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How Do Natural Resource - Backed Loans Affect the Public Debt Sustainability in Developing Countries ? Empirical Evidence.

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Abstract

Several countries with abundant subsoil assets in the form of oil, gas and minerals have shown significant interest in the financing model known as resource-backed loans. In this paper, we examine the effectiveness of resource-backed loans on public debt sustainability for 64 developing countries over the period 1990-2018. Using the propensity score matching method through a battery of econometric and alternative specification tests, we find that resource-backed loans reduce public debt. In addition, we look at the magnitude over the first seven years, the results indicate that resource-backed loans are most effective from the second to the seventh year after adoption. We also show that this favorable effect is sensitive to several structural characteristics of countries. These findings help inform policymakers in resource-rich countries that underwriting resource-backed loans is not only a crucial dimension to the provision of public goods and services through infrastructure investments and development, but also a path to better fiscal policy management some year after the signing of loans and the completion of the targeted investments in developing countries. However, resource-rich countries considering a resource-backed loan will need to focus on anti-corruption, good governance and strengthening institutional quality to prevent these resource-backed loans from triggering a pro-cyclical effect on their fiscal policy.

Keywords: Resource-backed loans, Natural Resources, Natural resource rents, Public Debt, Economic Growth, Public & Private Investment, Propensity Score Matching.
JEL Codes: O13, H81, H63, H54, F41

1 Introduction

The new international tracks of the Sustainable Development Goals (SDGs)[1] add a stronger climatic and environmental dimension than the previous ones defined in the Millennium Development Goals. Among them, goal number 9 aims to "Build resilient infrastructure, promote sustainable industrialization that benefits everyone, and encourage innovation by 2030". To achieve this objective, the States have bet on the accumulation of the stock of capital mainly through productive public investments. However, the countries are not at the same stages of development in this area. While developed countries direct their investments towards the key sectors that are more productive, most developing countries still face a lack of basic infrastructure such as roads, schools, hospitals, bridges, information and communication, sanitation, electric and hydraulic energy (Sawadogo, 2020).

[1] At the heart of the 2030 Agenda, 17 Sustainable Development Goals (SDGs) have been set according to the United Nations report on Sustainable Development (see https://www.agenda-2030.fr/17-objectives-de-developpement-durable/)

According to the 2020 United Nations report on progress towards Sustainable Development quoted by (Farigoul, 2020), the share of global gross domestic product (GDP) invested in research & development increased from 1.5% in 2000 to 1.7% in 2015 and remained virtually unchanged in 2017; yet it was less than 1% in developing regions. In addition, the International Energy Agency indicates in 2018 that 860 million people do not have access to electricity and among them, more than two thirds live in sub-Saharan Africa (IEA, 2019). In addition, a study conducted by the United Nations insists that making infrastructure resilient to disasters and climate change would require investing an additional $434 billion per year (Nations, 2019). As for the World Bank, it estimates that developing countries could achieve their sustainable development objectives in terms of infrastructure by devoting 4.5% of their GDP to it, while limiting global warming to 2°C (World, 2019). To respond rigorously to the growing needs of the population in these developing regions, which doubles every year, and to sustainable development challenges, developing countries have placed particular emphasis on the mobilization of domestic tax resources, because the standard sources such as official development assistance are not sufficiently able to ensure funding due to their volatility. However, the share of tax revenue collected on average in GDP is relatively lower to support such targeted economic development in the short, medium, and long term. It represents on average only 15% of GDP in Sub-Saharan Africa (Mascagni et al., 2014; OCDE/ATAF/CUA, 2017) and 13.6% of GDP in Latin America and the Caribbean (World, 2020a). In addition, another difficulty for these countries to finance their economies lies in access to international capital markets crucial for financing development (Sawadogo et al., 2021), which is limited to many of these countries due to their very high financial risks due to series of defaults or restructurings of public debt (Reinhart et al., 2003). Consequently, the natural resources of which these two regions[2] are abundantly endowed (Ben-Salha et al., 2021; Guan et al., 2020 ; Qiang and Jian, 2020; Dawda et al., 2019; Sadik-Zada and Gatto, 2019; Philippot, 2011; Mavrotas et al., 2011; Gylfason, 2011; Brückner, 2010; Kropf, 2010; Auty, 1997). could be a relevant solution to reveal these great challenges. Historically, the economic development of some developed and developing countries has been based on their endowment of natural resources. More recent studies of developing countries such as Botswana, Malaysia, South Africa and Chile estimate that these countries have achieved a higher level of income, in part due to the extraction of natural resources (Halland and Ossowski, 2016). Other industrialized countries like Australia, Canada and the United States have succeeded in transforming resource extraction into economic growth and development (Halland and Ossowski, 2016). In fact, natural resources through the extractive industries generate revenue for governments, foreign currency, and jobs for the populations and for those located in the regions of exploitation.

[2]The region of sub-Saharan Africa and Latin America and the Caribbean

Today, anew financing model has become popular allowing countries to obtain funds for the financing of public investments. This is the natural resource-backed loan market. For the past 15 years, resource-rich developing countries have been using resources as collateral to gain access to sources of finance and circumvent the obstacles they encounter when trying to obtain traditional loans. with banks or capital on the financial markets (Halland et al., 2015).

Basically, natural resource-backed loans refer to all financial commitments made in the form of borrowing by countries rich in natural resource endowments to finance infrastructure investments. In addition, the repayment of this loan is made either in kind or in cash[3]. Indeed, several developing countries have managed to conclude an agreement with China, which has a monopoly in this area. Recently, a study carried out by the team of researchers from the Institute of Natural Resources Governance revealed that the total amount of resource-backed loans amounts to 164 billion US dollars, of which 66 billion are granted to Africa, and 98 billion were granted to Latin America (Mihalyi et al., 2020). Moreover, many infrastructure investment projects have been carried out in these countries thanks to loans backed by natural resources,namely: the Pointe-Noire Road in Brazzaville, the Bui dam and gas processing plant in Ghana, the rural electrification in Zimbabwe, the construction of housing in the city of kilamba, the construction of the Coca Codo dam and hydroelectric power station in Ecuador, etc.

However, natural resource-backed loans could negatively or positively affect fiscal policy, particularly through the public debt channel for debtor countries due to their lack of transparency (Mihalyi et al., 2020). According to the World Bank's report on the debt situation of the world's regions, the total stock of external debt of low- and middle-income countries increased by 5.3% in 2018 to reach $7.8 trillion, i.e. almost half of the 10.4% accumulation rate recorded in 2017 and an increase of more than 40% compared to 2009 (World, 2020a). Going further, the recent study conducted by (Mihalyi et al., 2020), out of 52 natural resource-backed loans during the period 2004-2018 reveals that out of 14 subscribing countries, 10 countries faced severe debt situations following the commodity price shock in 2014. Also, all the conditions of these loans are not fully relayed, they are often secret. This could aggravate the financial difficulties of subscribing countries (Mihalyi et al., 2020). In addition, too large a resource-backed loans can lead to over-exploitation of natural resources leading to poor governance of natural resources, which negatively affects the perception of rent resulting in yet another loan. Hence the risk of undermining public debt sustainability and fiscal discipline in debtor countries.

However, natural resource-backed loans offer many advantages to the various countries rich in natural resources and willing to subscribe. They allow the accumulation of public capital stock, through the construction of public infrastructure, offer less expensive financ-

[3]Repayment is made both with future revenues from natural resources and in exchange for the promised resource

ing and can be renegotiated in the event of payment difficulties at maturity and can also be structured in such a way as to reduce volatility (Mihalyi et al., 2020). Indeed, since the appearance of the phenomenon known as the natural resource curse, studies have shown ways to harness the power of natural resources and go beyond this curse (Arezki et al., 2012). Along the lines suggested by these studies, natural resource-backed loans could help countries meet the challenge of reaping the benefits of natural resource wealth even if they entail risks, the advantages they offer are conducive to economic and sustainable development. Clearly, given the vast debate on the determinants of public debt, access to financial markets and infrastructure financing (Reinhart et al., 2003; Buffie et al., 2012; Melina et al., 2014; Halland et al., 2015; IMF, 2015; Morgan, 2015; Konopczak, 2015; IMF, 2017; IMF, 2018; Sadik-Zada and Gatto, 2019; Sawadogo, 2020; World, 2020b; World, 2020a), we examine whether natural resource-backed loan is an important determinant for financing the economy without compromising the sustainability of public debt over time, for resource-rich developing countries. In any event, relevant recommendations should be proposed to subscribing or future subscribing countries. The glowing literature on the link between natural resources and public debt has focused on natural resource rents (Ben-Salha et al., 2021; Ampofo et al., 2021; Guan et al., 2020; Sadik-Zada, 2016; Philippot, 2011), as a determinant of debt and economic growth. However, the impact that natural resource-backed loans may have on public debt over time has received very little attention.

In addition, previous studies that address the issue of resource-backed loans in developing countries (Halland et al., 2015; Mihalyi et al., 2020; ITIE, 2020; Nyamudzang, 2021), have so far remained silent on the macroeconomic impact of this type of loans.

Mihalyi et al. (2020) were the first to speak out on the issue of natural resource-backed loans. In their pioneering study of the risks and opportunities of resource-backed loans, they found that in the event of a commodity price shock in the market, subscribing countries are plunged into an increased budget deficit. This study indicates that several countries subscribing to loans backed by natural resources were exposed to a situation of over-indebtedness at the end of the oil shock that occurred in 2014. The authors believe that resource-backed loans are the cause of this crisis. of indebtedness in these countries because, out of 14 subscribing countries, 10 countries have faced major budgetary difficulties. These conclusions could be the subject of many criticisms. First, the authors show the inefficiency of resource-backed loans by focusing on a particular case, i.e., during a shock to the price of resources, which suggests that in the absence of a shock, resource-backed loans could be beneficial for the subscribing countries. Second, the authors do not consider the structural and institutional factors[4] that could influence the effect of this type of financing. Hence the omission of relevant variables or determinants leading to a

[4]The quality of institutions, macroeconomic and political stability, and the role of fiscal rules.

bias in interpretation. Finally, this study says nothing about how the public debt would evolve over time, five years for example after the subscription and the realization of the investments in the projects concerned. This is surprising because the investments made with these loans could make it possible to increase the attractiveness of FDI, employment, generate new tax revenues through the broadening of the tax base in the debtor countries. Hence the importance for us to study more carefully the countercyclicality of loans backed by natural resources over time, i.e., over the period (t+5) in developing countries.

Indeed, we justify the choice of this angle of analysis by the fact that the effect or the effectiveness of a loan on budgetary policy, specifically the public debt, can only be captured a few years after the investments made. There can be a return on investment capable of reviving the economy and enabling countries to mitigate the effects of shocks.

The contribution of this study to the literature is threefold. First, we add to the recent literature on natural resource efficiency and fiscal policy (Jia et al., 2021; Halland et al., 2016; Orluwene, 2013; Ruslan, 2012; Adam, 2010), based on evidence empirical. Secondly, we focus particularly on loans backed by natural resources given their magnitudes on the economies of the subscribing countries so far very little studied, the link with budgetary discipline and more precisely the accumulation of public debt, which our knowledge, has never been studied empirically. Identifying the transmission channels of public debt-backed loans is essential to enrich and guide policy discussions on the subject. Finally, we are the first to study the effect of resource-backed loans on both public debt over time (five periods), as well as the variation of public debt in developing countries.

Our results first indicate that natural resource-backed loans are effective in reducing public debt five years after the underwriting and completion of investments in targeted projects for subscribing countries compared to non-subscribing countries, through a methodology based on propensity score matching (PSM). Second, we find no significant effect on the year-on-year change in debt even though most of the coefficients remain positive. Moreover, we show that the effects are heterogeneous. Finally, we show through a robustness test battery that our obtained results are robust to any change.

The rest of the document is structured as follows. Section 2 presents the stylized facts and the review of the existing literature on the subject in Section 3. Then, Section 4 describes the methodology, followed by a presentation of the data and the empirical identification strategy used to estimate the impact of natural resource-backed loans on public debt. The results are presented in Section 5, while in Section 6, we investigate the sensitivity and heterogeneity of these results, respectively. Finally, Section 7 concludes the study and presents the main policy recommendations derived from the findings.

2 Stylized facts

In this section, we present some stylized facts that characterize resource-backed loans, natural resource rent and public debt in developing countries.

There is a slew of literature supporting the significant effect of natural resource windfalls on public debt in developing countries. Indeed, several studies find a positive and significant effect of natural resource rent on public debt (Ampofo et al., 2021; Sadik-Zada and Gatto, 2019; Melina et al., 2014; Carneiro, 2007). Figure 1 shows us the increase in the debt-to-GDP ratio relative to the natural resource rent over the period 1990-2018. On average, the debt ratio increased by 54.27% of gross domestic product. However, this increase was more substantial in countries subscribing to natural resource-backed loans around 63% of GDP than in non-subscribing countries with 53% of GDP on average (see Figure 1). We can notice on this figure a relation of convergence between the increase in

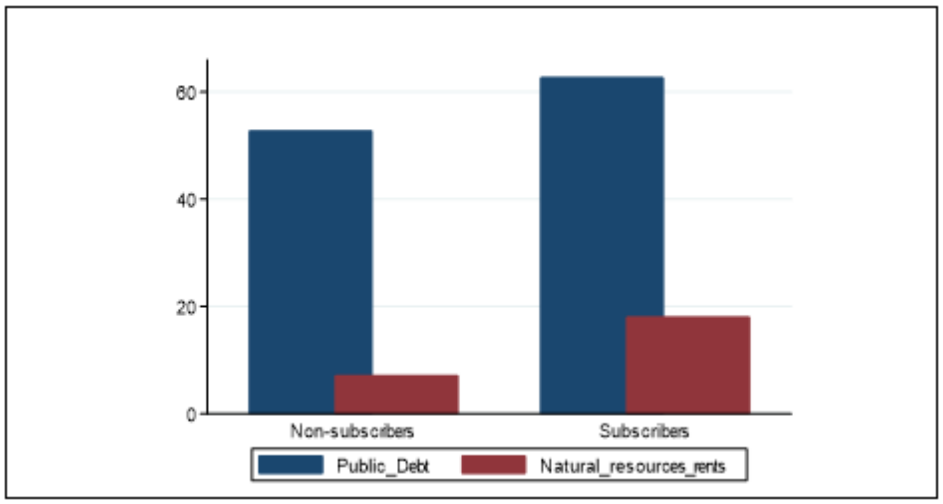

Figure 1: **Average evolution of public debt and natural resource rent of RBL and Non-RBL countries (% of GDP).**

the level of the public debt and the rent. This idea was championed by(Sadik-Zada and Gatto, 2019) in a pioneering study on public debt. In fact, these authors argue that if the commodity market operates on the classical assumptions (absence of shock or bubble), in the long term the increase in the rent[5] of natural resources therefore leads to an increase in public debt in developing countries, but in the short term no effect has been observed. In addition, the subscriber countries mobilize more rent on average 18% of GDP than the other countries in our sample which only mobilize 7% of GDP on average (see Figure1). This may lead them to take on more debt with a view to repaying it with future revenues

[5]The total natural resource rent is the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forest rents from which the cost incurred for extraction is deducted (World Bank, 2020) or the amount by which revenues exceed the full cost of production, including those of discovery and development, and the normal return to capital (IMF, 2012).

from natural resources. It also emerges that some countries, depending on their level of income, have a debt ratio above the reference average. Indeed, we can notice that there is not only a heterogeneity between the countries according to their income. For information, low-income countries recorded an average increase in public debt of 76% of GDP, unlike lower-middle-income and upper-middle-income countries with 50.27% and 48% of GDP respectively (see figure 2). This would have its origin in the strong dependence on natural resources in these countries and the fragility of their economies in the face of shocks to the cost of raw materials. Since the works (Aschauer, 1989),numerous studies

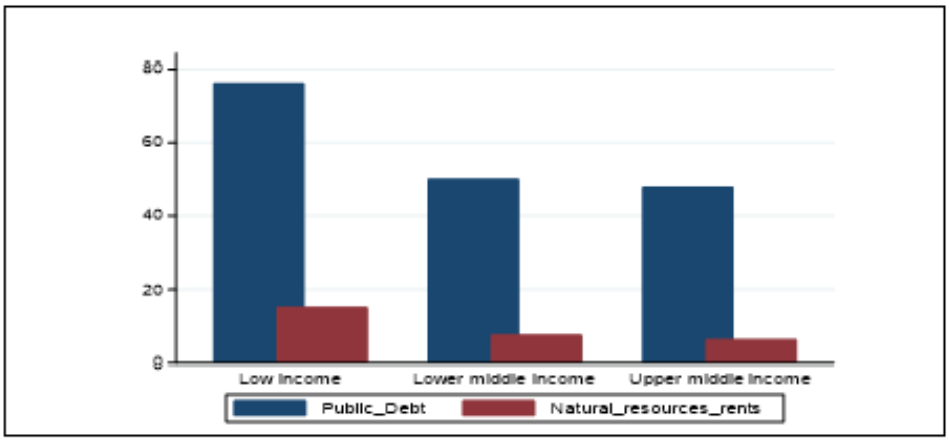

Figure 2: **Average public debt and natural resource rent of RBL and Non-RBL countries as per income level (% of GDP).**

have pointed out that an adequate supply of infrastructure services is considered a key element of economic development. To achieve this infrastructure and achieve the desired development, countries rich in natural resources have reached a partnership agreement that could be described as "win-win" with China (Alves, 2013).
The first loans backed by natural resources in African countries date back to the 90s contracted by Angola to finance the war that the country was going through. That of Latin America begins in 2009 with a total amount of 14 billion US granted by China to Brazil and Venezuela for a respective amount of 10000 million US and 4000 million US (Mihalyi et al., 2020).

Over the past fifteen years, we can see a marked increase in natural resource-backed loans in these regions with an average evolution of 28.46% of GDP (see Figure reffig:Graph). In addition, the peak reached at around 200% of GDP in 2017 derives from the sum of the loans made by Guinea Conakry and Brazil with 192.3% and 0.2% of GDP respectively (see Figure 3). This colossal loan would have been justified by Guinea in the construction of multi-sectoral infrastructure including the Coyah-Dabola road, Conakry Road and sanitation network and university building (Mihalyi et al., 2020). Except for 2017, natural resource-backed loans vary between 0 to 50% of gross domestic product.

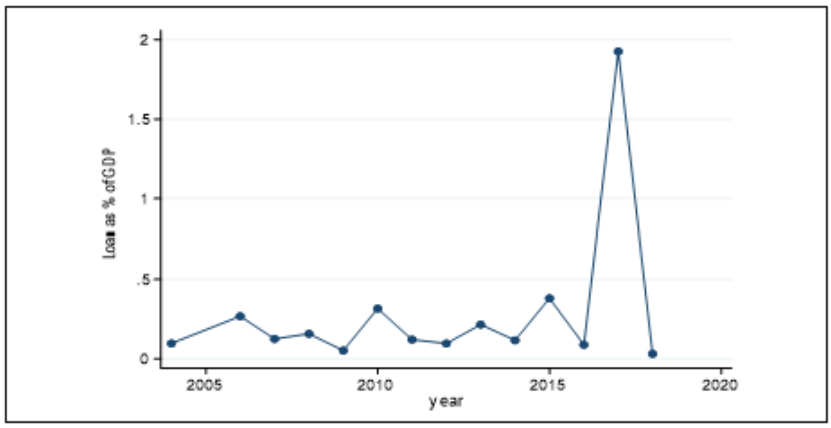

Figure 3: **Evolution of resource-backed loans as a % of GDP between 2000-2018**.

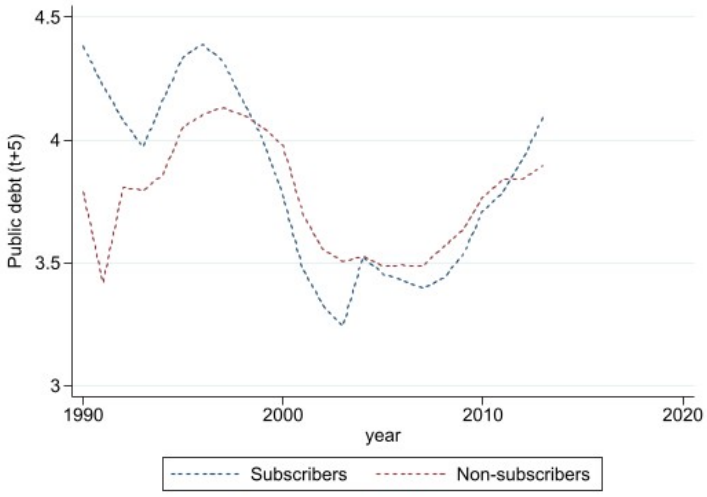

Figure 4: **Public debt at period (t+5) of subscriber and non-subscriber countries as a % of GDP.**

Moreover, the rapid evolution of these resource-backed loans in recent years could not only be explained by the growing needs of the population in terms of infrastructure, also by the fact that China offers a range of lower interest rates at issue between 5% and 11%, a repayment period between 3 and 25 years with 5 years of grace and a possibility of renegotiating in the event of difficulty at maturity unlike conventional lenders such as Euro-bonds or Euro-bonds (Mihalyi et al., 2020). In fact, all these advantages that China has offered to resource-rich countries are to incentive's them more to take out these types of resource-backed loans to capture the largest share of the financial market as lenders.
It is important to mention that these loans have facilitated the financing of many infrastructures' investment projects in these different countries. For example, Ghana's loan for the construction of the Bui dam was secured and repaid by selling 38,000 tons of cocoa to China each year for the 17-year lifespan (Habia, 2009).

3 Literature Review

This section reviews previous theoretical and empirical studies on the relationship between natural resources and public debt.

We begin the discussion on how natural resources affect public debt. Indeed, the argument of the curse of natural resources could be mobilized to explain the mechanism of over-indebtedness of countries based on natural resources. In fact, proponents of this theory describe an apparent paradox that developing countries endowed with abundant natural resources show poor economic performance while resource-poor countries do not (Auty, 1994; Kropf, 2010; Mavrotas et al., 2011; Carbonnier, 2013; Cust and Mihalyi, 2017) , a weak quality of institutions thus affecting the macroeconomic stability of these countries (Deacon, 2011; Deacon and Rode, 2015; Dauvin and Guerreiro, 2017; Bova et al., 2018; Souidi et al., 2018). In addition, the natural resource curse identified by (Sachs and Warner, 1997) could be linked to the over-indebtedness of the host countries according to (Manzano and Rigobon, 2001).

These authors noted that countries with large natural deposits (oil, natural gas, minerals, bauxite, etc.), use these assets as a means of guaranteeing loans; a significant commodity price catastrophe therefore results in a situation of extreme debt for these countries. According to (Melina et al., 2014) , although investing resource revenues in public capital is best known for promoting economic growth, borrowing against future revenues or spending without savings exposes the economy to public debt sustainability risks. Moreover, some authors believe that the causal link between the endowment of natural resources and the public debt would find its origin in the political regime in place in a country (Brückner, 2010). To sustain their power, some dictators use the resources against funds offered by external banking institutions (Meissner et al., 2010), which will result in an increase in the public debt. Raveh and Tsur (2020) showed that higher political myopia, induced by tighter re-election restrictions, makes the effect of natural resource windfalls positive on public debt. Indeed, the windfall of resources induces contradictory impacts on the public debt. On the one hand, they increase government revenue, which tends to reduce the need to borrow. On the other hand, they increase the wealth of the economy, which improves borrowing conditions which, in turn, induce further borrowing (Raveh and Tsur, 2020). These authors find very interesting results for American countries that maintain their level of democracy constant. The results indicate that resource windfalls can increase public debt in democratic countries through the channel of re-election prospects. However, in countries with a democracy, windfall resource gains reduce external debt (Arezki et al., 2012). Fundamentally, the major problem in the public finances of oil-producing economies very clearly lies in the volatility of oil prices. In fact, the

surge in the price of oil has enabled exporting countries to mobilize more tax revenues in the extracting sector to finance not only their development policy but also existing debt. (Gelb, 1988), showed that the rise in oil prices in the 1970s allowed many oil-exporting countries to finance large productive investment projects and external debt partly with oil revenues. Going in the same vein (Sadik-Zada, 2016), comes to the conclusion that revenues from oil exploitation should have a lower share of public debt and therefore a lower risk of sovereign default. Elkhan Sadik-Zada and Gatto (2019), pointed out that this rise in prices naturally leads to an increase in oil extraction, income, employment, the rate of growth of GDP, an improvement in the balance of payments which in turn reduces the public debt. On the other hand, a situation of over-indebtedness would occur in the event of a sudden fall in the price on the international market. This idea has been defended by many authors starting with (Carrasco, 1999).

In his pioneering article on the debt crisis, the author shows that the collapse in the price of oil contributed to a succession of debt crises in Latin America leading to an increase in poverty. Likewise, (Buffie et al., 2012) argue that a persistent negative economic shock to commodity prices can easily threaten the debt sustainability of countries with a high dependence on natural resources. The same result is found in (Arias and Restrepo-Echavarria, 2016). Moreover, the recent collapse of commodity prices on the international market in 2014 has put a strain on public finances in all resource-rich countries (Mihalyi et al., 2020).

Recent literature has attempted to study how natural resource rents positively affect public debt in developing countries. Ampofo et al. (2021) studying the relationship between total natural resource rent and debt in 17 resource-rich countries over the period 1991-2017, find that there is a significant positive relationship between countries' resource revenues and long-term public debt. term and a short-term negative link. Thus, through an estimation with a panel vector error correction model, the authors show that there is a causal relationship between the abundance of natural resources and the public debt. This implies that the excessive dependence on natural resources about total rents affects the sustainability of public debt. As (Elkhan Sadik-Zada and Gatto, 2019),who examined the important factors driving rising public debt in 184 countries based on a survey of central government debt in 2013. The authors found that the share of mining rent in total revenue has a statistically significant impact on public debt. Few studies have truly analyzed the impact of resource-backed loans on the increase in public debt. In addition, the few existing studies on the subject focus on the risks and opportunities of these loans. For example (Mihalyi et al., 2020), find that resource-backed loans can undermine public debt sustainability in subscribing countries. Moreover, they find that 52 countries in their sample that contracted a loan backed by natural resources experienced a situation of over-indebtedness following the oil shock that occurred in 2014.

Nyamudzang (2021), finds by studying the case of Zimbabwe that loans backed by nat-

ural resources constitute a high risk of indebtedness of the beneficiaries. Lederman and Maloney (2006) also pointed out that the excessive and irresponsible loans of the 1970s based on the notion of continuously changing oil prices led to the inevitable public debt crises in oil-rich countries.

Beyond theoretical and empirical considerations, based on the experience of the natural resource curse, natural resources can significantly impact the stock of debt insofar as they generate revenues for governments, currencies, and jobs. for the populations and in particular for those located in the areas of exploitation (Halland and Ossowski, 2016). As the literature clearly indicates, no empirical evidence exists between natural resource-backed loans and public debt in developing countries. Therefore, an econometric analysis is crucial to determine the impact of these natural resource-backed loans on public debt at the period (t+5) in developing countries.

4 Data and Methodology

4.1 Data

The dataset includes 64 developing countries, with 14 RBL (treatment group) and 50 non-RBL (control group). Our study, dictated by the availability of data, covers the period 1990-2018. The dependent variable used in this study is the public debt at period (t+5). Data on public debt come from (Kose et al., 2017), Fall 2021 version.

Our treatment variable is a dummy variable that takes the value 1 if the country has subscribed to an RBL, and 0 otherwise. In addition, our sample includes 406 country-year observations with RBL (Units of analysis or treated Unit) and 1450 country-year observations non-RBL (Control Units). Our potential non-RBL control group is 3 times larger than the RBL treatment group, which would provide a weighted control group for our treatment group. Drawing on recent empirical and theoretical literature on natural resource-backed loans and the determinants of public debt (IMF, 2018; IMF, 2017;World, 2020a; World, 2020b; Barro, 1979; Mihalyi et al., 2020; ITIE, 2020; IMF, 2015; Buffie et al., 2012; Meissner et al., 2010; Raveh and Tsur, 2020; Carrasco, 1999; Carrera and Pablo, 2021; IMF, 2020; Perry, 2020; Nyamudzang, 2021; Mubariz et al., 2021 etc.), we use a group of matching variables that capture factors that simultaneously influence the probability of taking a natural resource-backed loan and the increase in public debt as recommended by (Caliendo and Kopeinig, 2008):

(i) Resource rent – a large part of the rent captured by the government contributes to financing development through the provision of public goods and services. This variable is assumed to have a negative effect on the increase in public debt (Ampofo et al., 2021; Sadik-Zada, 2016).

(ii) Abundance of natural resources – which is a key indicator of economic development

in developing countries. In fact, a country rich in natural resources is likely to experience an influx of FDI. This contributes to improving macroeconomic indicators such as employment, poverty reduction, balance of payments through exports and broadening of the tax base. Theoretically, this variable negatively affects the increase in public debt because 20% of GDP tax revenues come from the extracting sector in developing countries (Halland et al., 2015).

(iii) Inflation rate- an indicator of macroeconomic stability. An expansionary monetary policy, for example, can lead to a rise in the general price level, which lowers the value of the currency and increases the debt service and public debt burden (Barro, 1979; Sawadogo, 2020). This is because an increase in inflation can reduce the real value of outstanding debt or, alternatively, increase interest payments on debt, thereby increasing the outstanding debt (Reinhart and Rogoff, 2010). Also, the higher the inflation rate, the higher the ratio of public debt to GDP (Cooray et al., 2017).

(iv) Trade openness as a percentage of GDP. From a theoretical point of view, the effect of trade openness on public debt passes through the tax revenue channel, which depends on many factors, in particular the structure of trade liberalization and its effect on each component of government revenue (Ebrill et al., 1999; Agbeyegbe et al., 2006). We believe that it will have a negative effect on the increase in public debt in developing countries.

(v) Gross Domestic Product per capita – which controls the economic cycle and promotes fiscal conditions. Indeed, a country with a high GDP growth rate can easily repay its loan unlike a country with a low rate (Sawadogo, 2020). Therefore, we expect it to negatively affect the increase in public debt.

(vi) Public investment (gross fixed capital formation). It is recognized that in a transitional regime, as the stock of public capital increases financed by borrowing, this generates strong economic growth, reduces the unemployment rate, the current account balance but leads to an increase in public debt as a % of the short-term GDP (Ragot and Saraceno, 2016). In the presence of the golden rule of public finance, the debt burden induced by the higher deficit by increasing public investment crowds it out in the long run due to some unproductive spending (Minea and Villieu, 2008), in turn increases the increase in public debt. On the other hand, increased public investment is reaping the required growth dividends, while maintaining the volatility of public finances and public debt (Collie and Venables, 2008; Dabla-Norris et al., 2011). Its sign on the increase in public debt remains ambiguous.

(vii) Fiscal rule. This is a dummy variable that takes the value 1 if the country has implemented a debt rule, 0 otherwise. Indeed, a strict debt rule provides a sound budgetary and financial situation for the country. In fact, it prevents the country from going bankrupt or restructuring its debt, which limits default. As (Reinhart and Rogoff, 2009), we believe that this variable negatively affects the increase in public debt.

(viii) Government revenue as a percentage of GDP. They include taxes, social security contributions, grants receivable and other revenue. Revenue increases the government's net worth, which is the difference between its assets and its liabilities (IMF, 2018). In theory as in practice, public revenues are mobilized to finance development policies and repay external and internal debt. As a result, its sign on the increase in public debt is negative.

(ix) Public expenditure as a percentage of GDP. It is recognized that public spending plays a catalytic role in the revival of economic activity in the Keynesian and post-Keynesian postulate. It can, through the financing of major public works, generate revenue to act negatively on the stock of debt. However, in the presence of high corruption, the higher the public expenditure, the higher the debt ratio ceteris paribus (Cooray et al., 2017; Reinhart and Rogoff, 2010). In fact, corruption can change the composition of public spending from sectors such as health and education to sectors such as military spending that are not closely monitored (Cooray et al., 2017), making these expenditures unproductive positively affecting public debt when financed by loans (Minea and Villieu, 2008; Tanzi and Davoodi, 1998).

(x) Private investment-which measures a country's ability to attract private investors. It negatively affects the increase in public debt insofar as it improves certain macroeconomic indicators such as employment.

4.2 Methodology

4.2.1 Identification strategy

Our objective is to analyze whether the subscription to an RBL has contributed to the increase in public debt. To obtain a causal impact of RBLs, we compare the increase in public debt of countries that have subscribed to an RBL with that of non-subscribers. However, a selection bias may affect this comparison. Indeed, treated, and untreated individuals are not identical and their differences, in addition to being treated, can thus act as confounding factors if they impact their increase in debt. A simple comparison of our control variables according to the treatment status of the individuals (Table 1) shows that this is the case in our sample. In fact, the reasons why developing countries endowed with natural resources subscribe to RBLs (lack of liquidity, limited access to financial markets, payment default, debt rule etc.) could be associated with a country's macroeconomic conditions and its political situation as well. Thus, the result of treated individuals and those of the control group may differ even in the absence of treatment. We address this existing endogeneity using a matching approach.

Table 1: Characteristics of the treatment and control groups

Variables	[1] Mean in treated	[2] Mean in Untreated	[3]=[2]-[1] Difference	P_value
Natural resources rents	18.14	6.18	-11.96	0.000
Resources_rich country	0.92	0.56	-0.36	0.000
Inflation	23.24	7.11	-16.13	0.000
Log (trade openness)	3.93	4.16	0.23	0.000
Gdp per capita	20.10	19.49	-0.61	0.317
Private investment	0.26	0.34	0.08	0.012
General government investment	336.50	125.19	-211.31	0.000
Government expenditure	43.52	17.65	-25.87	0.000
Government revenue	13.76	4.17	-9.62	0.000
DR	22.37	21.42	-0.95	0.121

Note: In this table of matching covariates, country-year observations where an RBL exists (the treatment group) are in column [1] and country-year observations where no RBL exists (the control group potential) are in column [2]. Column [3] reports the differences in means between the treated group and the control group and column [4] indicates the corresponding p values

4.2.2 Propensity score matching

To account for potential selection biases, we use a popular approach to assess the impact of development policies (Chapel, 2022), propensity score matching (PSM) proposed by (Rosenbaum and Rubin, 1983). This method aims to minimize the selection bias by comparing each subscriber country with a non-subscriber counterfactual judged to be quite similar on certain observable characteristics. Indeed, the PSM is a two-step process: first, thanks to a probit model, we generate for each country a propensity score p(x), which estimates the probability that this country with its vector of characteristics, takes out a loan backed by natural resources. Thus,

$$\text{p}(X)=\Pr(T=1|X)=\text{E}(T/X)$$

Where, T= {0;1} is the binary variable indicating whether the country has subscribed to an RBL, and X is the vector of characteristics observed before the treatment. We define the variables used for its estimation presented in the table B3 in the appendix and Table 2 reports their main descriptive statistics. Second, we assess the impact of RBLs by estimating the average treatment country effect (ATT), expressed as follows:

$$ATT=E[(Y_{i_1}-Y_{i_0})|T_i=1]=E[(Y_{i_1}|T_i=1)]-E[(Y_{i_0}|T_i=1)] \quad (1)$$

Ti (treatment) is a dummy variable equal to 1 for country i that has a natural resource-

backed loan, and zero otherwise. Y_{i_1} captures the public debt at the period (t+5) when the country adopts an RBL, and Y_{i_0} is the public debt at the period (t+5) that would have been observed if the country had not contracted an RBL. The problem is that we cannot observe Y_{i_1} and Y_{i_0} simultaneously. We are therefore faced with a counterfactual problem. One solution would be to compare the average levels of increase in public debt between subscribers and non-subscribers countries to circumvent this difficulty. However, this approach assumes that treatment assignment is random. This assumption would be ad hoc because the choice to contract RBL may be dictated by some omitted variables (macroeconomic situation, institutional quality, degree of vulnerability, etc.) that also affect the growth of public debt, which would lead to a self-selection bias.
Furthermore, according to the conditional independence hypothesis (Rosenbaum and Rubin, 1983; Smith and Todd, 2005), we can replace in equation 1 the unobservable term $E[(Y_{i_0}|T_{i_1})]$ by the observable term $E[(Y_{i_0}|T_{i_0}, Xi)]$. This allows us to obtain equation 2.

$$ATT{=}E[(Y_{i_1}|T_i{=}1, X_i)] - E[(Y_{i_0}|T_i{=}1, X_i)] \tag{2}$$

The second hypothesis is the existence of a common support also called recovery condition ($0 < \text{p(X)} < 1$). Indeed, this hypothesis assumes that for each treated country, there is at least one non-treated country which is comparable to it and whose propensity score is close. This allows us to rewrite our equation 2 as follows:

$$ATT{=}E[(Y_{i_1}|T_i{=}1, p(X_i))] - E[(Y_{i_0}|T_i{=}1, p(X_i))] \tag{3}$$

Where $p(X_i) = Pr(RBL_i = 1|X_i)$ predicts, subject to set X, the probability of taking out a natural resource-backed loan. Moreover, we represent in appendix the density distribution of the propensity score on the two sub-samples to make sure that the common support is large enough (see figure 5). This figure clearly tells us that for a loan-subscribing country, there is at least one counterfactual (non-subscribers' country) that is similar, which would make matching possible.

4.2.3 Choice of matching algorithms

In general, we match treated countries to untreated countries based on their propensity scores through various matching methods and the ATT of this is the difference in debt accretion outcomes between treated and untreated countries. matched based on a similar propensity score. Next (Caliendo and Kopeinig, 2008; Rubin and Thomas, 1996; Heckman et al., 1998), and to ensure the robustness of our results, we use several matching estimators commonly used in recent studies (Sawadogo, 2020; Sawadogo et al., 2021; Fatema, 2019; Chapel, 2022; Bagnoli, 2019; Vikram and Chindarkar, 2020; Tapsoba, 2012;

Sawadogo and Wandaogo, 2021). We start as suggest by (Lechner, 2002),to obtain more accurate standard errors for the ATT. First, we use nearest neighbor matching and its extension. It associates each treated country with a control country that has the closest propensity score. When extending this method, it is also possible to match each treated country with more than one control country. As a result, we match each country treated with the two and then the three nearest neighbors in terms of propensity score. However, it should be noted that with this method, it is possible for a treated country to be matched with one or more control countries with a very different propensity score leading to poor correspondence and potentially biased results. For this we follow (Dehejia and Wahba, 2002), using the radius gauge matching method to resolve this bias. With this technique, each treated country is paired with all the control countries that are within a well-defined neighborhood threshold, called a caliper. In our case, we use a low (r = 0.005), medium (r = 0.01) and high (r = 0.05) caliber. Finally, we use two last algorithms: kernel-matching and local linear regression matching.

associates each treated unit with a counterfactual equal to the average of all the untreated units weighted by a weight inversely proportional to their distance from the considered treated unit. The second is a generalized version of the kernel estimator, but the difference is that it includes a linear term in the propensity score of a processed unit.

Table 2: Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependant variable					
(Public debt)	1392	-0.004	0.31	-1.649	6.862
Treatment variable					
RBL	1856	0.235	0.424	0	1
Control variables					
Natural resources rents	1803	8.947	10.346	0	62.697
Resources rich country	1856	0.641	0.48	0	1
Inflation	1639	48.094	649.248	-11.686	23773.131
Log(trade)	1529	4.086	0.531	0.259	5.617
Government revenue	1611	20.768	9.607	0.637	164.054
Debt Rule	1856	0.255	0.436	0	1
Gdp per capita	1769	140.724	397.176	0.322	3139.523
Private investment	1751	18.218	56.544	0	526.342
General gov investment	1751	5.208	16.248	0	150.546
Government expenditure	1608	24.014	23.241	2.147	594.77

5 Results

This section presents my main conclusions. First, I present the estimates of the propensity scores to the subsection 5.1. Then, the subsection 5.3. presents estimates of the mean treatment effect on treated individuals after matching the corresponding propensity scores.

5.1 Estimation of propensity scores

Table 3 presents the results of the probit model used to predict the propensity scores for the matching algorithms. The first column shows the results for the initial model (the baseline) where the probability of a country contracts out a resource-backed loan is estimated. Since the onset of a financial crisis may lead to a shock to the cost of natural resources on the international market which could affect the probability for a country to take out a natural resource-backed loan or not and bias our result, we exclude the years marked by financial crises[6] in column [2].Indeed, trade openness, private investment, and

[6]The 2008 financial crisis and the oil shock that occurred in 2014.

government revenue reduce the likelihood that a country will take out a natural resource-backed loan. However, natural resource endowment, natural resource rents, inflation, GDP per capita, public investment, and public expenditure are positively correlated with natural resource-backed loans. The overall regression fit is acceptable with a Pseudo R^2 of 0.4859 for our base model (Table 3).
Moreover, except for indebtedness rules, all the variables are significant with expected signs.

5.2 Evaluation of the matching quality

It's almost important to verify the matching process before interpreting our results to avoid potential biases that may affect our results and conclusions. First, we show the common support before and after matching (left and right, respectively) in Figure 5. Before matching, the common support looks quite large, but the graph shows only processed units with propensity score may not be matched because of the low number of close control group units. This common support area ranges from 6.42e-14 to 1. After matching, the propensity score distribution in the treated and untreated group is similar, reflecting that treated units were indeed matched with untreated units exhibiting a similar propensity score. Then, Figure B1 in the appendix tells us that most of our treated individuals have a probability very close to 0. It would be very easy to match the treated units with low propensity scores but not so easy to match the treated units with a high propensity score. Note that there is no consensus on the best test to use to judge the effectiveness of this test in the literature. However, (Simone and Bazilian, 2019), propose to re-estimate the propensity score only for matched individuals and to compare the Pseudo R^2 obtained with that obtained before the matching process. Indeed, if the matching worked well, the pseudo R^2 of the probit model with only matched individuals must have been considerably reduced and turned out to be very low. This is indeed the case in our study since we see in table 3 that it went from 0.4859 to almost 0. Other authors rely instead on the standardized bias which calculates the percentage of bias on each covariate. The bias must have decreased significantly from that before matching for each covariate, and the closer it's 0, the more efficient our matching. Figure 6 and Figure B1 below show the bias before and after matching for each covariate in the estimation model. According to (Rosenbaum and Rubin, 1983), the p-value associated with the standardized bias must be greater than the critical value of 10%. In our analysis this is the case since all the values are above this threshold (Table 3).
Finally, we use the latest test to check the quality of our results, namely the Rosenbaum lower bound sensitivity test. This test analyzes whether there are any unobservable that could affect the probability of taking out a natural resource-backed loan on the increase in public debt. In the literature no threshold is retained but the thresholds that we find

are similar or even higher than those obtained by other authors using the propensity score (Sawadogo, 2020; Vikram and Chindarkar, 2020; Sawadogo and Wandaogo, 2021; Chapel, 2022; Bagnoli, 2019; Fatema, 2019).

Table 3: Estimation of the propensity score

VARIABLES	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Natural resources rents	0.0938***	0.0917***	0.0920***	0.2931***	0.0961***	0.1085***	0.1065***	0.1133***
	(0.0111)	(0.0110)	(0.0102)	(0.0347)	(0.0113)	(0.0105)	(0.0103)	(0.0129)
resources rich Country	3.2005***	3.2707***	3.7052***	12.0330***	3.0295***	3.1341***	3.5393***	2.1113***
	(0.6253)	(0.6445)	(0.6434)	(1.6793)	(0.6160)	(0.5730)	(0.6409)	(0.3514)
Inflation	0.0247***	0.0240***	0.0251***	0.0433*	0.0256***	0.0279***	0.0244***	0.0270***
	(0.0054)	(0.0053)	(0.0054)	(0.0233)	(0.0056)	(0.0067)	(0.0061)	(0.0052)
log(trade)	-0.5646***	-0.5505***	-0.5761***	0.3631	-0.5581***	-0.4569**	-0.7172***	-0.4878***
	(0.1525)	(0.1562)	(0.1491)	(0.2762)	(0.1549)	(0.1807)	(0.1768)	(0.1560)
gdp per capita	0.0040***	0.0037***	0.0038***	0.0056***	0.0042***	0.0040***	0.0047***	0.0023***
	(0.0008)	(0.0008)	(0.0008)	(0.0022)	(0.0008)	(0.0007)	(0.0008)	(0.0007)
Private investment	-0.0274***	-0.0247***	-0.0237***	0.0104	-0.0274***	-0.0268***	-0.0307***	-0.0187***
	(0.0055)	(0.0058)	(0.0062)	(0.0134)	(0.0055)	(0.0056)	(0.0059)	(0.0048)
General government investment	0.0562***	0.0560***	0.0577***	-0.0037	0.0522***	0.0576***	0.0592***	0.0421***
	(0.0123)	(0.0131)	(0.0132)	(0.0145)	(0.0117)	(0.0127)	(0.0131)	(0.0102)
Government expenditure	0.0696**	0.0631**	0.0703***	0.1989***	0.0109	0.1019***	0.0487*	0.0839***
	(0.0279)	(0.0293)	(0.0263)	(0.0332)	(0.0404)	(0.0189)	(0.0274)	(0.0313)
Government revenue	-0.0854**	-0.0813**	-0.0715**	-0.3844***	-0.0225	-0.1312***	-0.0624*	-0.0903**
	(0.0346)	(0.0361)	(0.0338)	(0.0520)	(0.0451)	(0.0211)	(0.0331)	(0.0383)
Debt rule	0.1969	0.2143	0.1129	-1.0982***	0.1423	0.1183	0.1985	0.3893***
	(0.1279)	(0.1336)	(0.1346)	(0.4065)	(0.1298)	(0.1506)	(0.1298)	(0.1414)
Age dependency ratio			-0.1619***					
			(0.0437)					
Tax revenue				-0.0882**				
				(0.0383)				
Primary balance					-0.0647*			
					(0.0366)			
Military expenditure						0.1297**		
						(0.0587)		
Current account balance							-0.0371***	
							(0.0084)	
Log(population)								0.4476***
								(0.0640)
Constant	-3.0833***	-3.1201***	-2.7981***	-15.4466***	-2.9324***	-3.6683***	-3.1888***	-10.0520***
	(0.9748)	(0.9921)	(1.0118)	(2.4451)	(0.9788)	(1.0138)	(1.0155)	(1.4036)
Pseudo R2	0.4859	0.4784	0.4948	0.7624	0.4878	0.5091	0.5062	0.5218
Observations	1151	1052	1141	526	1151	1007	1146	1151

5.3 Matching results

We present the results of the ATTs estimates in Table 4. Row [1] presents the base model estimates. In Row [2], we explore the effect of RBLs on the change in public debt. The estimated coefficients are negative and significant with a magnitude varying between 0.39 (N-nearest-Neighbors) and 0.43 (Kernel) percentage points. Therefore, these results suggest that the subscription to resource-backed loans contributed to reducing public debt five years after the completion of the targeted projects. In fact, a possible explanation for these results lies in the countercyclicality of fully invested loans. The investments in infrastructure made positively affect well-being increase economic growth notably through consumption and demand, strong attractiveness of FDI which generates new tax revenues intended for the reimbursement of previous public debt.

Table 4: Average Treatment Effect on Treated (ATT).

Dependent Variable : debt(t+5)	1-Nearest Neighbor	2-Nearest Neighbor	3-Nearest Neighbor		Radius Matching		Local lineair regression	Kernel
	Matching	Matching	Matching	r=0.005	r=0.05	r=0.01	Matching	Matching
Baseline								
[1] ATT	-0.3916***	-0.4239***	-0.4498***	-0.3724***	-0.3689***	-0.4118***	-0.4863***	-0.4259***
	(0.1421)	(0.1237)	(0.1026)	(0.1201)	(0.0971)	(0.0999)	(0.1048)	(0.1174)
Observations	877	877	877	877	877	877	877	877
- Treated	217	217	217	217	217	217	217	217
- Untreated	660	660	660	660	660	660	660	660
Comparaison with $\Delta(Publicdebt)$								
[2] ATT	-0.0151	0.0921	0.0745	0.0345	0.0287	0.0207	0.0659	0.0184
	(0.0690)	(0.0740)	(0.0592)	(0.0403)	(0.0302)	(0.0641)	(0.0640)	(0.0740)
Observations	1005	1005	1005	1005	1005	1005	1005	1005
- Treated	244	244	244	244	244	244	244	244
- Untreated	761	761	761	761	761	761	761	761
Matching Quality								
Pseudo-R2	0.070	0.070	0.079	0.013	0.013	0.061	0.070	0.062
Rosenbaum bounds sensitivity test	1.2	1.7	1.5	2.3	1.1	1.1	1.6	1.1
Standardized bias (p-value)	0.854	0.151	0.229	0.367	0.467	0.727	0.328	0.759

Bootstrapped standard errors based on 50 replications in parentheses. *** p <0.01, ** p <0.05, * p <0.1

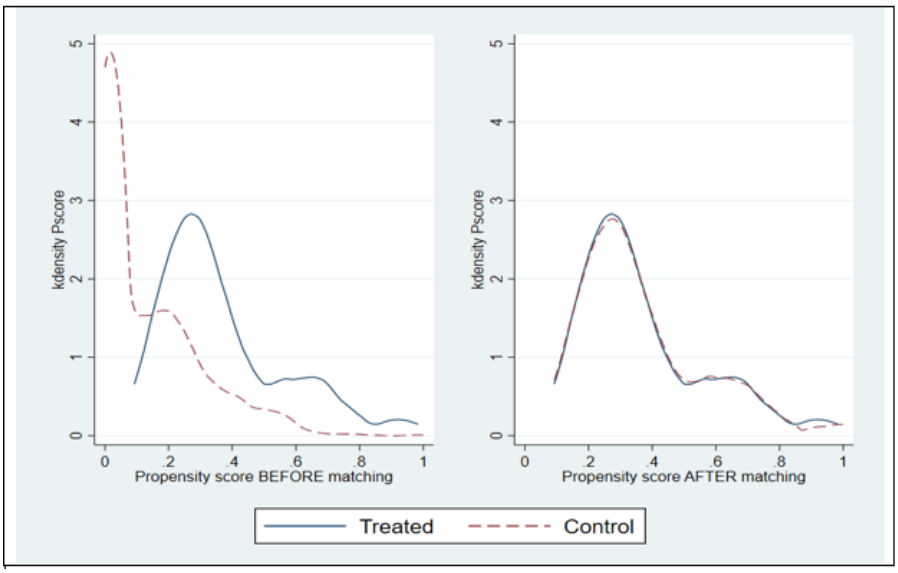

Figure 5: **Common support before and after matching.**

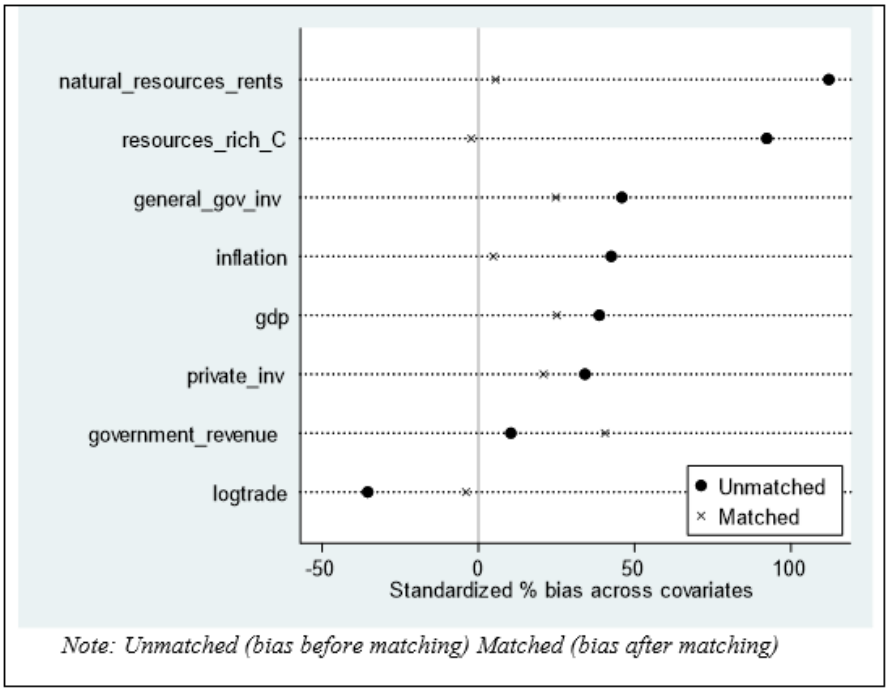

Figure 6: **Standardized bias before and after nearest neighbor matching.**

6 Robustness check

First, we test the sensibility of the main results in subsection 6.1. Next, we test for potential heterogeneity in the effect of resource-backed loans on public debt (t+5) in the subsection 6.2.

6.1 sensibility analysis

6.1.1 Alternative matching method

To test the robustness of our results, we use an alternative matching method - Mahalanobis distance matching. Indeed, the literature has brought criticisms and limitations of propensity score matching as a matching method (King and Nielsen, 2019) and implemented other methods such as Mahalanobis distance matching. Also, this method compares each unit processed by the closest control unit in terms of estimated Mahalanobis distance. In effect, (King and Nielsen, 2019) argue that PSM produces fragile and unrobust estimates that can vary wildly depending on the outcome model used. If you gradually remove units that are far apart from each other, the balance eventually deteriorates with the PSM even if there are still units close to each other on the PS[7]. It is what they term the propensity score paradox that is the primary reason for recommending against the use of PSM in favor of potentially more robust methods like MDM[8] which correspond directly on the covariate space. For all these stated reasons, we use this matching technique to capture the robustness of our results even though recent literature finds that PSM generally performed well on covariates and that even though the paradox occurred with some data , it was not a problem as long as extreme thickness values were not used, well beyond what would be recommended (Ripollone et al., 2018). Using this method, our estimated ATT remains negative and significant (Table 5).

Table 5: Robustness of the ATT to change the matching method.

	Baseline :Local lineair regression	Mahalanobis distance
Dependent variable : Public Debt (t+5)	Matching	Matching
ATT	-0.4863***	-0.1362***
	(0.1048)	(0.1014)
Observations	877	877
-Treated	217	217
-Untreated	660	660
Quality of Matching		
Pseudo R2	0.070	0.170

Bootstrapped standard errors based on 50 replications in parentheses. *** p <0.01, ** p <0.05, * p <0.1

6.1.2 Modification of sample

The number, the total amount as well as the share in GDP of resource-backed loans are not evenly distributed among the subscribing countries (Figure 3, Table A2 in the

[7]By imposing an ever-tighter caliber
[8]Mahalanobis Distance Matching

appendix). Indeed, while Venezuela subscribed to its ninth loan, some countries such as Guinea, Sudan, Sao Tome and Principe, Niger etc., subscribe for the first time to this type of loan. For reasons of robustness, we initially decided to reduce our sample to countries with more than two resource-backed loans. The probit model estimate of the propensity score can be found in Table 3, while those of the ATT according to the different algorithms are reported in Table 6 (row [2]). Next, we do not know the year 1990, which marks the year of the start of the subscription of the very first loan backed by natural resources by Angola (Table 6, row [3]). Theoretical and empirical evidence shows that some countries have experienced rounds of debt restrictions following economic crises and other victims of debt intolerance (Reinhart et al., 2003). For these reasons, we have excluded years marked by a financial and oil crisis (Row[4]). Moreover, since 36 countries in our sample experienced at least one episode of hyperinflation from 1990 to 2018, such extreme values could bias the estimates, thanks to the appreciation of the exchange rate. Therefore, in row[6] (Table 6), we exclude from the sample any episode of hyperinflation, defined as an inflation rate greater than or equal to 40% (Lin and Ye, 2009). In row [5] of Table 6, we exclude lower-middle-income countries. In fact, a very low level of wealth created by a country could discourage donors from loans it the funds necessary for its investment. As a result, it would be tempted to migrate to the loan market backed by its natural resources, which could probably increase the weight of RBLs and affect the increase in public debt over time.

6.1.3 Additional control variables

Finally, we test the robustness of our results by increasing the specification of our base model. To do this, we control through several additional variables likely to be positively or negatively correlated with both resource-backed loans and the outcome variable (Table 3, column [3]-[8]). These variables are respectively: age dependency ratio, tax revenue as a percentage of GDP, primary balance, military expenditure, current account balance and demographics. These variables are not introduced ad hoc because each of them gives an economic justification. Indeed, the age dependency ratio captures the ratio between dependents aged over 64 and the population of working age. (Arawatari and Ono, 2015), explain that increasing population aging puts strong upward pressure on public spending and public debt through age-related public health and pension spending. A country endowed with a natural resource with a high aging ratio might be tempted to contract or increase its RBL to finance its expenditures.

Going in the same orders as (Sawadogo, 2020),we can consider that a good budgetary discipline reduces the probability that a government will default on past loans, thus increasing its odds on the financial market with a good debt rating, reducing the probability of subscribing to an RBL. Therefore, tax revenues should be negatively correlated with

RBLs. Similarly, in the presence of a sound fiscal policy, the government's tax revenue increases, the primary balance improves because the government's ability to repay its debt would increase, which would reduce the probability of subscribing to an RBL. A positive primary balance is likely to reduce the probability for a state rich in natural resources to contract an RBL. However, Fiscal indiscipline accompanied by a negative sign of the primary balance could affect the probability of increasing RBLs and increasing public debt. Its sign on the RBLs depends on the fiscal efforts of the country. Referring to the literature, in the presence of a strong endowment of natural resources, some dictators considerably increase military expenditure to stay in power. They therefore use the revenue from the exploitation of natural resources to acquire military equipment. We believe that this variable positively influences the probability of subscribing to an RBL and indirectly affects the increase in public debt.

In addition, we control with the current account balance which captures the current balance of payments defined as the record of a country's international transactions with the rest of the world (OCDE/ATAF/CUA, 2017)[9].

Next, we add a variable that captures population growth. In fact, strong population growth has a strong influence on public spending, notably through the increase in needs and demand. If the population grows faster than the level of the country's wealth, this can modify the structure and allocation of resources, resulting in responsible borrowing. We believe that this variable acts positively on the probability of subscribing to an RBL. We report in columns ([3]-[8]) the results of the propensity score which remain qualitatively comparable to those obtained previously and like the results obtained for our reference model (column [1], table 3). Moreover, the results support most of our hypotheses. Military spending and demographics are positively colored by the likelihood of taking out a resource-backed loan. However, the age dependency ratio, tax revenue, primary balance, and lagged value of RBL are negatively colored to the probability of taking out a resource-backed loans. The results of the ATT are reported in Table 6 (Row [7]-[13]). The new coefficients remain qualitatively and quantitatively comparable to the results of the reference model (Row [1], table 4).

[9]The current account includes all transactions (other than those relating to financial items) which relate to economic values, and which take place between resident and non-resident entities.

Table 6: Robustness of ATT with the use of additional control variables.

Dependent Variable : debt(t+5)	1-Nearest Neighbor	2-Nearest Neighbor	3-Nearest Neighbor	Radius Matching			Local lineair regression	Kernel
		Matching		r=0.005	r=0.05	r=0.01	Matching	Matching
Baseline								
[1] ATT	-0.3916***	-0.4239***	-0.4498***	-0.3724***	-0.3689***	-0.4118***	-0.4863***	-0.4259***
	(0.1421)	(0.1237)	(0.1026)	(0.1201)	(0.0971)	(0.0999)	(0.1048)	(0.1174)
Observations	877	877	877	877	877	877	877	877
- Treated	217	217	217	217	217	217	217	217
- Untreated	660	660	660	660	660	660	660	660
Robustness								
Excluding								
[3] Countries with 1 and 2 RBL	-0.6584**	-0.3583	-0.5826**	-0.4604**	-0.4475**	-0.3801*	-0.4112	-0.3956**
	(0.2740)	(0.2794)	(0.2367)	(0.2020)	(0.2039)	(0.2057)	(0.2672)	(0.2137)
[4] Year 1990	-0.3516**	-0.4459***	-0.4597***	-0.2536***	-0.3624***	-0.4087***	-0.4945***	-0.4164***
	(0.1672)	(0.1310)	(0.1319)	(0.0971)	(0.1090)	(0.1222)	(0.1122)	(0.1127)
[5] Year of financial and oil crisis	-0.3729**	-0.4383***	-0.4696***	-0.2753**	-0.3234***	-0.4230***	-0.4908***	-0.4350***
	(0.1452)	(0.1335)	(0.1210)	(0.1184)	(0.1022)	(0.1177)	(0.1106)	(0.1119)
[6] Lower middle income countries	-0.3513**	-0.2738**	-0.3105***	-0.2057**	-0.2573**	-0.2710**	-0.3208**	-0.2899**
	(0.1430)	(0.1413)	(0.1171)	(0.1032)	(0.1135)	(0.1086)	(0.1275)	(0.1144)
[7] Hyperinflation episodes	-0.2074*	-0.3346***	-0.2442*	-0.2236**	-0.2011**	-0.2386**	-0.2365*	-0.2217*
	(0.1304)	(0.1265)	(0.1329)	(0.1017)	(0.0947)	(0.1042)	(0.1264)	(0.1212)
Adding variables								
[8] Oil dependency ratio	-0.3009	-0.4445***	-0.5087***	-0.2374**	-0.2407**	-0.4283***	-0.5465***	-0.4281***
	(0.1966)	(0.1367)	(0.1551)	(0.1173)	(0.1096)	(0.1573)	(0.1153)	(0.1553)
[9] Tax revenue	-0.2077	-0.3591**	-0.2881*	0.14806	0.0906	-0.0134	-0.1580	0.0307
	(0.2244)	(0.1625)	(0.1687)	(0.4788)	(0.4134)	(0.2532)	(0.2354)	(0.1951)
[10] Primary balance	-0.3209**	-0.4412***	-0.4979***	-0.3015**	-0.3259***	-0.4075***	-0.5192***	-0.4058***
	(0.1329)	(0.1227)	(0.1294)	(0.1276)	(0.0999)	(0.1184)	(0.1200)	(0.1064)
[11] Military expenditure	-0.5864***	-0.5757***	-0.5573***	-0.2313**	-0.3337***	-0.5624***	-0.5990***	-0.5636***
	(0.1582)	(0.1503)	(0.1320)	(0.1260)	(0.1224)	(0.1439)	(0.1304)	(0.1015)
[12] Current account balance	-0.4319***	-0.5049***	-0.5408***	-0.3645***	-0.4451***	-0.5193***	-0.5448***	-0.5109***
	(0.1227)	(0.1232)	(0.1093)	(0.1169)	(0.1100)	(0.0965)	(0.1158)	(0.1040)
[13] Log(population)	-0.0644	-0.1447	-0.1409	-0.0934	-0.1015	-0.0973	-0.0944	-0.0972
	(0.1325)	(0.0941)	(0.1314)	(0.0978)	(0.0963)	(0.0962)	(0.1158)	(0.0839)

Bootstrapped standard errors based on 50 replications in parentheses. *** p <0.01, ** p <0.05, * p <0.1

6.2 Heterogeneity

Several studies have explored potential sources of macroeconomic and political heterogeneity in developing countries. We explore the sensitivity of our results to these factors.

6.2.1 Macroeconomic stability: role of institutions

Here we explore the heterogeneous effect based on the idea that structural factors can dampen or amplify the effect of RBLs on increasing public debt. To do this, we follow the literature by constructing two composite indicators, namely: political stability and institutional quality. Next (Sawadogo, 2020), we use the method of simple weighted averages to calculate each of the indicators. For the first indicator, unlike these authors who only use six variables, we increase the number of variables to nine. These different variables used are government stability, internal & external conflict, corruption, military in politics, religious & ethnic tensions, democratic accountability, bureaucracy quality, socioeconomic conditions, and investment profile. For the second indicator, which measures institutional quality, three variables are used, namely: government effectiveness, control of corruption, and political stability. The results are reported in Table 7 (row [A]-[B]) The reported results remain robust and significant. Indeed, these results indicate that in the presence of good institutional quality and political stability, RBLs are more effective and significantly reduce the growth of public debt.

6.2.2 The effect of fiscal rules

An important literature has shown the crucial role of the existence of budgetary rules in the management of economic policies. For example (Combes et al., 2018), have shown that fiscal rules by positively affecting inflation targeting strengthen fiscal performance. Furthermore, the natural resource curse theory suggests that a large perception of natural resource rent triggers looser fiscal and monetary policies. For example, (Arezki et al., 2017) find budgetary indiscipline during the first five years after the discovery of a natural resource. Thereby, (Sawadogo et al., 2021) believe that the adoption of fiscal rules would enable these countries not only to avoid fiscal debauchery but also to strengthen and solidify fiscal policy by reducing the cost of borrowing. We therefore assess the effect of RBLs in the presence of these fiscal institutions. The results of the ATT are reported in Table 8. In row ([1]-[3]), we estimate the effect of a balanced budget rule (BBR), an expenditure rule (ER) and a fiscal rule (FR). The estimated coefficients are negative and economically significant. This suggests that RBLs are more effective in reducing debt build-up when fiscal rules are in place in the host country.

Table 7: Heterogeneity: the role of institutions

Dependent Variable :	Nearest Neighbor			Radius			Local lineair	Kernel
Public debt(t+5)	Matching			Matching			regression Matching	Matching
	N=1	N=2	N=3	r=0.005	r=0.05	r=0.01		
Political stability index								
[A] ATT	-0.3489**	-0.4614***	-0.4800***	-0.2725**	-0.3835***	-0.3678***	-0.4480***	-0.3876***
	(0.1598)	(0.1193)	(0.1374)	(0.1154)	(0.1267)	(0.1195)	(0.1196)	(0.1267)
Observations	686	686	686	686	686	686	686	686
Quality of institutions								
[2] ATT	-0.4950**	-0.4355**	-0.3881*	-0.3786*	-0.4338**	-0.3687*	-0.5612**	-0.4292*
	(0.2434)	(0.2141)	(0.2200)	(0.1958)	(0.2102)	(0.1911)	(0.2612)	(0.2358)
Observations	676	676	676	676	676	676	676	676

Bootstrapped standard errors based on 50 replications in parentheses. *** p <0.01, ** p <0.05, * p <0.1

Then, in row ([4]-[5]), we evaluate the potential effect of a cross between our treatment variable two budgetary rules: a balanced budget rule and an expenditure rule. The ATT coefficients are all significant and negative (local linear regression). This suggests that RBLs would be complementary to these two fiscal rules. A possible explanation for this result lies in the positive effect of fiscal rules on fiscal discipline (Sawadogo, 2020).

6.2.3 Treatment of conditional effects

In this section, we explore conditional effects considering possible differences between the countries in our sample. To do this, we take into account a wide range of potential sources of heterogeneity related to fiscal, monetary, political and other structural variables using a control function regression approach as in (Sawadogo, 2020; Lin and Ye, 2009; Tapsoba, 2012). Additionally, we estimated Equation 4 through an OLS regression.

$$Y_{i_t}=\alpha+\beta RBL_{i_t}+\gamma Pscore_{i_t}+\psi X_{i_t}+\phi RBL_{i_t}X_{i_t}+\varepsilon_{i_t} \tag{4}$$

Where Y is the outcome variable, Pscore is the PS estimated from the reference model, X the vector of variables which may be a source of heterogeneity. The results are reported in Table 9 below. First, column [1], we estimate the RBLs on the treatment variable. In column [2], the estimated propensity score (Pscore) is included for our base model as a control function. The propensity score coefficient is positive and significant, suggesting the presence of a selection bias. Next, in column ([3]-[4]), we evaluate the effect of RBLs on debt at period (t+5) in the presence of high rent collection. The results suggest that RBLs are more effective in reducing debt at the period (t+5) when there is high mobilization of natural resource rent. In column ([5]-[6]), we evaluate the effect of RBLs in the presence of a natural resource endowment. Thus, in column [6], we cross the RBLs with resource endowments to capture the effect of the presence of heterogeneity. The results indicate that RBLs negatively affect public debt in the period (t+5) when the country is endowed with a subsoil rich in natural resources. In column ([7]-[8]), we consider the assessment of factors affecting investment risk that are not covered by the other components of political, economic, and financial risk. The results suggest that RBLs are more effective in reducing public debt in countries where the business climate seems conducive. In fact, investors are very attracted to countries where the investment risk is very low to facilitate the repatriation of their profits, for example. In column [9], we explore a potential heterogeneity of RBLs in the presence of a monetary regime in this case, inflation targeting. In row with the theoretical literature, the adoption of inflation targeting has a significant and positive effect on fiscal discipline (Combes et al., 2018).

Table 8: Heterogeneity: the role of fiscal rules

Dependent Variable :	Nearest Neighbor				Radius		Local lineair	Kernel
Public debt(t+5)	Matching				Matching		regression Matching	Matching
	N=1	N=2	N=3	r=0.005	r=0.05	r=0.01		
[1] BBR: ATT	-0.4166***	-0.4869***	-0.4972***	-0.2465**	-0.4155***	-0.3548***	-0.5020***	-0.4309***
	(0.1157)	(0.1323)	(0.1335)	(0.1149)	(0.1021)	(0.0910)	(0.1249)	(0.1296)
Observations	877	877	877	877	877	877	877	877
[2] RE: ATT	-0.4366***	-0.4243***	-0.4485***	-0.3635***	-0.4044***	-0.3778***	-0.4800***	-0.4179***
	(0.1552)	(0.1163)	(0.1238)	(0.0988)	(0.1174)	(0.1185)	(0.1087)	(0.1223)
Observations	877	877	877	877	877	877	877	877
[3] FR: ATT	-0.3624***	-0.4195***	-0.4628***	-0.1987*	-0.4319***	-0.2956***	-0.4781***	-0.4523***
	(0.1394)	(0.1439)	(0.1214)	(0.1080)	(0.1069)	(0.0994)	(0.1350)	(0.1341)
Observations	877	877	877	877	877	877	877	877
[4] RBL*ER: ATT	-0.2848**	-0.3837***	-0.4089***	-0.3754***	-0.4284***	-0.3367**	-0.4831***	-0.4108***
	(0.1349)	(0.0984)	(0.1217)	(0.1311)	(0.1019)	(0.1331)	(0.1399)	(0.1228)
Observations	541	541	541	541	541	541	541	541
[4] RBL*BBR: ATT	-0.2478*	-0.3262*	-0.3396***	-0.1107	-0.4079***	-0.1400	-0.4166***	-0.3959***
	(0.1421)	(0.1426)	(0.1128)	(0.1990)	(0.1034)	(0.1699)	(0.0964)	(0.1211)
Observations	606	606	606	606	606	606	606	606

Bootstrapped standard errors based on 50 replications in parentheses. *** p <0.01, ** p <0.05, * p <0.1

Table 9: Exploration of heterogeneity

VARIABLES	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
RBL	0.0347	-0.1980	-0.1119	0.1062	-0.1636	0.2869*	-0.1147	0.2862	-0.2429	-0.0115	-0.4838**	-0.1772	-0.0723
	(0.1682)	(0.1774)	(0.1773)	(0.1954)	(0.1756)	(0.1543)	(0.1808)	(0.3886)	(0.1824)	(0.1759)	(0.2454)	(0.1816)	(0.1891)
Pscore		0.4949**	0.7107***	0.6278***	0.5069**	0.4908**	0.3942**	0.4019**	0.4995**	0.4002**	0.3641**	0.4643**	0.4295**
		(0.2154)	(0.2526)	(0.2271)	(0.2175)	(0.2171)	(0.1612)	(0.1664)	(0.2156)	(0.1744)	(0.1695)	(0.2103)	(0.2073)
Natural resources rents			-0.0138**										
			(0.0063)										
RBL*Natural resources rents				-0.0180***									
				(0.0061)									
Resources rich country					-0.1153								
					(0.1300)								
RBL*Resources rich country						-0.5237***							
						(0.1570)							
Investment profile							-0.0437*						
							(0.0241)						
RBL*Investment profile								-0.0549					
								(0.0384)					
Inflatin Targeting (IT)									-0.2401*				
									(0.1239)				
Corruption										0.0979**			
										(0.0419)			
RBL*corruption											0.2331***		
											(0.0881)		
FDI/Inflows												-0.0110	
												(0.0093)	
RBL*FDI/Inflows													-0.0244**
													(0.0096)
Constant	3.7721***	3.5742***	3.6384***	3.5574***	3.6386***	3.5747***	3.8971***	3.5600***	3.6163***	3.3346***	3.5656***	3.6155***	3.5834***
	(0.0662)	(0.0714)	(0.0755)	(0.0722)	(0.1058)	(0.0715)	(0.1985)	(0.0675)	(0.0801)	(0.1228)	(0.0675)	(0.0746)	(0.0710)
Observations	1364	877	877	877	877	877	686	686	877	686	686	875	875

Robust standard errors in parentheses *** p <0.01, ** p <0.05, * p <0.1

Moreover, inflation targeting can promote the accumulation of external reserves and reduce the current account deficit (Lin and Ye, 2009).

As a result, RBLs contribute effectively to reducing public debt in countries that have adopted inflation targeting. To do this, we have constructed an inflation targeting (IT) variable which takes the value 1 if the country adopts the policy and 0 otherwise. The results in column [9] suggest a negative and significant effect (not significant enough). This suggests that RBLs are becoming more effective in reducing debt for countries that have adopted inflation targeting.In column ([10]-[11]), we explore the effect of RBLs on public debt in the presence of corruption. The coefficient is positive and significant. The result obtained is not surprising, it thus suggests that the negative effect of RBLs on debt seems to be attenuated by the presence of high corruption. Finally, column ([12]-[13]), tests a potential heterogeneity of RBLs in the presence of a strong attractiveness of foreign direct investments (FDI). The results also indicate that RBLs are more effective in reducing public debt in countries that have a large inflow of FDI.

7 Conclusion and implications

In this article, we explore the effectiveness of natural resource-backed loans (RBL) in reducing public debt through public infrastructure investment in developing countries. We consider a sample of 64 countries for the period 1990-2018. A total of 406 country-year observations is associated with an established RBL (treatment group), and 1450 country-year observations associated with a non-RBL (control group). Using the propensity score matching method, we show a negative and significant impact of natural resource-backed loans on fiscal discipline in developing countries. As part of the literature on the effectiveness of resource-backed loans, this study reinforces the arguments in favor of its effectiveness. Indeed, it highlights the benefits of this type of financing for developing countries in a sector which itself has a great influence on human and economic development, namely infrastructure. Then, we look at the effect of such a financing tool on public debt over the first seven years after subscription. We find a negative and very significant effect from the second year on the public debt. This means that this type of financing does not begin to produce its effects until the second year, the first year being able to be considered as a year of transition between the realization and the use of the infrastructures. Finally, we find that natural resource-backed loans are very effective in reducing public debt when fiscal rules are put in place by the country. In fact, fiscal rules facilitate access to financial markets by reducing the cost of borrowing (Sawadogo, 2020). These results are robust to a wide range of alternative specifications of the propensity score matching method and an alternative matching method namely: Matching Mahalonobis distances. In terms of recommendations, our results encourage this type of specific financ-

ing to meet the growing needs of the population in terms of infrastructure but also to promote sustainable development. Thus, governments of resource-rich countries looking for sources of financing should turn to these loans. But, these resource-backed loans could increase public debt and loosen fiscal policy in cases of high corruption, poor institutional quality and bad governance. Signatory countries should focus on improving these indicators to avoid the debt unsustainability that such resource-backed loans could cause. This is because resource-based lending can jeopardise the public debt situation (Horn et al., 2021; Mihalyi et al., 2022) and can prevent the country from mobilising financial resources to fund the provision of goods and services. Even if we were able to bring forward certain novelties in our analysis, other improvements can still be made. Indeed, future research could focus on the efficiency factors of this type of loan, such as transparency. It's all the same important to examine the comparison between the effectiveness of projects financed by these types of loans and those financed by other bilateral donors and the World Bank for better arbitration. We intend to explore these avenues of research later. However, some limitations can be noted when interpreting the results. The latter are related to the quality of the matching provided. In view of the literature, the debate on the ability of propensity score matching to provide unbiased estimates seems far from over (King and Nielsen, 2019; Dehejia and Wahba, 2002; Peikes et al., 2008).

Despite our conclusive results on hidden biases, we cannot completely rule out the influence of unobserved factors, although the wide range of robustness tests we have performed gives us confidence that our results are reliable. In addition, we were not able to exploit for our control group, variables capturing the fact that an individual not treated not to subscribe to an RBL was interested in another type of loan other than the RBL despite our identification strategy. Indeed, we were forced to control the treatment variables over time. However, not controlling for these variables could expose us to a bias in the estimates. Another potential source is observations that cannot be matched and are not used to measure the causal effect. In fact, causal effects estimated from matched pairs vary depending on how the matching is specified.

References

Adam, M. A. (2010). *Fiscal Policy Options for Managing an Oil Economy.*

Agbeyegbe, T. D., Stotsky, J., and WoldeMariam, A. (2006). Trade liberalization, exchange rate changes, and tax revenue in Sub-Saharan Africa. *Journal of Asian Economics*, 17(2):261–284.

Alves, A. C. (2013). Chinese Economic Statecraft: A Comparative Study of China's Oil-backed Loans in Angola and Brazil. *Journal of Current Chinese Affairs*, 42(1):99–130.

Ampofo, G. M. K., Jinhua, C., Bosah, P. C., Ayimadu, E. T., and Senadzo, P. (2021). Nexus between total natural resource rents and public debt in resource-rich countries:A panel data analysis. *Resources Policy*, 74:102276.

Arawatari, R. and Ono, T. (2015). Inequality and public debt: a positive analysis. Technical report.

Arezki, R., Gylfason, T., and Sy, A. (2012). Beyond the curse : policies to harness the power of natural resources.

Arezki, R., Ramey, V. A., and Sheng, L. (2017). News Shocks in Open Economies: Evidence from Giant Oil Discoveries*. *The Quarterly Journal of Economics*, 132(1):103–155.

Arias, M. A. and Restrepo-Echavarria, P. (2016). Demographics help explain the fall in the labor force participation rate. *The Regional Economist*, (October).

Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2):177–200.

Auty, R. M. (1994). Industrial policy reform in six large newly industrializing countries: The resource curse thesis. *World Development*, 22(1):11–26.

Auty, R. M. (1997). Natural Resource Endowment, the State and Development Strategy. *Journal of International Development*, 9(4):651–663.

Bagnoli, L. (2019). Does health insurance improve health for all? Heterogeneous effects on children in Ghana. *World development*, 124:104636.

Barro, R. J. (1979). On the determination of the public debt. *Journal of political Economy*, 87(5, Part 1):940–971.

Ben-Salha, O., Dachraoui, H., and Sebri, M. (2021). Natural resource rents and economic growth in the top resource-abundant countries: A PMG estimation. *Resources Policy*, 74:101229.

Bova, E., Medas, P., and Poghosyan, T. (2018). Macroeconomic Stability in Resource-rich Countries: The Role of Fiscal Policy. *Journal of Banking and Financial Economics*, 9(1):103–122.

Brückner, M. (2010). Natural resource dependence, non-tradables, and economic growth. *Journal of Comparative Economics*, 38(4):461–471.

Buffie, M. E. F., Berg, M. A., Portillo, R., Pattillo, M. C. A., and Zanna, L.-F. (2012). *Public Investment, Growth, and Debt Sustainability: Putting together the Pieces*. International Monetary Fund.

Caliendo, M. and Kopeinig, S. (2008). Some Practical Guidance for the Implementation of Propensity Score Matching. *Journal of Economic Surveys*, 22(1):31–72.

Carbonnier, G. (2013). The resource curse and its antidotes. *Revue internationale et strategique*, 91(3):38–48.

Carneiro, F. (2007). Development Challenges of Resource-Rich Countries: The Case of Oil Exporters. Technical report, Social Science Research Network, Rochester, NY.

Carrasco, E. R. (1999). The 1980's: the debt crisis and the lost decade of development. 9:119.

Carrera, J. and Pablo, d. l. V. (2021). The impact of income inequality on public debt. *2021*.

Chapel, C. (2022). Impact of official development assistance projects for renewable energy on electrification in sub-Saharan Africa. *World Development*, 152:105784.

Collie, P. and Venables, A. J. (2008). Managing resource revenues: lessons for low income countries. page 31.

Combes, J.-L., Debrun, X., Minea, A., and Tapsoba, R. (2018). Inflation targeting, fiscal rules and the policy mix: Cross-effects and interactions. *The Economic Journal*, 128(615):2755–2784.

Cooray, A., Dzhumashev, R., and Schneider, F. (2017). How Does Corruption Affect Public Debt? An Empirical Analysis. *World Development*, 90:115–127.

Cust, J. F. and Mihalyi, D. (2017). Evidence for a Presource Curse? Oil Discoveries, Elevated Expectations, and Growth Disappointments. Technical report.

Dabla-Norris, E., Brumby, J., Kyobe, A. J., Mills, Z., and Papageorgiou, C. (2011). Investing in Public Investment: An Index of Public Investment Efficiency. *IMF Working Papers*, 2011(037). ISBN: 9781455217892 Publisher: International Monetary Fund Section: IMF Working Papers.

Dauvin, M. and Guerreiro, D. (2017). The Paradox of Plenty: A Meta-Analysis. *World Development*, 94:212–231.

Dawda, A., Adams, K., Kweku, A., and Farid, U. (2019). Globalisation, governance, accountability and the natural resource 'curse': Implications for socio-economic growth of oil-rich developing countries. *Resources Policy*, 61:128–140.

Deacon, R. (2011). The Political Economy of the Natural Resources Curse: A Survey of Theory and Evidence. *Foundations and Trends® in Microeconomics*, 7(2):111–208.

Deacon, R. T. and Rode, A. (2015). Rent seeking and the resource curse. In *Companion to the Political Economy of Rent Seeking*, pages 227–247. Edward Elgar Publishing.

Dehejia, R. H. and Wahba, S. (2002). Propensity Score-Matching Methods for Nonexperimental Causal Studies. *The Review of Economics and Statistics*, 84(1):151–161.

Ebrill, L. P., Gropp, R., and Stotsky, J. G. (1999). *Revenue implications of trade liberalization.* International Monetary Fund.

Elkhan Sadik-Zada, A. G. and Gatto, A. (2019). Determinants of the Public Debt and the Role of the Natural Resources: A Cross-Country Analysis. Technical Report 2019.04.

Farigoul, S. (2020). Objectif de Développement Durable - Industrie, innovation et infrastructures.

Fatema, N. (2019). Can land title reduce low-intensity interhousehold conflict incidences and associated damages in eastern DRC? *World Development*, 123:104612.

Gelb, A. H. (1988). *Oil Windfalls: Blessing Or Curse?* World Bank.

Guan, J., Kirikkaleli, D., Bibi, A., and Zhang, W. (2020). Natural resources rents nexus with financial development in the presence of globalization: Is the "resource curse" exist or myth? *Resources Policy*, 66:101641.

Gylfason, T. (2011). Natural Resource Endowment: A Mixed Blessing? Technical report, Social Science Research Network.

Habia, J. K. (2009). *The Bui Dam impact on Ghana-China relations : transparency, accountability and development outcomes from China's Sino Hydro Dam Project in Ghana.* Thesis, Massachusetts Institute of Technology.

Halland, H., Beardsworth, J., Land, B., and Schmidt, J. (2015). *Infrastructures Financees Par des Ressources Naturelles.* World Bank Publications, Washington.

Halland, H., Lokanc, M., Nair, A., and Kannan, S. P. (2016). *Le secteur des industries extractives: Points essentiels à l'intention des économistes, des spécialistes des finances publiques et des responsables politiques*. World Bank Publications.

Halland, H. and Ossowski, R. (2016). *Fiscal Management in Resource-Rich Countries: Essentials for Economists, Public Finance Professionals, and Policy Makers*. World Bank Publications.

Heckman, J. J., Ichimura, H., and Todd, P. (1998). Matching As An Econometric Evaluation Estimator. *The Review of Economic Studies*, 65(2):261–294.

Horn, S., Reinhart, C. M., and Trebesch, C. (2021). China's overseas lending. *Journal of International Economics*, 133:103539.

IEA (2019). World Energy Outlook 2019. https://www.iea.org/reports/worldenergy-outlook-2019.

IMF (2015). Public Debt Vulnerabilities in Low Income Countries - The Evolving Landscape.

IMF (2017). "Review of the Debt Sustainability Framework in Low-Income Countries: Proposed Reforms." (Washington).

IMF (2018). "Debt Vulnerabilities in Emerging and Low-income Countries," Development Committee. (Washington).

IMF (2020). THE EVOLUTION OF PUBLIC DEBT VULNERABILITIES IN LOWER INCOME ECONOMIES.

ITIE (2020). Prêts garantis par des ressources : dettes viables ou menaces imminentes ?

Jia, J., Liu, Y., Martinez-Vazquez, J., and Zhang, K. (2021). Vertical fiscal imbalance and local fiscal indiscipline: Empirical evidence from China. *European Journal of Political Economy*, 68.

King, G. and Nielsen, R. (2019). Why Propensity Scores Should Not Be Used for Matching. *Political Analysis*, 27(4):435–454.

Konopczak, M. (2015). Government debt holdings of non-residents–an analysis of the impact on selected emerging economies' sovereign risk.

Kose, M. A., Kurlat, S., Ohnsorge, F., and Sugawara, N. (2017). A Cross-Country Database of Fiscal Space. page 48.

Kropf, A. (2010). Resource abundance vs. resource dependence in cross-country growth regressions. *OPEC Energy Review*, 34(2):107–130.

Lechner, M. (2002). Program Heterogeneity and Propensity Score Matching: An Application to the Evaluation of Active Labor Market Policies. *The Review of Economics and Statistics*, 84(2):205–220.

Lederman, D. and Maloney, W. F. (2006). *Natural resources, neither curse nor destiny*. World Bank Publications.

Lin, S. and Ye, H. (2009). Does inflation targeting make a difference in developing countries? *Journal of Development economics*, 89(1):118–123.

Manzano, O. and Rigobon, R. (2001). Resource Curse or Debt Overhang? Working Paper 8390, National Bureau of Economic Research.

Mascagni, G., Moore, M., and McCluskey, R. (2014). *Tax Revenue Mobilistation In Developing Countries: Issues and Challenges*.

Mavrotas, G., Murshed, S. M., and Torres, S. (2011). Natural Resource Dependence and Economic Performance in the 1970–2000 Period. *Review of Development Economics*, 15(1):124–138.

Meissner, C., Sarr, M., Bulte, E., and Swanson, T. (2010). Sovereign Debt and the Resource Curse. Retrieved from.

Melina, M. G., Yang, M. S. S., and Zanna, L.-F. (2014). *Debt Sustainability, Public Investment, and Natural Resources in Developing Countries: the DIGNAR Model*. International Monetary Fund.

Mihalyi, D., Adam, A., and Jyhjong, H. (2020). Prêts adossés à des ressources naturelles: pièges et potentiel. page 8.

Mihalyi, D., Hwang, J., Rivetti, D., and Cust, J. (2022). Resource-backed loans in subsaharan africa.

Minea, A. and Villieu, P. (2008). Faut-il financer l'investissement public par emprunt? *Revue économique*, 59(1):5–32.

Morgan, J. (2015). "Are Foreign Holdings of EM Local Bonds a Technical Risk?" Global Emerging Markets Research, October.

Mubariz, M., Rana, H., Richard, S.-Z., and Andrea, G. (2021). What Drives Public Debt Growth? A Focus on Natural Resources, Sustainability and Development. *01 May 2021*.

Nations, U. (2019). Economic and Social Survey of Asia and the Pacific 2019: Ambitions beyond growth.

Nyamudzang, L. (2021). What do we know about resource-backed loans?

OCDE/ATAF/CUA (2017). Statistiques des recettes publiques en Afrique 2017, Éditions OCDE, Paris.

Orluwene, O. B. (2013). Elite Conspiracy And Fiscal Indiscipline In Nigeria: An Overview. *Leadership & Organizational Management Journal*, 2013(2).

Peikes, D. N., Moreno, L., and Orzol, S. M. (2008). Propensity Score Matching. *The American Statistician*, 62(3):222–231.

Perry, K. K. (2020). The triple crisis of debt, demand and decarbonisation: a preliminary analysis of the impact of COVID-19 on commodity-dependent developing economies. *International Journal of Development Issues*, 20(2):226–242.

Philippot, L.-M. (2011). Rente naturelle et institutions. Les Ressources Naturelles: Une " Malédiction Institutionnelle "? page 32.

Qiang, Q. and Jian, C. (2020). Natural resource endowment, institutional quality and China's regional economic growth - ScienceDirect.

Ragot, X. and Saraceno, F. (2016). Investissement public, capital public et croissance. *OFCE Policy brief*, (7).

Raveh, O. and Tsur, Y. (2020). Resource windfalls and public debt: A political economy perspective. *European Economic Review*, 123:103371.

Reinhart, C. and Rogoff, K. (2010). Debt and growth revisited.

Reinhart, C., Rogoff, K., and Savastano, M. (2003). Debt Intolerance. Technical report, National Bureau of Economic Research.

Reinhart, C. M. and Rogoff, K. S. (2009). *This Time Is Different: Eight Centuries of Financial Folly*.

Ripollone, J. E., Huybrechts, K. F., Rothman, K. J., Ferguson, R. E., and Franklin, J. M. (2018). Implications of the Propensity Score Matching Paradox in Pharmacoepidemiology. *American Journal of Epidemiology*, 187(9):1951–1961.

Rosenbaum, P. R. and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1):41–55.

Rubin, D. B. and Thomas, N. (1996). Matching Using Estimated Propensity Scores: Relating Theory to Practice. *Biometrics*, 52(1):249–264.

Ruslan, A. (2012). Monetary Policy in Resource-Rich Developing Economies. *SSRN Electronic Journal*.

Sachs, J. D. and Warner, A. M. (1997). Sources of Slow Growth in African Economies1. *Journal of African Economies*, 6(3):335–376.

Sadik-Zada, E. R. (2016). *Oil Abundance and Economic Growth*.

Sadik-Zada, E. R. and Gatto, A. (2019). Determinants of the Public Debt and the Role of the Natural Resources: A Cross-Country Analysis. *7 May 2019*, page 24 Pages.

Sawadogo, F. and Wandaogo, A.-A. (2021). Does mobile money services adoption foster intra-African goods trade? *Economics Letters*, 199:109681.

Sawadogo, P. N. (2020). Can fiscal rules improve financial market access for developing countries? *Journal of Macroeconomics*, 65:103214.

Sawadogo, P. N., Combes, J.-L., and Minea, A. (2021). Does the composition of government spending matter for government bond spreads? *Economic Modelling*, 96:409–420.

Simone, T. and Bazilian, M. (2019). The role of international institutions in fostering sub-Saharan Africa's electrification. *The Electricity Journal*, 32(2):13–20.

Smith, J. A. and Todd, P. E. (2005). Does matching overcome LaLonde's critique of nonexperimental estimators? *Journal of econometrics*, 125(1-2):305–353.

Souidi, R., Belkacem, D. K., and Sami, L. (2018). Natural Resources, Quality of Institutions and Public Spending: The Algerian Case. 20(1):18.

Tanzi, V. and Davoodi, H. (1998). Corruption, public investment, and growth. In *The welfare state, public investment, and growth*, pages 41–60.

Tapsoba, R. (2012). Does Inflation Targeting Matter for Attracting Foreign Direct Investment into Developing Countries?

Vikram, K. and Chindarkar, N. (2020). Bridging the gaps in cognitive achievement in India: The crucial role of the integrated child development services in early childhood. *World Development*, 127.

World, B. (2019). Beyond the Gap – How Countries Can Afford the Infrastructure They Need while Protecting the Planet.

World, B. (2020a). 4 graphiques sur l'explosion de la dette.

World, B. (2020b). Nouveauté : publication de rapports périodiques sur la dette.

Appendix A Data and Sample

Table A1 – List of countries

Treatment group (RBL)			
Country	Number of RBL	Number of projects financed	years
Angola	6	6	2004,2007,2009, 2010 and 2015
Brazil	5	4	2009,2015,2016 and 2017
Chad	2	1	2014 and 2014
RDC	2	2	2008 and 2011
Ecuador	7	4	2011,2012,2015 and 2016
Ghana	3	3	2011 and 2018
Guinée	1	1	2017
Niger	1	1	2013
Republic of congo	5	3	2006,2011, 2012 and 2015
Sao Tomé-et-Príncipe	1	1	2010
South Sudan	3	1	2015 and 2016
Soudan	1	1	2007
Venezuela	10	10	2006,2007,2009,2010,2011, 2013,2014,2015 and 2016
Zimbabwe	2	2	2006 and 2011

Control group (Non-RBL)		
Argentina	Grenada	Nicaragua
Benin	Guinea-Bissau	Nigeria
Botswana	Guyana	Panama
Cabo Verde	Haiti	Paraguay
Cameroon	Honduras	Peru
Central African Republic	Jamaica	Rwanda
Colombia	Kenya	Senegal
Comoros	Lesotho	Sierra Leone
Costa Rica	Liberia	South Africa
Côte d'Ivoire	Madagascar	St. Lucia
Dominica	Malawi	St. Vincent and the Grenadines
Dominican Republic	Mali	Suriname
El Salvador	Mauritania	Tanzania
Equatorial Guinea	Mauritius	Togo
Eswatini	Mexico	Uganda
Ethiopia	Mozambique	Zambia
Gabon	Namibia	

Source: Author's construction based on information from Mihalyi et al. (2020)

Table A2 – List of resource-backed loans

Loan year	Country	Loans in millions of USD	Resources used	loans country	loans entity	Sectors targeted for investment
2004	Angola	2000	Oil	Chine	Eximbank	Infrastructure
2007	Angola	500	Oil	Chine	Eximbank	Infrastructure
2007	Angola	2000	Oil	Chine	Eximbank	Infrastructure
2009	Angola	2000	Oil	Chine	Eximbank	Infrastructure
2010	Angola	2500	Oil	Chine	ICBC	housing
2015	Angola	15000	Oil	Chine	CDB	Infrastructure
2013	Chad	600	Oil	International	Glencore	Budget support and debt refinancing
2014	Chad	1356	Oil	International	Glencore	Oil
2008	RDC	3000	Copper & Cobalt	Chine	Eximbank	Infrastructure
2011	RDC	500	Copper	Corée	Korea Exim	Infrastructure
2011	Ghana	1500	Oil	Chine	CDB	Infrastructure
2011	Ghana*	1500	Oil	Chine	CDB	Infrastructure
2018	Ghana	2000	Bauxite	Chine	Sinohydro	Infrastructure
2017	Guinée	20000	Bauxite	Chine	CCC	Infrastructure
2013	Niger*	1000	Oil	Chine	Eximbank	Oil
2006	Republic of Congo	1600	Oil	Chine	Eximbank	Infrastructure
2011	Republic of Congo	625	Oil	International	Gunvor	Oil
2012	Republic of Congo	1000	Oil	Chine	Eximbank	Infrastructure
2015	Republic of Congo	1000	Oil	International	Trafigura	Unknown
2015	Republic of Congo	850	Oil	International	Glencore	Unknown
2010	Sao Tome and Principe	30	Oil	Nigeria	Gouvernement	Oil
2015	South Sudan	75	Oil	International	CNPC	Unknown
2015	South Sudan	1000	Oil	Chine	Eximbank	Soutien budgétaire
2016	South Sudan	169	Oil	Chine	Eximbank	Route
2007	Soudan	3000	Oil	Chine	Eximbank	Infrastructure
2006	Zimbabwe	200	platinum	Chine	Eximbank	Agriculture
2011	Zimbabwe	98	Diamond	Chine	Eximbank	Education

Source: Author's construction based on information from Mihalyi et al. (2022)

Note: RBLs marked with * were subsequently cancelled without disbursement.

Table A3 – Summary statistics for all variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Debt (t+5)	1364	3.772	0.726	-2.645	6.398
RBL	1856	0.204	0.403	0	1
Natural resources rents	1803	8.947	10.346	0	62.697
Resources rich country	1856	0.641	0.48	0	1
Inflation	1639	48.094	649.248	-11.686	23773.131
Log (trade)	1529	4.086	0.531	0.259	5.617
Government revenue	1611	20.768	9.607	0.637	164.054
Debt Rule	1856	0.255	0.436	0	1
GDP per capita	1769	140.724	397.176	0.322	3139.523
Private investment	1751	18.218	56.544	0	526.342
General gov investment	1751	5.208	16.248	0	150.546
Lag (RBL)	1856	927.5	535.925	0	1855
Fiscal Rule (All fiscal rules)	1856	0.156	0.363	0	1
ER	1856	0.094	0.292	0	1
Bureaucracy Quality	1334	1.518	0.888	0	4
Democratic Accountability	1334	3.544	1.278	0	6
Ethnic Tensions	1334	3.696	1.274	0	6
Religious Tensions	1334	4.635	1.287	0	6
Military in Politics	1334	2.907	1.686	0	6
Corruption	1334	2.323	0.919	0	5
External Conflict	1334	9.751	1.635	2	12
Internal Conflict	1334	8.287	2.003	.167	12
Investment Profile	1334	6.793	1.997	0	11.5
Socioeconomic Conditions	1334	4.156	1.7	0	8.5
Government Stability	1334	7.562	1.919	1	11.583
Quality institutions	1265	-0.498	0.646	-2.212	1.036
Political Stability	1268	-0.393	0.857	-2.845	1.219
Government Effectiveness	1265	-0.573	0.643	-2.475	1.057
BBR	1856	0.266	0.442	0	1
Primary balance	1596	-1.232	21.201	-549.84	126.464
Log (population total)	1856	15.582	1.791	11.151	19.16
Age dependency ratio	1827	7.246	2.57	3.537	17.339

Table A4 – Robustness of ATT with the use of Public Debt on several period (7 fist period)

	Nearest Neighbor			Radius			Local lineair regression	Kernel
Dependent Variable	Matching			Matching			Matching	Matching
	N=1	N=2	N=3	r=0.005	r=0.05	r=0.01		
Debt (t+1) : ATT	-0.1601	-0.1905	-0.1564	-0.1379	-0.2103*	-0.1619*	-0.1998**	-0.2109*
	(0.1167)	(0.1294)	(0.1182)	(0.1038)	(0.1113)	(0.0952)	(0.0955)	(0.0854)
Observations	1014	1014	1014	1014	1014	1014	1014	1014
Debt (t+2) : ATT	-0.2233**	-0.2392**	-0.2362**	-0.2015**	-0.2476***	-0.1448	-0.2516***	-0.2468***
	(0.1118)	(0.1080)	(0.1003)	(0.0943)	(0.0985)	(0.0943)	(0.0893)	(0.0746)
Observations	984	984	984	984	984	984	984	984
Debt (t+3) : ATT	-0.2825**	-0.2915***	-0.3421**	-0.0581	-0.3186***	-0.1638	-0.3434***	-0.3190***
	(0.1241)	(0.1107)	(0.1433)	(0.1027)	(0.1128)	(0.1128)	(0.1098)	(0.1171)
Observations	951	951	951	951	951	951	951	951
Debt (t+4) : ATT	-0.4642**	-0.3748***	-0.3995***	-0.1996**	-0.4060***	-0.2620**	-0.4242***	-0.4018***
	(0.1801)	(0.1362)	(0.1288)	(0.0808)	(0.1023)	(0.1125)	(0.1139)	(0.1157)
Observations	916	916	916	916	916	916	916	916
Debt (t+6) : ATT	-0.4034***	-0.4698***	-0.4832***	-0.2455**	-0.4391***	-0.3310***	-0.5253***	-0.4347***
	(0.1243)	(0.1245)	(0.1178)	(0.1176)	(0.1055)	(0.0993)	(0.1103)	(0.1028)
Observations	836	836	836	836	836	836	836	836
Debt (t+7) : ATT	-0.4372***	-0.4382***	-0.4523***	-0.3576***	-0.4447***	-0.3852***	-0.5432***	-0.4438***
	(0.1280)	(0.1284)	(0.1162)	(0.1344)	(0.1393)	(0.0874)	(0.1365)	(0.1109)
Observations	790	790	790	790	790	790	790	790

Bootstrapped standard errors based on 50 replications in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Appendix B Graphs and variable definition

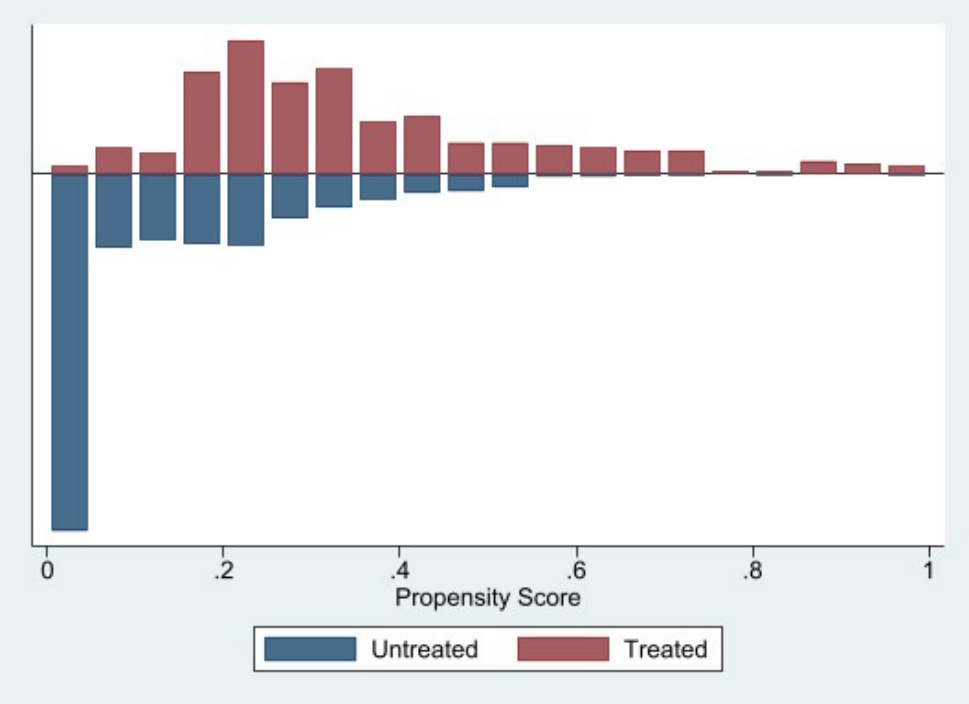

Figure B1 - Graphs of propensity score histogram by treatment status.

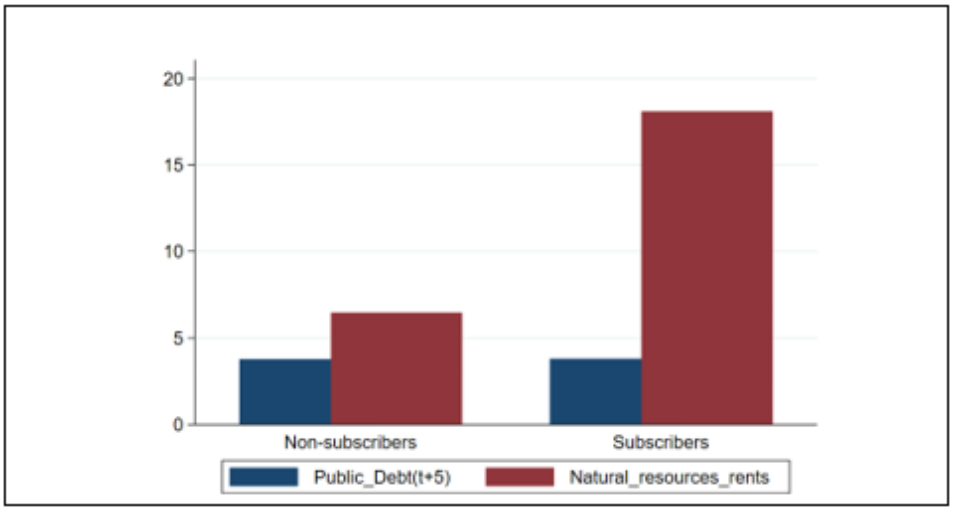

Figure B2 - Average Public debt at the period (t+5).

Table B3 – Definition and sources of variables

Variables	Descriptions	Sources
Debt/GDP	General government gross debt, % of GDP	Kose et al. (2017)
Primary balance	Primary balance, % of GDP (government debt sustainability)	
RBL	Binary variable equal to 1 if country i in year t was targeting inflation, and 0 otherwise.	Authors' calculations based on NRGI dataset
Inflation Targeting (IT)	Binary variable equal to 1 if country i in year t was targeting inflation, and 0 otherwise.	Rose, 2006; Minea & Tapsoba, 2014; Roger,2009
Resource rich country	Dummy which equals 1 if a given country is a resource rich country and 0 otherwise	Author's calculations based on WDI
FR	Dummy equal to 1 if there is a fiscal rule in place and 0 otherwise	
BBR	Dummy equal to 1 if there is a balanced budget rule in place and otherwise	IMF Fiscal Rules Dataset, 2022
DR	Dummy equal to 1 if there is a debt rule in place and 0 otherwise	
ER	Dummy equal to 1 if there is an expenditure rule in place and 0 otherwise	
Inflation rate	Annual percentage change of consumer price index	
Trade Openness	Sum of exports and imports of goods and services, % of GDP.	
Natural resources rents	Total natural resources rents (% of GDP)	
GDP per capita	GDP per capita growth (annual %)	WDI
FDI Inflows	Net inflows (new investment inflows less disinvestment) in a given economy from foreign investors, divided by GDP.	
Age dependency ratio	Age dependency ratio, old (% of working-age population)	
Military expenditure	Military expenditure (% of GDP)	
Population	Population, total	
Tax revenue	Tax revenue (% of GDP)	
Investment profile	The risk to investment computed as the sum of contract viability/expropriation, profits repatriation, and payment delays.	
Socioeconomic conditions	A higher value signals a lower risk. This is an assessment of the socioeconomic pressures at work in society that could constrain government action or fuel social dissatisfaction. The risk rating assigned is the sum of three subcomponents, each with a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk.	
Internal Conflict	This is an assessment of political violence in the country and its actual or potential impact on governance. The highest rating is given to those countries where there is no armed or civil opposition to the government and the government does not indulge in arbitrary violence, direct or indirect, against its own people. The risk rating assigned is the sum of three subcomponents, each with a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk.	
External Conflict	The external conflict measure is an assessment both of the risk to the incumbent government from foreign action, ranging from non- violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc) to violent external pressure (cross-border conflicts to all-out war).	
Corruption	This is an assessment of corruption within the political system. Such corruption is a threat to foreign investment for several reasons: it distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability; and, finally introduces an inherent instability into the political process.	ICRG database
Military in policy	The military is not elected by anyone. Therefore, its involvement in politics, even at a peripheral level, is a diminution of democratic accountability	
Bureaucracy Quality	The institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize revisions of policy when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services.	
Ethnic tensions	This component is an assessment of the degree of tension within a country attributable to racial, nationality, or language divisions. Lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist.	
Democratic accountability	This is a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one	
Religious tensions	Religious tensions may stem from the domination of society and/or governance by a single religious group that seeks to replace civil law by religious law and to exclude other religions from the political and/or social process; the desire of a single religious group to dominate governance; the suppression of religious freedom; the desire of a religious group to express its own identity, separate from the country	
Government stability	This is an assessment both government's ability to carry out its declared program(s), and its ability to stay in office	
Index of institutions and political stability	A composite index of institutions, computed as the simple average of nine ICRG indicators (government stability, internal & external conflict, corruption, military in politics, religious & ethnic tensions, Investment profile, Socioeconomic conditions, Bureaucracy Quality, and democratic accountability).	Authors' calculations based on ICRG dataset
Political stability	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. Estimates give a country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5	
Control of corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimates give a country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5	WGI database
Government effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service, and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimates give a country's score i.e., on the aggregate indicator, in units of a standard normal distribution, ranging from approximately -2.5 to 2.5.	
Index for Quality of institutions	A composite measure of the quality of institution, computed as the simple average political stability of government effectiveness, control of corruption, and	
Private investment	Private investment (gross fixed capital formation), in billions of constant 2017 international dollars.	IMF Investment and Capital Stock Dataset
General government investment	General government investment (gross fixed capital formation), in billions of constant 2017 international dollars	
Government expenditure	General government total expenditure (% of GDP)	IMF, WEO
Current account balance	Current account balance (% of GDP)	