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Wash it all away – impact of the Lava Jato scandal on FDI stocks in Brazil

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Dissertation written under the supervision of Prof. Dr. Daniela
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Dissertation submitted in partial fulfilment of requirements for the MSc in
International Management, at the Universidade Católica Portuguesa and for the
Executive Master's in Business Administration, at the Escola Brasileira de
Administração Pública, Fundação Getúlio Vargas, 20 May 2

“Cui honorem, honorem.”

To my family, which is always supporting my personal and academic development in every possible way.

Acknowledgements

I want to thank my supervisor Prof. Dr. Daniela Campello for her support during the process of writing my thesis.

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List of symbols, abbreviations and acronyms:

BRIC	Group of 4 major developing countries: Brazil, Russia, India, China
CPI	Corruption Perception Index
DV	Dependent Variable
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HDI	Human Development Index
IMF	International Monetary Fund
IV	Independent Variable
LAC	Latin America and the Caribbean
MDB	Movimento Democrático Brasileiro
MNE	Multinational Enterprise
MSPE	Mean Squared Predicted Error
OLI	Ownership, Location and Internalisation
PT	Partido dos Trabalhadores
SEC	U.S. Securities and Exchange Commission
TI	Transparency International
UNCTAD	United Nations Conference on Trade and Development
WEF	World Economic Forum

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Abstract

This paper investigates if and how the detection and rigorous prosecution of a corruption scheme in Brazil affected German FDI flows to the country. To do so, the so-called Lava Jato investigation was taken as a shock to German investors. Using a synthetic control research design we show, that German investors indeed invested less in Brazil than it would have been the case without the scandal occurring. We estimate the costs of the scandal only with regards to German investments at 4.6 billion Euros between January 2014 and December 2017. We find our results to be significant at the 6.7% level, meaning that an effect of this size is quite unlikely to be the pure result of chance. The findings provide evidence for the theory that foreign investors are sensitive to perceived levels of corruption in emerging markets, even though those countries represent a huge market potential.

Keywords: Foreign direct investments, Lava Jato, corruption, Brazil, synthetic control design

Resumo

Este artigo investiga se e como a detecção e acusação de um esquema de corrupção no Brasil afectou os fluxos de IDE da Alemanha para o país. Para isso, a chamada investigação Lava Jato foi tomada como um choque para os investidores alemães. Utilizando um projeto de pesquisa de controlo, foi demonstrado que os investidores alemães na verdade investiram menos no Brasil do que teriam investido caso o escândalo não tivesse ocorrido. Os custos do escândalo, apenas em relação aos investimentos alemães, foram de 4,6 bilhões de euros entre Janeiro de 2014 e Dezembro de 2017. Os resultados têm um nível de significância de 6,7%, o que significa que é improvável que um efeito desta magnitude seja totalmente resultado do acaso. As conclusões fornecem evidências para a teoria de que os investidores estrangeiros são sensíveis aos níveis de corrupção nos mercados emergentes, mesmo que esses países tenham um enorme potencial de mercado.

Palavras-chave: Investimento Directo Estrangeiro, Lava Jato, Corrupção, Brasil, Design Sintético de Controlo

1) Introduction

1.1) MNEs, Foreign Direct Investments and corruption

The 21st century is, like no period ever before, characterized by blurring borders between nations, leading to an increase in the movement of goods, services, money and people across the globe (McKinsey Global Institute, 2014). These developments heavily affect corporations which, in order to stay competitive, are forced to expand internationally, turning from domestic firms into Multinational Enterprises (MNEs) over time (Aharoni & Ramamurti, 2011). In 2014, MNEs contributed 33 percent of the global output and 28 percent of global Gross Domestic Product (GDP), reflecting their importance in today's economy (OECD, 2018). The preferred instruments¹ of companies to start off or expand operations abroad are Foreign Direct Investments (FDIs), which enable corporations to among others, improve efficiency or exploit economies of scale (Cohen, 2007; OECD, 2002). Companies will invest if they are convinced that their specific technology or knowledge will allow them to compete successfully in the foreign market (Denisia, 2010).

According to the United Nations Conference on Trade and Development (UNCTAD), a Foreign Direct Investment is defined as “[...] an investment involving a long-term relationship and reflecting a lasting interest and control² by a resident entity in one economy [...] in an enterprise resident in an economy other than that of the foreign direct investor [...]”³ (UNCTAD, 2017, S. 3). In general, it can be distinguished between FDI stocks, measuring the total level of direct investment in a country and FDI flows, capturing the value of direct investment related transactions over a certain time interval (OECD, 2019a, 2019b).

The importance of FDI in the global economy has increased considerably over the last decades, for instance in order to save costs in production and transportation or to enlarge the market served and thereby increase sales volume (Gutterman, 2011). Between the years 2000 and 2017, notwithstanding the global financial crisis, FDI stock globally has more than quadrupled⁴, over the

¹ Some foreign investors internationalize differently, for instance through contractual agreements with foreign companies or international trade (Cuervo-Cazurra, 2006).

² Mostly considered as such, when 10 percent or more of shares or in general of company control are held (OECD, 2018).

³To be distinguished from portfolio investments, where investors buy shares or debt of foreign companies, but there is no long-lasting interest of the investor involved (European Commission, n.d.).

⁴ Measured in US Dollars at current prices.

last thirty years even increased by more than factor 20 (UNCTADSTAT, 2019). Total FDI stock on world level has accumulated to 31.5 trillion US\$⁵ in 2017 (UNCTADSTAT, 2019).

In this context, the so-called BRIC countries consisting of Brazil, Russia, India and China, which are characterized by huge domestic markets as well as a massive growth potential (Wilson & Purushothaman, 2006), have increased their share of worldwide FDI inflows by 244 percent in 2017 relative to 2000 (UNCTADSTAT, 2019). While the countries of Latin America accounted for 7.3 percent of worldwide FDI inflows in 2017, Brazil alone has attracted 60 percent of this sum, making it by far the most important recipient of FDIs in Latin America⁶. FDI inflows to Brazil represented 3 percent of Brazil's GDP in 2017. A more detailed overview over major investing countries and an exemplary breakdown by sector in 2017 can be found in Annexes 1 and 2.

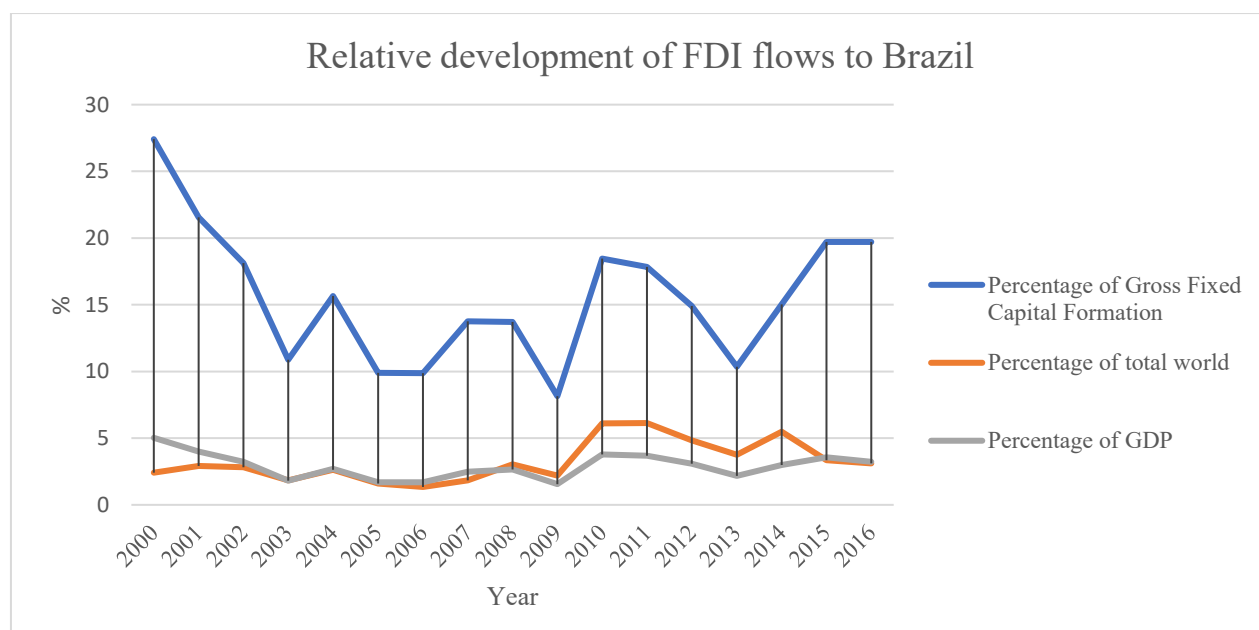


Figure 1: Relative development of FDI flows to Brazil - own representation (UNCTADSTAT, 2019).

Azim (1999) pointed out two reasons for the increasing inflow of FDIs to Latin America and the Caribbean (LAC). Those are the economic reform of many countries in the form of privatization of public companies as well as the general bettering of conditions for foreign investors and secondly the increased integration among the nations of South America. In addition, the 2003 to 2013 boom in commodity prices (Ocampo, 2017) increased the investment attractiveness of countries primarily producing commodities, hence further accelerating growth of FDI stock in Latin America.

⁵ Measured in US Dollars at current prices.

⁶ For a detailed outline of the development of Brazil's FDI inflows in the recent history as well as the trend for developing and developed countries see Annexes 3 and 4.

When deciding in favour or against FDIs to a specific country, firms take into consideration a multitude of factors characterising the potential host countries (Porter, 2000). In the recent past, the FDI-decision has repeatedly been linked to the level of corruption⁷ in the recipient country (Cuervo-Cazurra, 2006; Woo & Heo, 2009). One of the reasons for this might be increased competitive pressure worldwide, making the smooth flow of corporate processes and hence the direction of the relationship between corruption and efficiency more important (Tanzi, 1998). This is consistent with data of the World Economic Forum (WEF), according to which the annual costs of corruption amount to 3.6 trillion US\$ per year (Johnson, 2018), proposing that this topic deserves some closer examination from politicians as well as businesses.

The increasing interest in this topic led to many researchers investigating a possible connection between corruption and FDI, however, finding mixed evidence⁸. A few papers have moreover examined the influence corruption has on FDI in studies particularly focused on developing countries, where an increasing share of those transfers is flowing, highlighting the importance of such analysis for MNEs which transfer significant portions of their resources into growth regions (De Angelo, Eunni, & Martins Dias Fouto, 2010; Smarzynska & Wei, 2000; Uhlenbruck, Rodriguez, Doh, & Eden, 2006). It is especially surprising that, contradicting their publicly declared zero-tolerance of MNEs for corruption, huge quantities of FDI flow into highly corrupt countries such as China or Brazil, even when seen in relation to country GDP⁹ (World Bank, 2019). In this context, Habib & Zurawicki (2002, S. 293) argued, that “[h]onesty has its price [...] if it means inability to compete in some markets”, basically proposing that many companies are not deterred by corruption in a foreign country, as long as they think they are able to compete.

1.2) Research question and methodology

There is still very limited research on how major political scandals in host nations may affect the FDI stock foreign companies hold in those countries (compare e.g. (Abdel-Latif & Ouattara, 2017; Burger, Ianchovichina, & Rijkers, 2016)). This is also the case for developing countries which is surprising, considering the huge share of worldwide FDIs they attract.

⁷ Among others, due to increased interest of media, politics and research in this topic (Harrison, 2003).

⁸ For a detailed outline see 2.1) Related literature.

⁹ See Annex 5 for a graphical visualization.

Considering this gap in the literature, the purpose of this paper is to investigate the effect of publicly revealing a major corruption scandal in Brazil on FDI stocks held by foreign companies in the country. The scandal used for this purpose is the so-called “Lava Jato” operation, which refers to the detection and prosecution of a massive money laundering and bribing scheme in Brazil, and is also referred to as one of the biggest corruption scandals in history (Londoño, 2017). The bribery scandal, which first came to public knowledge on 17 March 2014 (Comunicação Social da PF, 2014) involves the state-owned oil and gas company Petrobras as well as major construction and engineering companies and Brazilian politicians. In 2019 the case is still under investigation and frequently more participants in the scheme are being uncovered.

To empirically examine if, and if so, what kind of effect the scandal had on FDI stocks in Brazil, we use a synthetic control design, taking German FDI stocks in the country as a proxy for a developed country’s reaction to such an event. We assemble a synthetic counterfactual for Brazil as a weighted average from control states closely matching Brazil in the pre-treatment period in terms of FDI stock and variables commonly seen as predictors of FDIs. Our estimate for the effect of the Lava Jato corruption scandal is defined as the difference between the actual development of Brazil after the treatment and the development for its synthetic counterpart which does not experience any treatment. This is based on our assumption that Brazil and its counterfactual are completely identical, except for the treatment.

1.3) Findings and research contribution

Our results are as follows: In general, FDI stock of German enterprises in Brazil stayed relatively constant over time after the Lava Jato investigations were announced to the public. However, when looking at the predicted trend for a synthetic Brazil, it becomes obvious that if no scandal would have occurred, FDI stock in the country should have increased considerably during our observation period. We estimate the size of the treatment effect at 4.6 billion Euros between January 2014 and December 2017, being significant at the 7 percent level. Therefore, we conclude that the Lava Jato scandal had a strong negative effect on the German FDI stock residing in Brazil, a finding likely to extend to other investor countries with a similar degree of development.

Overall, our results suggest that foreign investors react in a negative way to information about corruption investigations in emerging markets, especially when involving political and business elites. This is the case even though these investigations are the first of their kind reaching up to the highest level of political and economic leaders and thereby potentially marking a turnaround in the history of Brazil. These findings are aligned with literature mostly describing a negative reaction of developed countries to corruption in host countries. This is probably because short-time concerns of foreign decision makers regarding instability in the country caused by the rigorous prosecution outweigh the perceived benefits of a future with potentially less corruption.

Our research contributes to existing literature by showing that foreign investors are more deterred from potential risks arising from a corruption scandal than being attracted by possible opportunities from a turnaround in the country. Moreover, we add to the large literature examining the impact of corruption on FDIs using a synthetic control design for a single exemplary country, as opposed to the regression analyses over a group of heterogeneous countries used in most of the papers.

The remainder of this paper is organized as follows: In chapter 2, relevant literature related to the research question will be presented. Moreover, the Lava Jato investigation will be outlined in more detail. Consecutively, based on the empirical theories presented before, the research hypotheses will be introduced. In chapter 3 of the paper, a description of the methodology applied for the purpose of this study will be given. Hereafter, the main findings obtained from the data analysis will be summarized. In chapter 5, robustness tests will be conducted before we conclude in chapter 6.

2) Background and Hypothesis

2.1) Related Literature

2.1.1) Internationalization theories and Dunning's OLI paradigm

For which reasons do MNEs invest in countries abroad and on which variables do they base their decision-making? There is a variety of theories¹⁰ trying to answer this question, amongst other the product cycle theory (Vernon, 1966), the Uppsala model (Johanson & Vahlne, 1977; Johanson & Wiedersheim-Paul, 1975), the exchange rate theory (Cushman, 1985; Itagaki, 1981), the internalization theory (Buckley & Casson, 1976; Hymer, 1960) and the eclectic paradigm (Dunning, 1979). Even though there is much controversy, the most frequently used and probably most complete¹¹ theory in the context of FDI is the OLI paradigm which was first formulated by Dunning in 1979.

This theory, often also referred to as eclectic paradigm aims to explain “[...] the extent and pattern of international production [...]” (Dunning, 2001, S. 176). According to the framework, there are three forces which define the direction and magnitude of investments which enable companies to produce internationally.

The first component of the framework is ownership (O) advantages. These can be defined as particular advantages in competition which companies from one country have over companies from other countries in meeting market demand. These advantages stem from specific income-generating assets that competitors do not possess (Dunning, 2001).

Location (L) advantages are the second building block of the theory. Dunning defines them as “[t]he extent to which firms perceive it to be in their best interests to internalise the markets for the generation and/or use of these assets; and by so doing add value to them” (Dunning, 2001, S. 176).

The last advantage to explain FDI flows are internalisation (I) advantages. They refer to the decision of companies to undertake some of their value-adding activities outside of their home country (Dunning, 2001). The firm could, in contrast, also decide to sell or license its ownership advantages without entering the new market (Dunning, 2001).

¹⁰ For a more detailed overview over the theories, please see Denisia (2010).

¹¹ According to (Dunning, 2001), competing theories such as the product cycle theory or the diversification theory (Rugman, 1976) can only explain specific sets of FDIs, for instance market- or asset-seeking FDIs. Even though not able to readily explain all kinds of foreign activity, he states that the OLI paradigm is the most complete theory.

Dunning also highlights that even though the framework aims to explain the big macroeconomic picture, the importance of each of these three components is still likely to vary depending on geographic region, industry, and business sector (Dunning, 2001).¹²

The knowledge how to deal with a corrupt environment and how to benefit from it is part of the O components of Dunning's paradigm as well as of the L component, in which it is part of the political risk variable, which was added by Dunning in 1988 (Dunning, 1998; Godinez & Liu, 2015). Even though it is often assumed that globalization would lead to an overall decreasing importance of location, this factor is still a major factor in competitiveness of firms (Porter, 2000). When MNEs consider investments abroad, they conduct cost-benefit analyses for the potential markets, a process which also makes it necessary to account for uncertainty prevailing in the foreign market. One component of such uncertainty, due to its hidden nature, is corruption (Witte, Burger, Ianchovichina, & Pennings, 2016).

2.1.2) Theory on corruption and importance of FDI's

Corruption has only recently gained importance in the field of international business, as an increasing number of companies started operations in developing and transitioning countries, highlighting differences between countries (Rodriguez, Siegel, Hillman, & Eden, 2006; Tanzi, 1998). Before, it has mostly been considered as part of other, broader indicators such as political stability (Zurawicki & Habib, 2010).

According to Transparency International (TI) corruption can be defined as “[...] the abuse of entrusted power for private gain” (Transparency International, 2019a).

Corruption in a country is often, however not always¹³, characterized by the need to make additional payments in order to carry out a task (Kaufmann, Kraay, & Mastruzzi, 2003). Bribes might be used by companies to achieve advantages over their competitors they would not obtain without the payment (Cuervo-Cazurra, 2006). Such advantages can be granted if people employed by the government can exclusively provide access to goods or benefits, which might lead to

¹² Dunning (2001) argues, that no single theory can be expected to precisely explain all kind of FDI's-related activities, just because motives (variables in research design) and expectations from import-substituting FDI's are different from those of resource-oriented FDI's or strategic asset-seeking FDI's.

¹³ See Tanzi (1998) for examples where no payment is involved in corrupt behaviour.

officials personally charging for providing them, especially as they have low costs for them to obtain (Shleifer & Vishny, 1993).

As a result of the Watergate investigations in America, over 400 American corporations reported bribes to officials of foreign governments, showing that corruption is a common way to do business in less developed countries (Hines, 1995). This is in line with (Shleifer & Vishny, 1993; Wilhelm, 2002), which argue that high levels of corruption are mostly, but not exclusively to be found in developing countries. Slow progress made by these countries in their development efforts can be reasoned for instance by the effect corruption has on the composition of country spending. As not all sectors offer equal opportunities to extract bribes, corrupt countries prefer to invest in infrastructure projects or military as opposed to education or public health (Shleifer & Vishny, 1993), the latter being areas much more often related with economic development (Barro, 2001; Piabuo & Tieguhong, 2017).

An official will only demand bribes if the expected payoff exceeds the potential costs (Drabek & Payne, 2002). Such a cost could for instance arise from a penalty if the official is caught accepting a bribe, as such behaviour is illegal in many countries (Kaufmann & Vicente, 2005). Nevertheless, corruption might be so strongly established in a country's culture, that people accept such behaviour (Drabek & Payne, 2002). Corruption does not only prevail in public service, but also in the private sector. Companies might for instance pay bribes in order to secure contracts when competing with other actors (Tanzi, 1998):

“There is no question that public or state enterprises have been a major source of corruption and especially of political corruption because they have occasionally been used to finance the activities of political parties and to provide jobs to the clientele of particular political groups.” (Tanzi, 1998, S. 563).

Even though seemingly intuitive, intensifying competition is not always a mean to decrease corruption and can even lead to an opposite outcome, as Bliss & Tella (1997) show in an equilibrium model on bribery and competition. However, corruption might first-hand lead to below-average competition levels in an economy, as existing firms might bribe officials to prevent the market entry of other (foreign) companies (Bliss & Tella, 1997; Shleifer & Vishny, 1993). This does not only mean that the government's task as resolving problems created by purely capitalistic interests of firms is not fulfilled, but also that the government might actively contribute to market

failures (Tanzi, 1998). Several forms of corruption can be distinguished, a few of them summarized in Annex 6.

One might ask the question why nations would care about the FDIs they receive and hence be interested in the relation between corruption and FDIs. First of all, FDIs generally represent a long-term investment in developing countries and hence are more stable than other form of foreign financing (Wei & Wu, 2001). Developing countries are particularly interested in attracting foreign capital, as needed investments clearly surpass available financial sources (Drabek & Payne, 2002), making it an obligation for the government to keep the level of such sustainable inflows of capital constant or even increase it. Moreover, a decreasing share of FDIs in relation to total capital flows should be closely monitored, as potentially representing a significant threat to the stability of a country's entire financial system (Wei & Wu, 2001). In a study using panel data from 42 developing and 28 developed countries covering the years 1998-2008, Freckleton, Wright, & Craigwell (2012) find positive and significant long- as well as short-term effects of FDI on economic growth notwithstanding the level of development. Kumari (2014), reviewing literature since 1959, concludes that literature supporting a positive correlation between FDI and economic growth outweighs literature in line with the contradicting view, even though they propose specific studies for each individual country.

2.1.3) Conflicting literature on the relation between corruption and FDI and synthesis

There are two conflicting theories on how corruption will influence the country in which it is prevailing and hence the value of FDIs received by them.

Greasing the wheel theory:

Leff (1964), Leys (1965) and Huntington (1968) proposed that corruption is “greasing the machinery” of the host country, thereby stating a positive correlation between corruption and growth. According to this, corruption might even attract more FDIs, as it is smoothing and accelerating bureaucratic processes and thereby making the country more opted for FDIs. If governmental institutions and bureaucracy at large are inefficient and not able to fulfil their purpose, corruption might help to overcome these inefficiencies and establish a working system

(Huntington, 1968; Leff, 1964). Lui (1985) showed in an equilibrium model of queuing in front of a counter that bribe payments can lead to desired outcomes for individual as well as society.

Sand in the machinery theory:

The contradictory theory pioneered by Mauro (1995), depicts corruption as “sand in the machinery”. Hence for a higher level of corruption in the host country a lower attractiveness for foreign production and hence for FDI-inflows is assumed¹⁴. Moreover, bribes are described as more inefficient than taxes due to their higher inherent transaction costs resulting from the uncertainty of the outcome and the need for secrecy (Shleifer & Vishny, 1993). This uncertainty arises from the fact that contracts obtained through bribes cannot be legally enforced, and hence the official can demand multiple bribes for guarantying one and the same service (Boycko, Shleifer, & Vishny, 1995). In line with this theory, corruption is acting as a tax and therefore decreases the expected profitability of projects in corrupt countries. As profitability is a major concern for MNEs, they take the corruption of the host country into consideration when making the investment decision. Kaufmann & Wei (1999) argue, that corruption does not help to reduce effective red tape for firms, but in contrast offers incentives for bureaucrats to put such regulation in place to fill their pockets.

The contradictory theories presented above require a profound empirical investigation. In order to get an overview over relevant research that has been conducted in this area and their respective findings, we list some empirical evidence for both theories below.

Greasing the machinery empirical findings:

Comparing 17 India states with different levels of corruption and using an instrumental variable regression, Kato & Sato (2015) find the interaction between high regulation and high corruption to have positive and significant effects on value added per worker in manufacturing. This implies a positive effect of corruption on economic performance in the case of India. In addition, Méon & Weill (2010), using a sample of 69 states show, that corruption is less detrimental to efficiency in countries where institutions are very ineffective. They further suggest, that in countries with extremely ineffective institutions, corruption and efficiency might be positively correlated.

¹⁴ In addition, see Rose-Ackerman (1999) for a detailed analysis of the connection between corruption and quality of governments.

Empirical evidence supporting a positive connection between corruption and FDI is summarized in Annex 7:

Sand in machinery empirical findings:

In his research, Mauro (1995) finds corruption to significantly reduce investment rate as well as economic growth, a result also obtained in a subsample of highly bureaucratic countries. This clearly contradicts the rationale posed by Huntington (1968) & Leff (1964), that in slowly operating bureaucracies, corruption would accelerate processes. Wei (2000, S. 8) finds evidence that the corruption level in host countries has a strong negative impact on FDI inflows, meaning that “[an] increase in the corruption level from that of Singapore to that of Mexico would have the same negative effect on inward FDI as raising the tax rate by eighteen to fifty percentage points [...]”. In a Probit model, Smarzynska & Wei (2000) show for transitioning economies that the likelihood of a foreign company making an investment at all decreases with higher corruption level in the host country. Drabek & Payne (2002), using a composite transparency index including corruption, find that countries, when increasing their transparency ranking by one point, can expect their FDI inflows to go up by on average 40 percent. Further empirical evidence supporting a negative connection between corruption and FDI is summarized in Annex 8.

In addition, there is some evidence finding no significant connection between corruption and FDI or different effects based on subgroups of the sample. Some of this research is summarized in Annex 9.

Synthesis:

It is noteworthy that many of the older studies were restricted in terms of longitude of the study as well as number of observations. This of course affected the number of variables that could be included into the regression and hence the quality of the findings (Zurawicki & Habib, 2010). Besides, results could be driven by different methodologies as well as different measures of corruption takes as an independent variable (IV) (Zurawicki & Habib, 2010). Especially older studies used cross-sectional data, making it impossible to account for cross-country heterogeneity, however later mostly being replaced by panel data estimations (Egger & Winner, 2006). Nonetheless, mixed evidence is surprising as many researchers based their research on Dunning’s eclectic paradigm. This could, as most studies find an effect of corruption on FDI flows but are

ambiguous about the direction, point to an omitted variable not controlled for which could explain such contradictory signs of the coefficient. For instance, Cuervo-Cazurra (2008) distinguishes between pervasive and arbitrary corruption and finds that corruption acts as sand in countries with established institutions, while acting as grease in countries where institutions are poorly developed. According to Habib & Zurawicki (2002), depending on the motivation for a certain project, different criteria apply for the selection of the investment location, proposing to choose different sets of variables for different investment types, implying that corruption might increase or decrease FDI based on the particular type of investment. Cuervo-Cazurra (2008) argues that the impact corruption has on the value of FDI might depend on the peculiarities of the economic system prevailing in the host country. Moreover, different levels of corruption might reveal different impacts on the amount of FDIs, as potentially representing a non-linear relationship.

We conclude, that the evidence for a negative impact of corruption on willingness of foreign enterprises to invest in that country outweighs the evidence for the contrary position pointing towards a positive correlation between FDI and corruption. Yet, it seems that this is only the case when looking at aggregate FDI flows and can change considerably when looking at more disaggregated data.

2.2) Operation Lava Jato

Lava Jato – or, in English: Car Wash. This name was given to a police operation which would uncover one of the largest corruption scandals in Brazilian history. According to the Brazilian Federal Police, the operation started on 17 March 2014, when a few hundred policemen searched offices and arrested several suspects accused of money laundering. One of the groups of money dealers resided next to a petrol and car wash station, which gave the operation its name “Lava Jato” (Comunicação Social da PF, 2014). Only three days later, investigations gathered momentum when the Federal Police arrested Paulo Roberto Costa, former head of Petrobras’ refining and supply department. Costa had received a Range Rover as a present from black-market dealer and key-suspect Alberto Youssef, suggesting his involvement in the scheme (Stauffer, 2015). Later, Costa would agree to explain the corruption scheme and name involved people as part of a deal with criminal prosecutors (Stauffer, 2016). In October 2014, even though further inquiries had raised questions about the involvement of government officials in the scandal, Dilma Rousseff was re-elected as Brazilian president (Aglionby, 2015).

Investigations reached their preliminary climax between September 2014 and February 2015, when the involvement of petroleum giant Petrobras became more and more obvious after several senior executives had been arrested. On top of this, an enquiry by the US Securities and Exchange Commission (SEC) due to a price slump of its shares was revealed to the public (Aglionby, 2015).



Figure 2: Development of the Petrobras share price after disclosure of involvement in the Lava Jato corruption scandal – horizontal lines mark share price development between September 2014 and February 2015 (Reuters, 2019).

Moreover, the huge scope of the corruption scandal, involving major Brazilian construction and engineering companies as well as politicians, became more and more obvious (Stauffer, 2016). In the further course of 2015, the investment rating of Petrobras was slashed to junk level, even before the company had reported a record loss after having written down billions as corruption-related costs.

More and more politicians were under investigation or convicted, amongst them Dilma Rousseff who was impeached in 2016 and former president Luiz Inácio Lula da Silva (Stauffer, 2016; Watts, 2016). Dilma Rousseff was impeached because she had misused state bank funds in order to cover budget deficits before the 2014 election (Wallenfeldt & Ray, n.d.). However, we argue in line with a large number of press reports, that Rousseff's backing by fellow politicians and the population had declined significantly as a result of the Lava Jato investigations. As she had been the chair of Petrobras which was now stuck in middle of the scandal and moreover had tried to appoint Luiz Inácio Lula da Silva chief of staff shortly after he had been charged, guarantying him immunity from prosecution with the exception of the Supreme Court (Wallenfeldt & Ray, n.d.), her entanglement in the scandal was commonly assumed. We argue that this unfavourable public

picture together with the dissatisfaction of politicians due to increasing criminal prosecution against them contributed significantly to the start of and final vote for an impeachment of Rousseff¹⁵.

2.3) Corruption scheme, theoretical background and hypothesis

In short, the corruption scheme around Petrobras worked as follows: At the centre of the scheme there is the majorly state-owned oil and gas company Petrobras being one of the world's biggest corporations in this segment. When issuing a call for tenders e.g. to build a new oil-processing facility, bribes in the size of 1-2 percent of contract value would be paid from suppliers to Petrobras officials for getting the surcharge. Middlemen such as Youssef would launder the money before distributing it to Petrobras officials as well as politicians who would use the funds to finance their electoral campaigns. Involved parties were the ruling parties, such as the Workers' Party (PT) or the Party of the Party of the Brazilian Democratic Movement (MDB). Politicians from these parties would contribute their share by appointing people from their network as Petrobras executives responsible for the selection of suppliers.¹⁶ However, as the suppliers had formed a cartel, for each bidding process one of the engineering firms would win without real competition from the other firms, raising the prices for Petrobras even further (Moro, 2018).

Lava Jato in this magnitude would not have been possible without some significant changes in Brazil's legal system. While in the past it had been incredibly difficult to charge wealthy individuals due to some legal particularities, this changed in 2012 with the Mensalão process¹⁷, when the supreme court sentenced high ranking individuals to prison, sending a signal across the country (Moro, 2018). Moreover, the strong use of plea agreements with criminals during Lava Jato made it possible to scale the investigations to a higher level of society, which had not been the case before (Moro, 2018).

In line with Mauro (1995), in the Lava Jato corruption scheme construction contracts were used, which are hard to estimate in terms of monetary value, making it easier to extract bribes. As the

¹⁵ For a more detailed timeline of events in the context of Lava Jato please see Annex 10.

¹⁶ The nomination of executives of state-owned firms is one of the key perks for politicians of the ruling parties.

¹⁷ The process was mainly about monthly bribes paid to congressmen by the ruling party in order to secure their support for legislative initiatives (The Economist, 2013).

construction companies colluded, the major share cost of corruption was ultimately borne by investors and end customers (Svensson, 2005).

Based on the literature introduced above, we pose the hypothesis, that the Lava Jato scandal reduced FDI stocks in Brazil as compared to a Brazil in which such a scandal did not happen.

There are several reasons why this hypothesis might be true. First of all, foreign investors might have been surprised by how high the real level of corruption in the country is as opposed to the findings of studies on the presence of corruption. This possibility gets supported by the fact that the TI Corruption Perception Index (CPI) for Brazil fell from 43 (2014) to a 38 (2015), suggesting an underestimation of corruption prevalence by analysts and experts (Transparency International, 2019b). A strong reaction from investors would however not be expected before 2016, when the CPI for the year before was published. This effect could be further aggravated by human psychology, meaning that recent changes are very salient and hence receive more weight in decision making processes (Drabek & Payne, 2002).

A second reason supporting this hypothesis is that uncertainty for foreign investors skyrocketed as a consequence from political instability, which resulted from the Lava Jato corruption charges against political leaders such as Dilma Rouseff, Luiz Inácio Lula da Silva or Michel Temer.

A third argument supporting this hypothesis is that countries with lower corruption levels suffer a competitive disadvantage in highly corrupt countries. This refers to access to political leaders and business contracts as well as to the general knowledge about how to bribe. When foreign companies understand by how much they had underestimated the number and value of contracts purely allocated on the base of bribes, they might significantly reduce their investment in the country. Moreover, foreign investors might suffer serious consequences from corrupt practices abroad in their home countries, making it undesirable to adapt to this part of the host country culture.

3) Empirical Strategy

3.1) Methodology

In order to empirically investigate the impact of an intervention on one or more variables of interest, researchers have regularly used comparative case studies, where similar units, some affected and some unaffected by the intervention, are compared against each other before and after a treatment (Abadie, Diamond, & Hainmueller, 2010). This is because in research the optimal scenario is having two identical units, one then being treated and one not, so that differences in the outcome can then be traced back to nothing but the received treatment (causal effect). However, here problems such as the unavailability of a counterfactual similar in key characteristics or subjectivity in the selection of the comparison unit can lead to problems in the research design. This similarity, however, together with the similar trend assumption, is a necessary condition to infer causality. Assembling an appropriate comparison group solely based on data from multiple untreated units can properly address such problems and thus improve the validity of research findings. Our synthetic control method tries to proxy such a scenario by predicting how FDI stocks in Brazil would have developed without the Lava Jato scandal occurring. This is done by assembling a synthetic unit from a selection of untreated countries, matching the treated unit in variables assumed to be predictors of the dependent variable (DV) as well as the trend of the DV.

By using this research design, further problems of classical regression analysis such as the inability to infer causality as opposed to correlation can be overcome. Moreover, just as is the case in this paper, there are situations where the treated unit is unique and there is no control unit with similar characteristics available. In such cases, creating a synthetic control unit from multiple single units can help to establish a proper comparison group (Abadie et al., 2010). Moreover, fit can be proven by the comparison of observable predictor variables in the pre-treatment period between treated unit and control group. It is assumed that the matching on these criteria also makes both units comparable in terms of unobservable characteristics (Abadie, Diamond, & Hainmueller, 2012).

As the synthetic control methodology was chosen as the best fitting research design, we had to decide for one exemplary home country for which we measure and predict stock held in Brazil as well as in the countries making up the comparison group. We decided to use Germany as the exemplary home country, because it is holding the third largest FDI stock abroad after the Netherlands and the United States (CIA, 2019) and in addition, Brazil is not receiving most of its

FDIs from Germany. Looking at, for instance, the Netherlands, a major share of their FDIs each year is invested in Brazil, which first of all would make it difficult to find an appropriate synthetic control group and secondly could bias our findings. This is because a high FDI stock held by a country in another country might predict future FDI flows to this country, potentially leading to non-representative findings.

3.2) Estimation model

We now introduce the synthetic control methodology described in Abadie & Gardeazabal (2003): Let A be the number of potential control countries for which we have data on German FDI stocks and W (w_1, w_2, \dots, w_A) be a vector with the dimensions ($A \times 1$) containing positive weights which total to 1. Moreover, w_A ($a = 1, \dots, A$) represents the weight of country A in synthetic Brazil. For each change in W , different weights are assigned to the countries making up synthetic Brazil, hence making the weights given to (w_1, \dots, w_A) essential for the quality of our control group.

Consequently, weights for (w_1, \dots, w_A) are chosen in a way that the synthetic counterfactual best mirrors Brazil in the pre-treatment period.

To do so, let X_1 be a ($C \times 1$) vector of pre-treatment values of C FDI predictors and let X_0 be a ($C \times A$) matrix containing the values of the same variables for all the A possible donor countries. In addition, V is a diagonal matrix with nonnegative values, reflecting the importance of the different FDI stock predictors.

We choose the vector of weights W^* in a way that we minimize $(X_1 - X_0W)'V(X_1 - X_0W)$ subject to $w_a \geq 0$ ($a = 1, 2, \dots, A$) and $w_1 + \dots + w_A = 1$. W^* represents the weights in which the different potential donor countries enter synthetic Brazil in order to best match Brazil in FDI determinants in the pre-treatment period. Since we do not know exactly about the importance of each of the FDI predictor variables, V is chosen in a way that quarterly FDI stocks in the synthetic control country most closely match those of Brazil before the treatment.

3.3) Data

Our pool of untreated host countries, also referred to as donor countries¹⁸, to build a synthetic Brazil consists of 37 countries for which data was available on EUROSTAT¹⁹. Our dataset covers 31 time periods between the second quarter of 2010 and the fourth quarter of 2017. We did not include Hong Kong and Romania for which data was available on EUROSTAT due to missing data on some of the key predictor covariates.²⁰

While most of the countries we have data for are members of the European Union (EU) which we mostly assume not to be similar to Brazil, we also have data on FDI stock of Germany in the BRIC countries Brazil, Russia, India and China. These countries are commonly assumed as somewhat similar in terms of development stage of the economy and size, which will also be observed in our later analysis. The dataset moreover includes data on German FDI stock in Japan, the United States and Canada, increasing the geographic scope of our potential control group. A full overview over the potential donors can be found in table 1.

¹⁸ Donor country means that the respective countries potentially donate their characteristics to synthetic Brazil, hence making up a certain percentage of the synthetic control unit.

¹⁹ For a more detailed outline of how data is compiled by Eurostat, please see Eurostat (2019).

²⁰ Even though OECD data was available on German FDI flows to a lot more countries, we decided for the Eurostat data for some reasons. First, Southern American countries (only included in the OECD data) which are similar to Brazil regarding variables considered as important for the investment decision of foreign investors might not be a suitable comparison group. This is because in a later phase of Lava Jato it was discovered that the scandal reached far beyond Brazil's borders and also other Latin and Central American countries were involved (Transparency International, 2017). This is a fact which might severely bias the validity of our analysis for later time periods, when including those countries as control units potentially forming a synthetic Brazil. In addition, we would not be able to rule out the possibility that due to the scandal investors were sensitised to corruption in the whole geographic region and not only in Brazil, which might have resulted in a changed investing behaviour biasing our findings. A second reason is that data from OECD only contains yearly data, making it more difficult to connect effects of certain events and FDI stocks in this country.

Home country:		
Germany		
Treated host country:		
Brazil		
Untreated, potential host countries (control group):		
Austria	France	Netherland
Belgium	Greece	Poland
Bulgaria	Hungary	Portugal
Canada	India	Russia
China	Ireland	Slovakia
Croatia	Italy	Slovenia
Cyprus	Japan	Spain
Czechia	Latvia	Sweden
Denmark	Lithuania	Switzerland
Estonia	Luxembourg	United Kingdom
Finland	Malta	United States

Table 1: Countries of control and treatment group - own representation.

We build our synthetic control unit from weighted averages of the countries listed above which did not experience any treatment (Lava Jato corruption scandal) during our observation period. The algorithm chooses the weight to which the countries enter the synthetic control group in a way that predictor covariates which were chosen based on economic theory and empirical findings match those observed for Brazil in the best possible way. In total our control group consists of 33 potential donors.

3.4) Variables

As mentioned before, our dependent variable is the quarterly FDI stock of Germany in the respective host country, measured in million Euros. FDI stocks can be broken down into equity capital and reinvested earnings as well as other FDI capital. While outward FDI stocks enter the books as assets for the reporting country, inward stocks are reported as liabilities. Equity capital and reinvested earnings “is the value of the own capital of the enterprise, including the value of own reserves that are accumulated from past reinvested earnings” (Eurostat, 2019). Other FDI capital denotes the stock of debt (which can be assets or liabilities) between home and host country firms (Eurostat, 2019).

The vectors X_1 and X_0 which we use to match Brazil to an adequate weighted control group contain data on our predictor covariates for the treated and the 33 untreated units, respectively. We included the following predictor covariates into our model, all deeply rooted in economic theory on determinants of FDIs:

<u>Name of covariate/predictor</u>	<u>Description</u>	<u>Frequen cy</u>	<u>Matching period</u>	<u>Data source</u>
Exchange rate	Exchange rates, Euro per domestic currency, period average, rate.	quarterly	2010Q2-2014Q1	International Monetary Fund (IMF): http://data.imf.org/regular.aspx?key=61545863
Consumer Price Index	Consumer Price Index, base year 2010 equals 100%.	quarterly	2010Q2-2014Q1	IMF: http://data.imf.org/regular.aspx?key=61545861
Corruption Perception Index	Corruption perception index from Transparency International, ranges from 0 (highest) to 100 (lowest).	yearly	2011Q1-2014Q1	Transparency International: https://www.transparency.org/research/cpi/overview
Gross Domestic Product (log)	GDP at constant 2010 prices measured in Million US Dollars.	yearly	2011Q1-2014Q1	UNCTADSTAT: https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=96
Global Competitiveness Index	Measures determinants of the level of a country's productivity, ranges from 0 (worst) to 100 (best).	yearly	2011Q1-2014Q1	World Economic Forum: http://reports.weforum.org/global-competitiveness-report-2018/
Tax rate	Includes marginal tax rate on personal and corporate income as well as overall tax level, ranges from 0 (lowest) to 100 (highest).	yearly	2011Q1-2014Q1	Heritage Foundation: https://www.heritage.org/index/
Heritage Score	Measures economic freedom derived from 12 qualitative/quantitative factors, each graded on a scale of 0 (worst) to 100 (best).	yearly	2011Q1-2014Q1	Heritage Foundation: https://www.heritage.org/index/ranking
Political Stability	Measures perception-based likelihood of political instability and/or politically motivated violence (includes terrorism), ranges from -2.5 (weak) to +2.5 (strong) performance of the government.	yearly	2011Q1-2014Q1	World Governance Indicators: https://info.worldbank.org/governance/wgi/#home
Gross Domestic Product per Capita (log)	Gross Domestic Product per capita (2011 PPP \$).	yearly	2011Q1-2014Q1	Human Development Reports: http://hdr.undp.org/en/data
Unemployment rate	Unemployment, total (% of labour force).	yearly	2011Q1-2014Q1	Human Development Reports: http://hdr.undp.org/en/data
Human development index	Measures countries achievement in human development, ranges	yearly	2011Q1-2014Q1	Human Development Reports: http://hdr.undp.org/en/data

	from 0 (lowest) to 1 (highest).			
FDI Stock	Value of the investment of a certain country at the end of the period.	quarterly	2010Q2	Eurostat: https://ec.europa.eu/eurostat/web/balance-of-payments/data/database
FDI Stock		quarterly	2011Q2	
FDI Stock		quarterly	2013Q1	
FDI Stock		quarterly	2014Q1	

Table 2: Predictor variables - Exchange rate, Consumer Price Index, Industrial Production, Corruption Perception Index, Gross Domestic Product, Global Competitiveness Index, Tax rate, Heritage Score, Political Stability, four years of lagged FDI stock – own representation.

We now outline why we matched on each of these variables, including sources where researchers confirmed their importance in determining the value of FDI at the end of each description:

Exchange rate: When transferring money to a country with a different currency as is the case in an investment abroad, it matters for companies how much of the foreign currency they receive for one unit of their own. Companies prefer to invest in countries where the current exchange rate is beneficial when benchmarked against its fluctuation over time (Castro, Fernandes, & Campos, 2013; Drabek & Payne, 2002).

Consumer Price Index: The consumer price index mirrors quarterly changes in the price level of a country and hence proxies for inflation in a country. Inflation is commonly seen as detrimental to FDIs, as the money invested in a country quickly loses value over time (Cuervo-Cazurra, 2008; Drabek & Payne, 2002).

Corruption Perception Index: In order to match on pre-treatment corruption, we used the most commonly used Transparency International CPI. As broadly discussed before, corruption is commonly considered as having an impact on the size of FDI flows. We are particularly interested in how this variable will diverge from the corruption index of the synthetic counterfactual after the treatment (Caetano & Caleiro, 2007; Egger & Winner, 2006; Voyer & Beamish, 2004).

Gross Domestic Product: We use GDP to proxy for the market size of the host economy. Market size is especially important for market seeking FDIs which we assume mostly apply for Brazil (Egger & Winner, 2006; Gani, 2007; Smarzynska & Wei, 2000).

Global Competitiveness Index: This prominent index published yearly by the WEF rates the competitiveness of nations on a broad scale (World Bank, 2017).

Tax rate: The tax rate of a host economy is a major decision factor for foreign investors. The tax rate directly affects profits that can be reinvested or retained from the host economy. (Smarzynska & Wei, 2000; Wheeler & Mody, 1992).

Heritage Score: Yearly published by the Heritage Foundation, this index measures economic freedom in the four areas Rule of Law, Government Size, Regulatory efficiency and Open Markets.

We use the index to match on factors such as protection of property rights or freedom of trade which are commonly considered important determinants of FDIs (Castro et al., 2013; Habib & Zurawicki, 2002; Nunnenkamp, Andrés, Vadlamannati, & Waldkirch, 2012).

Political stability: Political stability is a major factor when it comes to uncertainty involved in an investment abroad. Political changes can lead to changes in laws, violence or state arbitrariness, which can threaten business thrive (Gani, 2007; Mauro, 1995).

GDP per capita: Proxies for the available income per person and hence for their purchasing power. Especially interesting for market-seeking investments (Egger & Winner, 2006; Mauro, 1995; Woo & Heo, 2009).

Unemployment rate: Proxies for the availability and cost of labour (high unemployment means low costs of labour) (Voyer & Beamish, 2004).

Human Development Index: We include the Human Development Index (HDI) in order to match on overall level of development – which is probably also leading to comparable investment motives of the foreign direct investors.

FDI stock: We include four years of lagged FDI stock in order to improve the quality of our match between synthetic control group and Brazil (Abadie et al., 2010).

Applying the methodology described before, we created a synthetic control unit matching Brazil in terms of predictor covariates as well as in terms of FDI stocks in the pre-treatment period from 2010Q2 until 2014Q1.

Our estimate for the effect of the Lava Jato corruption scandal is defined as the difference between the actual development of Brazil after the treatment and the predicted development for its synthetic counterpart which does not experience any treatment. Hereafter, a couple of robustness test were run which showed that our estimates for Brazil are large when compared to the distribution of estimates for other countries of the donor pool.

4) Empirical Analysis

4.1) Matching on predictor covariates and dependent variable

As shown in the methodology section, the first step in building our synthetic counterfactual consists of selecting and weighting the countries from our donor pool which match Brazil best in terms of pre-treatment values for FDI stock predictors. Table 3 compares the mean values of the predictor covariates in the pre-treatment period from 2010Q2 to 2014Q4 between Brazil, synthetic Brazil and the average of all countries included in the donor pool as well as for two exemplary countries part of the donor pool.

Variable	Brazil		Donor pool average	Exemplary countries	
	Real	Synthetic		France	India
Exchange rate	0.40	0.40	0.69	1.00	0.02
Consumer Price Index	111.22	110.68	105.08	103.18	117.35
Corruption Perception Index	41.50	44.74	62.67	70.25	35.25
Gross Domestic Product (ln)	6.37	5.98	5.53	6.44	6.28
Global Competitiveness Index	4.35	4.42	4.77	5.10	4.28
Tax rate	69.30	69.87	67.80	51.88	77.30
Heritage Foundation Index	57.20	60.37	68.34	63.85	55.03
Political Stability	-0.10	-0.24	0.66	0.48	-1.21
Gross Domestic Product per Capita (ln)	4.18	4.12	4.48	4.57	3.70
Unemployment	6.90	6.95	9.76	9.6	3.50
Human Development Index	0.74	0.74	0.86	0.89	0.60
German FDI stock in 2010Q2	11,478.00	11,511.35	9,270.91	6,608.00	9175.00
German FDI stock in 2011Q2	12,917.00	12,619.61	7,535.61	6,102.00	11,598.00
German FDI stock in 2013Q1	13,302.00	13,122.36	9,754.64	27,841.00	13,462.00
German FDI stock in 2014Q1	11,981.00	12,133.05	9,570.58	27,062.00	11,998.00

Table 3: Exchange rate and Consumer Price Index averaged between 2010Q2 and 2014Q1; German FDI stock measured only in indicated year; all other variables averaged between 2011Q1 and 2014Q1 – own representation.

A large gap between the values for Brazil and the average for all the countries for which data is available can be observed, which is in line with our assumption that countries in which German enterprises invest are quite diverse. This can also be seen when comparing the averaged values of the variables for Brazil to India or France (see table 3). Hence, a simple aggregate of all these countries to create a comparison unit would most likely not produce valid results. When, however, comparing the predictor values for the synthetic counterfactual to those of Brazil, we obtain quite similar results, proposing that Brazil and synthetic Brazil represent comparable units in the pre-treatment period. There is a perfect match on exchange rate and Human Development Index.

Moreover, there are quite good matches on Consumer Price Index, Global Competitiveness Index, Tax rate, Gross Domestic Product per Capita and Unemployment. For the remaining predictors Corruption Perception Index, Gross Domestic Product; Heritage Foundation Index and Political Stability we still we can see that despite a little difference between the values for real and synthetic Brazil, they still match much better than the averaged donor pool. Overall, we conclude that in terms of predictor covariates, we were able to assemble a synthetic Brazil which is quite similar on these characteristics and hence should be an adequate counterfactual for our following analysis.

For an optimal fit between a country and its synthetical counterfactual we want to minimize the Mean Squared Prediction Error (MSPE), equalling the sum of squared FDI stock residuals in the pre-treatment period between Brazil and synthetic Brazil (Hainmüller, 2015). Our matching algorithm chooses V over all the given predictor covariates in a way that the MSPE of German FDI stocks between Brazil and synthetic Brazil is minimized for the matching period which is 2010Q1 until 2014Q1²¹. This is, the covariates are given weights based on their predictive power of our DV FDI stock before the treatment. A good match between covariates for Brazil and synthetic Brazil implies a stronger predictive power of the variable when set in relation with the other covariates, hence implying a larger value in our V vector.

With regards to the W parameter, our countries from the donor pool were assigned weights. These weights were chosen based on how good the single countries match Brazil in terms of pre-treatment values of the predictor covariates while at the same time accounting for their predictive power for German FDI stocks in the country. The weights for the countries in the donor pool are summarized in table 4. We see that the countries mainly entering synthetic Brazil are India (48.3%), Italy (18.7%), Malta (8.4%) and Czechia (8.3%). Minor weights are obtained by France (5.4%), Spain (4.3%), Hungary (3.7%), the United States (1.7%), Luxembourg (1.0%) and Denmark (0.1%).

²¹ We chose this starting point on the basis of availability of data for our matching variables as well as to get a reasonable distance to the global financial crisis of 2008 which might bias our analysis.

Country	Weight in synthetic control unit	Country	Weight in synthetic control unit
Austria	0%	Japan	0%
Belgium	0%	Latvia	0%
Bulgaria	0%	Lithuania	0%
Canada	0%	Luxembourg	1.0%
China	0%	Malta	8.4%
Croatia	0%	Netherlands	0%
Cyprus	0%	Poland	0%
Czechia	8.3%	Portugal	0%
Denmark	0.1%	Russia	0%
Estonia	0%	Slovakia	0%
Finland	0%	Slovenia	0%
France	5.4%	Spain	4.3%
Greece	0%	Sweden	0%
Hungary	3.7%	Switzerland	0%
India	48.4%	United Kingdom	0%
Ireland	0%	United States	1.7%
Italy	18.7%		

Table 4: Country weights in synthetic Brazil – own representation.

For these countries entering the synthetic control group, we performed a check regarding corruption scandals occurring after the treatment period, which could bias our findings²² as potentially entering the gap between Brazil and synthetic Brazil. We found some of such events for India, however, as India had experienced corruption scandals of a similar dimension regularly before and has continuously improved its TI Corruption Perception index between 2013 and 2017 (Transparency International, 2019b), we did not exclude India from the synthetic control group. In the case of the Gürtel corruption scandal in Spain which overlapped with our treatment period, the court only pronounced a final judgement in May 2018 (Edwards, 2019), which is the reason why we would not expect a major reaction of German investors during our observation period. Moreover, the Czech graft scandal of 2013 had its main implications revealed before the treatment (Mlcochova & Muller, 2013), which is why we stick with Czechia as part of our synthetic control group.²³

²² However, due to the sensitivity of FDIs to a lot of variables apart from corruption, it is impossible to control for all of these developments which can potentially bias our analysis up - as well as downwards.

²³ There have been many further corruption scandals occurring in the countries of our synthetic control group after the treatment period, which we do not mention here, as to be expected due to the similar level of corruption needed in synthetic Brazil to mirror Brazil. These events, however, did not have the scope to affect German FDIs to the country in such a way as assumed for the case of Lava Jato.

It is noteworthy that, even if any of the main donor countries had experienced a major scandal after the treatment period which we overlooked, this would reduce, not increase, our estimate of the treatment effect (assuming a similar reaction to the scandal by German firms in the respective country to such occurrences in Brazil), so that our estimate is rather conservative.

Based on our calculations, we can now plot the development of German FDI stocks in Brazil against those of the synthetic control group (see figure 3).

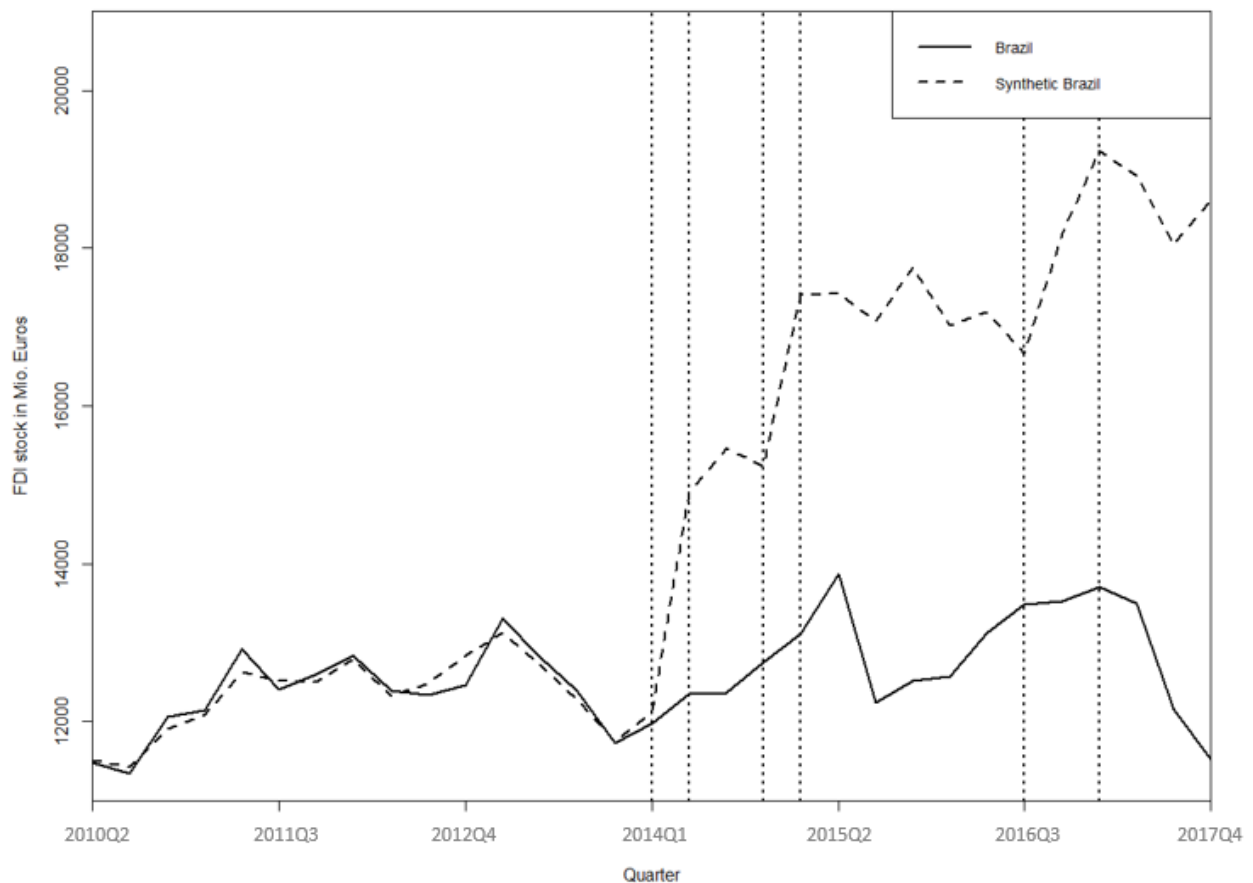


Figure 3: Trend in German FDI stocks in Brazil vs. synthetic Brazil – own representation.

It is apparent that the paths of the synthetic control group and Brazil are now closely aligned in the pre-treatment period between 2010Q2 and 2014Q1. Moreover, the trend of the two curves is, apart from two minor deviations in 2011Q3 and 2012Q4, extremely similar. As a consequence, we are confident that synthetic Brazil should pretty well proxy for the development of German FDI stocks in Brazil if the Lava Jato scandal had not occurred.

When looking at the plot, we observe that the lines diverge strongly, however mainly driven by synthetic Brazil as opposed to our expectation of a negative trend for Brazil after the treatment. We argue that this is due to huge flows of German FDIs to countries comparable to Brazil in the respective periods, while investments to Brazil have remained relatively stable. Due to the Lava Jato investigations, foreign investors were deterred from investing in Brazil in these time periods, so that this pattern only benefitted countries similar to Brazil. This is visible in the remarkable increases of FDI stock for synthetic Brazil in periods we link to major scandals in Brazil. Moreover, there might be an upward-bias further widening the gap because German FDIs originally planned for the Brazilian market might have been invested in one or more of the countries making up the synthetic control unit. The strong investment of German companies in countries similar to Brazil in quarters we link to Lava Jato events in Brazil is illustrated in figure 4 for the case of India, making up almost half of the synthetic control unit. Similar figures for Brazil as well as countries making up big percentages of the synthetic control unit can be found in Annexes 12 to 15.

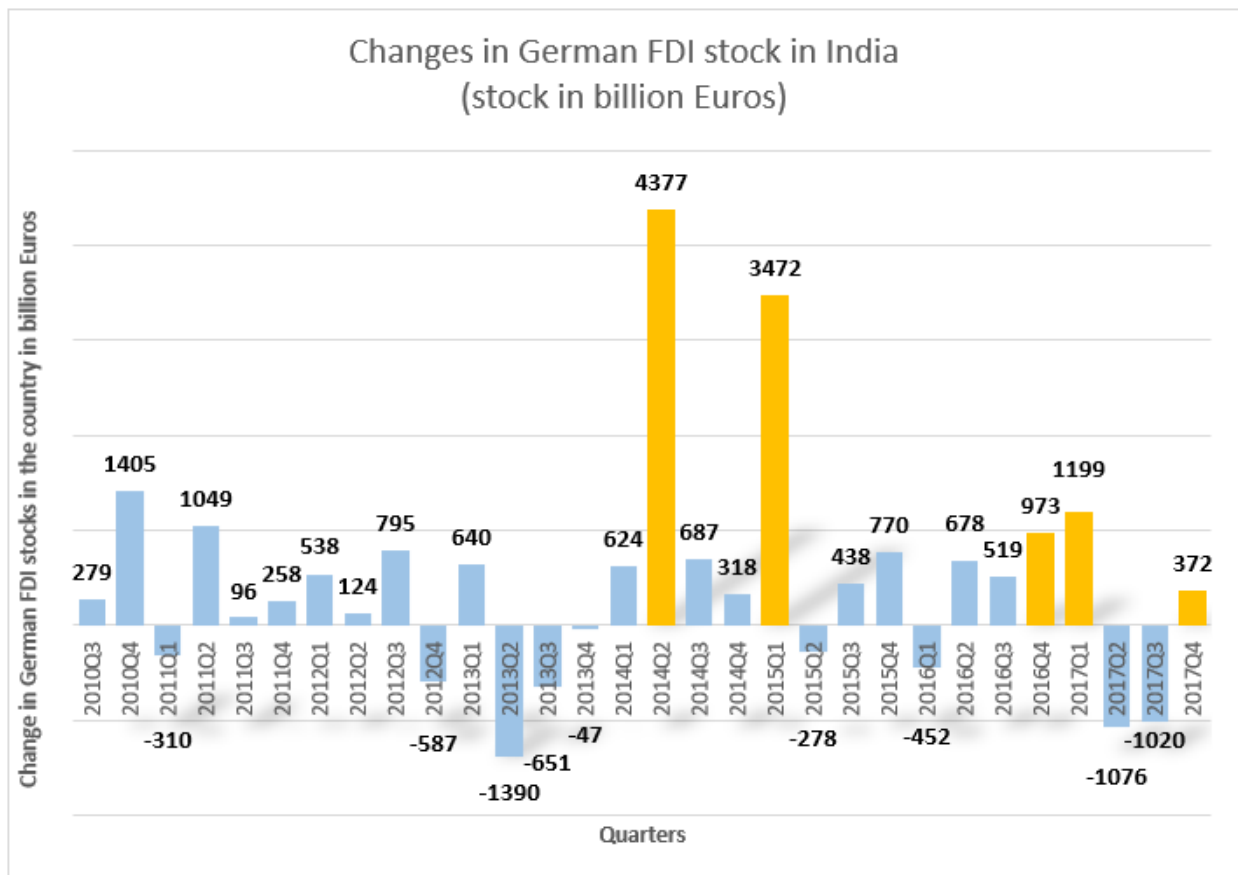


Figure 4: Changes in German FDI stock in Malta in billion Euro. Quarters highlighted in orange mark periods where the gap between Brazil and synthetic Brazil diverged and which we link to major events - own representation. (Eurostat, 2019).

We measure the effects of the Lava Jato scandal as the gap between German FDI stocks in Brazil and the predicted stock for synthetic Brazil after German investors became aware of the scandal²⁴.

4.2) Linkage of Lava Jato events and trend shifts

When looking at the gaps plot in figure 5, it becomes apparent that there have been two periods of time when huge gaps between Brazil and synthetic Brazil emerged. The first time-interval was between 2014Q1 and 2014Q2, when the two curves diverged by 2.4 billion Euros, proposing an event occurring here.

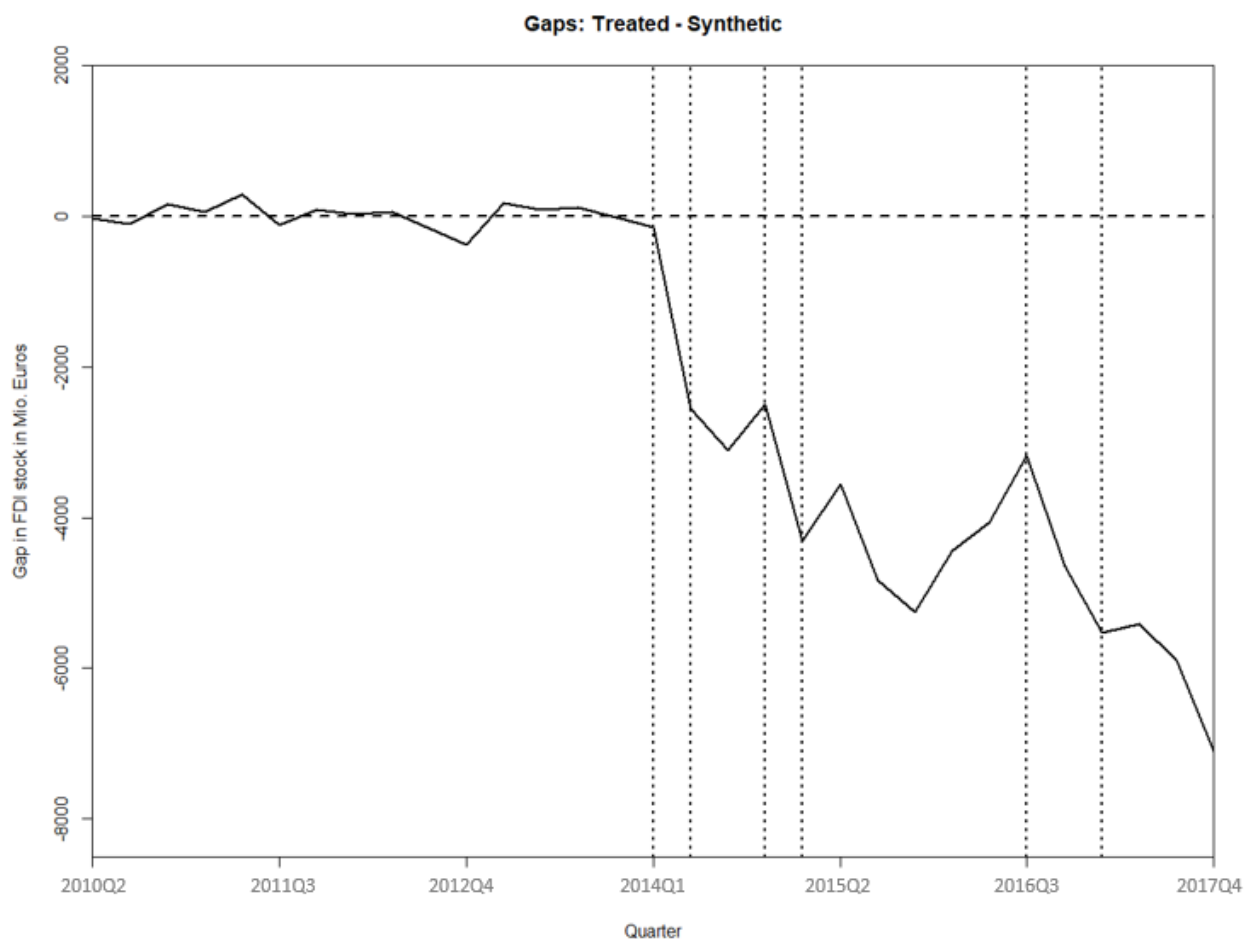


Figure 5: Gap in German FDI stock between Brazil and its synthetic counterfactual – own representation.

Even though the Lava Jato scandal officially started in 2014Q1, such an immediate reaction to the Lava Jato investigation announced on 17 March is extremely unlikely. This is first because the scandal started in small with almost no coverage in international media. Secondly, researchers

²⁴ For a detailed overview over the size of the gaps between Brazil and synthetic Brazil please refer to Annex 11.

commonly assume a time gap between investment decision and execution. Even though research largely agrees on the existence of such a time gap²⁵, there is controversy about its length, often described as between quarter a year and one year, mostly depending on the measurement frequency of the DV. Accordingly, we rule out Lava Jato as a potential cause of this gap.

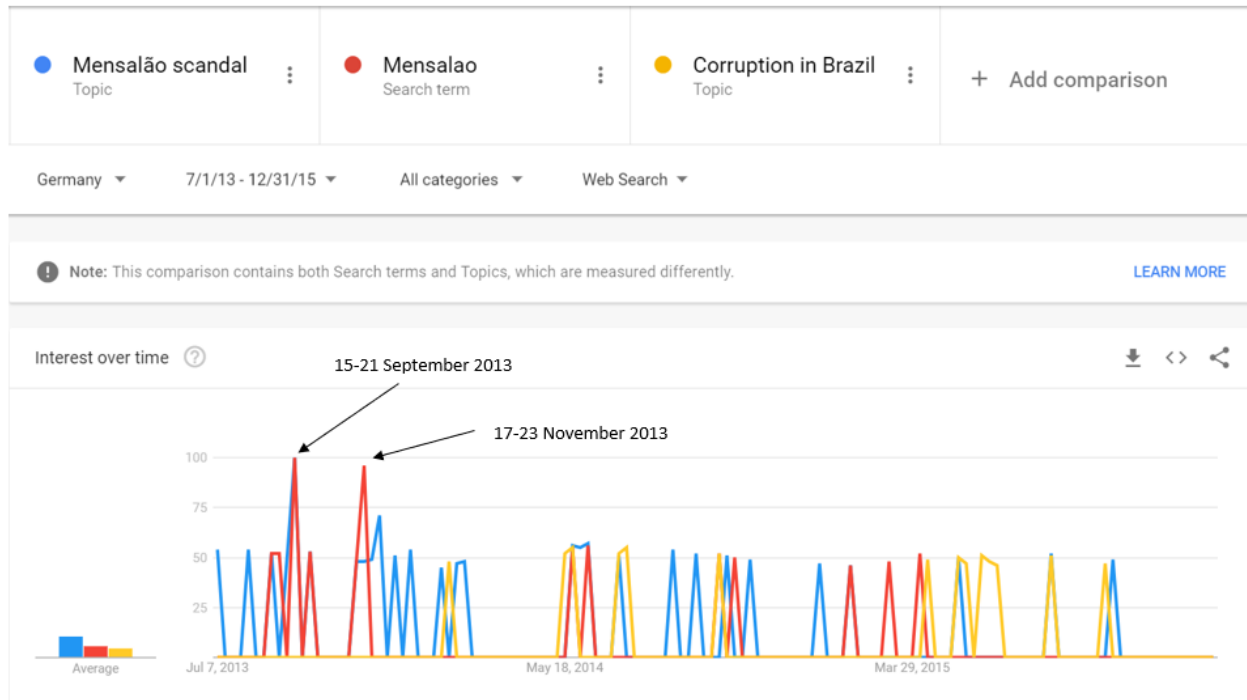


Figure 6: trends for the topics “Mensalão”, the search term “Mensalão scandal” as well as the topic “Corruption in Brazil” over time (‘Google Trends’, 2019).

A possible event to explain this first gap is the Mensalão scandal already mentioned earlier in this paper. We looked at Google search trends (figure 6) to establish a connection between interest in this topic and reactions of FDI stock. Major interest arose in September and November 2013 when the supreme court issued the first arrest warrants against high ranking people involved (BBC, 2013). Not finding other reasonable causes for this increase in the gap between Brazil and its synthetic counterpart checking Google results for this timeframe, we establish a causal connection between the Mensalão scandal and the reaction of foreign investors occurring roughly five months after the reports in media.

We did not extend our pre-treatment period to the expected start of Lava Jato, as it would extremely reduce the fit between Brazil and its synthetic counterfactual, the negative development in FDI

²⁵ Usually incorporated into the empiric models by lagging the independent variables assumed to be determinants of FDI, see for instance (Burger, Ianchovichina, & Rijkers, 2016; Cuervo-Cazurra, 2008; Egger & Winner, 2006).

stock over this period only being the case for Brazil. Instead, we do not count the gap emerging before the Lava Jato treatment as part of the treatment effect but stick with our similar trend assumption after this first gap emerged. This is a reasonable assumption considering the length of the matching period as well as the excellent match of paths between Brazil and synthetic Brazil in the pre-treatment period. Furthermore, the gap between Brazil and its synthetic counterfactual does not increase over the next two quarters after the decrease between 2014Q1 and 2014Q2, further supporting this hypothesis.

The second widening of the gap between Brazil and synthetic Brazil occurred between 2014Q4 and 2015Q1, equalling an FDI value of 1.8 billion Euro. From the synthetic control curve, we can derive that Brazil should have expected massive FDI flows in this period of time, however German FDI stock in the country only went up slightly. We again looked at Google search trends in Germany (see figure 7) and identified the week between 16 and 22 November 2014 as a point in time where Google searches and hence awareness about Lava Jato went up extremely, which can be reasoned by a major operation by the police (Operação Juízo Final) on 14 November (Polícia Federal, 2019). Accordingly, we define the time period between 2014Q3 and 2014Q4²⁶ as the interval when the majority of German investors must have been informed about the scandal, hence representing our treatment period.

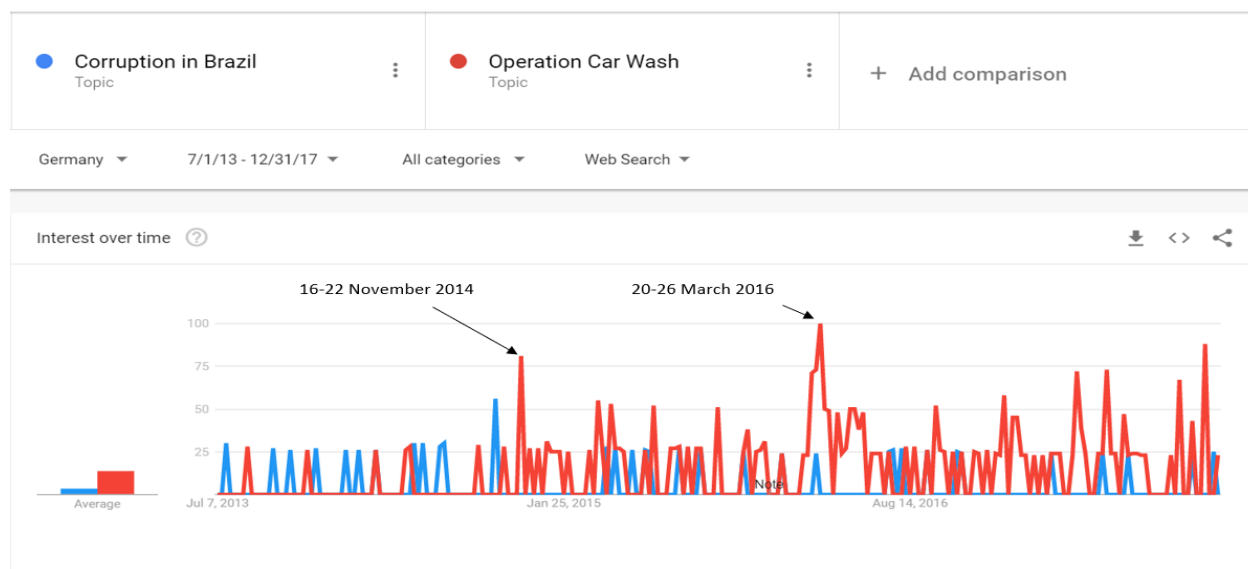


Figure 7: Google search trends for the topics “Corruption in Brazil” and “Operation Car Wash” over time (‘Google Trends’, 2019).

²⁶ As FDI stock is measured at the end of the respective quarters.

As mentioned before, we assume a time-delay between treatment and reflection in the DV. In line with our observations from the Mensalão scandal we assume one to two quarters of time lag to be a reasonable estimate. As we observe a huge gap between Brazil and synthetic Brazil emerging between 2014Q4 and 2015Q1 which is roughly one quarter after the treatment, we assume a causal effect of this news to investors on the increasing gap between Brazil and synthetic Brazil in this period.

To challenge the validity of this assumption we checked for other events that could explain the diverging curves at this point in time. One major event we find is Standard & Poor's downgrading of Brazil's investment rating from BBB to BBB- in March 2014 (Sheng & Junior, 2016), representing the last level before non-investment grade and happening before Moody's and Fitch's downgrading later in the year. Standard & Poor's reasoned the downgrading with Rousseff's costly efforts trying to improve the economic performance of the country, which had, however, only limited success (Soto, 2014). Considering the expected time-lag and the stable outlook given by the rating agency for Brazil at this point in time (Soto, 2014), we conclude that this event cannot explain the emerging gap at this point in time. This is also the case for the downgrading of Brazil's investment rating from BBB- to the highest non-investment grade BB+, first declared by Standard & Poor's in September 2015 due to Rousseff's failing economic policy (Brandimarte, 2015). Considering a time-gap of one to two quarters, this event cannot be related to a widening gap and hence does not show a visible effect on German FDIs in Brazil.

We only observe one period in time where the widening of the gap between Brazil and the synthetic control group is not due to increased German investments to the countries making up the counterfactual, but instead driven by reduced investment to Brazil, which is between 2015Q3 and 2015Q2. We argue, that the overall widening of the gap in the period between 2015Q2 and 2015Q4 stems from the first protests demanding an impeachment of Dilma Rousseff, as assuming an involvement of the Brazilian president in the corruption scandal which had received major attention by then (BBC, 2015). This basically marked the first point in time when the impact of Lava Jato on political stability in Brazil became clear and moreover, the scope continued widening to other state directorates (Comunicação Social da PF, 2014).

When we follow the curves for Brazil and synthetic Brazil over later periods, we see the spread between them increasing over time. We argue that this is due to the long-term effects of the Lava

Jato scandal, such as political instability after the Rousseff impeachment, starting with her suspension on 12 May 2016 and the appointment of Michel Temer as the interim president before she was permanently removed from office on 31 August 2016²⁷. We relate these events to the third massive divergence between FDI stock in Brazil and synthetic Brazil which occurred between 2016Q3 and 2017Q1, pretty well aligned with the one-quarter gap we assume as the time gap between investment decision and execution. As the impeachment of Dilma Rousseff was partly related to the investigations as explained before, we attribute its impact on FDI stocks to the Lava Jato scandal.

Annex 16 confirms our findings about Google search trends proxying media coverage on a worldwide level, showing that spikes in interest are very much aligned between Germany and worldwide Google searches. Our results are further supported when looking at trends for the single predictor covariates which can be found in Annexes 17-27. Even though we averaged the values over the pre-treatment period for the matching procedure, which means that some single predictors are not well-aligned in terms of long-term trend, we see that still most predictors have a similar trend in the pre-treatment period. However, after the pre-treatment period, lines diverge for predictor variables of FDI, meaning that especially from 2014Q1 to 2015Q1, for Brazil the Corruption Perception Index worsened, unemployment skyrocketed and Political Stability increased remarkably, which we relate to the impact of the Mensalão as well as Lava Jato investigations. In addition, Brazil's Gross Domestic Product per Capita and its competitiveness decreased, pointing to a more unfavourable economic situation in the country. This is well aligned with media reports stating the importance the economic well-being of Petrobras has not only for investors (Rapoza, 2012), but also for Brazilian companies in general.

Overall, we see a strongly negative effect of the events which occurred in the context of Lava Jato on the willingness of German companies to invest in Brazil. According to our findings, between 2014Q4 and 2017Q4 Germany invested a total of 4.6 billion Euros less in Brazil than it would have without the corruption scandal happening.²⁸

²⁷ The spike in Google searches for "Operation Car Wash" in March 2016 may well be seen as a result of calls for Dilma Rousseff's resignation in March 2016.

²⁸ We cannot clearly separate the Lava Jato investigations from other events occurring during the same observation period such as Operation Weak Flesh in March 2017 (Alerigi & Freitas, 2017). However, as also related to corruption and receiving much less media coverage than Lava Jato, we argue that the changes in German FDI stock in Brazil mostly stem from the ongoing Lava Jato investigations.

5) Robustness

5.1) Additional variables and interference

We performed several robustness tests in order to challenge the validity of our results. First of all, we used other predictors variables of FDI to match Brazil and its synthetic counterfactual, such as producer price index, industrial production, population, property rights, business freedom, trade freedom or rule of law. However, including them did not considerably change the spread between FDIs in Brazil and the control group after the Lava Jato scandal occurred. This proposes that we already matched on key variables explaining FDI stock in the country and matching on other predictors of FDI flows leads to the same countries being chosen for the synthetic control group. It moreover strengthens our basic assumption regarding overall similarity of Brazil and synthetic Brazil, thus supporting the similar trends assumption.

In addition, we lengthened or shortened the period over which our predictor covariates are averaged before being matched with the potential donor countries. As before, our results did not change notably. We observed that, when prolongating the pre-treatment period after 2014Q1, our MSPE increased significantly, proposing that a shock occurred here and matching should be done before this point in time to be done in a reliable way. Moreover, as India is making up more than 48 percent of the donor countries, we re-estimated the gap between Brazil and synthetic Brazil excluding India from the donor pool. We obtain a much poorer match on the predictor covariates, however still get a very similar development path of the synthetic control group after the treatment. Even though the overall gap diminished, the periods of time when the gap widens are well-aligned with our findings when including India, strengthening the validity of our results.

Another common area of concern for difference in difference research designs is interference. In our case, there might be interference between our treated country and the other countries from the donor pool. For instance, we could overestimate the increase in German FDI stocks in the synthetic control group after the treatment event, as funds originally planned for the Brazilian market could be converted to countries which are part of the control group instead. This might be the case for India making up a 48.4% of synthetic Brazil which is part of the BRIC countries and might be a viable alternative for German companies to an investment in Brazil. However, in other scenarios, German companies could also refrain from FDIs in developing countries due to the fear of other corruption scandals occurring there where similar levels of corruption prevail. This would lead to

a rather conservative estimate from our side. A last alternative would be that German companies which had initially planned to invest in Brazil do not invest at all, a scenario which would not bias our results. This could only lead to biased results at later points in time as that money might be invested in Brazil or one of the components of synthetic Brazil in a later quarter. However, these alternatives would only lead to overstating the gap between Brazil and its synthetic counterfactual at a certain point in time and not our overall finding of a reduction of German FDI in Brazil due to Lava Jato.

Overall, we assume that due to the size and continuity of the effect observed, such interference effects must have been extreme in order to satisfactorily explain our findings.

5.2) Placebo tests

In order to further check the reliability of our results we performed additional placebo tests. These help us to establish a confidence-interval that our findings are not a product of chance, but can be traced back to the treatment. In order to establish such a link, we apply the same methodology of creating a synthetical counterfactual to the other countries of the control group to check if an effect of the size observed would also occur for other countries.

Our rationale is the following: If the gap for untreated units after the treatment period is at least as large as that observed for Brazil, we cannot infer significance to our results, as the change in FDI inflows to Brazil is not outstanding in comparison to the untreated units. If, however, the effect observed for Brazil is much bigger than for most of the control countries, we are quite confident that in the case of Brazil a strong reaction of foreign investors to the shocks happened which can be explained by the Lava Jato scandal.

In order to conduct these placebo studies, we apply the synthetic control method to every single state from the control group. We did however, exclude Brazil from the donor pool in order not to let our treated country bias the estimates for the other countries from the donor pool. We then plot the results from this iteration against the results obtained for Brazil. The corresponding gaps plot can be found in figure 8.

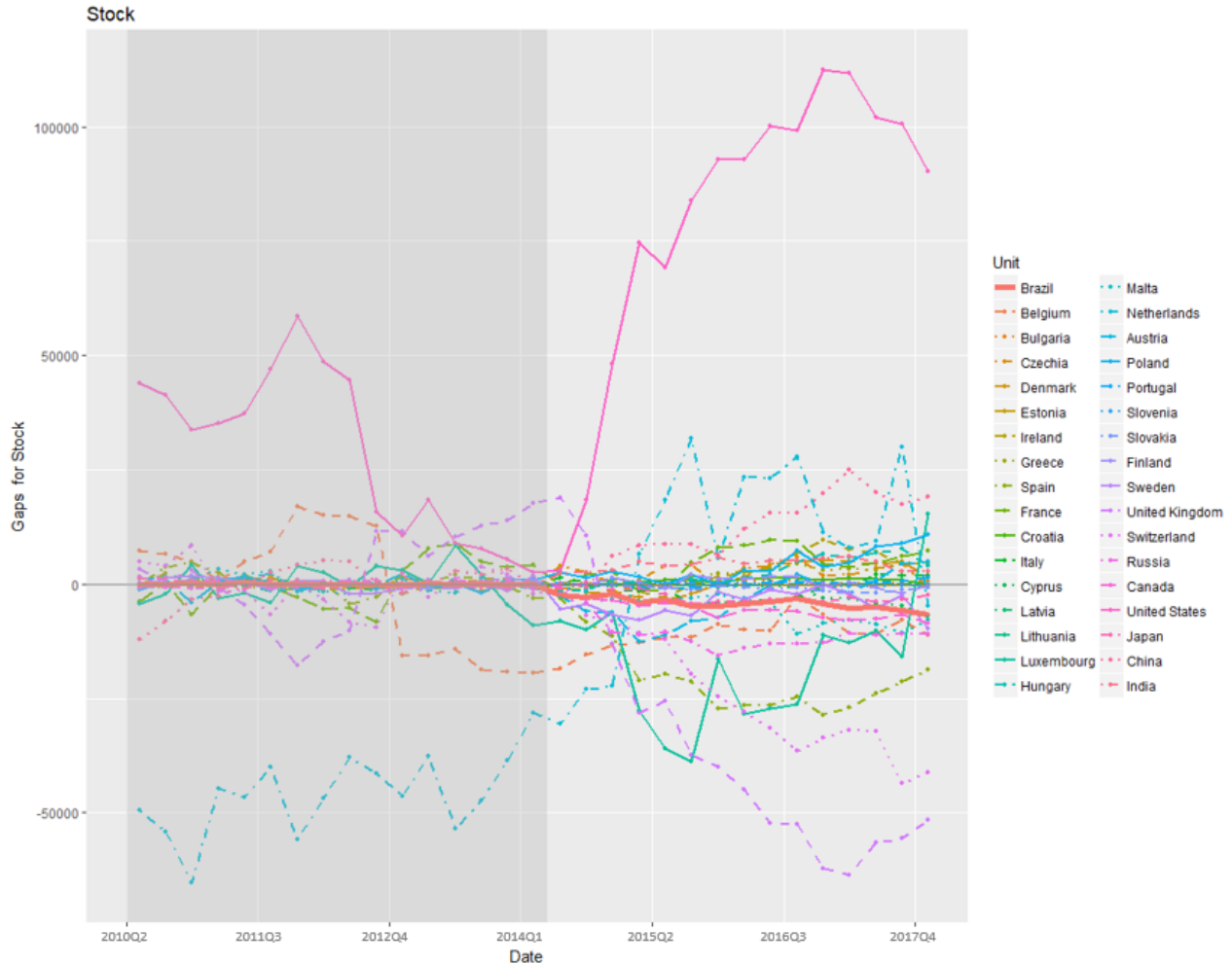


Figure 8: German FDI stock gap in Brazil and the 33 control states which also received FDIs from Germany – own representation.

In the plot the red line represents the gap in FDI stock between Brazil and its synthetic counterfactual over time, the vertical line representing the occurrence of the Lava Jato scandal. In contrast, the lines in different colours display the same gaps for all the control countries which did not experience the treatment, when performing synthetic control studies for them. From this first plot it does not seem that Brazil experienced an outstandingly large gap after the treatment in comparison to the other countries where no corruption scandal occurred.

It can moreover be seen that Brazil and its synthetic counterpart do match quite well in terms of FDI stock from Germany in the country in the pre-treatment period. Expressed in numbers, the MSPE for Brazil, equalling the sum of squared FDI stock residuals in the pre-treatment period between Brazil and synthetic Brazil totalled to 24,397.

Nevertheless, it can also be concluded from the graph that such a good fit between country and synthetic counterpart does not apply for all the nations from the donor pool²⁹. This is especially true for the United States (pink line showing big positive gap to countries making up its synthetic control group in pre-treatment period) and the Netherlands (turquoise line showing big negative gap in pre-treatment period). No reasonable control group can be synthesized from the other countries for these two outliers due to highly positive (United States) and highly negative (Netherlands) amounts of German FDI stock in the countries, leading to the extreme MSPEs in the pre-treatment period for them.

If there is poor fit between a country and its synthetic counterfactual in the pre-treatment period, it is quite likely that gaps after the treatment are resulting from this defect. In order to account for this, when running our placebo studies, we exclude countries with a high MSPE before the treatment from our distribution pool for the significance test. In doing so, we can establish that eventually large gaps in the after-treatment period for countries of the control group do not stem from bad fit. In line with Abadie et al. (2010), we estimate several versions of placebo studies with different ratios of MSPE that we exclude.

In figure 9 we set this ratio of MSPE to 16 times the level of Brazil.

²⁹ This can be seen from big gaps for some of the countries in the pre-treatment period, representing huge MSPEs between treated countries and their synthetic counterfactual and hence a poor fit. This weakens the similar trends assumption and makes large gaps after the treatment more likely for these countries, which is why we iterate the MSPE to a low level similar to that between Brazil and synthetic Brazil. Once the pre-treatment MSPE is comparable, we can perform a significance test on our result, meaning that we check if Brazil experienced an after-treatment effect larger than most of the other countries which did not experience the treatment. If this is the case, we are confident to state that the treatment had an effect on the treated country and the gap is not just due to poor fit or other influencing factors.

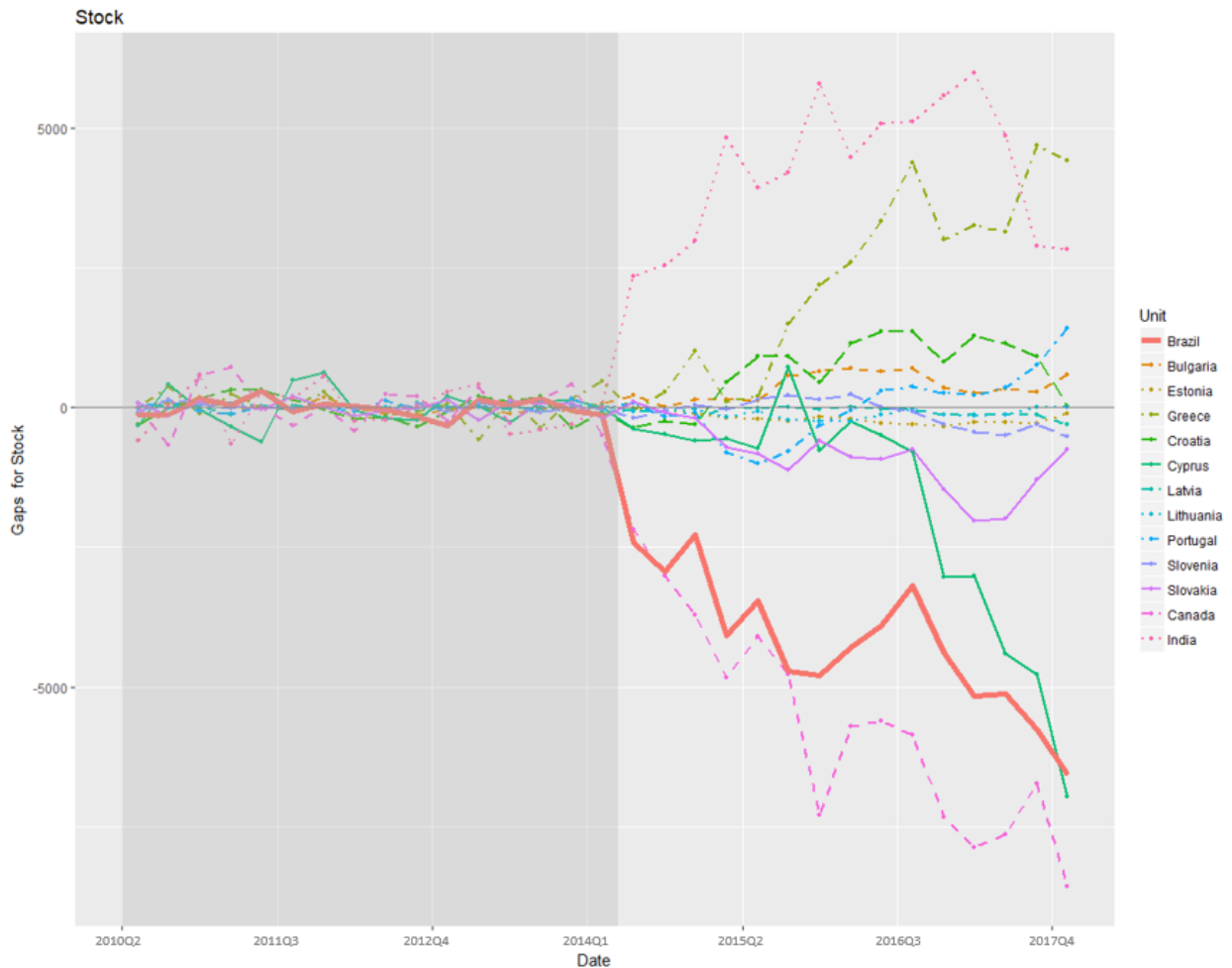


Figure 9: Gap of German FDI stock in Brazil and control states (only includes cases where the Mean Squared Predicted Error equalling the residual between each country and its respective counterfactual in the pre-treatment period 16 times bigger than Brazil's) – own representation.

As we can see, 21 states do not meet this criterion and vanish from the plot. For the remaining control units, we see better, however not perfect fit in the pre-treatment period. It is apparent that the line representing the gap between Brazil and synthetic Brazil post-treatment now along with the line representing Canada (dashed pink line at the bottom) is the most deviant one from the others. In order to rule out the possibility that the big gap for Canada is not caused by a worse fit in the pre-treatment period, we iterate the placebo study to a lower MSPE.

Figure 10 below depicts the placebo study with a lower cut-off of a MSPE of 6, now excluding a total of 23 countries which exceed this threshold. In this picture, the line depicting the gap between Canada and synthetic Canada disappears, suggesting that the outstanding gap after the treatment for this country did indeed partly stem from poor fit before the treatment. Now, for the period after the treatment Brazil clearly shows the most deviant behaviour, however the gap for Cyprus catching up at a later point in time.



Figure 10: Gap of German FDI stock in Brazil and control states (MSPE 6 times bigger than Brazil's) – own representation.

We lower the MSPE threshold once more in order to just stay with states with a fit almost as good as Brazil in the graph. The result of the new threshold of two times that of Brazil can be seen in figure 11.

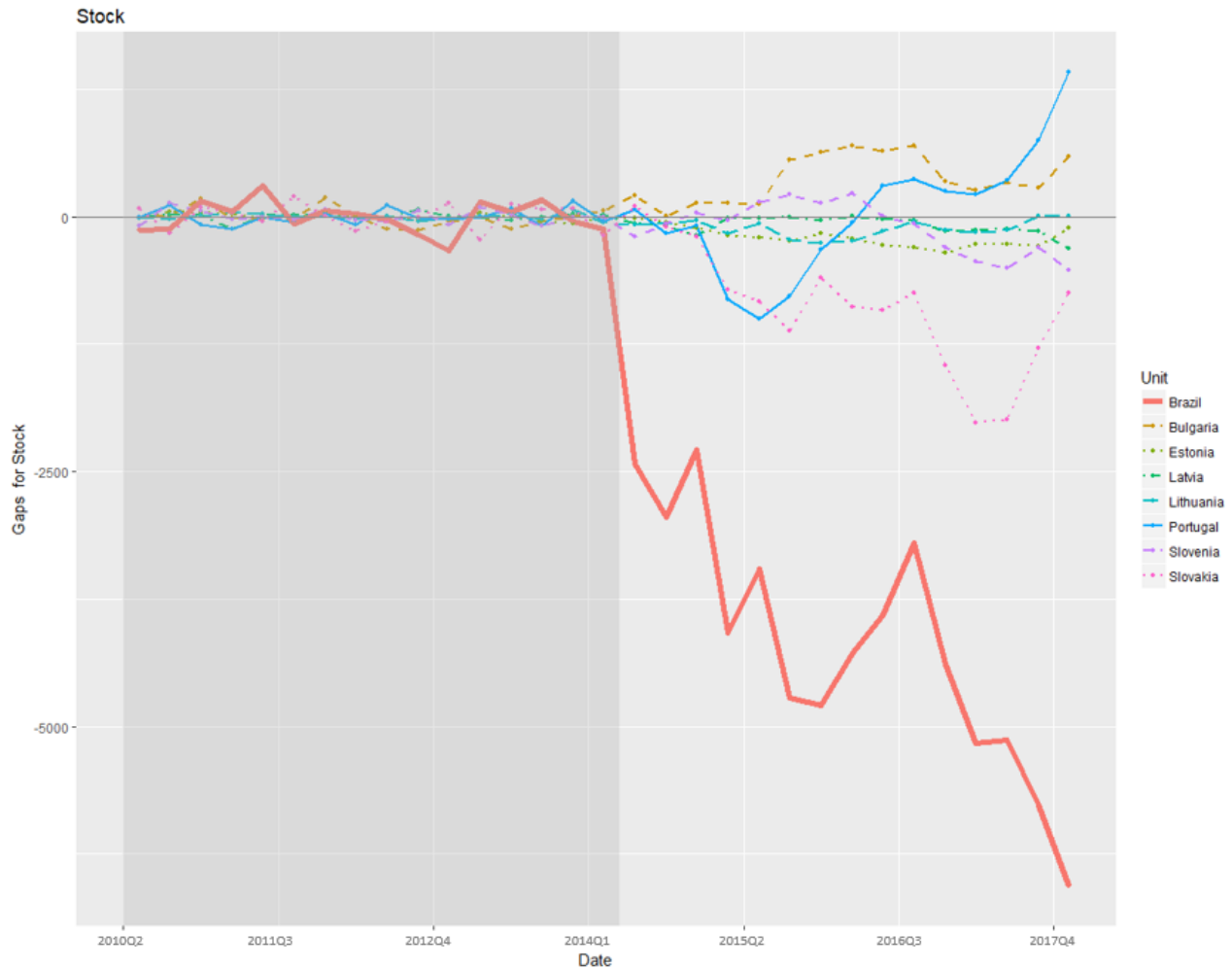


Figure 11: Gap of German FDI stock in Brazil and control states (MSPE 2 times bigger than Brazil's) – own representation.

We remain with a total of 7 states which Brazil is benchmarked against and can clearly observe that the gap in FDI stocks for Brazil is by far the largest. Just as in other research methodologies, we can now perform a test of statistical significance for the gap being as large as Brazil's in the post-treatment period. For the period between 2014Q4 and 2017Q4 we obtain significance at the 6.7 percent level, meaning that we can be quite confident that the development of Brazil after the treatment is exceptional when compared to other countries which received FDIs from Germany. The size of our effect is negative and equals 4.6 billion Euros, proposing that Lava Jato reduced the German FDI stock in Brazil by this amount due to a negative reaction of investors to the investigations.

6) Conclusion

32.9 percent of firms of Brazilian companies are expected to give gifts to government representatives in order to win contracts (World Bank, 2009). If one compares this number from an enterprise study of the World Bank conducted in 2009 to the average over all Latin American and Caribbean countries (14.3%), it becomes obvious that corruption is a topic deeply rooted in the Brazilian culture. While it can be assumed, that in many parts of Brazilian society bribes are demanded and accepted because of low salaries, the Lava Jato scandal clearly represents the other extreme: corruption as the outcome of greed. Top Executives of Petrobras, politicians or the managers of the construction and engineering suppliers – it can be assumed that none of them engaged in corrupt behaviour just for the motive of survival. Instead, elites from politics as well as business were using their entrusted power for their personal gain at the expense of their fellow citizens and their shareholders.

The Lava Jato investigations could potentially mark the begin of the end of such behaviour. Rigorous prosecution and punishment of corrupt practices seems to become the new standard of legal authorities around chief-prosecutor Sérgio Fernando Moro.

However, the question remains: How will the people superseding the current generation of Elites shape Brazil's future? Will they engage in the same corrupt behaviours as their predecessors, once the threat of legal prosecution and conviction is not that present anymore? Will politicians find legal ways to fund their election campaigns?

All of these questions will need to be posed in the future in order to ensure that not as in the past with the Mensalão scandal in 2005 or the Lava Jato investigations today, corruption is impeding the whole country from a path towards more equality and prosperity.

In this research paper we have studied the impact of the Lava Jato corruption scandal in Brazil on the level of FDI stocks in the country, using Germany as an exemplary investor. We used a synthetic control research design to compare FDI stocks of German companies in Brazil to those in other countries. Namely we assembled a synthetic Brazil from countries similar in characteristics seen as predictors variables of FDI which we then compared to Brazil regarding the level of German FDI stocks residing in the country after the treatment occurred. We find that the scandal, after having aroused international attention, significantly decreased the level of German FDI stock in the country when compared to the trend that would have been expected without the scandal

happening. The gap in terms of FDI stock after the treatment between Brazil and its synthetic counterfactual proved to be extraordinarily large when compared to the other countries from our dataset which received FDI from Germany in the observation period, applying the same methodology for them. More precisely, a gap as large as for Brazil between 2014Q4 and 2017Q4 statistically speaking only occurs in 7 percent of the cases, making it quite unlikely that our results are the product of chance.

This paper supports the sand in the machinery theory by finding a negative impact of corruption disclosures in Brazil on the level of foreign investments residing in the country. We contribute to existing research by showing that corruption scandals, even though potentially pointing towards improvement in the future, deter foreign investors. Moreover, we add to literature regarding how investors from a country react to sudden changes in perceived corruption of a potential host country, especially for major developing countries which are attracting an increasing share of worldwide FDIs.

This paper opens up a few important questions on which further research should be conducted. First, a breakdown of FDIs made to developing countries in target industry, size of the investing company or already invested stock in the country would generate valuable insights. This is because Zurawicki & Habib (2010) posed the concern that not only quantity, but also the quality of investments matters. They argue that corruption for instance might lead to winning less attractive projects or might increase the share of FDI made by less attractive countries of origin. Burger et al. (2016) propose that the impact of political instability on value and characteristics of FDI flows should be investigated at sector-level instead of the aggregate flow, which might result from varying sensitivity of industries to host country risks.³⁰ Moreover, industries might vary on the custom of paying bribes (Hines, 1995), hence making an in-depth examination of this matter well-suited for putting more accurate numbers on the cost of corruption.

Secondly, the scope of this research did not include the questions if countries such as Argentina, Chile or Venezuela which were found as involved in the Lava Jato corruption scandal experienced

³⁰ Moreover, at the company level, some corporations might completely abandon/not decide for an initial investment into the host country due to corruption. A contrary rationale would be that no companies drop out, but on average companies tend to lower their total investment during times of uncertainty, for instance by retaining earnings (Zurawicki & Habib, 2010). Both lead to the same outcome which is the overall downfall of FDI stock growth in the country, but might require completely different policy actions and lead to different consequences for an economy.

similar reactions from foreign investors. In this context moreover the question arises, if countries with a development level similar to Germany reacted in the same way to the corruption scandal, which could not be answered within the scope of this paper.

A last area of interest would be the long-term implications of the scandal: Will foreign investors invest more in the future if Brazil keeps fighting corruption in the country?

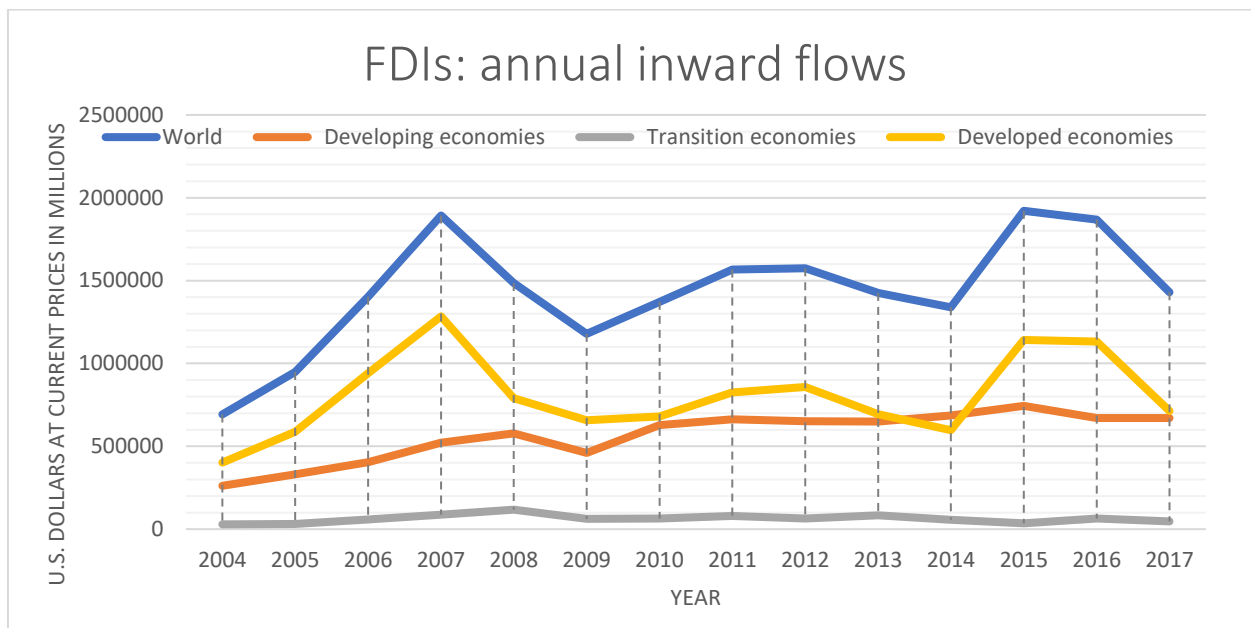
Annex:

<u>Country</u>	<u>Share of total FDI flow to Brazil in 2017</u>	<u>Share of total FDI flow to Brazil in 2013</u>	<u>Absolute value of FDI flows to Brazil in 2017 (Million USD)</u>	<u>Absolute value of FDI flows to Brazil in 2013 (Million USD)</u>
United States	18.4%	18.1%	11,078	9,024
Netherlands	18.1%	21.1%	10,894	10,511
British Virgin Islands	15.0%	0.5%	9,069	265
Luxembourg	7.1%	10.2%	4,305	5,067
Germany	5.3%	2.0%	3,221	1,011
France	5.2%	3.0%	3,168	1,489
Spain	3.8 %	4.5%	2,309	2,246
Chile	2.7%	5.9%	1,620	2,963
Italy	2.5%	1.8%	1,521	902

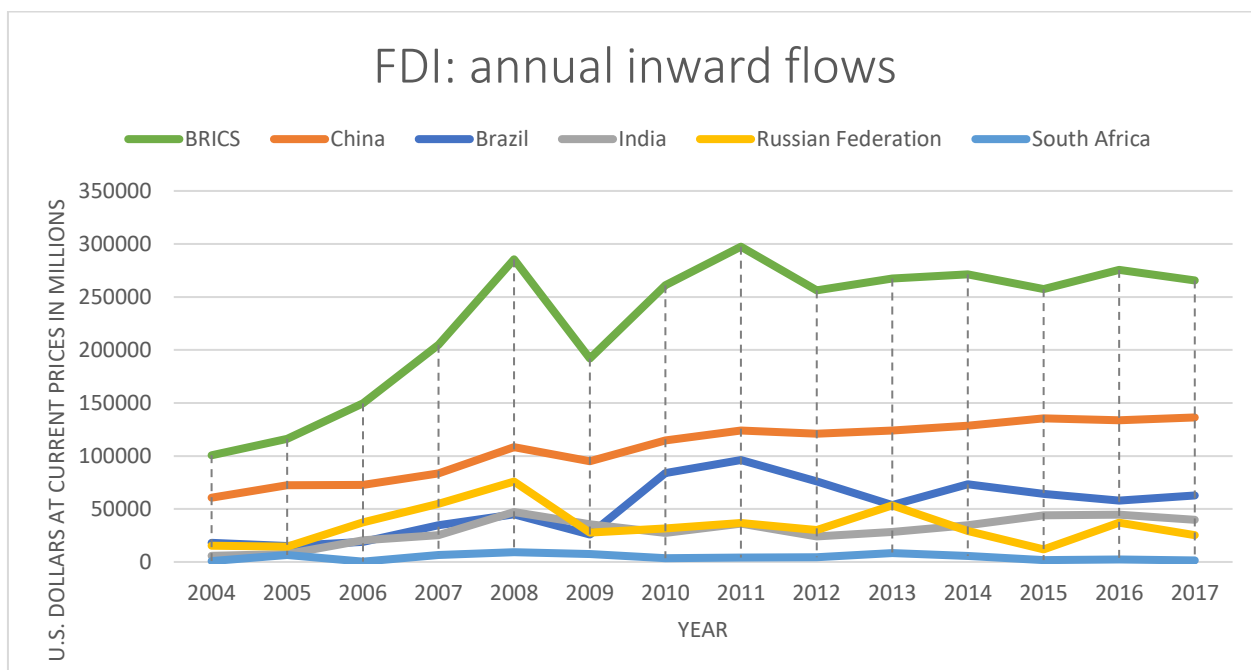
Annex 1: Direct investment other than reinvestment of earnings by biggest investing countries in 2013 and 2017 - own calculation (Banco Nacional do Brasil, n.d.).

<u>Sector</u>	<u>Share of total FDI flow to Brazil in 2017</u>	<u>Share of total FDI flow to Brazil in 2013</u>	<u>Absolute value of FDI flows to Brazil in 2017 (Million USD)</u>	<u>Absolute value of FDI flows to Brazil in 2013 (Million USD)</u>
Crop, livestock and mineral extraction	9.7%	20.0%	5,862	9,990
• Oil and gas extraction	6.2%	14.3%	3,738	7,131
• Metallic mineral extraction	1.6%	1.6%	961	822
Industry	30.9%	30.5%	18,635	15,218
• Motor vehicles, trailers, semi-trailers and related parts	6.5%	3.7%	3,952	1,867
• Basic metallurgy	5.3%	3.0%	3,214	1,493
• Chemical products	5.2%	4.0%	3,141	2,009
• Foodstuff	4.3%	3.0%	2,620	1,487
Services	59.1%	48.9%	35,657	24,385
• Electricity and gas	20.9%	3.1%	12,588	1,544
• Commerce, except vehicles	9.1%	12.5%	5,503	6,242
• Transportation	7.0%	4.3%	4,219	2,127
• Storage and transportation auxiliary activities	4.1%	0.7%	2,472	373

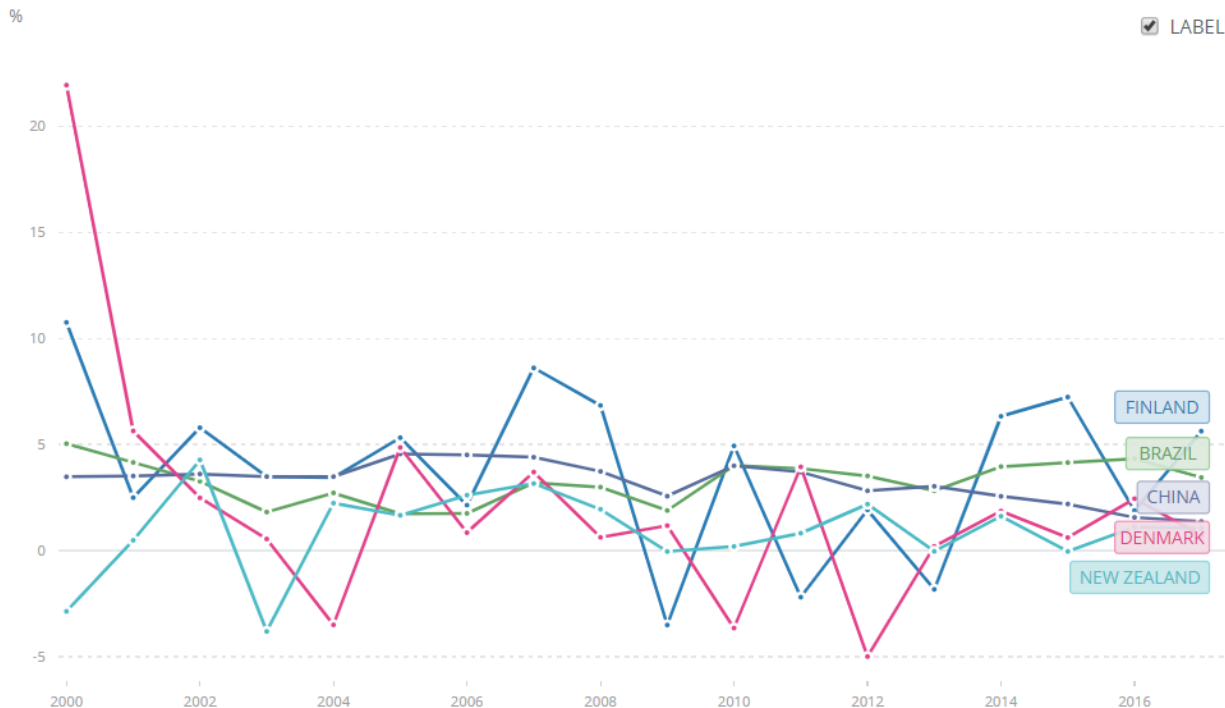
Annex 2: Direct investment other than reinvestment of earnings by dominating sector in 2013 and 2017 - own calculation (Banco Nacional do Brasil, n.d.).



Annex 3: Annual FDI inflows – overview - own representation (UNCTADSTAT, 2019).



Annex 4: Annual FDI inflows – BRICS - own representation (UNCTADSTAT, 2019).



Annex 5: Foreign direct investment, net inflows (% of GDP). New Zealand, Denmark and Finland being constantly ranked among the best countries in terms of TI Corruption Perception Index, Brazil and China representing upper middle levels of corruption (Transparency International, 2019b; World Bank, 2019).

bureaucratic/petty	political/grand
public sector	private sector
cost-reducing for briber	benefit-enhancing for briber
briber-initiated	bribee-initiated
coercive	collusive
centralized/institutional	decentralized/personal
predictable/systematic	arbitrary/isolated
cash payment	no cash payment
local	national
traditional	modern

Annex 6: Types of corruption – own representation (Tanzi, 1998; Zurawicki & Habib, 2010).

Author(s)	Title	Research Design	Variables used	Main findings
(Méon & Weill, 2010)	Is corruption and efficient grease?	Sample of 69 countries, observations between 2000 and 2003. Measure aggregate efficiency, applying frontier efficiency techniques using a one-stage approach (how close is a country's efficiency as compared to its optimal production for the same inputs).	DV: corruption index*governance index IVs: World Bank corruption index, TI corruption index, government effectiveness index, regulatory burden Macroeconomic data: real output per worker, real capita per worker, total number of years of schooling of the working-age population over 15 years old Control variables: openness to trade, index of ethno-linguistic fractionalization, latitude, year dummies	Corruption is less detrimental in countries with very ineffective institutions. In countries with extremely inefficient institutions there might even be a positive correlation between corruption and efficiency.
(Kato & Sato, 2015)	Greasing the wheels? The effect of corruption in regulated manufacturing sectors of India	Instrumental variable two-stage least squares estimation. Interaction term of regulation and regulation as IV of interest. Compare 17 Indian states with different levels of corruption between 1988 and 1997.	DV: economic performance of a three-digit manufacturing sector of an Indian state IV: regulation, corruption, corruption*regulation Control variables: year dummy, industry dummy and state dummy, generic time trends	Combination of regulation and corruption has positive and significant effects on gross value added per worker. Thus, in the highly regulated Indian bureaucracy, corruption might exercise a "greasing the wheel" effect.

Annex 7: Empirical studies in line with "greasing the machinery" theory - own representation.

Author(s)	Title	Research Design	Variables used	Main findings
(Wei, 2000)	How taxing is corruption on international investors?	Data on bilateral stocks of FDI from 12 source countries to 45 host countries (OECD data) in 1993; OLS method (quasi fixed effect model); Tobit estimation	DV: log of bilateral FDI stock from source to host country IV: corruption of host (3 measures from Business International, International Country Risk Group and Transparency International); GDP; population data; wage and labour compensation; linguistic tie dummy; greater circle distance; adult literacy ration; total secondary school enrolment; statutory and effective tax rate (host); source country dummies	Rise in either the tax rate on multinational firms or the corruption level in a host country reduces inward FDIs. The US and other OECD countries are averse to corruption in host countries.
(Smarzynska & Wei, 2000)	Corruption and cross-border investment: firm-level evidence	Volume and ownership structure of FDIs. Firm-level data on investments into 22 transitioning economies from investors worldwide (Sample of	First: Probit model to estimate likelihood of entry, then: DV: ownership dummy (wholly owned or JV)	Corruption leads to an increase in the popularity of Joint Ventures as form of investment, but not for companies with a lot of intangible assets (they

		262 firms). Investments between 1989 and 1995. Probit-model	IV: host country corruption level (3 different measures (WDR index, KKR, Neumann index) Control variables: technical sophistication of firm	still prefer wholly-owned projects). Corruption leads to reduced overall inward-FDI/lower likelihood of an investment taking place.
(Habib & Zurawicki, 2002)	Corruption and Foreign Direct Investment	Aggregated FDI data on bilateral FDI-flows 1996-1998 from the IMF between 89 countries; OLS regression and Probit model	DV: log of FDI; over-/under proportional investment in host country by home country (Probit) IV: corruption (CPI); absolute difference in corruption Control variables: log of population; GDP growth; log of GDP/capita; trade/GDP; political stability; unemployment; science & technology rating; trade agreement dummies; cultural proximity; log of geographic distance; TI represented in country dummy Probit: additionally, log of absolute difference in Gross Capital Formation/capita between home/host	Foreign investors generally avoid corruption for ethical and business reasons, hence corruption lowers FDI. Bigger differences in the CPI of investor and host country lead to less investments.
(Cuervo-Cazurra, 2006)	Who cares about corruption?	Gravity model, double-log model (FDI & GDP & distance) with quasi-fixed-effects (country dummy) and one-year lag (IVs)	DV: FDI inflows from home to host country IV: Host country corruption; laws against bribery(dummy); high corruption level (dummy); country-dummies (capture other country influences on FDI) data on bilateral FDI inflows from 183 home economies to 106 host economies (UNCTAD)	Higher levels of corruption lead to less FDI flow from countries that signed the OECD anti-bribery convention. Countries with higher level of corruption invest relatively more.
(Egger & Winner, 2006)	How corruption influences FDI: A panel data study	KK model on trade and international activities. Study impact of corruption in panel of bilateral outward FDI stocks of 21 OECD countries in 59 OECD and non-OECD economies between 1983 and 1999	DV: log of bilateral real stocks of outward FDIs (OECD) IV: CPI from TI (home and host country) Control variables: transport costs: greater circle distance in miles; difference in bilateral country size: real GDP; relative factor endowment differences: GDP per capita/secondary; school enrolment; country pair specific fixed effects; common time-specific fixed effects	Negative impact of corruption on FDI. Corruption not important for extra-OECD FDI flows (growth there driven by economic growth and chance in factor endowment, corruption less importance). Impact of corruption has declined over the years.
(Gani, 2007)	Governance and foreign direct investment links: evidence from panel data estimations	Panel data, using countries from Asia and LAC, time between 1996 and 2002; pooling technique estimation	DV: FDI/GDP IV: indicators of governance from World Bank (rule of law, control of corruption,	The study shows that the variables rule of law, regulatory quality, government effectiveness and political stability are

			regulatory quality, government effectiveness, political stability and voice and accountability) Control variables: growth rate of GDP, log of GDP, degree of trade/GDP, telephone average cost of local calls Country dummies; Asia dummy	highly significant determinants of FDI and positively correlated with FDI. Control of corruption is less significant but also positively related to FDI inflows.
(Woo & Heo, 2009)	Corruption and Foreign Direct Investment Attractiveness in Asia	Study 8 non-OECD Asian countries over the span of 21 years (1984-2004); time series and cross-sectional analysis; use OLS with panel corrected standard errors (PCSE)	DV: ration for a country's share of global FDI inflows to its share in global GDP IVs: Corruption (International country risk guide); Democracy level Control variables: GDP growth rate; GDP; GDP per capita; trade-to-GDP;	Corruption in general leads to lower FDI attractiveness. Non-OECD countries in Asia can benefit more from reducing their perceived levels of corruption than the rest of the world.

Annex 8: Empirical studies in line with "sand in the machinery" theory - own representation.

Author(s)	Title	Research Design	Variables used	Main findings
(Wheeler & Mody, 1992)	International investment location decisions: The case of U.S. firms	Manufacturing and electronics investments by U.S. multinationals. Panel data on 42 countries for the period 1982-1988. Intertemporal first-differencing, translog specification; least square estimates, sub-estimations by country incomes and per-capita GNP	DV: log of U.S. multinationals capital expenditure (Investment) IV: Business International Country Assessment (Corruption together with other 12 indicators part of RISK measure); labour costs; corporate taxes, market size; infrastructure quality; degree of industrialization; level of FDI; relationship with West; relationship with neighbours; openness (composite measure); dummies for fixed annual effects	Infrastructure development, international relations industrial growth and a growing domestic market are the dominant factors for companies to invest in developing countries. Foreign investment and industrialization rank highest for developed countries. Short-run incentives have limited apparent impact on location choice. The risk factor, including corruption has small weight.
(Hines, 1995)	Forbidden payment: Foreign bribery and American business after 1977	Observation period 1977 until 1982	DV: post 1977 growth of US FDI IV: Corruption level or dummy (Business International) Control variables: GDP growth rate in host country; overall FDI growth in host country;	Finds, that the Foreign Corrupt Practices Act which came to force in 1977 did in fact only reduce US firm's competitiveness, while not leading to a decrease in the importance of bribery in international trade. U.S. business activity declined in corrupt countries after 1977. Local corruption influenced FDI from the United States as much as did 31% difference in GDP growth over 5 years. (but overall insignificant effect on post-1977 growth of FDI)

Caetano and Caleiro (2006)	Corruption and Foreign Direct Investment. What kind of relationship is there?	Use fuzzy clustering techniques to determine conceivable clusters in the FDI-corruption space for 97 countries from 2001-2003	DV: inward FDI performance index (ratio of a country's share in global FDI inflows to its share in global GDP) IV: Corruption Perception Index (TI)	There exist two clusters: One of high-corruption countries where corruption is significantly negatively correlated with FDI; second of low-corruption countries where influence of corruption on FDI less evident/other factors matter more
Cuervo Cazurra, 2008	Better the devil you don't know: Types of corruption and FDI flows in transition economies	Data on bilateral FDI inflows in 1999 from UNCTAD/OECD; gravity model; double-log model with fixed effects and one-year lag; Tobit specification	DV: log of FDI inflows from a home country to a host country (US\$ Million) IV: CPI from TI; pervasive corruption and arbitrary corruption (World Business Environment Survey by World Bank) Control variables: Host country characteristics: economic, demographic size; wealth of population; inflation; oil producer; transitioning country Home country characteristics: size; level of corruption; country dummies Common characteristics: geographic distance; common language; colonial relationship	Corruption in general reduces FDI. Corruption in transitioning economies has a smaller negative influence on corruption than in other countries. Overall, pervasive and arbitrary corruption have a negative effect on FDI. In the case of transitioning economies, the influence of arbitrary corruption on FDI is significant and positive. Hence, pervasive corruption (corruption that is widely present/somewhat predictable) is deterrent to FDI because increases costs of investing. Arbitrary corruption (uncertain corruption) is not deterring to FDI because part of uncertainty of operating in transitioning country (normally already regarded and accepted in investment decision).
(Voyer & Beamish, 2004)	The effect of corruption on Japanese Foreign Direct Investment	29546 investments in 59 countries in 1998, further split in industrialized and emerging countries; OLS regression/hierarchical techniques with two sets of predictors; variance inflation factors (VIF) to address multicollinearity	DV: Japanese FDI in foreign countries in US\$ IV: Corruption (CPI by TI) Control variables: FDI per capita in host country; mean GDP host country; cultural proximity; unemployment rate; labour growth; government consumption; dummy for economic development in host country (emerging vs. industrialized)	Corruption reduces FDI into transitioning countries where no adequate regulatory framework exists to prevent corrupt behaviour. Corruption no significant effect on FDI per capita in industrialized economies. CPI very strong predictor of FDI per capita in emerging countries.

Annex 9: Empirical studies finding no significant effects or contrary findings when disaggregating the data - own representation.

Date	Event
17 March 2014	Police operation targeting money launderers in Brasília and other cities.
26 October 2014	Re-election of Dilma Rousseff as president of Brazil.
14 November 2014	Massive police operation against people involved into the bribe scheme around Petrobras in whole Brazil (among them CEOs of construction companies such as OAS, UTC, and senior executives of further companies).
21 November 2014	SEC opens investigation against Petrobras under the Foreign Corrupt Practices Act because of share price decline.
14 January 2015	Warrant of arrest for former director of Petrobras Paulo Roberto Costa executed.
05 February 2015	Further search warrants and imprisonments; discovered that the fraudulent system also concerned state directories other than Petrobras.
15 April 2015	Petrobras market value had halved since September of the previous year.
10 April 2015	Supreme court sentences some former federal deputies to prison for 11 up to 20 years.
19 June 2015	Investigations into formation of a cartel, corruption, diversion of public funds and money laundering against two big contractors of Petrobras (Odebrecht Group and Andrade Gutierrez S.A.) - CEOs of both arrested.
02 July 2015	Investigations regarding if Board of Directors of Petrobras has received illicit benefits.
28 July 2015	Involvement of State formerly state-owned company ELECTRONUCLEAR becomes obvious.
25 November 2015	André Santos Esteves, CEO of the Brazilian investment bank BTG Pactual arrested. Moreover, the arresting of Senator Delcídio do Amaral (PT) marked the first arrest against a sitting senator since more than 35 years. By then, high rank politicians such as the former minister of finance or former president Fernando Collor de Mello were under investigation and accusations by Amaral were made against Rousseff and Lula.
early 2016	Luiz Inácio Lula da Silva (Lula) himself under close investigation, questioned and house searched.
13 March 2016	Public protests call for Rousseff's resignation as president.
17 April 2016	Chamber of Deputies votes to continue impeachment process against Dilma Rousseff.
12 May 2016	Senate votes 55 to 22 to suspend Rousseff and consider impeachment. Michel Temer (PMBD) becomes appointed interim president.
31 August 2016	Senate votes to permanently remove Rousseff from office.
July 2017	Lula convicted of corruption and money laundering, sentenced to prison for almost 10 years.
late June 2017	Michael Temer officially charged with corruption, but Senate would vote for his immunity.

Annex 10: Timeline of major events in context with the Lava Jato investigations (Kaltman, 2014; Sotero, n.d.; Watts, 2017).

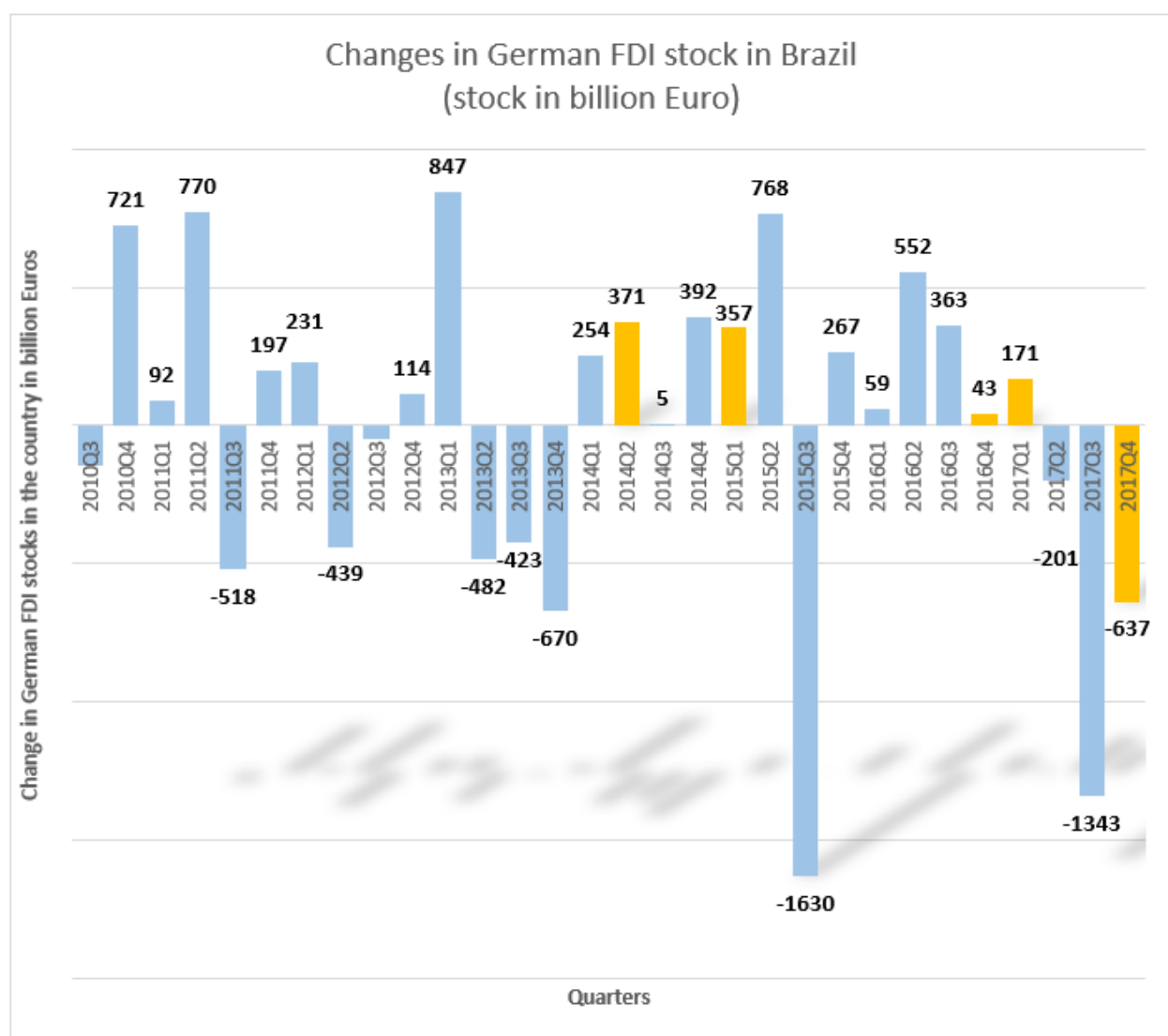
2010Q2	2010Q3	2010Q4	2011Q1	2011Q2	2011Q3	2011Q4	2012Q1	2012Q2	2012Q3
-33.35	-95.00	154.96	54.27	297.39	-111.45	90.91	29.08	65.19	-152.47

2012Q4	2013Q1	2013Q2	2013Q3	2013Q4	2014Q1	2014Q2	2014Q3	2014Q4	2015Q1
-372.48	179.64	94.24	110.50	-16.65	-152.05	-2552.29	-3100.44	-2492.28	-4305.07

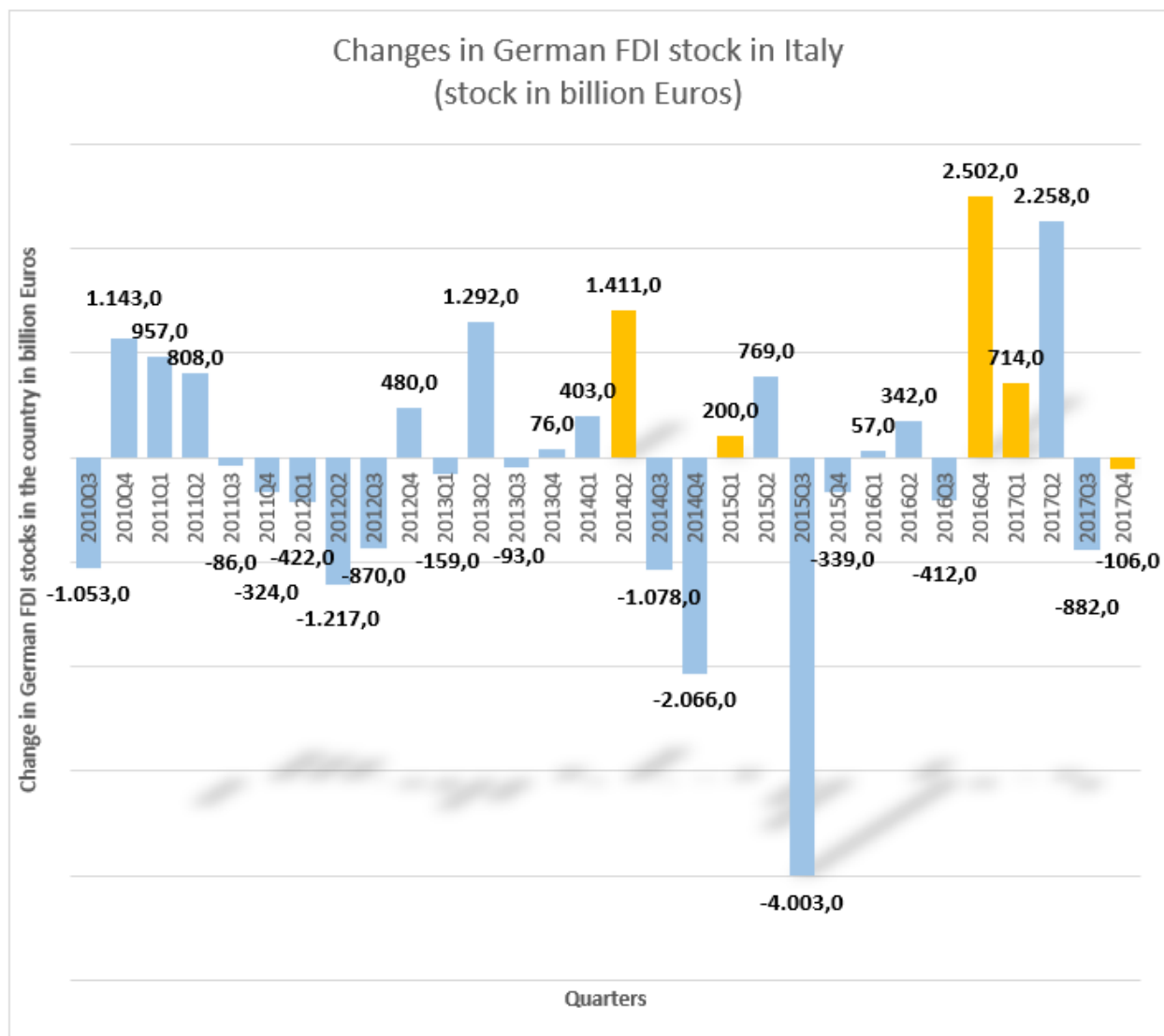
2015Q2	2015Q3	2015Q4	2016Q1	2016Q2	2016Q3	2016Q4	2017Q1	2017Q2	2017Q3
-3550.01	-4834.57	-5249.00	-4445.23	-4070.16	-3178.37	-4651.06	-5531.47	-5417.50	-5894.72

2017Q4
-7096.81

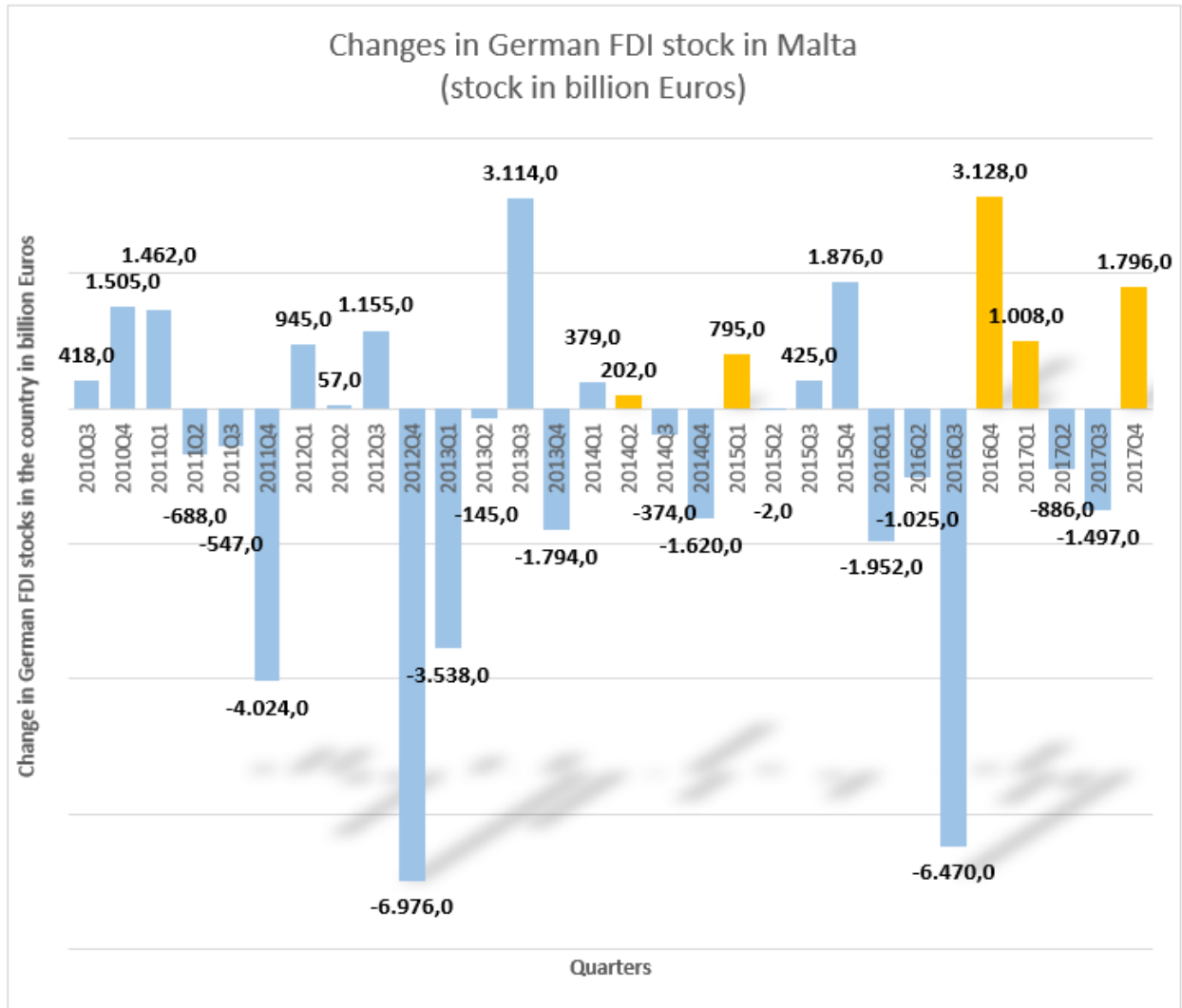
Annex 11: Gaps in German FDI stock residing in the country between Brazil and synthetic Brazil in million Euro - own calculation.



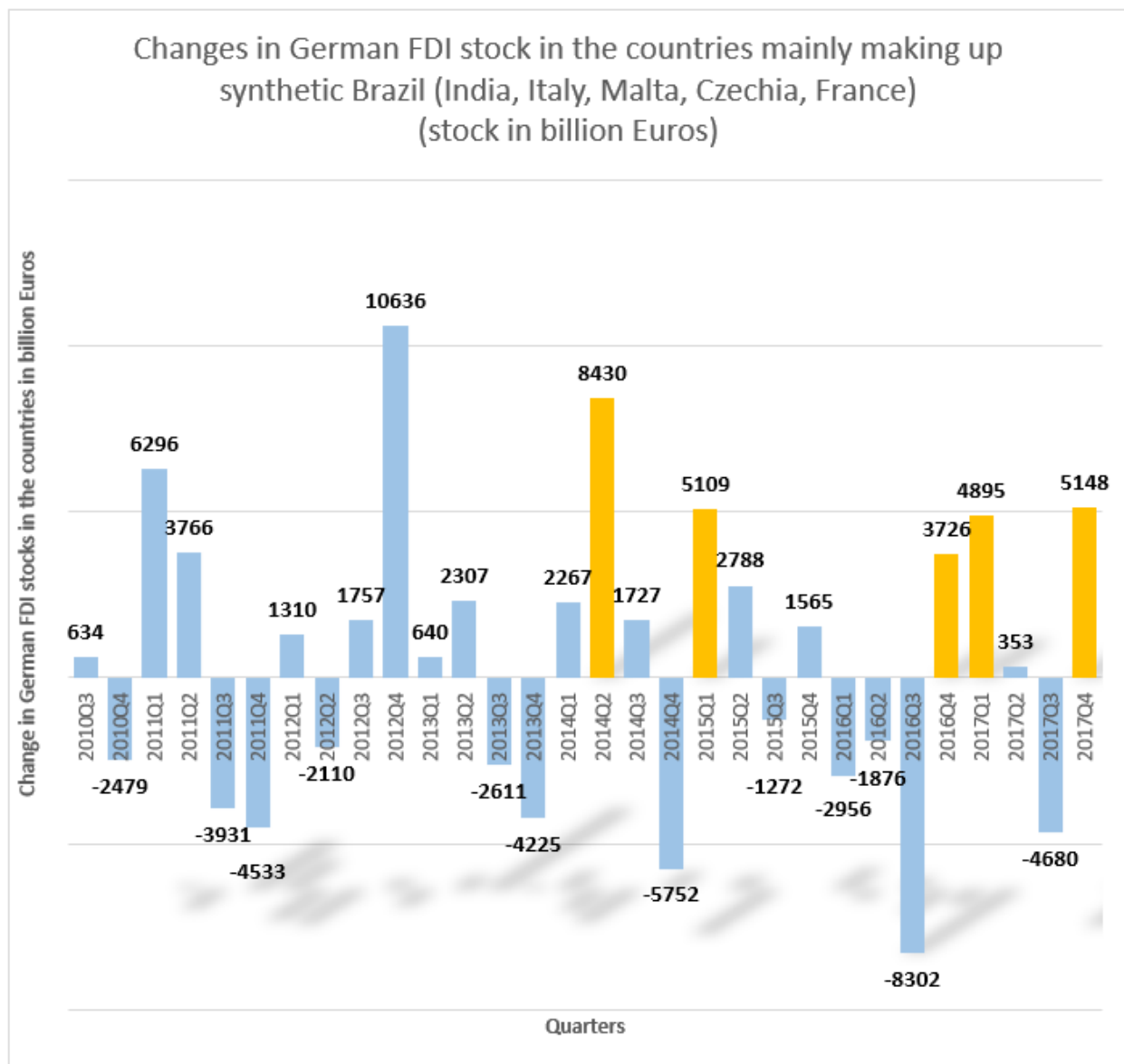
Annex 12: Changes in German FDI stock in Brazil in billion Euro. Quarters highlighted in orange mark periods where the gap between Brazil and synthetic Brazil diverged and which we link to major events - own representation. (Eurostat, 2019).



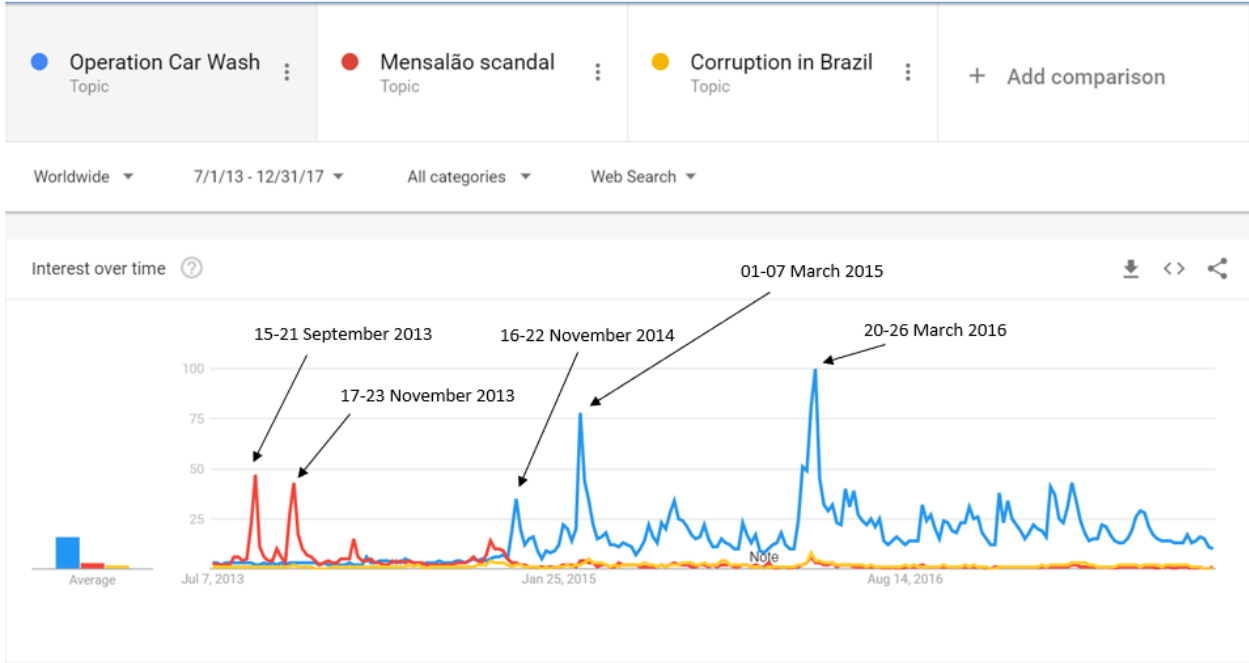
Annex 13: Changes in German FDI stock in Italy in billion Euro. Quarters highlighted in orange mark periods where the gap between Brazil and synthetic Brazil diverged and which we link to major events - own representation. (Eurostat, 2019).



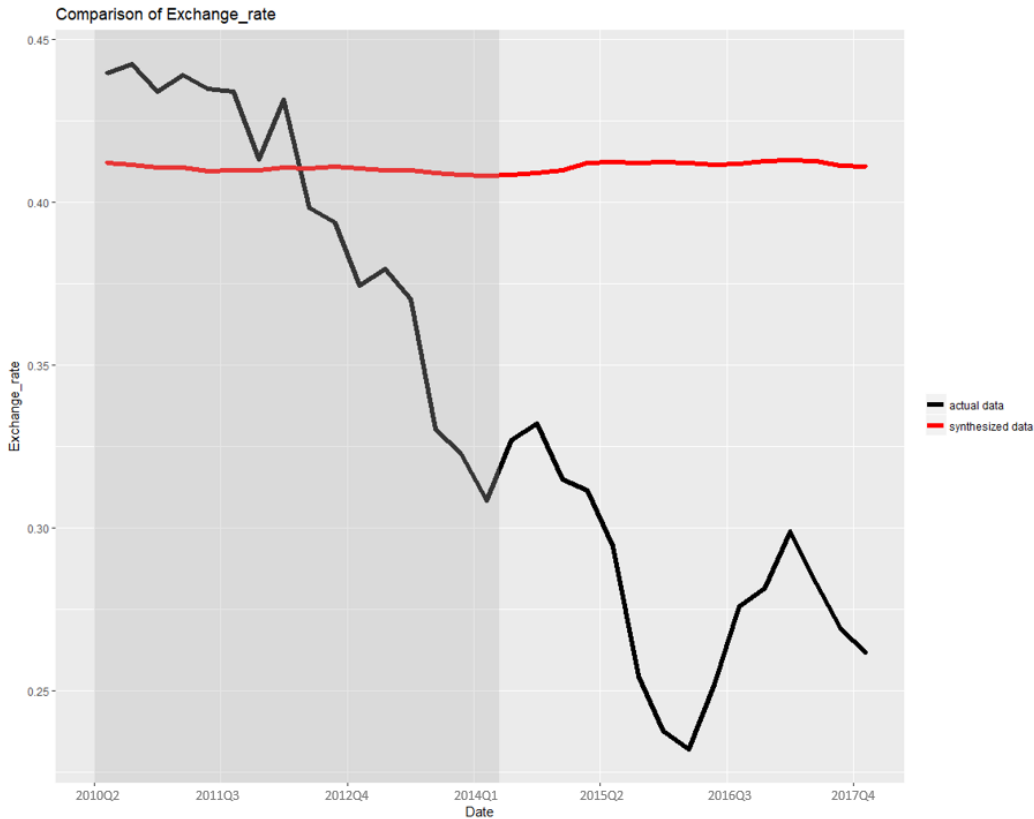
Annex 14: Changes in German FDI stock in Malta in billion Euro. Quarters highlighted in orange mark periods where the gap between Brazil and synthetic Brazil diverged and which we link to major events - own representation. (Eurostat, 2019).



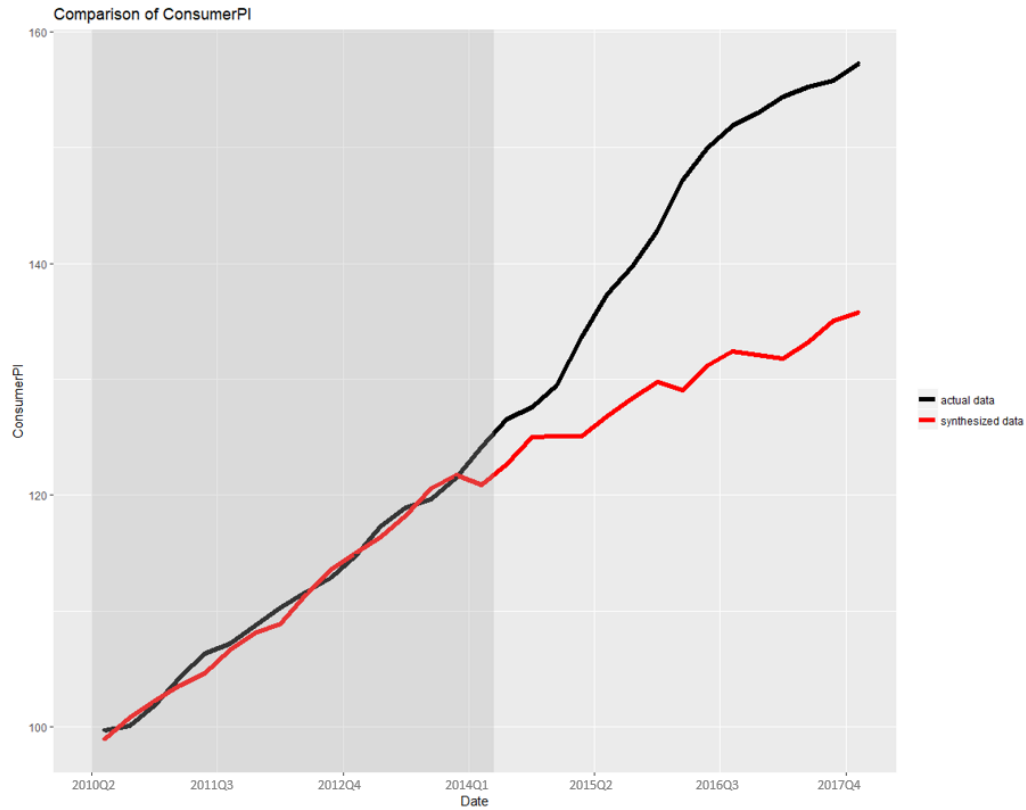
Annex 15: Changes in German FDI stock in countries mainly making up synthetic Brazil (India, Italy, Malta, Czechia and France) in billion Euro. Quarters highlighted in orange mark periods where the gap between Brazil and synthetic Brazil diverged and which we link to major events - own representation. (Eurostat, 2019).



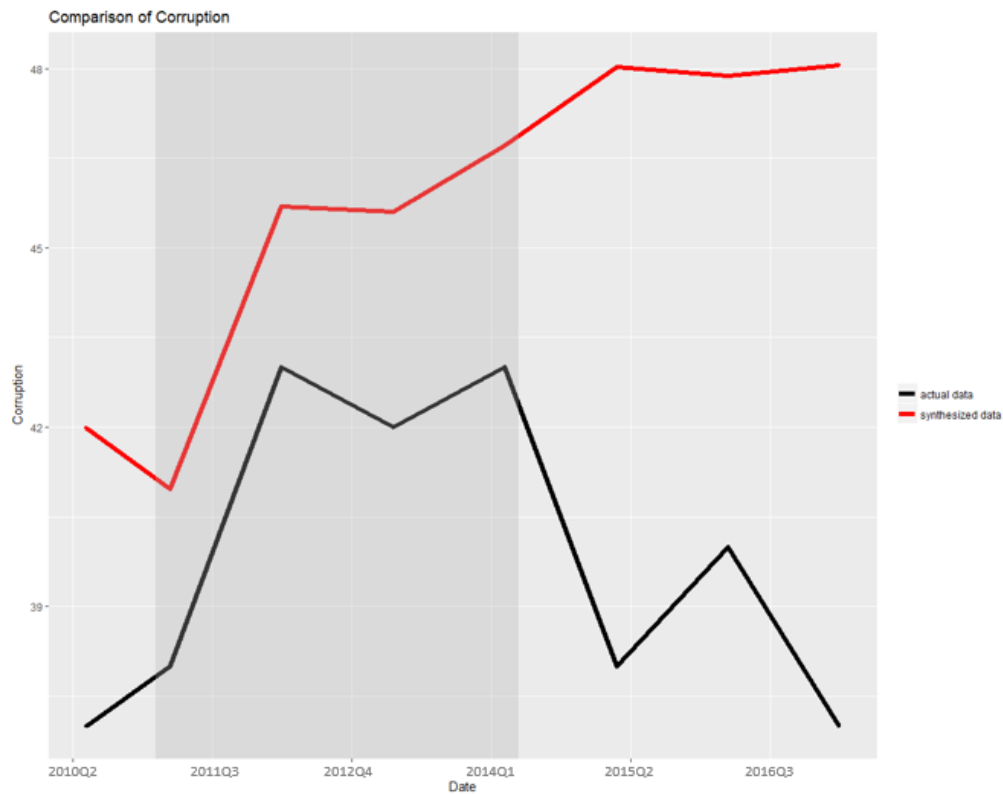
Annex 16: Google search trends worldwide confirming results obtained for Germany regarding main periods of interest in Mensalao scandal and Lava Jato ('Google Trends', 2019).



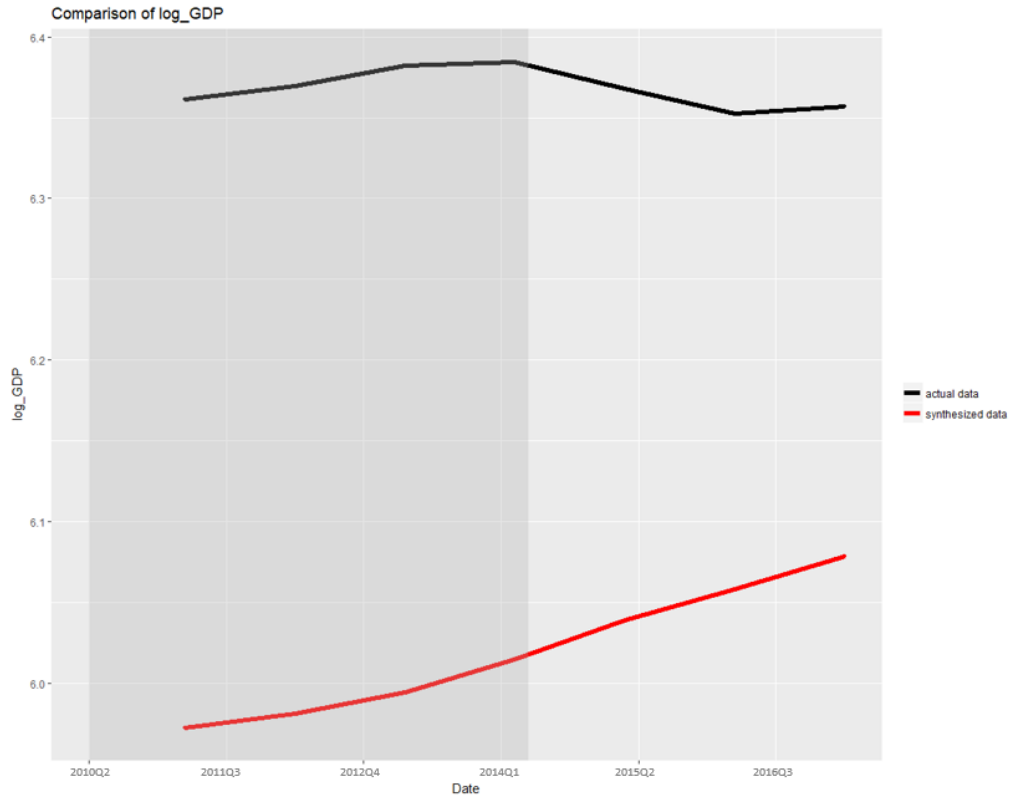
Annex 17: Trend of Exchange rate for Brazil and synthetic Brazil - own representation.



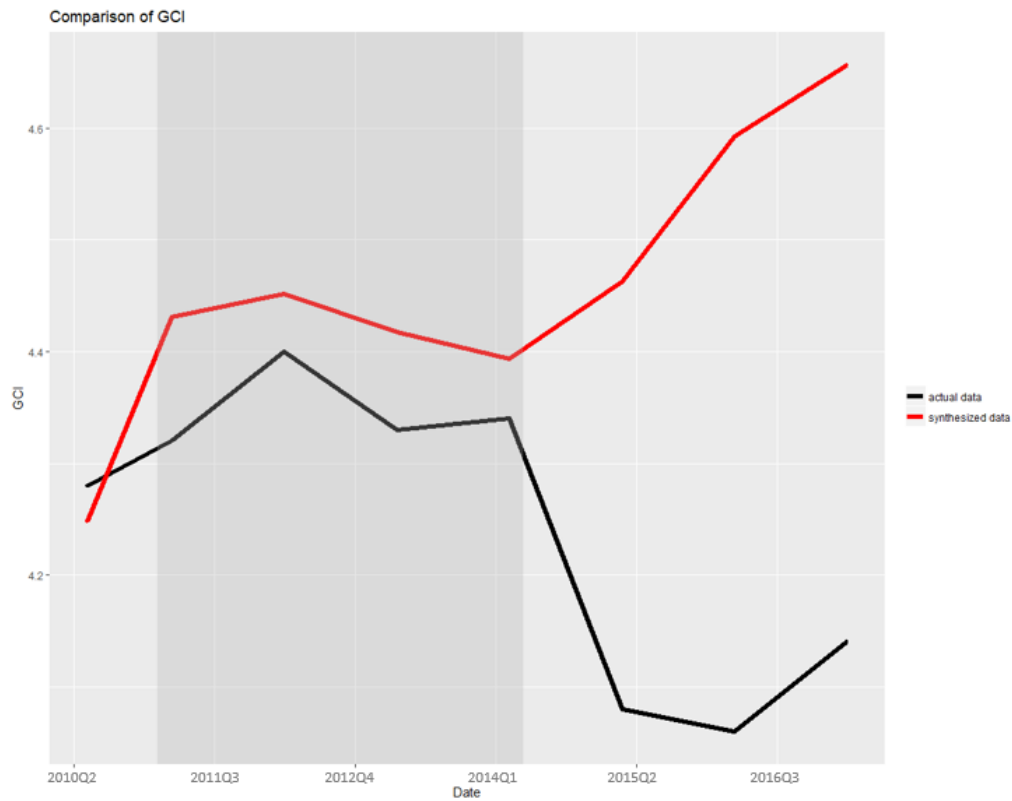
Annex 18: Trend of Consumer Price Index for Brazil and synthetic Brazil - own representation.



Annex 19: Trend of Transparency International Corruption Perception Index for Brazil and synthetic Brazil - own representation.



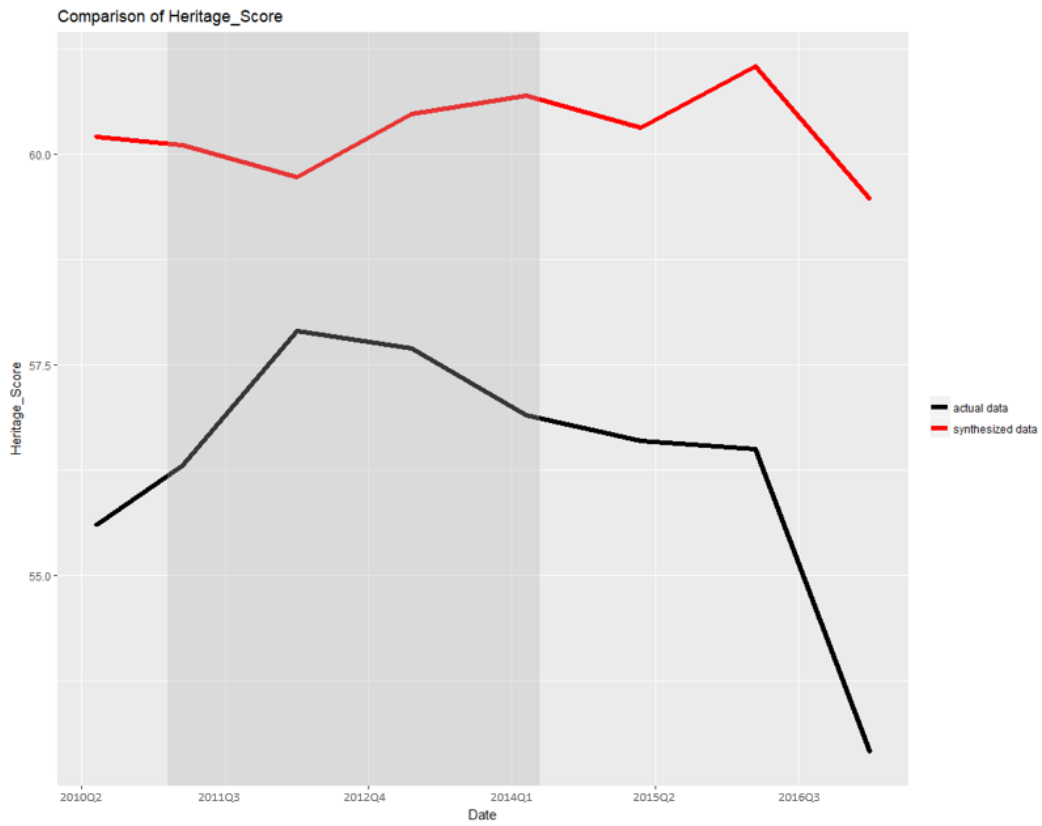
Annex 20: Trend of ln of Gross Domestic Product for Brazil and synthetic Brazil - own representation.



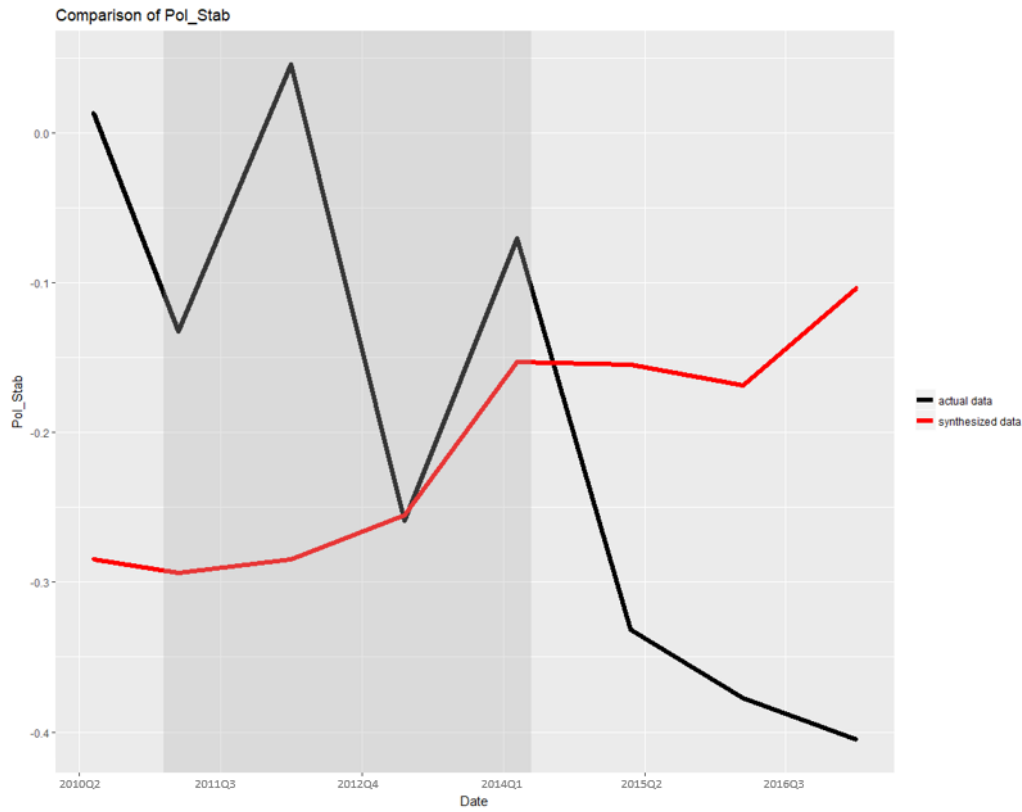
Annex 21: Trend of Global Competitiveness Index for Brazil and synthetic Brazil - own representation.



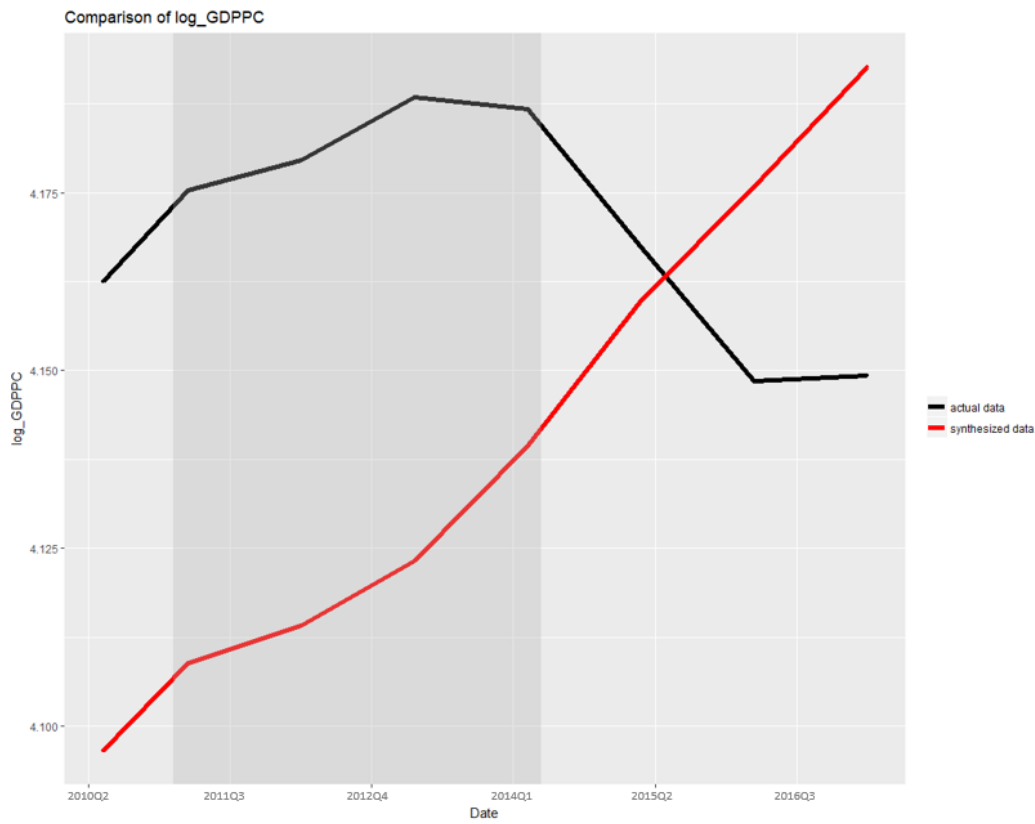
Annex 22: Trend of tax rate for Brazil and synthetic Brazil - own representation.



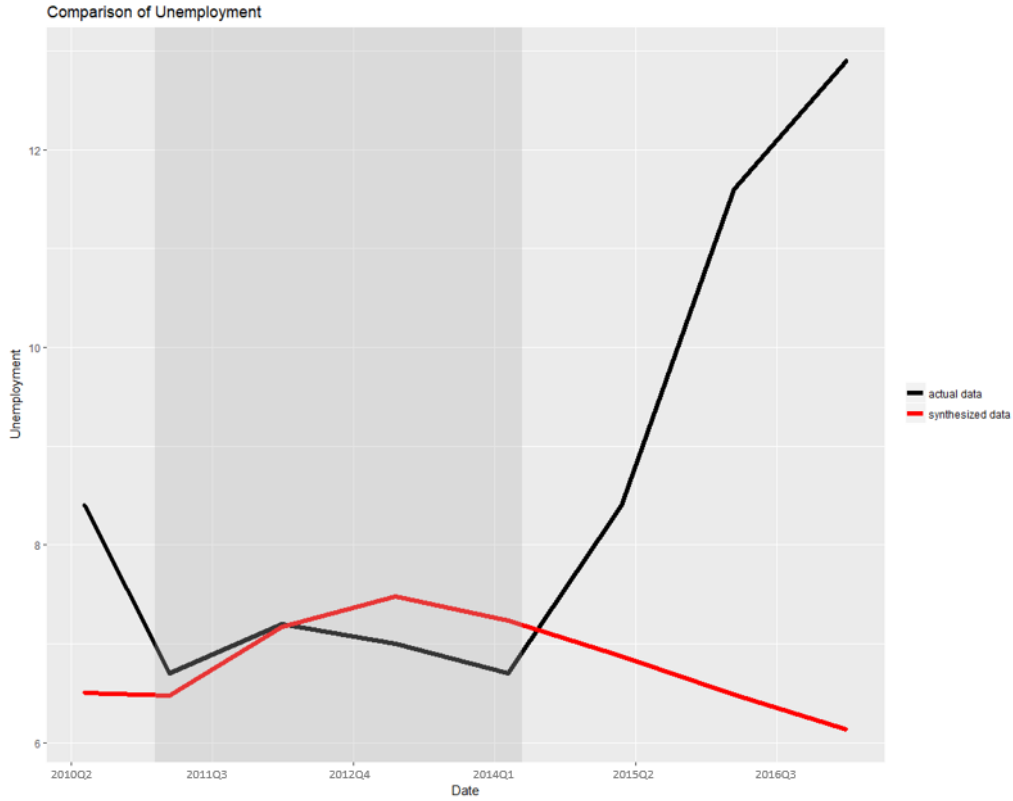
Annex 23: Trend of Heritage Foundation Score for Brazil and synthetic Brazil - own representation.



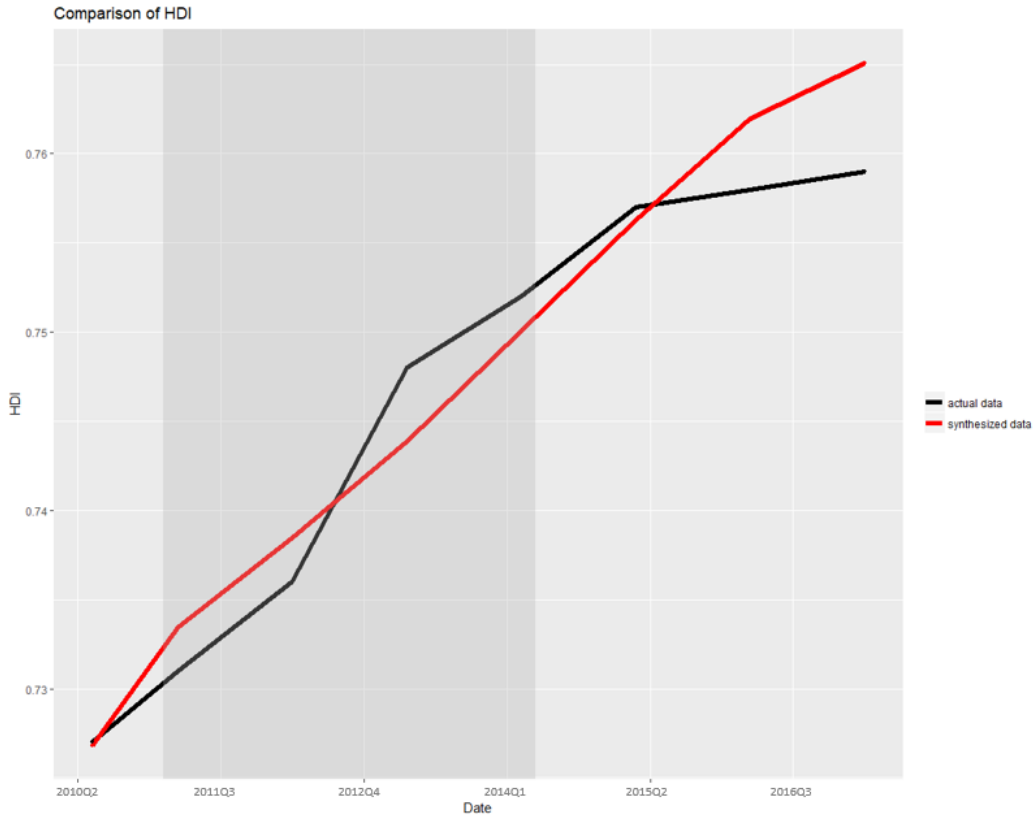
Annex 24: Trend of Political Stability for Brazil and synthetic Brazil - own representation.



Annex 25: Trend of ln Gross Domestic Product per Capita for Brazil and synthetic Brazil - own representation.



Annex 26: Trend of Unemployment rate for Brazil and synthetic Brazil - own representation.



Annex 27: Trend of Human Development Index for Brazil and synthetic Brazil - own representation.

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