resource sector reflects demand for the natural resource and level of technology at time *t* as well as climate, the size of the natural resource endowment, and other static exogenous parameters. Productivity in the manufacturing sector M, however, is considered endogenous and grows and knowledge accumulates over time:

$$\dot{M}_t = \delta X_t^M, \quad \delta > 0 \tag{4.4}$$

The fact that the theoretical small economy is open has important implications for how productivity in the natural resource sector affects industrialization. Extrapolating from Matsuyama (1992)'s observations on agricultural productivity, if the economy were closed, it would need to produce natural resources at or above subsistence level for its entire population.

A rise in productivity in R would mean less labor is required to meet subsistence level consumption. Labor would be "released" from the natural resource sector into other sectors of the economy, namely manufacturing (Matsuyama 1992). In a small open economy that can import food and other natural-resource intensive products to reach subsistence, the manufacturing and natural resources sector compete for the same pool of labor. Workers, being perfectly mobile and rational and having to intrinsic differences in productivity, will move so as to equalize nominal wages throughout the economy. This equilibrium condition is shown mathematically in equation 4.5 and graphically in figure 1:

$$M_t F'(l_t^M) = RG'(l_t^R) \tag{4.5}$$

Figure 4.1: Starting Two-Sector Labor Market.

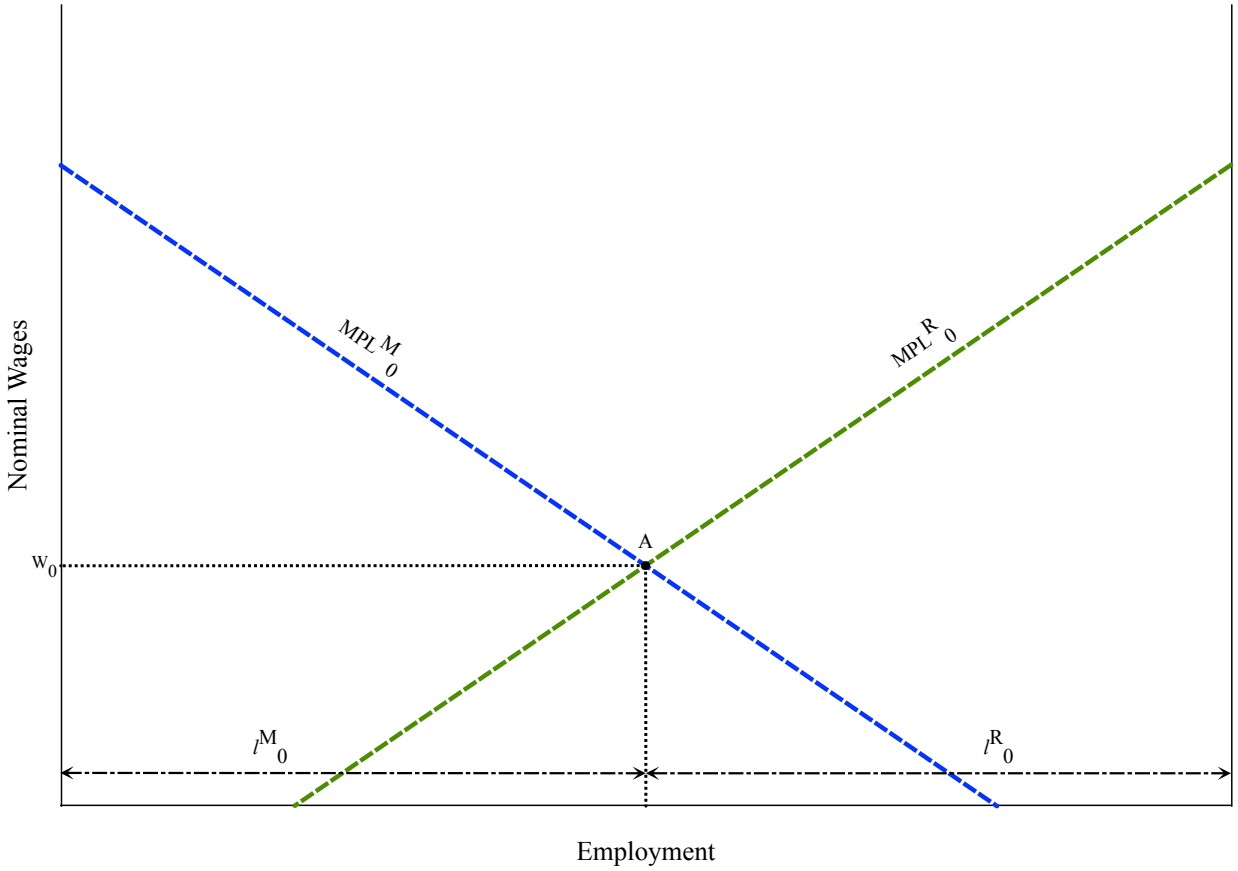
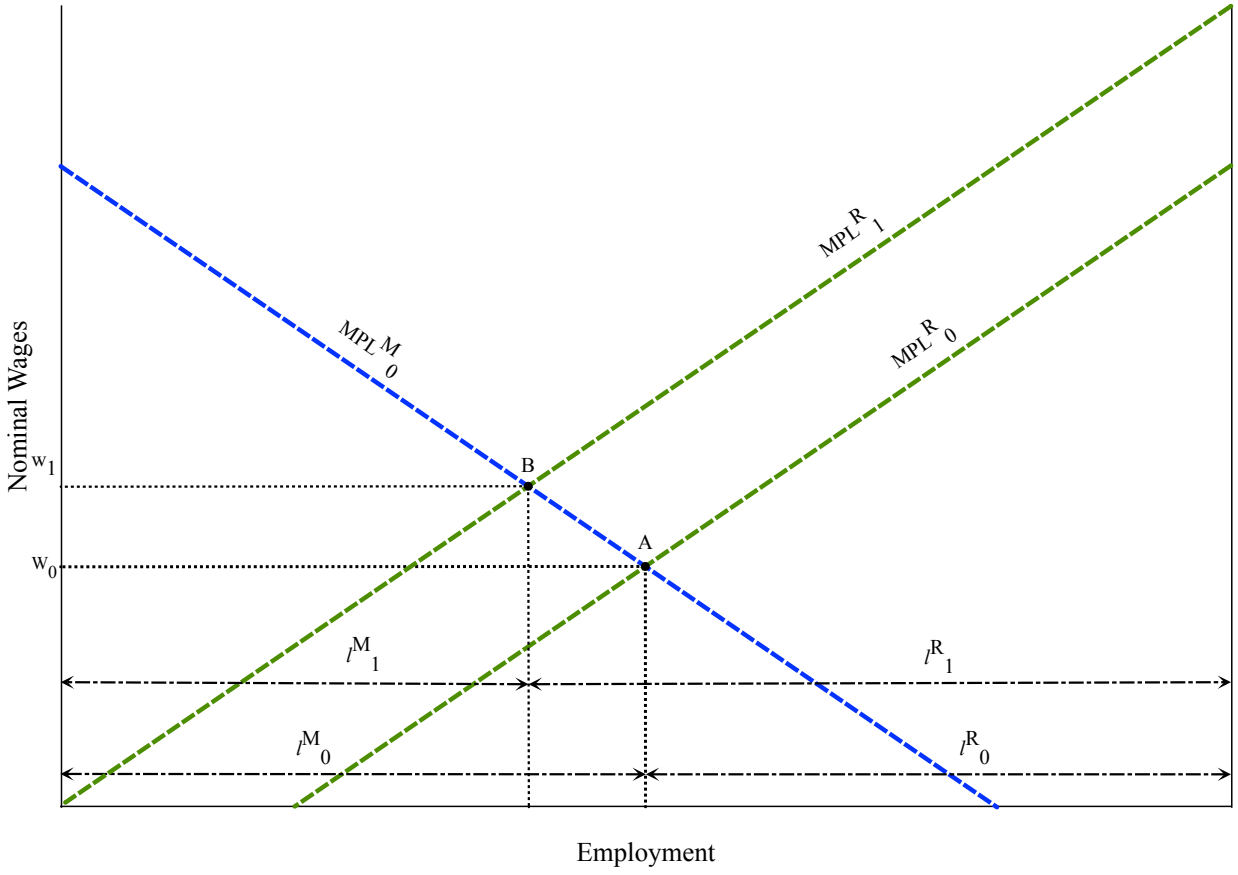


Figure 1 is a two-sector labor market that shows wages and employment for both sectors. Equilibrium wage w_0 is at the level where the marginal products of labor for Manufacturing ($F'(l^M)$) and Natural Resources ($G'(l^R)$) are the same. The X axis represents the entire employed population $\bar{l}$. The distance to the left of point A represents l^M and the distance to the right of point A represents l^R. This implies another key assumption: no unemployment. Empirically, this was obviously not the case for any South American economy during any stage of the commodity boom, however I make this assumption for the sake of simplicity. Now observe the effect of a natural resource boom:

Figure 4.2: The Effect of a Commodity Boom on a Two-Sector Labor Market.



A ‘boom’ in the natural resource sector can be caused by local windfall discoveries, advances in extraction technology, or exogenous shifts in worldwide demand. In the case of the 2003-2013 Latin American commodity boom, the exogenous demand scenario applies. It is worth noting that the economy represented by the theoretical model, being small and open, acts as a price taker and cannot influence world markets. A positive shock in world prices leads to a rise in total output per worker. This shifts the MPL^R curve outward at all price levels. The manufacturing sector must reduce its employment from l^M_0 to l^M_1 in order to maintain equilibrium wages, which have been raised from w_0 to w_1. In mathematical terms, the effect of a resource boom on manufacturing employment is:

$$l_t^M = v(R), \qquad v'(R) < 0 \tag{4.6}$$

Manufacturing employment is negatively related to natural resource productivity, all else equal.

4.4 Three-Sector Theoretical Economy

Matsuyama’s two-sector model describes *direct deindustrialization*, which refers to mobile labor moving away from manufacturing and into the booming natural resource sector. This is part of the Dutch disease, but it does not tell the full story. The Dutch disease also entails *indirect deindustrialization*, which involves not just natural resources and manufacturing, but also the non-tradeable service sector. To describe both direct and indirect deindustrialization, I will use a three-sector model for the remainder of this chapter.

The three-sector model uses the same assumptions as the two-sector model, but adds a non-tradeable sector consisting of mostly services. Like R, productivity in the non-tradeable sector N is considered exogenous and does not accumulate through learning-by-doing. I also add a tradeable sector. Productivity in this sector, labeled E for ‘exports,’ represents the horizontal sum of M and R. Since E includes M, it also grows over time. Output in the N and E

sectors follow the same diminishing returns schedule, represented by H and J in equations 4.2 and 4.3:

$$X_t^N = NH(l_t^N), \qquad H(0) = 0, H' > 0, H'' < 0 \tag{4.7}$$

$$X_t^E = E_t J(l_t^E), \qquad J(0) = 0, J' > 0, J'' < 0 \tag{4.8}$$

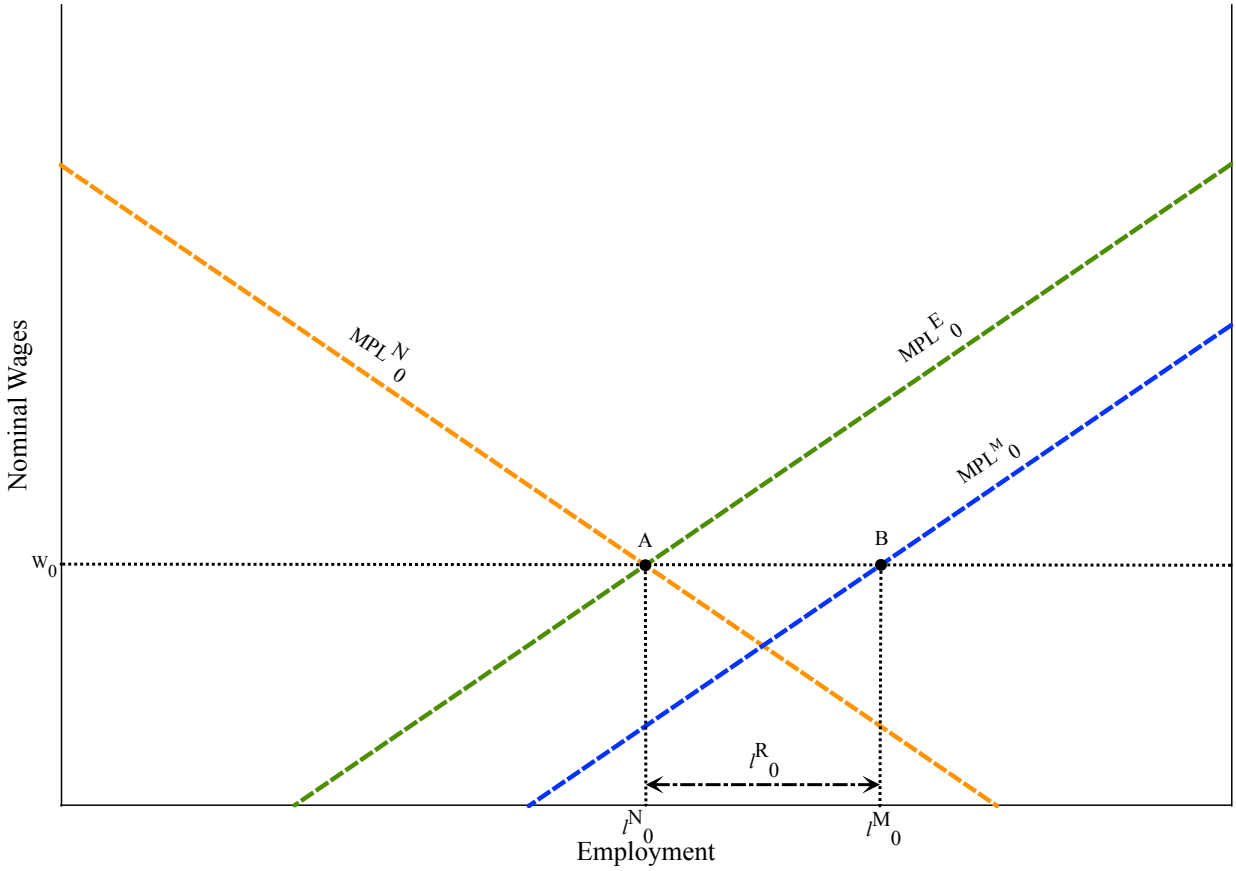
The composition of labor throughout the economy can be expressed as:

$$l_t^E = l_t^M + l_t^R \tag{4.9}$$

$$\bar{l} = l_t^E + l_t^N \tag{4.10}$$

Figure 3 presents the starting equilibrium in a three-sector labor model:

Figure 4.3: Starting Three-Sector Labor Market



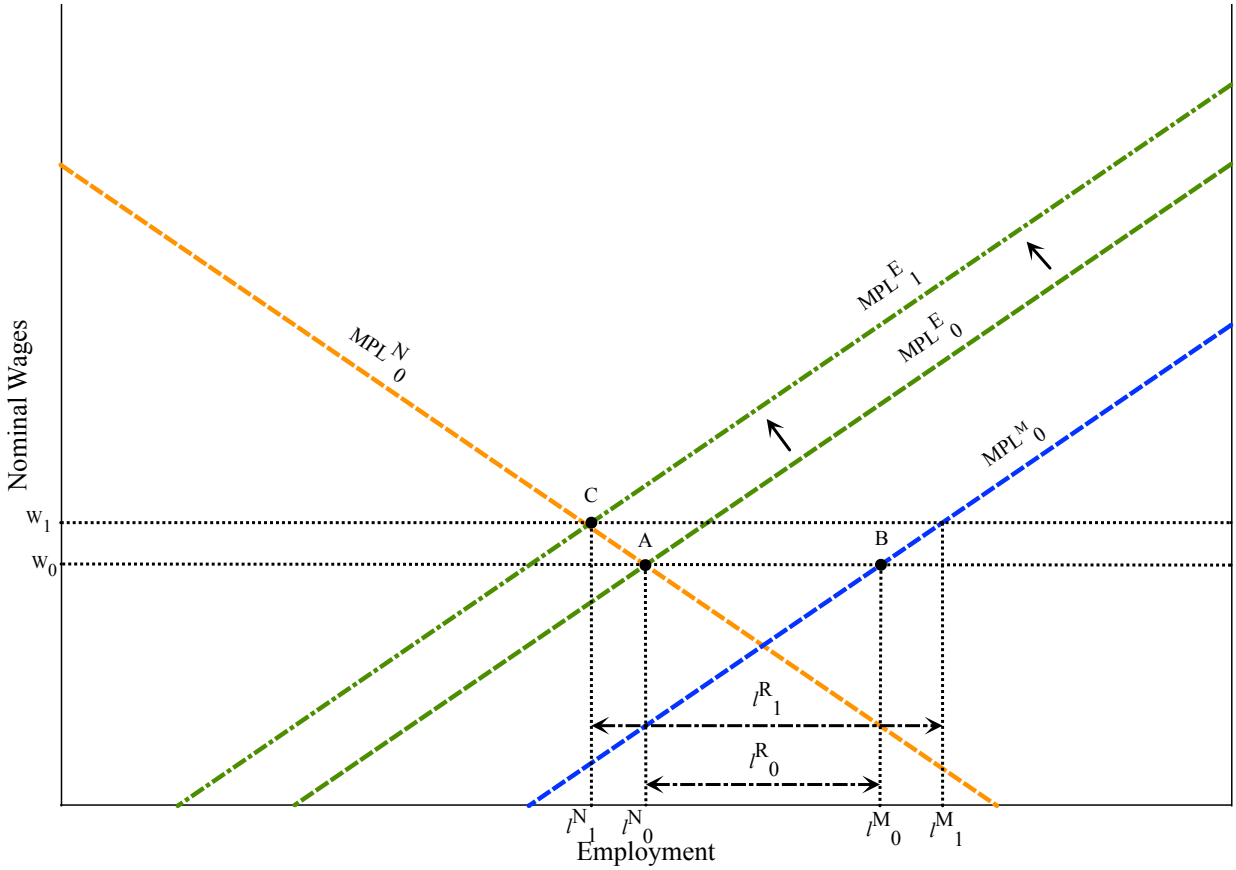
As in figures 1 and 2, X axis represents $\bar{l}$. The distance from the left Y axis to point A represents l^N, the distance from point A to point B represents l^R, and the distance from point B to the right

Y axis represents l^M. Note that in the three-sector model, the tradeable and non-tradeable sectors are competing for labor rather than manufacturing and natural resources. Therefore, the equilibrium condition becomes:

$$E_t J'(l_t^E) = NH'(l_t^N) \tag{4.11}$$

Figure 3 shows the effect of a commodity boom:

Figure 4.4: The Effects of a Resource Boom on Labor Allocation and Nominal Wages.



The exogenous increase in demand, and subsequent increase in prices, leads to an expansion of the 'booming' natural resource sector. The booming industry is able to hire more workers and due to rising prices, each worker produces more output. This boom causes a series of shifts throughout the economy. The equilibrium point between the tradeable and non-tradeable sectors

shifts from point A to point C, raising nominal wages throughout the economy. Labor shifts into the booming natural resource sector and away from manufacturing and non-tradeables.

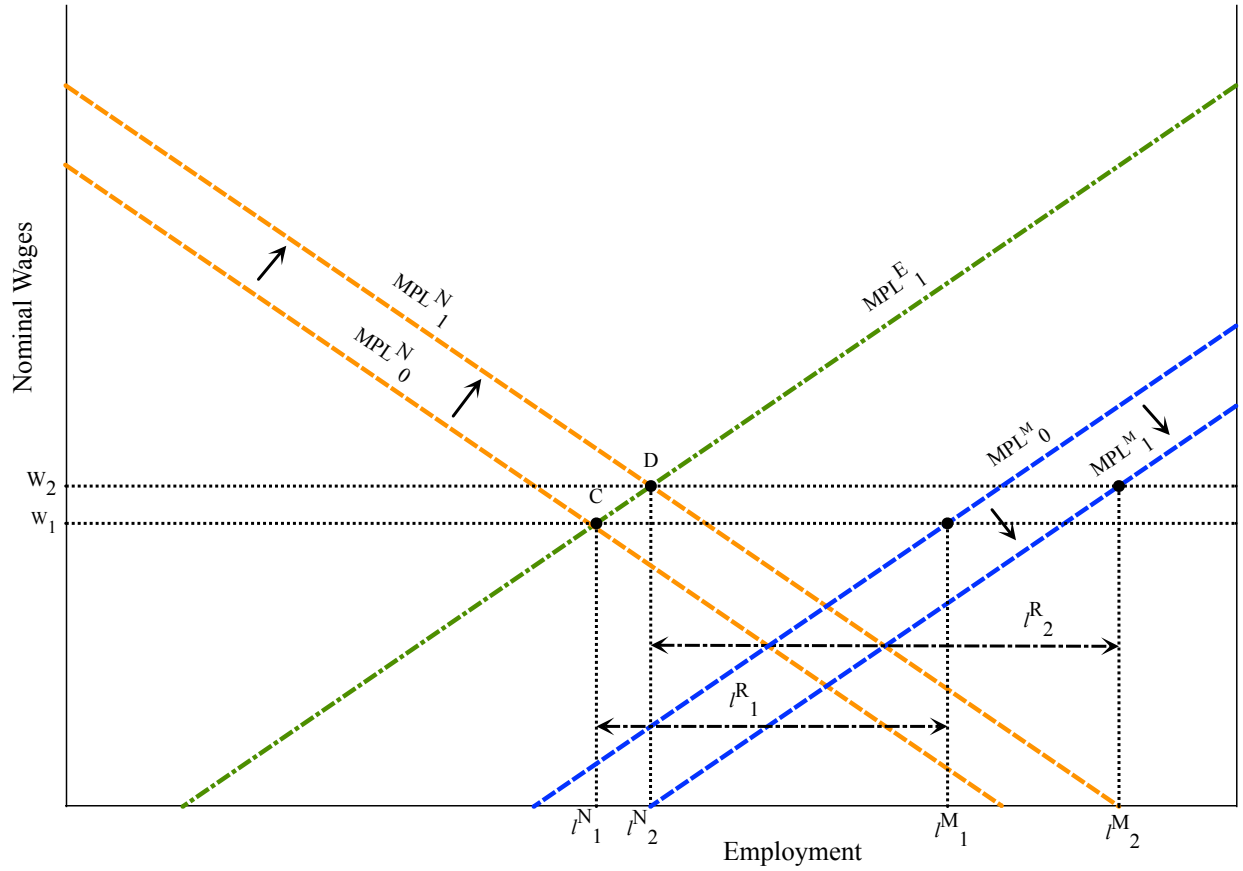
Deindustrialization also occurs due to an appreciation of the real exchange rate ϵ which renders many non-booming domestic exports unable to compete. Appreciation of the real exchange rate occurs through a combination of spending and resource movement. New income gained from the booming sector creates a demand for services while labor in the non-tradeable sector moving toward the booming sector. Since income elasticity of demand for non-tradeable services is positive, the rise in demand raises the price of non-tradeable goods and services relative to tradeable goods (Corden 1984). As income increases (as the result of a commodity boom, for instance), demand for non-tradeable goods and services will rise, leading to higher prices at all employment levels.

Consumers paying more for non-tradeable goods and services raises domestic price index P^D. This raises the real exchange rate, which is the nominal rate *e* multiplied by the ratio of domestic price index to foreign price index P^F:

$$\epsilon \uparrow = e * \frac{P^D \uparrow}{P^F} \tag{4.12}$$

Note the difference in the lowercase *e* denoting nominal exchange rate and the upper-case *E* denoting the tradeable sector. A rise in the real exchange rate shifts the marginal product of labor for manufacturing inward. Since the price of manufactured goods has now risen, output per worker in the manufacturing sector falls. The spending and real exchange rate appreciation effects from the resource boom are shown below in figure 5:

Figure 4.5: The Effects of Increased Spending and Real exchange rate appreciation



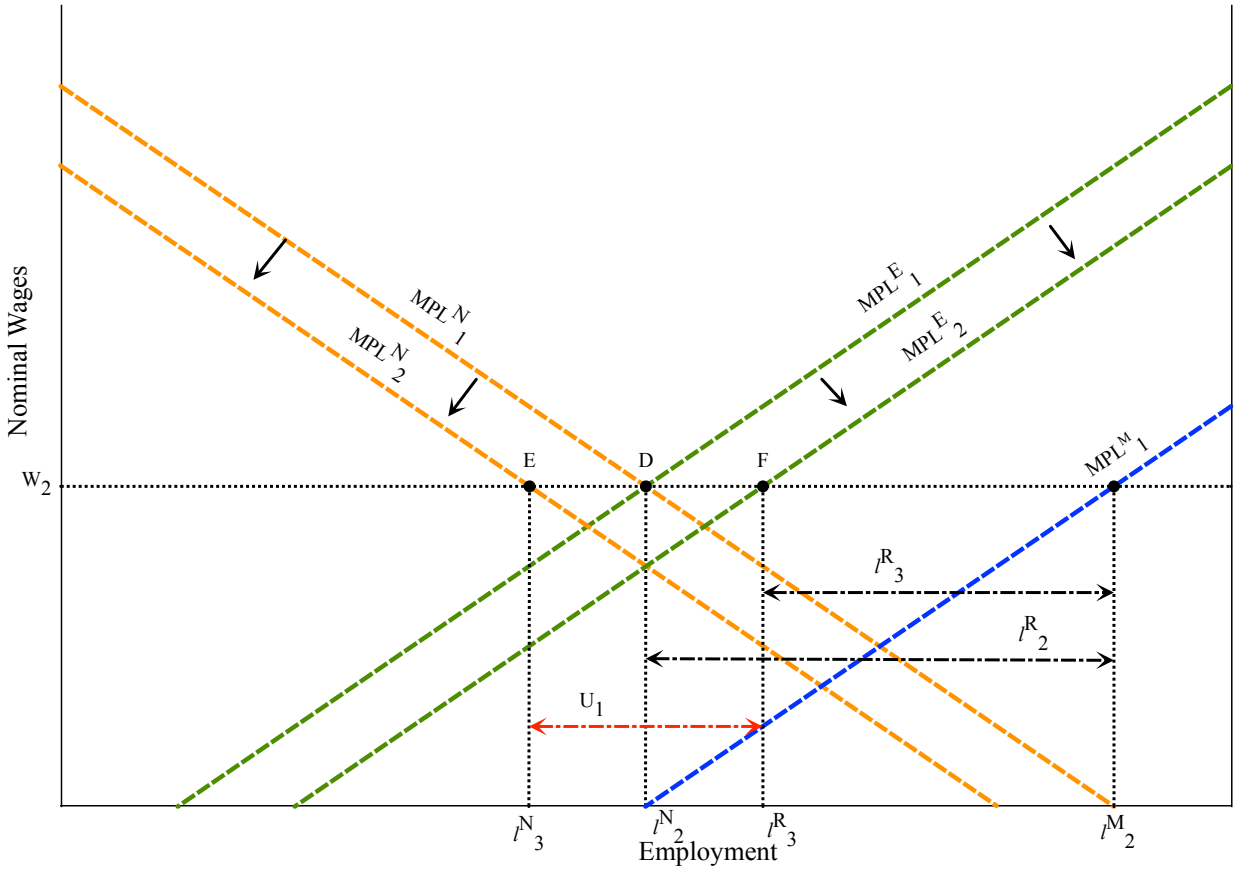
Due to the forward shift of the MPL curve for non-tradeables, wages again rise throughout the economy. l^M is reduced significantly due lower productivity per worker and higher equilibrium wages, which are now at the level of point D. Displaced labor from the manufacturing sector is absorbed by the natural resource sector and by the non-tradeable sector. l^N is around the same as it was before the boom, however the price (nominal wage) for services is higher. This is consistent with the empirical findings of Sachs and Warner (2001), who observe higher domestic prices in countries with higher natural resource dependence.

As was the case throughout South America around 2014, the 'boom' stage of the Dutch disease turns out to be short-lived. As growth in the world's consuming class slowed, demand —and with it, prices— for primary commodities began to drop. As the commodity boom in

South America became a commodity bust, the adverse effects of the Dutch disease began to show.

The positive price cycle which led to the South American commodity boom lasted roughly from 2003 to 2013 (Ocampo 2017). As worldwide prices for commodities began to drop, many of the Dutch disease effects detailed above occur in reverse. With lower world prices for primary commodities, output per worker in the booming sector drops significantly. In figure 6, the MPL^E shifts inward to its original position. Whether or not productivity falls below stage 0 levels is an empirical question, the answer to which varies by country. The exact extent to which productivity falls in the natural resource sector depends on a variety of factors, such as price cycles and progress in extractive technologies that many have occurred over around a decade.

Figure 4.6: The Effects of a Resource Bust on Nominal Wages and Labor Allocation.



Both the natural resource boom and spending effect occur in reverse here. With lower demand for non-tradeable goods and services, MPL^N falls. Wages, however, remain at their previous levels. With wages above market equilibrium, the shortage of labor, shown by the distance between points E and F, represents a combination of urban informal sector workers and unemployed people U_1 (Recall that I assume U_0 is 0). The unemployed population does not necessarily go without work. In fact, they could be more accurately described as not *formally* employed. Those who work informally are typically self-employed and sell low value-added goods and services.

I make the assumption that wages are 'sticky' based on observations from literature. As mentioned earlier, Sachs and Warner (2001) observe higher prices in the service sector in

countries with higher dependence on natural resources. Paus (2017) Also points out that two fixtures of Latin America's 'middle income trap' situation are comparatively high wages and a persistently large urban informal sector. In 2012, the share of the informal economy in South American non-agricultural employment ranged from 38.4% in Brazil to 68.8% in Peru (ILO 2013). Given the trends of large urban informal sectors in South America and high service prices in resource rich countries, it is reasonable to assume wages should be 'sticky downward' in the theoretical model.

A resource boom can cause both direct and indirect deindustrialization within a small open economy. Direct deindustrialization occurs as labor flows out of the manufacturing sector due to higher productivity in the natural resource sector, as shown in figure 4. Indirect deindustrialization occurs due to a loss of competitiveness on international markets due to currency appreciation. I predict that both of these effects applied throughout South America during the 2003-2013 commodity boom. I test this hypothesis in the empirical section of this study.

5. Methodology

5.1 Data

All of the data used for this study was collected from a sample of 106 upper-middle and lower-middle income countries (as defined by the World Bank), including all 10 South American republics, from the years 1995-2019. Each data point represents a given variable for country *i* during year *t*.

Table 5.1 lists every variable included in my study as they are labeled in my regression equations, along with their definition and source:

Table 5.1: Every variable used in this study's regressions.

Variable Name	Definition	Source
MVA	Manufacturing Value Added (% of GDP)	World Bank Development Indicators Database
RER	Real Exchange Rate: An index which measures the development of the real value of a country's currency against a basket of 66 trading partners. The index for the baseline year, 2007, is always 100.	Bruegel Databases
GDP	The Natural Log of GDP per capita (constant 2010 US$)	World Bank Development Indicators Database
rawagX	Agricultural Raw Materials Exports (% of Merchandise Exports). Agricultural raw materials comprise SITC (revision 3) section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).	World Bank Development Indicators Database
foodX	Food Exports (% of Merchandise Exports). Food comprises the commodities in SITC (revision 3) sections 0 (food and live animals), 1	World Bank Development Indicators Database

	(beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels).	
fuelX	Fuel Exports (% of Merchandise Exports). Fuels comprise the commodities in SITC (revision 3) section 3 (mineral fuels, lubricants and related materials).	World Bank Development Indicators Database
mineralX	Ores and Metals (% of Merchandise Exports). Minerals comprises the commodities in SITC (revision 3) sections 27 (crude fertilizer, minerals nes) and 28 (metalliferous ores, scrap).	Author's Calculations based on United Nations Statistics Division
PRI	Proportion of exports categorized as SITC (revision 3) level 0,1,2,3, and 4	Author's Calculations Based on United Nations Statistics Division
south	South America Dummy. Includes Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela.	General Geographical Knowledge
chinaX	China's Export Partner Share (%)	World Integrated Trade Solution (WITS)
chinaM	China's Import Partner Share (%)	World Integrated Trade Solution (WITS)
saving	Resource-Adjusted Savings: gross savings minus resource depletion (sum of energy depletion, mineral depletion, and forest depletion)	Author's Calcutations Based on World Bank Development Indicators Database
gini	Gini Coefficient: a 0-100 scale 0 representing perfect equality and 100 representing perfect inequality (World Bank Estimate	World Bank Development Indicators Database
rents	Resource Rents (% of GDP): combines coal, oil, natural gas, mineral, and forest rents as %'s of GDP	World Bank Development Indicators Database

ruleoflaw	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Scored on a scale of (-2.5)=weak to (2.5)=Strong	World Governance Indicators (WGI) Dataset

5.2 Model

In order to test my theory of a widespread Dutch disease in South America, I estimated 3 cross-country, time series regressions. The first two regressions test the Dutch disease theory against other factors that are associated with deindustrialization and the resource curse in some way they correspond to hypotheses 1 and 2 from table 4.1. In my third regression, I test hypotheses 3 and 4 by measuring the relationship between PRI and RER. The fourth breaks up primary commodities by type to observe how the type of primary commodity export can lead to direct and indirect deindustrialization. In the first three regressions, I include an interaction term between PRI and a South America dummy variable. This allows me to observe whether the Dutch disease has especially pertinent to South America, as Kim and Lee (2014) and Ocampo (2017) suggest. All regressions include entity and time fixed effects to control for omitted variable bias. Each independent variable is lagged by one year. I decided that a one-year lag would be most appropriate for my study based on the literature. Behzadan et al., the only study in the literature to estimate a lagged regression, use a lag of one year. González et al. and Desfrancois use quarterly data when evaluating the symptoms of the Dutch disease in Colombia and Ecuador. All this is to say the precedent set by the literature on my topic is to study the *immediate* effects of the Dutch disease, using as short of a lag as possible.

To test for the Dutch disease hypothesis, I use the PRI variable, following the logic that a greater share of primary commodities in a country's export basket will lead to stronger Dutch disease effects. If the Dutch disease hypothesis is true, PRI will be negatively correlated with MVA and positively correlated.

The controls in the first two regressions each reflect observations made in the literature. Probably the most influential piece of literature is Kim and Lee (2014). Like Kim and Lee, I test for the inverted-U curve hypothesis presented originally by Rowthorn (1987). This hypothesis essentially states that deindustrialization is part of a natural progression in countries that reach a certain income level. To test for the inverted-U hypothesis, I use the GDP and GDP^2. If the coefficient is significantly lower for GDP^2 than from GDP, we know that MVA only correlates with income level up to a certain point. Also borrowing from Kim and Lee, I test the Dutch disease hypothesis against the 'China effects' hypothesis. As has been discussed in previous chapters, China's recent economic growth has had major implications for the composition of its trading partners' economies. Bilateral trade with China can be a deindustrializing force through both imports and exports. Due largely to its abundant supply to low-cost labor, China has a comparative advantage in manufacturing over almost any country in the world (with the relative exception of other Asian countries). Chinese manufactured imports can often compete with domestic manufacturing, leading to deindustrialization in the long term. As Wise (2020) and Kim and Lee (2014) point out, China is increasingly dependent on imports of raw materials to accommodate its growing consuming class. As Ocampo (2017) demonstrates, the Latin America to China export basket is dominated by primary commodities (this is especially the case for South America). We know that the '03-'13 resource boom was driven mainly by Chinese demand. Therefore, greater exports to China can be a deindustrializing force as they can crowd

out manufacturing and cause Dutch disease effects. I expect that both China's import partner share and export partner share will be negatively correlated with MVA. I am not able to include the variables for import partner share and export partner share due to collinearity. If a given country has a more open trade relationship with China, it is likely that that China accounts for a large share of that country's imports as well as its exports.

I also control for factors that can amplify or mitigate the Dutch disease and resource curse. Torvik (2009) identifies saving, or lack thereof, as a key factor behind the resource curse. Most countries that have 'escaped' the resource curse tend to have positive resource-adjusted savings rates while many of many of the still 'cursed' countries have negative rates. The use of the resource adjusted savings rate, rather than a traditional savings rate, is important because many natural resources are non-renewable. If a country spends all of the income it gains from a non-renewable resource, its official savings rate would be zero. However, since the country can no longer earn income from the resource wealth it lost, the resource-adjusted savings rate is negative. This is also relevant for the Dutch disease. A low resource-adjusted savings rate indicates greater consumption of services using resource income. All else equal, this will raise domestic prices and displace labor from the manufacturing sector. According to Behzaden et al. (2017), inequality is another factor that can aggravate the Dutch disease. The logic behind this is similar to the logic behind resource adjusted savings. Rich people have a higher propensity to consume services than poor people. The more resource income is concentrated into a small amount of rich people, the greater the likelihood that a resource boom will cause a Dutch disease. To include this hypothesis in my regression, I include resource rents as a percent of GDP, Gini coefficient, and the interaction term between the two. Institutional quality is also frequently used in the literature, especially pertaining to the resource curse. Torvik (2009)

argues that quality institutions, namely strong property rights and control of corruption, natural resource wealth can lead to greater private sector investment, which can in turn lead to greater industrialization. Wise (2020) points to the specific examples of Argentina and Brazil as countries who have not been able to fully take advantage of their resource wealth due to institutional issues. I use the World Governance Indicators (WGI) Rule of Law rating as a general indicator for institutional quality. In general, higher levels of confidence in things like stable rules, contract enforcement and property rights are a sign that institutions are 'investor-friendly' as opposed to 'grabber-friendly'. Li et al. (2012) and Branstetter et al. (2011) have shown empirical evidence for this claim. Equations 5.1 and 5.2 demonstrate regressions (1) and (2) respectively:

$$\begin{aligned} MVA_{it} = {} & \beta_0 + \beta_1 PRI_{it} + \beta_2 PRI_{it} * south_{it} + \beta_3 GDP_{\ it} + \beta_4 GDP_{it}^2 \\ & + \beta_5 saving_{it} + \beta_6 ruleoflaw_{it} + \beta_7 rents_{it} + \beta_8 gini_{it} \\ & + \beta_9 rents_{it} * gini_{it} + \beta_{10} chinaX_{it} + \alpha_2 EF_2 + \cdots + \alpha_N EF_N \\ & + \gamma_2 TF_2 + \ldots + \gamma_T TF_T + \epsilon_{it} \end{aligned} \tag{5.1}$$

$$\begin{aligned} MVA_{it} = {} & \beta_0 + \beta_1 PRI_{it} + \beta_2 PRI_{it} * south_{it} + \beta_3 GDP_{\ it} + \beta_4 GDP_{it}^2 \\ & + \beta_5 saving_{it} + \beta_6 ruleoflaw_{it} + \beta_7 rents_{it} + \beta_8 gini_{it} \\ & + \beta_9 rents_{it} * gini_{it} + \beta_{10} chinaM_{it} + \alpha_2 EF_2 + \cdots + \alpha_N EF_N \\ & + \gamma_2 TF_2 + \ldots + \gamma_T TF_T + \epsilon_{it} \end{aligned} \tag{5.2}$$

Regression (3) tests for indirect deindustrialization where the first two regressions test for direct deindustrialization. Indirect deindustrialization occurs through real exchange rate appreciation, so I use RER as the dependent variable. I do not use the same controls as the first two regressions, as they represent different theories of deindustrialization, not real exchange rate appreciation:

$$RER_{it} = \beta_0 + \beta_1 PRI_{it} + \beta_2 PRI_{it} * south_{it} + \alpha_2 EF_2 + \cdots + \alpha_N EF_N + \gamma_2 TF_2 + \ldots + \gamma_T TF_T + \epsilon_{it} \quad (5.3)$$

Regressions (4) and (5) break primary commodities down by type. Ocampo (2017) establishes that different commodities have different levels of price volatility. Countries that specialized in fuels and minerals had more dramatic shifts in their terms of trade during the commodity boom than countries that specialized in agriculture. It is therefore worth testing how each category of primary commodity as a share of exports correlates with MVA and RER. Evidence from Ocampo (2017) suggests that the share of fuels and minerals in a country's exports will have the strongest negative relationship with MVA and positive relationship with RER. Exports with volatile prices have greater potential to create 'booms' that can dramatically reorient economies. Equations 5.5 and 5.6 demonstrate these regressions:

$$MVA_{it} = \beta_0 + \beta_1 fuelX_{it} + \beta_2 rawagX_{it} + \beta_3 foodX_{it} + \beta_4 mineralX_{it} + \beta_5 GDP_{it} + \beta_6 GDP_{it}^2 + \beta_7 ruleoflaw_{it} + \alpha_2 EF_2 + \cdots + \alpha_N EF_N + \gamma_2 TF_2 + \ldots + \gamma_T TF_T + \epsilon_{it} \quad (5.4)$$

$$RER_{it} = \beta_0 + \beta_1 fuelX_{it} + \beta_2 rawagX_{it} + \beta_3 foodX_{it} + \beta_4 mineralX_{it} + \alpha_2 EF_2 + \cdots + \alpha_N EF_N + \gamma_2 TF_2 + \ldots + \gamma_T TF_T + \epsilon_{it} \quad (5.5)$$

Note that in equation 5.4, I am not able to use all of the same control variables as in equations 5.1 and 5.2. This is because resource-adjusted saving and the distribution of rents both use *total* natural resources to measure depletion and rents, rather than depletion and rents figures for *specific* resources. Since regression (4) compares specific categories of resources, using these controls would be inappropriate.

5.3 Results

My results indicate that there is significant evidence to support the Dutch disease as a cause of deindustrialization, however there is not significant evidence to indicate that this is particularly the case in South America. In regressions (1) and (2), a 1% increase in PRI is related to a 0.03% decrease in MVA. Both coefficients are statistically significant at the 1% level. This is similar to the results of Kim and Lee (2014). The coefficients for the PRI*South America Dummy variable will be discussed in the next section. Unlike Kim and Lee, my results do not present statistically significant evidence that the Inverted-U curve. The coefficients for GDP^2 are lower than those of GDP, however none of them are statistically significant. My results present some limited evidence that saving has a significant effect on industrialization. Regression (1) indicates that a 1% increase in resource-adjusted saving is related to a 0.03% increase in MVA. This coefficient is significant at the 10% level, but the same coefficient in regression (2) is insignificant. My results present significant evidence for rule of law being positively related to industrialization. A 1-unit increase is the rule of law index is associated with a 1.51% increase in MVA in regression (1) and 1.3% increase in regression (2) (bear in mind that the relationships are this strong because the rule of law index only runs from -2.5 to 2.5). Both coefficients are significant at 1%. My results do not show significant evidence to support Behzadan et al. (2017)'s claim that an uneven distribution of resource rents enhances Dutch disease effects. The coefficients for the resource rents*Gini index interaction term were both negative, but neither were statistically significant. Finally, my results show evidence that 'China effects' have an effect on deindustrialization, but only in terms of imports. A 1% increase in China's import partner share is related to a 0.07% decrease in MVA. The coefficient for China's export partner share is not statistically significant. This is not necessarily surprising.

Exporting a large share of goods to China can mean a number of things. In Latin America, particularly South America, the export basket to China is dominated by primary commodities, but this is not necessarily the case for other regions. For instance, and Kim and Lee note, exporting to China has actually been an industrializing force in southeast Asia, since these countries export more complementary manufactured goods. The effects of importing from China, however, are more universal. China exports manufactured goods around the world. Those goods compete with local manufacturing, lowering MVA. The full results from regressions (1) and (2) are shown below:

Table 5.2: Lagged panel regressions. Dependent variable: manufacturing value added as a % of GDP.

VARIABLES	(1) Exports	(2) Imports
PRI	-0.0307***	-0.0342***
	(0.0115)	(0.0114)
PRI*South America Dummy	0.00615	0.0110
	(0.0279)	(0.0272)
GDP	-0.0925	1.845
	(4.967)	(4.968)
GDP^2	-0.346	-0.385
	(0.303)	(0.300)
Resource-Adjusted Saving	0.0317*	0.0263
	(0.0189)	(0.0186)
Rule of Law	1.511***	1.303***
	(0.402)	(0.396)
Resource Rents	0.189**	0.201**
	(0.0928)	(0.0924)
Gini Index	-0.0123	-0.0147
	(0.0299)	(0.0304)
Resource Rents*Gini Index	-0.00213	-0.00298
	(0.00216)	(0.00213)
China's Export Partner Share	-0.0265	
	(0.0266)	
China's Import Partner Share		-0.0672***
		(0.0242)
Constant	41.64**	29.03
	(20.50)	(20.72)
Observations	564	568
R-squared	0.403	0.396
Number of Countries	73	74

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regression (3) uses RER for its dependent variable in order to provide evidence of indirect deindustrialization. My results provide evidence that increased primary commodity exports have led to indirect deindustrialization in South America. Evidence for the rest of the 106 middle income countries in the dataset is inconclusive. The coefficient for the relationship

between PRI and RER is near zero and statistically insignificant. When we look specifically at South America, we see that a 1% increase in PRI is related to a 1.21-unit increase in RER. This coefficient is significant at the 1% level. This result provides evidence that from 1995 to 2019, South America has experienced indirect deindustrialization as a result of the Dutch disease Table 5.3 displays the full results:

Table 5.3: Lagged panel regression. Dependent variable: real exchange rate.

	(3)
VARIABLES	Real Exchange Rate
PRI	-0.00718
	(0.0610)
PRI*South America Dummy	1.211***
	(0.212)
Constant	93.96***
	(3.289)
Observations	1,645
Number of Countries	90

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regressions (4) and (5) breaks down PRI by type of natural resource. The dependent variables are MVA and RER respectively. My results show evidence that increased fuel exports lead to indirect deindustrialization but not direct deindustrialization. The coefficient for fuels in regression (4) is not statistically significant. The coefficient for fuels in regression (5) indicates that a 1% increase in fuel exports is related to a 0.194-unit increase in RER and is significant at the 5% level. More minerals and raw agricultural materials, the opposite is true — neither coefficient in regression (5) is statistically significant. Regression (4), however, indicates that a 1% increase in mineral exports is related to a 0.03% decrease in MVA and a 1% increase in raw material exports is related to a 0.07% decrease in MVA. Both coefficients are significant at 1%

level. The coefficients for food export show evidence for both types of deindustrialization. A 1% increase in food exports is related to a 0.04% decrease in MVA (significant at 1%) and a 0.15-unit increase in RER (significant at 5%). There is likely bias in these regressions, however, which I will discuss in the next section.

Table 5.4: Lagged panel regressions. Dependent variables indicated by column names.

	(4)	(5)
VARIABLES	MVA	Real Exchange Rate
Food	-0.0386***	0.151**
	(0.00937)	(0.0751)
Raw Agricultural Materials	-0.0677***	-0.267
	(0.0246)	(0.188)
Minerals	-0.0277***	0.135
	(0.00977)	(0.0856)
Fuels	-0.000645	0.194**
	(0.00940)	(0.0794)
GDP	8.626**	
	(3.430)	
GDP^2	-0.818***	
	(0.214)	
Rule of Law	0.940***	
	(0.311)	
Constant	0.109	98.57***
	(13.78)	(2.912)
Observations	1,369	1,588
R-squared	0.172	0.010
Number of Countries	92	90

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of my regressions provide evidence that the Dutch disease is one of many factors driving deindustrialization in middle-income countries today. When controlling for the Inverted-U hypothesis, 'China effects,' saving, and resource distribution, and institutional quality, the proportion of primary commodities in a country's exports has a significant negative relationship to manufacturing value added. I was not able to demonstrate that *direct* Dutch

disease effects are especially prevalent in South America as I had predicted. In fact, the results almost always indicated a weaker, less significant correlation. This could be due to a small sample (the South America only includes 10 countries) or due to bias in the data, although it could also mean that my hypothesis is simply wrong. After all, South America is far from the only resource-rich region in the world. This is one of several surprises from my results. If my results are any indication, exporting heavily to China is not necessarily a deindustrializing factor, in fact it may have the opposite effect depending on the composition of the export basket.

Regarding indirect deindustrialization, I have sufficient evidence to reject my null hypothesis. Higher PRI is associated with a higher exchange rate, and this positive relationship is stronger in South America than in other regions.

Finally, my results allow me to make inferences about the nature of the Dutch disease. The Dutch disease can lead to deindustrialization both directly and indirectly. Which type of deindustrialization a country experiences may in fact be related to what kind of resource is experiencing a boom. Regressions (4) and (5) indicate that fuel export booms lead to indirect Dutch disease effects, mineral and agricultural raw material export booms lead to direct effects, and food export booms lead to both direct and indirect effects.

5.4 Bias

There are a handful of possible reasons that I find insufficient empirical evidence to reject my null hypothesis regarding direct deindustrialization in South America. The first and simplest reason may be that the Dutch disease simply does not have a particularly strong effect on South America, or at least South America in particular. It could simply be that the straightforward interpretation of my regression results is accurate — the Dutch disease has an insignificant relationship to deindustrialization compared to other factors like rule of law,

bilateral trading relationships with China, or the inverted-U curve. This is unlikely, given that these results reach a different conclusion than the result consistently found in the literature. Cross-country studies like Kim and Lee (2014) and country-level case studies like Gonzalez et al. (2017) and Desfrancois (2019) both indicate that the Dutch disease is a prevalent deindustrializing force in the region. I believe it is more likely that the reason for my results lies in the data.

One of the simplest explanations is a small sample size. I only categorize 10 countries as being in South America. Perhaps it was impossible to reach a statistically significant coefficient while narrowing the dataset to include only 10 entities. Another possible explanation is that the Dutch disease may not be unique to South America. It may be that the Dutch disease affects South America, but not as much as other regions. Table 5.4 lists the 10 countries that recorded the highest PRI index, the year during which they recorded it, and their PRI index that year:

Table 5.5: The 10 countries in the dataset that recorded the highest PRI. Source: Author's calculations based on UN statistics division.

Country	Year PRI was highest	PRI
Nigeria	2000	99.7815
Iraq	2010	99.7643
Algeria	2013	99.1195
Angola	2017	98.6609
Belize	2008	98.5808
Buthan	2008	98.549
Azerbijan	2008	98.3668
Solomon Islands	2005	98.2995
Venezuela	2013	98.0517
Gabon	1996	98.0517

Note that only one of these countries is in South America and a plurality of these countries are in Africa. It could be that due to a heavier dependence on primary commodities

larger the Dutch disease accounts for deindustrialization on the African continent more so than in South America.

Another potential reason is that the definitions of primary commodity exports and manufacturing overlap. As I define it (based on Kim and Lee 2014), PRI exports is anything that falls in the Standard International Trade Classification (SITC) revision 3 classifications 0-4, listed below:

Table 5.6: SITC one-digit level classifications 0-4.

Classification	Definition
0	Food and Live Animals
1	Beverages and Tobacco
2	Crude Materials, Inedible, Except Fuels
3	Mineral Fuels, Lubricants and Related Materials
4	Animal and Vegetable Oils, Fats and Waxes

Recall that I also use the World Bank Development Indicators categories for different types of primary commodities. *Food* comprises everything in sections 0,1, and 4, as well as section 22 (oil seeds, oil nuts, and oil kernels). *Raw Agricultural Materials* includes everything in section 2 except for sections 22, sections 27 (crude fertilizer, minerals) and 28 (metalliferous ores, scrap). *Minerals* includes sections 27 and 28. This is the only category I define differently than the World Bank, since the original World Bank definition includes section 68 (non-ferrous metals — these are more complex and rightly fall under the category of manufacturing). *Fuels* comprises everything in section 3. Because it does not necessarily have to do with trade, The World Bank cannot define MVA using SITC and instead uses the International Standardized Industrial Classification (ISIC) revision 3. Any activity that falls under divisions ISIC 15-37 counts toward manufacturing value added. Within these 22 divisions are several primary

commodity-based manufacturers. Below are a handful of the divisions than may also fall under SITC classifications 0-4, along with the classifications the categories likely overlap with:

Table 5.7: Sample of ISIC divisions 15-37.

Division	Definition	Overlapping Category
15	Manufacturing of food products and beverages	Food
23	Manufacture of coke, refined petroleum products and nuclear fuel	Fuels
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Raw Agricultural Materials
27	Manufacturing of basic metals	Minerals

Every category of primary commodity has some manufacturing activities associated with it. Therefore, the definition of MVA and PRI are not mutually exclusive. This is a major source of bias in my regression estimations, and it is likely one of the reasons why the Dutch disease does not appear to significantly account for direct deindustrialization in South America. This also reveals an important issue with regression (4). If all of the categories of primary commodity exports are subject to overlap with MVA, none of the coefficients can reliably indicate how different categories of primary commodity exports affect the Dutch disease.

6. Conclusion

My empirical analysis provides evidence that the Dutch disease has affected South America indirectly, but not directly. Windfall gains from the region's resource boom increased incomes in the primary sector. That new income raised demand for services, which in turn raised domestic prices and with them the real exchange rates. This rendered manufacturing exports throughout the region even less competitive internationally. I strongly believe that the lack of significant evidence for direct deindustrialization in the region is due to bias in the data, given that both multi-country studies and case studies support my theoretical claim. Kim and Lee (2014), who have the most similar empirical analysis to this study, believe the Dutch disease accounts for lower MVA in Latin America but not in Southeast Asia. González at. Al. (2016) and Desfrancois (2019) find evidence of direct deindustrialization Colombia and Ecuador respectively. I believe if the MVA variable did not include resource-based manufacturing, causing it to overlap with PRI, my results would provide evidence of direct deindustrialization in South America.

Another reason the MVA doesn't quite capture what I hoped it would is that it doesn't necessarily draw the line between industries that experience learning-by-doing and industries that do not. Based the ideas of Matsuyama (1992) and Sachs and Warner (1995), I make the assumption that the manufacturing sector always experiences learning-by-doing, and the natural resource sector does not. This certainly holds as a general rule for reasons I explored in chapter 1, but there are likely exceptions to it in the non-theoretical world. For instance, Ahumada (2019) and Ocampo (2017) both point out that Mexico and Central America have come to specialize in *maquila* (low-value-added assembly) since the 1990s. *Maquila* is considered

manufacturing by the ISIC but doesn't appear to produce the same learning-by-doing effects as more traditional manufacturing.

The PRI variable can also be improved — it includes both raw natural resources exports and resource-based manufactured exports. The existence of resource-based manufacturing implies that there may be primary commodity-based activities that are complex and knowledge-intensive enough to produce learning-by-doing effects. One way to extend this work would be to attempt to answer the question of where learning-by-doing begins. Can we identify the point along the supply chains of both natural resources and manufactured goods at which learning-by-doing starts occur? If so, how is the Dutch disease affecting those specific industries? This reframing would perhaps alter the policy implications — the goal would no longer be to become less reliant on natural resources in favor of manufacturing, but to make sure that the production processes of exports, including natural resources, are complex enough to produce learning-by-doing. This view is also articulated by Pérez (2010), who argues that Latin America should look to specialize in areas such as biotechnology, nanotechnology, and new materials — all of which are both extremely knowledge-intensive and extremely natural resource intensive.

Despite the only partially conclusive results of my regressions, there is enough evidence from theory, history, and literature on the topic to indicate that the Dutch disease (or more broadly, the adverse effects of a commodity boom) is an issue that South American policy makers must be acutely aware of. Colombia and Ecuador have clearly exhibited Dutch disease symptoms. In Argentina and Brazil, windfall gains from natural resources caused institutional quality to regress in a way that had dire consequences, both economically and politically. In Venezuela, the sudden drop in oil prices set in motion a chain of events that led to a full-on economic catastrophe.

Another open question remains as to whether South America's deindustrialization has been inevitable. Some authors, like Ahumada (2019) and Palma (2019) point to an alternate timeline in which South America embraces a more open industrial policy similar to East Asia. Both authors acknowledge, however, that a number of external factors would have had to be different in order for this to work. Between the dismantling of state-led industrialization after the debt crisis, the lack of policy autonomy during structural adjustment, the boom in Chinese demand for natural resources, and the political tide of resource nationalism, most attempts in the last four decades to promote manufacturing in the region have been an uphill battle.

In our current timeline, the question remains — what to do about the Dutch disease. Some solutions have been proposed that aim to counter both the resource movement effect and the spending effect. For the resource movement effect, González et al. (2016) argue that governments should use natural resource rents to invest in higher value-added industries, thereby avoiding direct deindustrialization. If the experiences of Argentina and Brazil are any indication, the success of this approach depends on institutional quality, which varies significantly throughout the region. Regarding the spending effect, Behzadan et al. (2017) show significant empirical evidence that a more equal distribution of resource rents can stem the spending effect, which they point out is driven mostly by rich consumers. Ocampo (2017) argues for countercyclical macroeconomic policies like those applied in Chile to promote greater saving during boom years. Both of these approaches are designed to blunt the spike in demand for services during resource booms, thereby reducing real exchange rate appreciation and with it, indirect deindustrialization. The Dutch disease presents a difficult challenge for South America, but not an insurmountable one.

Conclusion in Spanish (Conclusión en Español)

Mi análisis empírico provee evidencia que la enfermedad holandesa ha afectado a Sudamérica indirectamente, pero no directamente. Ganancias inesperadas de la bonanza de recursos naturales aumentó a los ingresos en el sector primaria. Estos nuevos ingresos aumentaron a la demanda por servicios. Como resultado, subieron los precios domésticos y con ellos, los tipos de cambio reales. Esto hizo que las exportaciones de manufacturas en toda la región fueran aún menos competitivas a nivel internacional. Creo firmemente que la falta de evidencia de desindustrialización directo en la región es debido a problemas con el base de datos, dado que tanto los estudios de varios países como los estudios de caso proveen evidencia para mi afirmación teórica. Kim y Lee (2014), quienes tienen el análisis empírico mas similar a este estudio, da evidencia de que la enfermedad holandesa explica el VAM más bajo América Latina, pero no en el sudoeste de Asia. González y otros (2016) y Desfrancois (2019) encuentran evidencia de desindustrialización directa en Colombia y ecuador, respectivamente. Creo que, si la variable de VAM no incluyera manufactura basado en recursos naturales, causando que se superpusiera con PRI, mis resultados darían evidencia de desindustrialización directa en Sudamérica.

Otra razón por la que la variable de VAM no captura lo que esperaba es que no necesariamente marca la línea entre las industrias que se benefician del aprendizaje por la práctica y las industrias que no. Basado en las ideas de Matsuyama (1992) y Sachs y Warner (1995), supongo que el sector manufacturero siempre se beneficia del aprendizaje por la práctica, y que el sector primario no. Esto ciertamente se mantiene como regla general por las razones que expliqué en el capítulo 1, pero es probable que haya excepciones en el mundo real. Por ejemplo, Ahumada (2019) y Ocampo (2017) señalan que México y Centroamérica se han

especializado en maquila desde los 1990. Según la clasificación industrial uniforme, Maquila se considera 'manufactura,' pero agrega relativamente poco valor y no se beneficia de aprendizaje por práctica tanto como manufactura mas tradicional.

La variable PRI también se puede mejorar: incluye tanto las exportaciones de recursos naturales brutos como las exportaciones de manufacturas basadas en recursos. La existencia de manufacturas basadas en recursos implica que es posible que hay actividades basadas en recursos naturales que sean suficientemente complejos y intensivos en conocimiento para producir los efectos de aprendizaje de práctica. Una forma de ampliar esta tesis sería intentar responder a la pregunta de donde comienza en aprendizaje de práctica. ¿Es posible identificar un punto en las cadenas de suministro, tanto de recursos naturales como de manufactura, donde se inicia el aprendizaje por práctica? Si es así, ¿Cómo esta afectando la enfermedad holandesa a esas industrias específicas? Esto quizás replantearía las implicaciones políticas — el objetivo ya no sería volverse menos dependiente de recursos naturales, sino asegurarse que los procesos de producción de todas las exportaciones sean suficientemente complejos para beneficiarse del aprendizaje de práctica. Este punto de vista también es articulado por Pérez, quien sostiene que América Latina debe intentar especializar en áreas como biotecnología, "nanotecnología, bioelectrónica y nuevos materiales," todos los cuales bastante intensivo tanto en conocimiento que en recursos naturales (2010).

A pesar de los resultados sólo parcialmente concluyentes de mis regresiones, hay suficiente evidencia de la teoría, la historia y la literatura sobre el tema para indicar que la enfermedad holandesa (o más ampliamente, los efectos adversos de la bonanza de las materias primas) es un problema de que los autoridades y profesionales deben estar muy atentos. Colombia y Ecuador han exhibido síntomas de la enfermedad holandesa. En Argentina y Brasil,

las ganancias inesperadas de los productos primos hicieron que la calidad institucional bajó en una manera que tuvo consecuencias terribles, tanto políticas como económicas. En Venezuela, la caída repentina de los precios del petróleo puso en marcha una cadena de eventos que terminó en una catástrofe económica total.

Queda abierta otra pregunta: ¿La desindustrialización en Sudamérica ha sido inevitable? Algunos autores, como Ahumada (2019) y Palma (2019) señalan una línea temporal alterna en la que Sudamérica adopta una política industrial más abierta como la de los países de Asia. Sin embargo, ambos autores reconocen que varios factores externos habrían tenido que ser diferentes para que esto funcionara. El desmontaje de la industrialización dirigida por el estado después de la crisis de la deuda, la falta de autonomía política durante del ajuste estructural, la bonanza de la demanda china de productos primos y la marea política hacía el nacionalismo de recursos — todos estos factores hacían que la mayoría de los intentos en las últimas cuatro décadas para promover la manufactura en la región ha sido una batalla en subida.

En nuestra línea temporal actual, la cuestión es que hacer con la enfermedad holandesa. Se han propuesto algunas soluciones que buscan tratar con los efectos de reasignación de recursos y de gasto. Para el efecto de reasignación de recursos, González y mas (2016) argumentan que los gobiernos deberían utilizar las rentas de los recursos naturales para invertir en industrias de mayor valor agregado, evitando así la desindustrialización directa. Si las experiencias de Argentina y Brasil son un indicio, el éxito de esta estrategia depende de la calidad institucional, que varia mucho en la región. Para tratar con el efecto de gasto, Behzadan y mas (2017) muestra evidencia empírica significativa que una distribución mas igual de las rentas de recursos puede detener el efecto de gasto, que es impulsado principalmente por los consumidores ricos. También, Ocampo (2017) proponga políticas macroeconómicas anticíclicas

como las aplicadas en Chile para promover un mayor ahorro durante los años de bonanza. Ambos enfoques están diseñados para mitigar el aumento de la demanda de servicios durante el auge de los recursos, reduciendo así la apreciación del tipo de cambio real y, con ella, la desindustrialización indirecta. La enfermedad holandesa presenta un desafío difícil para Sudamérica, pero no insuperable.

7. Appendix

Sata Do-file used for this study:

```
/********
Gabriel Melmed
Idependent Study Spring 2021
*********/

clear all
set more off

use "/Users/gabrielmelmed/Desktop/Woo/Senior Year/IS/IS Dataset
(all).dta"

/*Changes to the dataset I've already made and saved:

encode countryname, gen (countryid) // creates a numeric country
ID variable

generate south=0 // creates a South America dummy
label variable south "South America Dummy" // labels the newly
created variable
replace south=1 if countrycode=="ARG" // assigns Argentina
replace south=1 if countrycode=="BOL"
replace south=1 if countrycode=="BRA"
replace south=1 if countrycode=="CHL"
replace south=1 if countrycode=="COL"
replace south=1 if countrycode=="ECU"
replace south=1 if countrycode=="PRY"
replace south=1 if countrycode=="PER"
replace south=1 if countrycode=="URY"
replace south=1 if countrycode=="VEN"

gen PRI = rawagX+foodX+mineralX+fuelX // creates % of primary
commodities in total exports
label variable PRI "Total Primary Commodities (% of merchandise
exports)"

gen saving=grosssavings-depletion

gen lnGDP=ln(GDP)
gen lnGDPsq=lnGDP^2
```

```
gen GDP_l1=l1.lnGDP // creates a lagged variable (1 time period
lag)
gen GDPsq_l1=l1.lnGDPsq
gen chinaX_l1=l1.chinaX
gen chinaM_l1=l1.chinaM
gen fuelX_l1=l1.fuelX
gen rawagX_l1=l1.rawagX
gen foodX_l1=l1.foodX
gen mineralX_l1=l1.mineralX
gen PRI_l1=l1.PRI
gen RER_l1=l1.RER
gen rents_l1=l1.rents
gen gini_l1=l1.gini
gen distribution_l1=l1.distribution
gen saving_l1=l1.saving
gen effectiveness_l1=l1.effectiveness
gen ruleoflaw_l1=l1.ruleoflaw
gen corruption_l1=l1.corruption

*/

xtset countryid time // setting it up for panel linear
regression, entity = country, time = year

*Regressions:

*MVA as DV:

xtreg MVA PRI_l1 south#c.PRI_l1 GDP_l1 GDPsq_l1 saving_l1
ruleoflaw_l1 c.rents_l1##c.gini_l1 chinaX_l1, fe // estimates a
time series regression with fixed effects
outreg2 using "/Users/gabrielmelmed/Desktop/Woo/Senior
Year/IS/Estimation Results 1.doc", replace ctitle(Exports)

xtreg MVA PRI_l1 south#c.PRI_l1 GDP_l1 GDPsq_l1 saving_l1
ruleoflaw_l1 c.rents_l1##c.gini_l1 chinaM_l1, fe
outreg2 using "/Users/gabrielmelmed/Desktop/Woo/Senior
Year/IS/Estimation Results 1.doc", append ctitle(Imports) //
adds another column to the word doc

*RER as DV:

xtreg RER PRI_l1 south#c.PRI_l1, fe
```

```
outreg2 using "/Users/gabrielmelmed/Desktop/Woo/Senior
Year/IS/Estimation Results 2.doc", replace ctitle(Real Exchange
Rate)

*categories:

xtreg MVA foodX_l1 rawagX_l1 mineralX_l1 fuelX_l1 GDP_l1
GDPsq_l1 ruleoflaw_l1, fe
outreg2 using "/Users/gabrielmelmed/Desktop/Woo/Senior
Year/IS/Estimation Results 3.doc", replace ctitle(MVA)

xtreg RER foodX_l1 rawagX_l1 mineralX_l1 fuelX_l1, fe
outreg2 using "/Users/gabrielmelmed/Desktop/Woo/Senior
Year/IS/Estimation Results 3.doc", append ctitle(Real Exchange
Rate)

corr MVA RER PRI lnGDP lnGDPsq saving ruleoflaw rents gini
chinaX chinaM

corr MVA RER foodX rawagX mineralX fuelX

twoway (line MVA time) if south==1
```

Correlation Matrices:

	MVA	RER	PRI	lnGDP	lnGDPsq	saving	ruleof~w	rents	gini	chinaX	chinaM
MVA	1.0000										
RER	-0.1088	1.0000									
PRI	-0.2287	0.1775	1.0000								
lnGDP	0.0383	0.0168	0.0898	1.0000							
lnGDPsq	0.0267	0.0197	0.0875	0.9986	1.0000						
saving	0.4092	-0.1070	-0.1591	0.0234	0.0212	1.0000					
ruleoflaw	0.1173	-0.0264	-0.1115	0.1488	0.1519	0.0298	1.0000				
rents	-0.1769	-0.0278	0.4403	0.0765	0.0815	-0.0231	-0.3180	1.0000			
gini	0.0080	0.1038	0.1792	0.2492	0.2470	-0.0824	0.3193	-0.1193	1.0000		
chinaX	-0.1196	0.0906	0.1636	0.1283	0.1351	0.0063	-0.1422	0.3680	-0.0999	1.0000	
chinaM	-0.0846	0.3006	0.1726	0.0691	0.0790	-0.0211	-0.0733	0.1532	-0.0883	0.4338	1.0000

	MVA	RER	foodX	rawagX	mineralX	fuelX
MVA	1.0000					
RER	-0.0570	1.0000				
foodX	-0.1423	0.0581	1.0000			
rawagX	-0.0669	-0.0363	0.1276	1.0000		
mineralX	-0.2834	0.0152	-0.0839	-0.0200	1.0000	
fuelX	0.0297	0.0889	-0.3725	-0.0883	-0.1115	1.0000

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