Reprimarization, Mining TNCs and the Environment in the Brazilian Amazon

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ABSTRACT

This article examines the current tendency of reprimarization in Brazil, and its relation to the transformations that took place in the Amazon, establishing it as a frontier of capitalist accumulation. It also analyzes the socio-environmental impacts of these changes. In order to explain these phenomena, this paper studies both global changes associated with the shift toward neoliberal globalization and the hegemony of transnational capital, as well as the role of the State in Brazil, from the time of the military dictatorship through to the present, and the role of ground rent for mining and agroindustry.

The sectors which have come to be emblematic for the reprimarization tendency of Brazil correspond to the most dynamic industries in the Amazon, namely mining, soy, and cattle. Among these, we analyze the mining sector in greater detail. Most notable about this sector is the role of the State, finance, and TNCs. Moreover, there is the importance with respect to socio-environmental issues, such as deforestation and hydroelectric dams. In order to provide a more in depth analysis we chose two paradigmatic cases of mining companies with a long history of links to transnational capital: Vale and Rio do Norte Mining. In addition to the mining sector we present a critical assessment of the social and environmental impacts of the changes which the Brazilian Amazon has experienced in recent decades.

Key words: Reprimarization, Brazilian, Amazon, Transnational Mining, Ground rent, Environment

1. INTRODUCTION

The Amazon is often described as the lungs of the planet and is often discussed in the context of global climate change. However, there is much less discussion of the degree to which the Amazon constitutes a frontier of global capital accumulation. The particularly strong expansion of mineral exploration, soy, lumber and cattle is far above the average for the rest of Brazil and this growth is associated with the tendency towards reprimarization, as well as with deforestation. This paper seeks to explain these transformations in the Brazilian Amazon by considering the overall global context and the role of the Brazilian State and transnational corporations (TNCs). Moreover, we examine the socio-environmental impacts associated with this recent expansion. Although several sectors, such as soy, cattle and lumber, have contributed to this tendency, we emphasize the mining sector and also consider the infrastructural projects linked to recent expansion, such as highways and hydroelectric dams.

This paper first considers the tendency toward reprimarization in general, identifying the role of neoliberal globalization, institutions, such as the WTO, and especially the role of TNCs. In addition to the role of the State in promoting transnational accumulation in the Amazon,[3] the attraction of highly fertile land and high productivity mines, associated with ground rent, is a major incentive for TNCs. The negative impacts for the environment as well as for peasant and indigenous populations are also considered.

Brazil was 3rd in terms of mining investments worldwide, in 2010, and the Amazon is the mining sector's frontier in Brazil. In this context, we evaluate the role of the State regarding transnational capital and finance in mining over recent decades. In order to present these aspects of mining concretely, two case studies are considered: Mineração Rio do Norte (Rio do Norte Mining Company, MRN); and Vale. The main results reveal how the Brazilian State, through a combination of legal and extra-legal means, accommodated mostly foreign mining TNCs. Unfortunately, this expansion of mining, as well as soy, cattle and lumber, have contributed to the troubling tendency of reprimarization in Brazil and to several negative consequences for the local populations and the environment.

2. TENDENCY TOWARDS REPRIMARIZATION

In order to understand the factors which led to reprimarization in Brazil and Latin America it is necessary to look back first at the rise of neoliberalism and other factors that contributed to the tendency for deindustrialization for a number of countries such as Brazil. In fact a number of phenomena which began in the 1970s, in the global economy, but also in Brazil, are key to understanding the phenomena of reprimarization in Brazil and the unprecedented growth in the Amazon over the last 20-25 years.

2.1 Neoliberal Globalization

During the 1970s the IMF encouraged the expansion of debt for countries such as Argentina, Brazil and Mexico. Although this led to increased industrialization for Brazil and Mexico, it unfortunately led to deindustrialization for Argentina. This increased debt became problematic, especially after the Volcker interest rate shock of 1979. In fact, it was seen as the principal catalyst for the debt crisis in Latin America during the 1980s. As a result, the IMF and creditors of the first world used the debt crisis as leverage for forcing countries to adopt neoliberal policies, often undermining national industry. For example, free trade meant less protection for national industry and financial deregulation led to increased financial speculation, often at the expense of investment in manufacturing. In the case of Brazil, the shift to neoliberal policies came later than most of Latin America. The trade liberalization began with Collor de Mello in the early 1990s, while the push for financial deregulation, and privatizations came with Cardoso and the neoliberal *Plano Real* in the mid-1990s. Subsequently, in order to keep attracting foreign capital, often speculative finance capital, Brazil maintained the highest interest rates in the world for over ten years, and this combined with an overvalued currency, meant an even more difficult situation for Brazilian manufacturing.

TNCs were also key actors in this process of neoliberal globalization, transforming production processes and the expansion of transnational *commodity*[4] chains across the globe. Associated with the increasing domination of TNCs, there has been the emergence of a transnational capitalist class (TCC), as argued by Robinson and Sklair (Robinson, 2004 and 2008, Sklair, 2001).[5] Given the imperative to accommodate the interests of TNCs and the emerging TCC, there has been a decline in terms of the autonomy and relevance of national policies, be it industrial, commercial or financial. Between transnationalization and the implementation of neoliberal policies, there was a clear end to the alternative represented by Import Substitution Industrialization (ISI).

The neoliberal reforms in the mining sector were particularly notable and in Latin America at least 14 countries made changes to accommodate TNC investment in mining since 1989. The reforms were implemented, as much in countries with a major mining tradition, such as, Chile, Bolivia, México and Brazil; as in those countries which had been almost inactive, such as the cases of Ecuador, Argentina, Uruguay, Paraguay and Colombia. Investments in mining exploration in Latin America increased by 500% between 1991 and 1999 (See Borg, 1998). Latin America went from being the fourth most common destination for investment in mineral exploration in 1991, to the primary destination by 1997 and still so in 2010. In terms of individual countries, Brazil was the third most common destination behind Australia and Canada with 13% of all investment in 2010 (See ECLAC, 2013: 30).

The amazing growth of China had led to a surge in the prices of metals at the world level, quadrupling between 2002 and 2007. As a result, many Latin American countries, which includes several progressive governments, have experienced an increased role of the State in facilitating the expanded role of TNCs in mining and associated infrastructure projects.

2.2 Role of the WTO

Another main factor, also associated with neoliberal globalization, has been the transformation of GATT into the WTO and the subsequent limiting of the autonomy of national policies, be it industrial, commercial or finance in the periphery. The rules have changed extensively, as well documented by Chang (2002). At present, most countries in the periphery have minimal chances of seriously competing on the world market in the area of manufacturing other than TNC assembly plants, and are thus forced to rely on those exports which have an associated differential rent, namely primary goods. It could be argued that, if the WTO rules were in effect in the 19th century, neither the U.S., nor Germany, could have come to have the success they did in competing against Great Britain. Moreover, the differentials in productivity today, range from 5 to 15 times between the center and the periphery, implying even less chance for technological catch up, with few exceptions, such as South Korea (See Chang, 2002: 21-22).

Between the ever-growing hegemony of the TNCs in the global economy, especially in manufacturing, combined with the necessity of accommodating WTO rules, the limited industrialization became further undermined and those that had been more successful often experienced deindustrialization. With the surge in *commodity* prices, the tendency of reprimarization became established for several countries in the periphery, including Brazil.[6]

2.3 Reprimarization

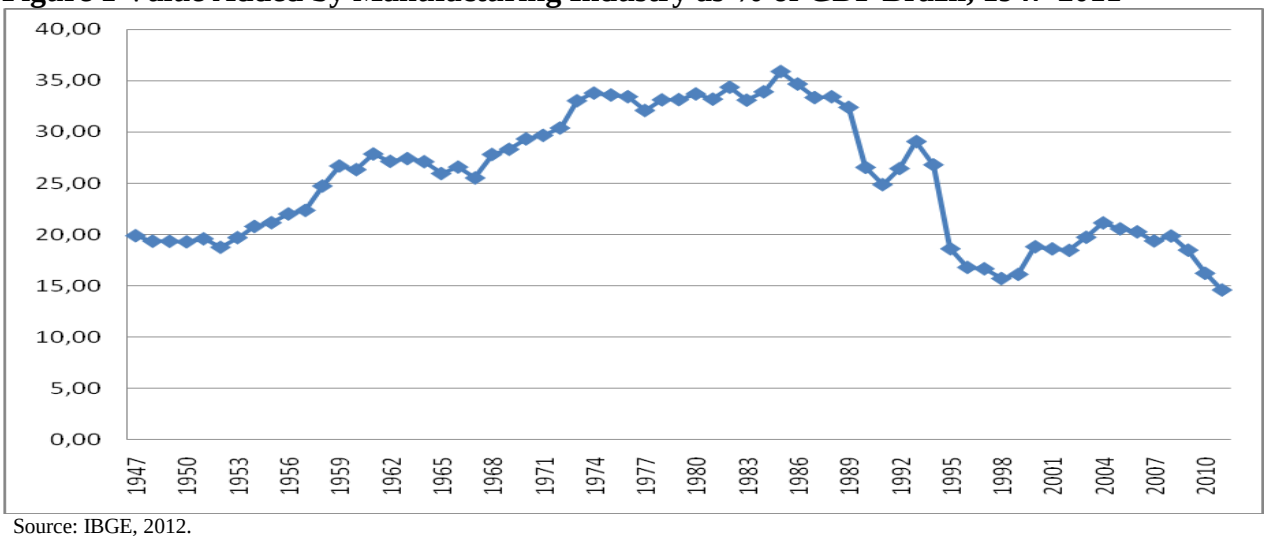
For Latin America in general, recent decades have seen a marked decline in manufacturing, especially national producers, while mining, agroindustry (e.g., soy and cattle), and other extractive sectors, associated with reprimarization, have expanded significantly. This has led a number of authors to describe the current period as neo-extractivist (for example, see Gudynas, 2009).

During the last ten years, there has been a particular increase of trade with China, such that it has become the first or second primary destination of exports and source of imports for the great majority of Latin America (See Slipak, 2014: 114). This is primarily due to China´s interest in insuring the supply of raw materials for its unparalleled manufacturing sector, but also another market for its manufacturing exports. Moreover, China has also been investing and buying land in many countries of the region, linked to the primary sectors mentioned, as well as engaging in major infrastructural projects, such as the construction of hydroelectric dams, highways, railroads, etc. In part, this has been accomplished through major loans for a number of Latin American countries, and in the case of Brazil, there are plans for the creation of a joint $50 billion fund to invest in Brazil's infrastructure, supported by Chinese and Brazilian banks. In just 2014, China increased its lending by 71% to the region, reaching US $ 22 billion dollars- the main recipients being Brazil, Venezuela, Argentina and Ecuador. As of 2016, the new BRICS Development Bank will issue its first loan, with Brazil being a potential candidate. Before presenting more details on the tendency of reprimarization in Brazil, a brief presentation of deindustrialization in first presented below.

2.4 Deindustrialization in Brazil

Considering the most cited measure of deindustrialization, namely manufacturing's share of GDP in percentage terms, Brazil's manufacturing industry achieved its maximum percentage of GDP in 1986, at 32%. This was followed by a declining tendency until bottoming out at 20% in 1998 and then beginning a slight recovery to 23% in 2005, though followed by a downward trend in recent years. This latter tendency is also clearly evident in the series for value added as a percentage of GDP as presented in Figure 1. It can be argued that this series is actually more worrisome, having declined from over 35% of GDP in 1986 to only 10.91% in 2014.

Figure 1 Value Added by Manufacturing Industry as % of GDP Brazil, 1947-2011

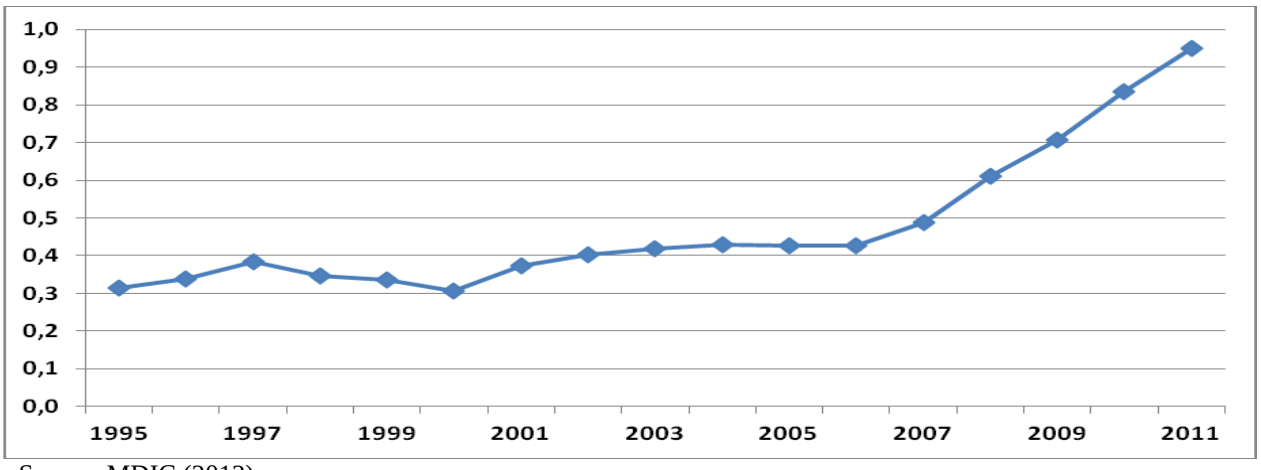


Source: IBGE, 2012.

2.5 Reprimarization in Brazil[7]

Brazil experienced a noticeable increase in the value of exports, tripling between the years 1999 and 2009, and reaching over US$ 100 billion. This trajectory of export expansion has been increasingly dominated by agroindustry and mining and as evident in Figure 2 below, the ratio of primary goods exports to that of industrial exports has increased substantially. In 1995, this ratio was 0.31, implying that primary goods represented less than a third of industrialized goods and over the last fifteen years, this index has continually increased, reaching 0.95 in 2011. Thus, exports of primary products are roughly 50% of total exports, and this is in clear contrast to the ISI period when exports of manufactured products were much higher in percentage terms. Brazil´s export dynamic is revealing for the period 1991 through 2009: while Brazil´s exports overall grew by approximately 318%, the exports of primary goods grew by 525%.

Figure 2: Ratio of Primary exports to manufacturing exports (Brazil - 1995-2011)



Source: MDIC (2012).

In addition to the steady shift from manufacturing toward primary sectors, there has also been a shift from sectors of higher value added to those with lower value added and a move towards less technologically advanced goods. The principle products exported by Brazil are primary goods: iron, oil and other soy products, sugar, coffee and beef, with iron ore being the principal item for export (see Table A1). Before moving on to section 3, the environmental impacts of reprimarization in general are first considered.

2.6 Environmental Impact of Reprimarization

The idea of scaling back industry and moving toward primary goods may initially seem like the environment should be better off. Nevertheless, in the case of reprimarization, in Latin America there are a number of serious environmental problems. The principal ones being: (1) deforestation of the Amazon Rain Forest, linked to the expansion of lumber, cattle and soy; (2) air, water, and soil pollution as a result of mining and the use of pesticides in agriculture, especially for soy; (3) soil erosion as a result of mining and soy; (4) socio-environmental issues around hydroelectric dams. The latter are often seen as strongly linked to the expansion of the mining sector, given its high demand for electricity.

In section 3 in the discussion of the expansion of soy and cattle, a number of environmental issues are highlighted. In particular, the issues of pesticides, the use of transgenic seeds, soil erosion and deforestation are considered. Subsequently, after an historical analysis and the two cases studies of mining in the Amazon are presented, the socio-environmental impacts associated with mining are discussed in section 5. Lastly, the general socio-environmental impacts associated with the tendency toward reprimarization are identified.

3. THE STATE AND CAPITALIST ACCUMULATION IN THE AMAZON

3.1 Historical Background

Historically, the State involvement with regards to development projects clearly demonstrate that the primary interest is the accumulation of capital. A fundamental role of the capitalist State is insuring social reproduction, namely maintaining the availability of key components necessary for accumulation: the labor force, access to land, and infrastructure. In addition, the capitalist State is also expected to carry out crucial political functions, such as ideological legitimation, and social control. (See O'Connor, 1977 and Jessop, 1982).

The Brazilian government, whether military or civilian, has been quite proactive for major development projects in recent decades, and thus insuring support for physical infrastructure

projects. The most salient examples were: (1) highways; (2) hydroelectric dams; (3) electricity and energy system grids; and (4) facilities for water access and treatment. Another major example of the role of the State was in the extensive process of the privatization of state enterprises during the 1990s.[8]

One of the main interventions carried out by the State in the Amazon has been the construction of major highways, seeking a greater integration of the region with the rest of the country (See Figure 3). The principle highway associated with this integration is known as the Belém-Brasília highway, route number BR-010. This was slated for construction back in the 1960s, during the Kubitschek government (1956-60), and the total distance covered was approximately 2,000 kilometers. During the military dictatorship (1964-1985) there were several highways proposed. The largest of them, namely, BR-230, is known as the Transamazon Highway, and it traversed the whole region, covering a total distance of approximately 5,000 kilometers. This highway is recognized as having been largely responsible for the intense process of deforestation and the often chaotic occupation of territories in the areas adjacent to it. Most recently, the main highway constructed in the region is BR-163, referred to as Cuiabá-Santarém, and it covers roughly 3,500 kilometers integrating the main points of production of soy, and one of the main export routes, from the *Centro-Oeste* (Center-West) of Brazil to the North and the port city of Santarém on the Amazon River.

A major aspect of the military government's strategy, was promoting the Amazon so as to provide primary and intermediate goods to complement the expansion of the strong industrial base in the South of Brazil. This process was promoted as part of the *II Plano Nacional de Desenvolvimento* (2nd National Development Plan, II PND), which was from 1975 to 1979. This was during the military government of Geisel, and is associated with a third phase of industrialization. As a result of IMF loans, the government was able to promote a range of projects and programs. One of the most notable examples was the *Superintendência de Desenvolvimento de Amazônia* (Amazon Development Authority, SUDAM), which involved major programs of fiscal incentives, leading to migrations of both capitalists and workers and also land speculation.

Another initiative pursued by the Brazilian State, seeking greater regional integration,[9] was known as the *Operação Amazônica*, the Amazon Operation. As of 1966, this was institutionalized through a combination of laws. Most notable was the policy of fiscal incentives, with a significant impact for agro-industry and livestock production. For example, private companies could obtain an exemption of up to 100% of their taxes; this policy was maintained until 1982. There were also tax exemptions for exports of regional goods and taxes on imported machinery and equipment. These are all examples of state intervention facilitating the dynamic process of capitalist accumulation in

the Amazon. In addition to these public policies, there were a range of mechanisms employed, not always legal, including the expropriation of peasant and indigenous communities.[10]

The centralized power of the State is able to control and regulate particular markets, such as for minerals. This influence was particularly strong under the dictatorship from 1964-1985, accommodating large private Brazilian firms and TNCs, and especially access to and control over financial resources and investments. In spite of the alleged claims of the collective development of the economy, the interests of big capital came to dominate. Although the military government is long gone, given the dominance of neoliberalism and the influence of TNCs in Brazil today, the transnational interests in finance, agribusiness or mining have a much greater influence compared to other social actors and the general population. In the next section, the dynamic expansion associated with the growth of lumber, soy and cattle since 1990 is presented, as well as the impact on deforestation in the Amazon.

3.2 Capitalist Accumulation in the Amazon and Deforestation[11]

As argued above, the Amazon currently constitutes a frontier for capital accumulation, reflecting the confluence of processes internal to the region and an ever growing presence of TNCs. In the last two decades, the economic expansion in the Amazon has been increasingly integrated with world markets, primarily for soy, cattle, lumber, and minerals.

A common trajectory is the removal of trees for the lumber industry and in order to establish pastures for cattle ranching. This is often followed by an intermediate crop, such as rice, prior to the planting of soy, given the need for reestablishing the nutrients in the soil which are undermined as a result of livestock production. Although soy is heralded as a green and environmentally friendly alternative to cattle ranching it is often the motor behind the process of deforestation in the Amazon.

From 1990-2007, the gross value of soybean production in the Amazon region grew by 21 percent per year, while cattle herds were growing at rates of 7 percent per year, compared to an average annual growth rate of just 0.57 percent for the rest of Brazil.. The combination of the expansion of cattle ranching and soy is a qualitative advance compared to the previous frontiers of colonization and land speculation. Both cattle and soy are strongly integrated with global markets and are far more capitalized than the other activities that dominated the region up through the 1970s and 1980s. In fact, this is an example of a process of accumulation by dispossession carried out by the military government, which laid the groundwork for a qualitatively new phase of capital accumulation. Most of the growth in Brazilian cattle—an increase of more than 180 percent in 16 years —occurred in the Amazonian states of Mato Grosso, Pará, and Rondônia, where deforestation is greatest. This phase of expansion in the Amazon is also reflected in the contribution of primary

good exports from the region compared to Brazil as a whole: from 10.13% in 1995 up to 22.2% in 2010.

Soy production in Mato Grosso constitutes some of the most competitive conditions for this crop globally. It is very capital intensive, based on the high tech machinery employed, such as harvesters, and the combination of genetically designed seeds, such as Roundup Ready, with the intensive use of agro-toxics, such as glyphosate. The recent shift toward a more intensive use of technology reached a more mature stage in the 1990s. This was with the introduction of a technological package including genetically modified zero-tillage seeds (GMOs), more agro-toxins, such as fertilizers, pesticides and herbicides (Teubal, 2006), especially glyphosate, as there was an increasing role of the ever more dominant GMOs and toxic cocktails.

"Roundup Ready" is a variant of a soy seed particularity resistant to glyphosate. As a result, the intensive use of "zero tillage" combined with RR increased productivity and reduced the level of erosion initially. However, afterwards the opposite took place as the toxic cocktail ended up impoverishing the soil in terms of nutrients, particularly impacting the microbial mechanisms necessary for a healthy subsoil. The soil eventually suffers an erosion worse than the initial one and leads to the destruction of key aspects of the biosphere. The use of pesticides also affect the workers and moreover, are transported through the air impacting adjacent communities, causing general health problems as well as more serious illnesses, such as cancer or anencephaly.

A major concern is the transnationalization of the market of inputs, in which the small clique of TNCs achieved a consolidation as providers of seeds, fertilizers, and pesticides and thus capturing an increasing portion of the ground rent generated by such activities. The TNCs associated with agrochemicals include Monsanto, Syngenta, Nidera and Bayer, while those which dominate the grain business are referred to as ABCD: Archer-Daniel Midland, Bunge, Cargill and Dreyfus, which in recent years have gained a considerable presence. (Kejsefman, 2014).

The high levels of profitability in these sectors, explain the attraction of TNCs, and in fact some are Brazilian companies. In the area of beef products, JBS has become the largest meat product company on the globe and much of its recent expansion is based on livestock production in the Amazon. In the case of soy, besides the ones referred to above, include the Brazilian company, Amaggi, which is a major producer of soy products globally. The high profitability of these sectors, especially soy, reflect the differential fertility and thus differential rents, which are expressed as extraordinary profits for the largest firms, often TNCs.

The current phase of development in the Amazon has two contradictory aspects. The first aspect is that the production chains involving primary goods exports are rather short, which implies the incapacity to generate value added in Brazil and the problem of not having the profits or rents

re-invested. If it were possible to appropriate the ground rent, be it from mining or agriculture, for local development, this could be the basis for a different type of regional development, one more sustainable for both society and the environment, instead of just one that primarily accommodates the large corporations, whether foreign or national TNCs. The second aspect is with respect to the tax and tariff exemptions for the companies that export the primary products extracted.[12] In spite of the national benefits in terms of foreign exchange, there is a clear lack of federal support, in the form of taxes or federal subsidies for the states that grant TNCs major tax breaks. Therefore the states that are net exporters of these primary goods, do not receive taxes from thee exporters and end up bearing the social and environmental fiscal burden alone. This section has primarily elaborated upon the soy and cattle sectors, identifying the increasing transnationalization in the Amazon, as well as environmental concerns. In the next section, the focus is on the mining sector and its expansion in the Amazon in recent decades.

4. MINING IN THE BRAZILIAN AMAZON

4.1 Historical Background

Of major importance is the special relationship between the Brazilian State and mining transnationals, whether foreign or Brazilian.[13] The role of the State with respect to mining TNCs is associated with three main areas. The first is facilitating the formation of joint ventures between foreign TNCs and Brazilian firms and securing financial support. The latter often involved either Brazilian public banks or foreign entities, such as the World Bank or IBRD, and often the State would bear the responsibility of paying back the loans. The second is the State's central role in the provision and maintenance of infrastructure necessary to insure smooth operations for the mining companies and transport of the products within the country or for export. The third is with respect to the legal apparatus for the regulation of mining, primarily for the benefit of mining companies. This includes not only mining codes and sub-soil property rights, but also systems of business and tax regulations.

In addition to an analysis of the three main areas referred to above, this section will analyze the dynamics of the accumulation of mining companies in the Amazon. Transnational mining capital is currently predominant in the Brazilian Amazon region and large-scale industrial mining has been ongoing for approximately six decades.

The industry was launched by the exploitation of manganese in Amapá, discovered shortly after WWII and exploited by an association between the Brazilian enterprise *Indústria e Comércio de Minérios* (Industry and Trade of Minerals, Inc., ICOMI) and the US transnational Bethlehem

Steel, starting in 1957. In the late 1960s, new mineral discoveries were made—particularly in Pará—which had been promoted by global mining giants, namely, US Steel and Alcan.

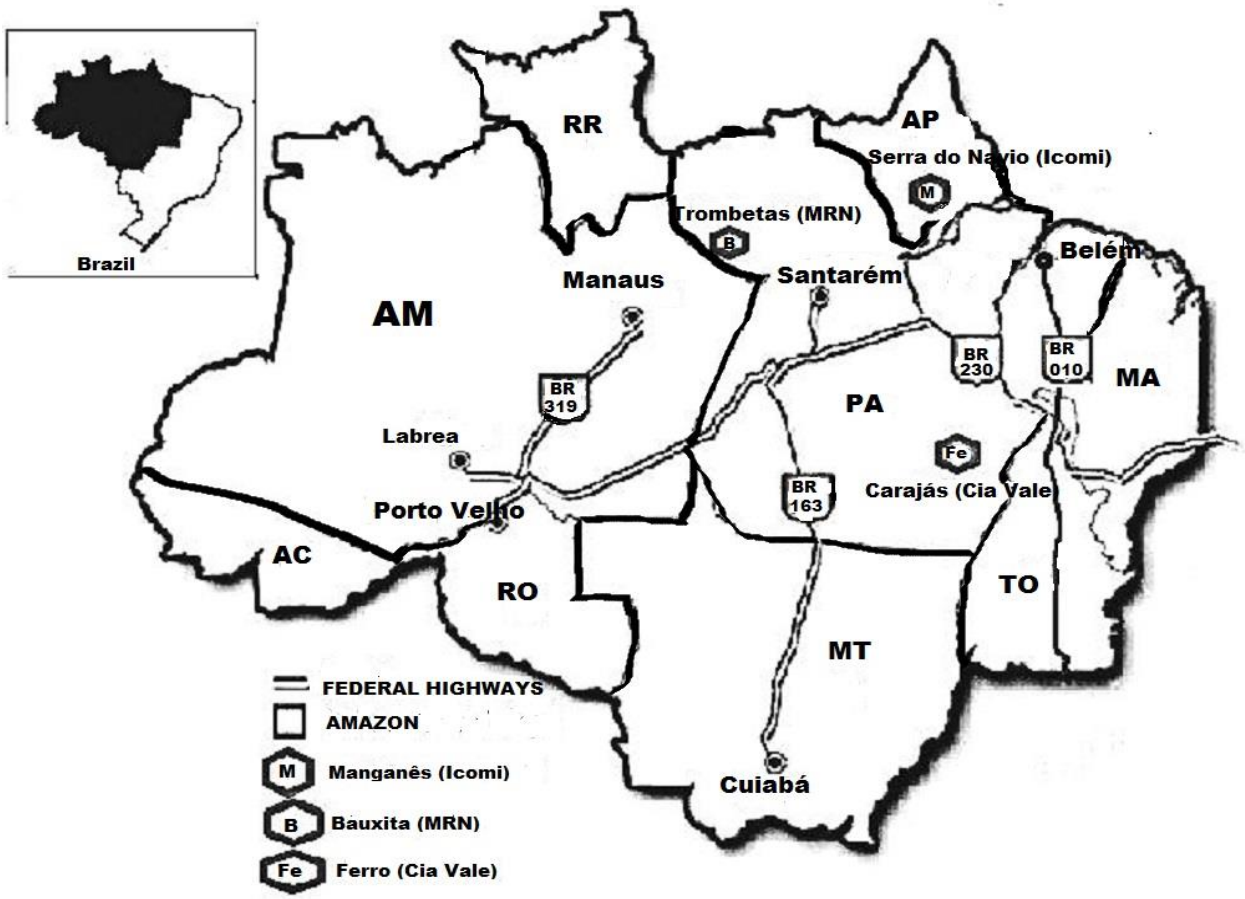
Related to these discoveries was the push by the military government to change Brazilian mining law in 1967, and thus accommodate TNCs operating in Brazil in two ways: (1) one by facilitating the formation of joint ventures between foreign TNCs and Brazilian firms; and (2) allowing TNCs to obtain ownership of any ore once a mining concession had been established. In the field of mineral exploration, the government`s involvement varied. At times the State operated in partnership with TNCs and at other times with private national firms, and lastly, mining was sometimes carried out by just state enterprises, such as Vale, which was previously the state enterprise CVRD (See note 10).

Nevertheless, it was during the decades of the 1970s and 1980s when the development of a group of mining enterprises in the Amazon reached another level. As mentioned above, part of the military government's strategy was to provide minerals for industry of the South, in addition to the generation of foreign exchange, by increasing mineral exports.

Mining codes establish the basis for economic exploitation of the subsoil,[14] and they are crucial in defining the conditions of land access and exploitation, which then determine the possibilities for accessing potential ground rent or surplus profit. The State can either hold the monopoly of the land or transfer it to private capital, enabling a greater or smaller appropriation of ground rent by capital, depending on the type of concession granted.

The Brazilian Mining Code of 1967, is currently being revised,[15] in spite of its already rather liberal or free-market orientation, as argued by Leal, in his excellent study on the "political aspect of mining" in the Amazon. This mining code is a legal framework which constitutes "the hand of the State assisting private enterprise" Leal (1988: 185). Vale argues that based on the Mining Code of 1967, the simple discovery of deposits establishes the primacy of access and rights for obtaining minerals available in the area explored. This is assuming that only TNCs have the required technological capacity for mineral exploration and extraction. Moreover, according to the Mining Code and the Federal Constitution, the minerals, once extracted, are not the property of the State.[16] This implies a significant concession to the TNC prospecting or exploring mineral resources. In addition to these major legal concessions for the TNCS, the State played a fundamental role in obtaining finance and establishing transnational mining operations in the Amazon. The two case studies of MRN and Vale provide examples to illustrate these aspects in the next section.

Figure 3. Map of the Amazônia Legal (legal definition of the Brazilian Amazon); includes Mining Sites, major highways referred to below and the main cities and States.



Source: IBGE, 2015.
Legend: Federal Highways, Amazon (Amazônia Legal), and then three different transnational Mining Sites, Manganese (ICOMI), Bauxite (MRN) and Iron (Vale). The latter two are the two case studies considered below.

A major interest for these mining TNCs, as mentioned above, is the potential surplus profits derived from ground rent, as a result of non-reproducible conditions. For example the manganese mine which was explored by Bethlehem Steel and ICOMI in Amapá corresponded to the best available conditions on the planet at the time, in 1957. Thus, such a high differential rent associated with this mine, meant an amazing potential for surplus profits for the firms involved. The attraction of such high profitability constitutes the predominant factor in attracting transnational capital to the mining sector of the Amazon. In this sense, it is the accumulation in the mining sector which became established due to the propitious conditions for appropriating ground rent, achieved through productivity gains and major cost reduction for mining enterprises in this region. The surge in mineral prices in recent years mean that many previously unprofitable mines are now able to turn a profit in spite of higher costs; although the opposite scenario seems to have begun in the last couple years..

4.2 Two Case Studies

This section presents an analysis of the two case studies of transnational mining in the Amazon: (1) the exploitation of bauxite from Trombetas in Pará by the joint venture MRN (1979-present); and (2) the exploitation of iron in Carajás, Pará, by Vale (1985-the present). These two sites have been marked in the map above in Figure 3.

The justification for the entry of mining companies into the region was supported through the propaganda of regional development. In defense of mineral exploitation, claims were made regarding the positive effects that would be achieved through forward and backward linkages and that companies complementary to the mining sector would be attracted to the region. In spite of some positives, the actual development was far from most of the government´s propaganda regarding the advantages to be experienced by the region´s population. In fact, the results of large-scale industrial mineral exploration in the Amazon tended to be more associated with the negative consequences of increased public debt and socio-environmental problems.

4.2.1 Mineração do Rio do Norte (MRN)

Historically, global aluminum production has been controlled by just a few TNCs. Until the 1970s, the so-called "Six Sisters" constituted the aluminum cartel responsible for almost 75% of world production; 95% of this being concentrated in the G8 (Tarsitano Neto, 1995:76). State action was instrumental in the promotion and implementation of these projects, and this sector received high priority during the II PND. As described above, the State facilitated the creation of joint ventures, the securing of loans, providing infrastructure for mining projects and lastly, insuring the property rights of TNCS with respect to the extracted ore.

The exploration of the Trombetas mine was initiated in 1974, with the creation of the MRN joint-venture, which between 1976 and 1979 involved an overall investment on the order of US$ 390 million. This meant a radical transformation of the surrounding area, which prior to that time had been inhabited by different groups associated with "quilombolas," whose economy was based on extractive activity with subsistence agriculture.[17]

The companies involved in the MRN joint venture were the following: (1) the State enterprise CVRD, *Companhia Brasileira de Alumínio*, (The Brazilian Aluminum Company, CBA), ALCAN (Canada), Billiton (British), Norsk Hydro (Norwegian) and Reynolds Metals (USA). The primary company in this joint venture was CVRD, which after privatization is referred to as just Vale, and whose current share total is 40%.[18] The State was proactive in obtaining funding from a range of Brazilian public banks, in addition to the World Bank and IBRD.[19] A major criticism with respect to the financing of the Trombetas project, was that the debt which was taken on by CVRD,

was simply transferred to the Brazilian State when privatized, instead of the TNC Vale being liable.[20] The State support in terms of infrastructure involved the construction of the Trombetas canal in 1976, facilitating access to the mine and also for exporting the bauxite.

The joint venture MRN was responsible for carrying out the extraction and processing of bauxite, which is the initial phase of the aluminum production cycle. The two principal aluminum producers which MRN supplies in the region are: (1) *Alumínio Brasileiro* S.A. (Brazilian Aluminum, Inc., Albrás, located in the municipality of Barcarena, near Belém; and (2) *Alumínio do Maranhão* (Maranhão Aluminum, ALUMAR), located in São Luís, Maranhão. They are both refineries which process bauxite, a particularly electricity-intensive operation, and it also is the primary cost component. This is part of the intermediate phase of producing alumina, from which primary aluminum is finally obtained (See CVRD, 1992: 432). Since the late 1990s, most of the bauxite produced in Porto Trombetas is transformed into alumina within Brazil.

At present, in 2014, MRN produced 18 million tons of bauxite, and had a annual growth of 4.5% in sales. Of all sales, 54% were within Brazil, supplying the Alunorte and Alumar refineries, while 46% were exported. The primary destination was the US with 19%, followed by Canada with 13%, Europe with 10%, China with 3% and 1% for India. Thus, in 2014, of the total production of approximately 18 million tons, 9.7 million tons were sent to Albras (Alunorte) and Alumar. In stark contrast to the limited demand by China for Brazilian aluminum, the demand by China has been quite significant for the ore from Vale´s Carajás iron mine.

4.2.2 Vale

Vale is currently the second largest mining TNC in the world and the iron mine it operates in Carajás is the largest open-pit iron mine in the world.[21] Vale had been established in two regions of Brazil: the Southern System, with approximately 55% of Vale´s mineral production; and the Northern System, located in the *Amazônia Legal* (Legal Amazon),[22] which has the other 45%.[23] Reflecting the expansion in the Amazon, the Northern System has grown three times faster than the Southern System during the last 15 years (See Vale, 2012).

Vale, which was the former state enterprise, *Companhia Vale do Rio Doce* (Sweet River Valley Company, CVRD), is Brazil's largest transnational corporation. In 1997, after major legal battles, Vale was privatized for R$ 3.3 billion (US $3 billion) but continued to rely on the presence of the State, directly and indirectly, to increase its production and to expand overseas. Thus, the company consolidated its position as the 2nd largest mining TNC in the world, with the assistance of the State bank- *Banco Nacional de Desenvolvimento Econômico e Social* (National Bank for

Economic and Social Development, BNDES) playing a fundamental role in the process. Of note, the loan of roughly US $ 7 billion, in 2009, was the largest loan made by BNDES to a private firm.

The establishment of the "North System" in the mid-1980s, which focused on iron exploitation in Carajás,[24] Pará, reflected a strong shift in the company's strategies of competition and expansion.[25] The Carajás-Iron project, begun in 1980, involved three sources of financing. The first was from the company's own resources, roughly 46.2% of the total (approximately US$ 2.35 billion). The second source of financing was facilitated by the State, and was obtained from several public banks: BNDES, the *Banco Nacional de Habitação* (National Housing Bank, BNH) and *Agência Especial de Financiamento Industrial* (Special Agency for Industrial Financing, AEFI). This source accounted for approximately 21.7% of the total. Lastly, the State was proactive in obtaining international financing, which accounted for approximately 32.3% (Da Silva, 2012). After the privatization of Vale, the services and amortization payments of Vale´s debt remained a burden for the State and yet patrimony and financial assets were privatized.

In fact, as mentioned, Vale was sold for roughly US$ 3 billion even though the estimated value at the time of the auction was roughly US $ 83 billion (market value estimated on the São Paulo stock market). Incredible as this sounds, that meant its value was 28 times the value paid for the firm. Understandably, the Cardoso government was strongly criticized and led to major questioning with respect to the privatization of Vale. Another major criticism was the fact that the State was selling a public enterprise with control over an important national resource to a private TNC. Moreover, minerals, are seen as strategic resources in the context of discussions of development policies and projects. Amazing how much State assistance was made for CVRD and also Vale being sold so far below market value and all the public debt taken on and what does the population get in return. In fact, Vale has not paid taxes for many years to the State of Pará, in spite of all its benefits and profits over the years. Since the 1990s, with the shift toward neoliberalism, the State control of Vale has been significantly reduced. In fact, the government exerts only indirect influence on this native TNC at present and has been forced to accept Vale´s attitude like other TNCS.[26]

4.2.3 Surplus Profit of TNCs and Ground Rent[27]

In the context of mining, the level of ground rent is related to location, accessibility and quality of the ore available in the subsoil, and is determinate for the potential for surplus profits for mining TNCs. After it became common to discover deposits with high mineral content during the 1960s, the superior characteristics of Amazonian mines produced an investment race among transnational mining companies. Each company ultimately sought to try to gain control of these mines so as to

guarantee the advantages of converting ground rent into surplus profits, which such non-reproducible resources make possible.

Thus, the TNCs in the mining sector are able to continue receiving surplus profits as a result of the differential productivities in mining and as a result of the government concession guaranteeing them the right to access mines or the subsoil. The total potential profit available for individual capitals is constituted by the average profit combined with ground rent. The level of this potential extra profit is given by the difference between the productivity of individual mines and the productivity of the worst mines in operation globally (See Harvey, 2006: 353-354; Marx, 1981: 779-787 and Shaikh, 1984).

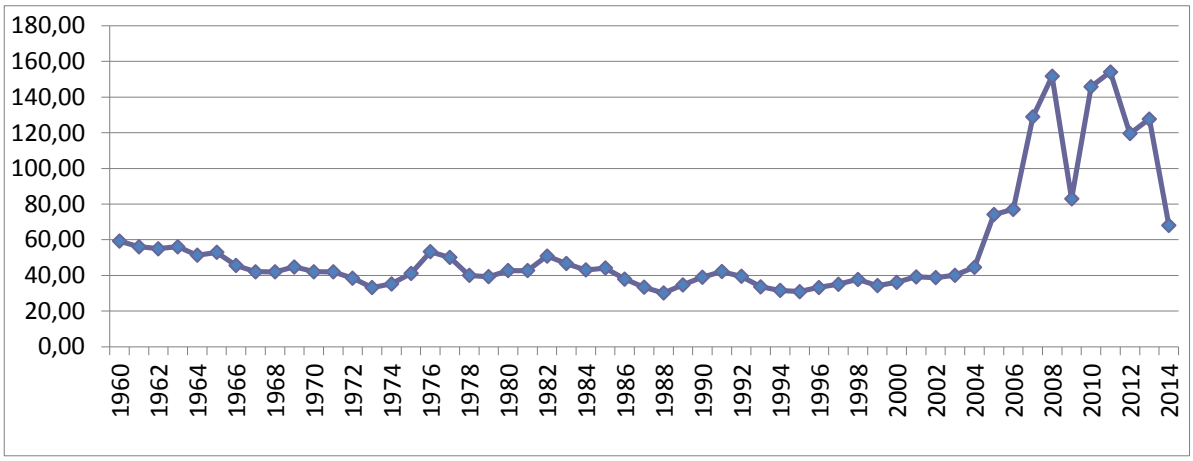
Although it may appear that mineral rent is a component of the final price, mineral ground rent is not a production cost. In fact, there is only absolute rent[28] contained in the market price, since it is the low productivity of the worst mine in operation which allows other mines to obtain a differential rent, and it is the next potential marginal conditions, which establish the level of absolute rent, something that can only be established in practice, not *a priori*. If there is a case where the market price rises, as a result of higher demand, there will tend to be an increase in rent, but this increase in rent is not the cause of the increase in price.

For example, as a result of China`s amazing growth, the increased demand led to significant price increases for minerals since 2002. As a result, many less-productive mines with lower mineral content, have been coming into operation, in spite of their higher costs. This has led to an increase in mining for several Latin American countries, some of which had minimal mining activity previously. Recently, the tendency of *commodity* prices has reversed, and if *commodity* prices continue to decline, this will have serious consequences for many of the low quality mines recently put into operation in Latin America.

As first presented by Ricardo and confirmed by Marx, it is the less productive or marginal conditions which provide the basis for establishing a new price. This analysis is valid whether one is examining agricultural production, such as soy or livestock, or petroleum or minerals. Thus, mineral rent arises only because there is a differential in productivities, and in general, a class monopoly of landed property and a tendency toward a uniform selling price on the world market. Thus the differentiation in terms of costs means there are a range of differential rents obtained by different mines, the highest quality ore receiving the highest levels of rent, as some would call the "benchmark" mines. This would apply to the case of the large deposits of iron ore in the largest open pit iron mine in the world, namely, Carajás, Pará. The Chinese are mining iron ore with increasingly lower iron content and higher production costs, currently around US $100/ton. In Brazil, the average price for iron ore is US $20 per ton, and in the Carajás mines, ore with 66% iron

content may be mined for as low as at US $15/ton (Freitas, 2013). If demand were sufficient to maintain Chinese mines in operation, the differential productivity of US $85/ton, constitute extraordinary surplus profits for Vale, given that they can produce at a mere US $ 15/ton.

Figure 4 Iron Ore Price (US$ /dmtu*)



Source: World Bank (2015). *dmtu stands for dry metric ton units

5. Socio-environmental Impacts in the Amazon

There are many relevant issues to consider in terms of the socio-environmental impacts of the new phase of expansion in the Amazon. In Section 2 above, there was a very brief discussion, after identification of the main environmental problems, namely, deforestation of the Amazon Rain Forest, problems of air, soil and water pollution, issues of soil erosion, and concerns over hydroelectric dams. In the discussion in Section 3 on the new phase of capitalist accumulation in the Amazon associated with lumber, soy and cattle, a number of specific problems were elaborated upon, mostly in connection to transgenic soy and the heavy use of pesticides. However, the discussion on deforestation was limited, in spite of establishing some clear aspects or trajectories involving lumber, cattle and soy. There is an extensive literature looking at the connection between these productive activities, including mining to deforestation, but we were not able to go into more detail, given the lack of space. In this section, a number of the socio-environmental problems related to mining and hydroelectric dams are presented.

5.1 Mining and the Environment

Mining companies' environmental discourse generally advertises mining as an economic activity that "spares trees", but three characteristic effects of mining activity contradict such an argument. First, mining involves the obligatory removal of vegetation cover, which is sometimes replaced

with “secondary forest”. This is generally poorer in biodiversity compared to “primary forest”. Second, mining involves the construction of roads and railways to transport minerals. This leads to increased valuation of surrounding lands and thus, accelerating deforestation, whether for illegal logging or to transform pastures for livestock. Thirdly, the increase in the demand for electricity for mining activities has led to the mining TNCs and the Brazilian government to promote the construction of several hydroelectric dams.

A major role being carried out by the State for infrastructural projects linked to reprimarization has been the development of hydroelectric dams, which are fundamental for the generation of electricity necessary for the processing of minerals. Brazil has had many major hydroelectric dams built over the decades, and often in association or proximity of major mining operations. This has brought about a number of serious social and environmental conflicts during recent years. In all fairness, in terms of general development, hydroelectric dams serve many functions beyond mining, however, the location and timing, often suggests that mining interests have greater priority than that of the majority of the Brazilian population.

In Brazil, there have been major conflicts, such as Rio São Francisco in the northeast of Brazil, Tucuruí,[29] which lead to major environmental impacts and conflicts in recent years (See Herrera and Moreira, 2013) and Belo Monte, in the State of Pará, with the projected displacement of 24,000 people, many of which are indigenous communities. In fact, in January 2016, the Belo Monte hydroelectric dam, one of the world´s largest, just weeks before the owner Norte Energia SA planned to start electricity generation has been suspended by a Brazilian court, given the lack of adequate support provided for the Juruna indigenous people impacted by the dam. This dam has recently been associated with the gold mining project of the Canadian company Belo Sun.

Other environmental problems with mining involve toxic waste generated, especially due to the increased usage of toxic chemical reagents. There are also the problems brought about through processing and chemical treatment; thousands of tons of rock of which more than 90% are solid and liquid waste. In addition, the tendency toward open pit and large scale mining only exacerbate the situation. There are diverse forms of chronic contamination and accidents which impact the air, soil and water, deforestation, and irreversible changes to the water table, etc. These are all issues generating negative effects for public health.

According to the Observatory of Conflicts in Latin America (OCMAL), in 2014 there were around 180 social conflicts around the mining areas in Latin America; the region with greater indices of conflicts of this type, reflecting the negative impacts on peasant and indigenous communities. There are many other relevant cases in Brazil, just consider the toxic mud slide in Minas Gerais recently, resulting from the ruptured dam in November 2015, for which damages of

more than US $2 billion are being claimed and for which Vale and BHP Billiton have been charged with corporate negligence. Unfortunately, these cases can only be mentioned in passing, though deserving more attention, given space and topic limitations.

6. CONCLUSIONS

In this article, we examined the tendency toward reprimarization in Latin America, and how this is linked to the conversion of the Amazon into a frontier of capitalist accumulation. We sought to identify some of the key external factors leading to this tendency, in addition to an analysis of the historical processes constitutive of major transformations in the Brazilian Amazon. The latter clearly involved a range of major projects and initiatives, many of which were begun under the military dictatorship of 1964-1985. Nevertheless, the shifts related to industry and neoliberal globalization, and the transnationalization of the global economy, came to play fundamental roles, especially since the 1990s in both Brazil and the Amazon.

Fundamental in these discussions was the role of the State and TNCs in a range of sectors: lumber, livestock, soy, and mining. With respect to the latter, two case studies were considered, namely MRN and Vale. Regarding the relationship between the State and mining TNCs three main areas were identified: (1) facilitating the formation of joint ventures, and access to financial resources; (2) providing and maintaining infrastructure necessary for mining operations; and (3) insuring a TNC-friendly legal apparatus for regulating mining activity. The two cases examined in detail, provided examples of how the State was fundamental in facilitating the interests of mining transnationals. This was made evident from the setting up of joint ventures, the construction of highways, railroads and canals and playing a huge role in obtaining funding from both public and international sources, and being the debtor of last resort, so to speak.

Beyond the detailed discussion of the two cases, a general discussion of the mining sector in the Amazon was considered, including a range of issues linked to socio-environmental impacts that have resulted from the reprimarization tendency and the expansion in the Amazon. Most pressing is the problem of deforestation of the largest tropical rainforest on the planet. In addition, there are major concerns regarding air, soil and water pollution resulting from activities such as mining, soy and cattle production, and also the problems both environmentally but also socially associated with the hydroelectric dams.

An important issue was that of TNCs extracting amazing wealth, given the high levels of differential rent, from the Amazon and giving back very little to Brazilian society, especially given their very propitious conditions and outrageous tax breaks. If it were possible to appropriate the ground rent, be it from mining or agriculture, for local development, this would constitute the basis

for a different type of regional development, one more sustainable for both society and the environment, instead of just one that primarily accommodates the large corporations, whether foreign or national TNCs.

However, it does not appear that the tendency of reprimarization is about to be reversed, especially with TNCs and the WTO functioning as they currently do. However, at some point, a bloc of countries will either exit the WTO *en masse* or demand a change of the rules, so as to break from the overdependence on foreign TNCs. This is a major concern for Brazil as well as for the Latin American region as a whole. Although some have argued that a phase of new developmentalism has begun, given the negative consequences observed, an alternative which allows for greater autonomy and industrial growth, for example via Mercosur, would clearly be preferred. Unfortunately a major shift is not likely in the short run. However, perhaps some years down the road, there may be a new constellation dominating the global economy, hopefully finally make a break from orthodox neoliberalism.

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[3] Unless stated otherwise, references to the Amazon, refer to the Brazilian Amazon.

[4] The term *commodity* has come to be associated with primary goods, such as agricultural products, minerals, oil, etc., in contrast to the general term for all goods used in economics.

[5] Although this concept is quite relevant for this paper, given space limitations, a proper exposition and debate about the TCC is not possible.

[6] It is clearly not appropriate to describe countries that had experienced minimal industrialization, as undergoing reprimarization, since these instances simply constitute a further expansion of the primary goods sector.

[7] For more on the discussion of reprimarization in Brazil, see our paper Trinidad et. al., 2016.

[8] The privatization of public enterprises constituted part of the neoliberal shift, associated with the Washington Consensus, pushed upon many countries of the periphery. In the case of Brazil, there were approximately 40 state enterprises privatized between 1990 and 2003. It is relevant to mention that the privatization of Vale, then known as Companhia Vale do Rio Doce (Sweet River Valley Company, CVRD) took place in 1997. (See Gonçalves, 1998).

[9] The slogan adopted by the military government during the 1960s to promote migration to the Amazon from Brazil's northeast was "the land without people for people without land" ('*a terra sem homens para homens sem terra*').

[10] See Oliveira, 2005, for a discussion of the violence associated with expropriations during the dictatorship, especially the cases of genocide in the state of Mato Grosso.

[11] An evaluation of the relevance of Harvey´s concept of accumulation by dispossession, for these historical processes, would be quite appropriate, however, due to space limitations, it is not feasible. For such a discussion, see Rivero and Cooney, 2010.

[12] These tax and tariff exemptions were established by the complementary Law 87/96, known as Lei Kandir (Kandir Law).

[13] Although foreign TNCs predominate the mining sector of Brazil, there have been crucial roles played by (1) foreign TNCS, such as ALCOA; (2) Brazilian TNCs, such as Vale; (3) non transnational private Brazilian firms, such as MRN; and (4) Brazilian state enterprises, such as *Companhia Vale do Rio Doce* (Sweet River Valley Company, CVRD). In certain instances, there are shifts, such as the case of the state enterprise CVRD, which after privatization, has become the 2nd largest TNC in the mining sector globally, namely, Vale.

[14] For a discussion of the "governance" of natural resources, there is an excellent study by ECLAC (2013) for the Union of South American Nations (UNASUR).

[15] Since October 2011, there is a proposal pending to rewrite the mineral regulations; the final result most likely favoring mining TNCs.

[16] Mining activity—with the exception of oil, natural gas and nuclear minerals (such as uranium and plutonium)—does not constitute a true state monopoly in Brazil although mineral resources are considered public goods.

[17] *Quilombola* corresponds to communities in Brazil which were formed by ex-slaves during the 18th century. The transformation in the 1970s often involved expropriation of local communities via legal and extra-legal means.

[18] The current composition of shares for MRN is as follows: Vale (40%), BHP Billiton (14.8%), Rio Tinto /ALCAN (12%), CBA (10%), ALCOA (18,2%), NORSK HIDRO (5%), REYNOLDS (5%) and ABALCO (4.62%).

[19] The main sources of financing were the following: Banco da Amazônia S.A. (Amazon Bank), (US$ 60 million); Banco do Brasil S.A (US$ 20 million); FINAME/BNDES (US$ 26 million); SUDAM (US$ 100 million); BNH (US$ 18 million); ORION BANK LTDA (US$ 40 million); Irving Trust Company (US$ 32 million); EXIMBANK (US$ 20 million); World Bank e IBRD (US$ 15 million).

[20] For a critical analysis of the financing of the Trombetas Project, see Leal (1988) and Trindade (2001).

[21] It is worth noting that Vale has begun to construct another iron mine nearby (SN11D in Canaã dos Carajás), which is six times the size of the currently largest one in the world also in the middle of the Amazon.

[22] The term used in Brazil is Amazonia Legal which refers to the following entire states: Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins in addition to parts of the states of Mato Grosso and Maranhão (from west of the 44th meridian), constituting a total area of approximately 5.2 million km².

[23] The Southern System includes the Brazilian States of Minas Gerais, Rio de Janeiro and Espirito Santo, and the Northern System includes the two States of Pará and Maranhão.

[24] In Abril 1996, there was a famous massacre of 19 people, who were blocking the highway which transported iron from with Vale´s iron mine in Carajás. Those killed were mostly members of the group Movimento dos Trabalhadores

Sem Terra (Landless Workers Movement, MST), who have been pushing for agrarian reform for many years. Evidently, both the State and Vale came under strong criticism for this massacre. (See Cota, 2010).

[25] For information on Vale before and after privatization, see Santos (2011: 156-175).

[26] An example is the impasse with the government over the construction of the Araguaia-Tocantins waterway (southeast of Pará), in which it was agreed that a portion of the investment would be funded by the Vale group. However, the company's lack of interest in assuming these costs, led the company to decline to participate in the initiative. There was a similar example regarding the push by the government to convince Vale to build its steel hub in the region, in Marabá, but Vale continues to drag its feet.

[27] This section derives from a range of readings, including Marx, 1981, Harvey, 2006, Fine and Saad-Filho, 2004, and Shaikh, 1984. Although the work by Shaikh is less well known, many of those familiar with it, would argue, that it is one of the more coherent interpretations of Marx´s theory of ground rent, though unfortunately not published, although circulated. In addition, there has been limited theoretical debate in English in recent years and thus many issues left open and a range of competing interpretations. In contrast, there has been more recent research in Latin America, where the issue of rent is recognized as quite important, given its importance concretely, for example see Paulani, 2012, Iñigo Carrera, Arceo, Astarita.

[28] Absolute rent is added on to the price of production of the worst land, as it is that rent which must be paid to the landlord of the worst land, which has no differential rent by definition. Without absolute rent, there is no reason why a given owner would allow the use of their land, see Marx, 1981: 884.

[29] The Phase I construction of the Tucuruí dam began in 1975and ended in 1984, while Phase II began in 1998 and ended in late 2010s.