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*Financial Intermediation, Human Capital Development and  
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# *Working Paper Series*

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## **Non-Technical Summary**

This paper employs a new variable to account for the non-homogeneous relationship between finance and economic growth – human capital development. We rely on the findings that connect variables used in the related literature to establish a threshold in the effect of finance on economic activity based on a common factor – the quality of past institutions. In addition, we investigate whether the correlation between finance and growth varies by different credit channels or credit recipients, such as the type of bank ownership, the type of credit, the credit purpose, and the type of borrower.

Our findings confirm the positive relationship between finance and growth. This pattern is more pronounced in regions with intermediate level of human capital development, which supports the argument that there is a minimum threshold required for finance (credit) to trigger economic progress. The results also imply this process loses momentum after human capital development reaches a yet higher given level.

We find the same pattern observed in the relationship between total credit and economic growth for the credit provided by private banks, credit funded with freely established sources of funding, credit for specific purposes, and credit extended to individuals. We claim these findings may have import implications for policymakers who intend to promote economic growth with support of financial intermediation.

## Sumário Não-Técnico

Este artigo emprega uma nova variável para explicar a relação não homogênea entre intermediação financeira e crescimento econômico – o desenvolvimento do capital humano. O trabalho fundamenta-se nas descobertas que conectam variáveis usadas na literatura para estabelecer um limiar no efeito da intermediação financeira sobre a atividade econômica baseado em um fator comum – a qualidade progressa das instituições. Ademais, investiga-se se a correlação entre a intermediação financeira e crescimento varia de acordo com os diferentes canais de crédito ou recebedores do crédito, tais como o tipo de propriedade do banco, o tipo de crédito, a finalidade do crédito e o tipo de tomador.

Os resultados confirmam a relação positiva entre intermediação financeira e crescimento. Esse padrão é mais pronunciado em regiões com nível intermediário de desenvolvimento de capital humano, o que corrobora o argumento de que há um limite mínimo necessário para que intermediação financeira (crédito) desencadeie o progresso econômico. Os resultados também indicam que esse processo perde força depois que o desenvolvimento do capital humano atinge um nível ainda mais alto.

Encontra-se o mesmo padrão observado na relação entre crédito total e crescimento econômico no crédito concedido por bancos privados, crédito financiado com fontes de financiamento livremente estabelecidas, crédito para fins específicos e crédito concedido a pessoas físicas. Essas descobertas podem ter implicações importantes para os formuladores de políticas que pretendem promover o crescimento econômico com o apoio da intermediação financeira.

# Financial Intermediation, Human Capital Development and Economic Growth<sup>1,2</sup>

Emerson Erik Schmitz<sup>3</sup>  
Thiago Christiano Silva<sup>4</sup>

## Abstract

This paper investigates a potential non-homogeneous relation between financial intermediation and economic growth by levels of human capital development. We focus on a period of exceptional growth of the credit market in Brazil, from 2004 to 2016, and investigate the overall correlation between credit and economic growth. In addition, we examine whether this association is different according to the following factors: bank ownership, type of credit, credit purpose, and type of borrower. We find that credit has positive and relevant connection with economic growth, which is noticeable in regions with intermediate levels of human capital development. This pattern is also observed in the credit provided by private banks, non-earmarked credit lines, credit to specific purposes, and personal credit. These findings may have important implications for policymakers who intend to promote economic growth with the support of financial intermediation.

**Keywords:** financial intermediation, economic growth, human capital development, government ownership of banks.

**JEL Classification:** G21, G28, O15, O40, O43

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<sup>2</sup> The views expressed in this paper are our own views and do not reflect the views of the Central Bank of Brazil.

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## 1. Introduction

The relationship between financial intermediation and economic growth has been an object of study since the beginning of the previous century, when Schumpeter (1911) emphasized the importance of finance to fund innovation and boost economic growth (Croitoru, 2012). Gurley and Shaw (1955) and Goldsmith (1969) reinforced this view, adding that more developed financial systems could enhance the allocation of capital in more productive projects, stimulating economic activity. In line with these theories, an extensive stream of theoretical literature addresses the role of financial intermediaries in reducing asymmetric information, with positive spillovers to investment returns and economic development (Townsend, 1979; Gale and Hellwig, 1985; Diamond, 1984; Boyd and Prescott, 1986).

The effects of financial intermediation deepening on economic growth have also been extensively tested empirically, with clear positive results (King and Levine, 1993; Rajan and Zingales, 1998; Levine et al., 2000). However, more recent works have also contributed to this literature with findings of a nonlinear impact of finance on growth, which might depend on different degrees of financial intermediation (Rioja and Valev, 2004a; Law and Singh, 2014), on the ratio of finance to economic output (Deidda and Fattouh, 2002; Huang and Lin; 2009; Samargandi et al., 2015; Arcand et al., 2015), or on the quality of institutions (Levine et al., 2000; Demetriades and Law, 2006; Law et al. 2013).

Following this stream of literature, we employ a new variable to account for the non-homogenous effect of finance on growth – human capital development. We rely on the findings that connect all the variables used to establish a threshold in the effect of finance on economic activity based on a common factor – the quality of past institutions. Additionally, we investigate whether the correlation between finance and growth varies by different credit channels or credit recipients, such as the type of bank ownership, the type of credit, the credit purpose, and the type of borrower.

Unlike most of the literature on the impact of financial deepening on economic growth, which usually relies on static cross-country studies (Levine, 2005), we address the subject using a panel dataset from one specific country (Demetriades and Andrianova, 2004;

Levine, 2005; Ang, 2008). Specifically, we focus on a period of exceptional growth in the credit market in Brazil, from 2004 to 2016. Brazil offers an interesting setting for this study, as it exhibits an uneven distribution of human capital development, financial inclusion, and economic development, which allows us to exploit the cross-sectional and time variation of these variables within the same regulatory environment and similar historical background and institutional context.

We use outstanding credit as a proxy for financial intermediation in our study, given the prevalence of bank credit for financing in Brazil, especially in more remote areas. We perform our analysis using a unique proprietary dataset extracted from the Brazilian Credit Risk Bureau (SCR), provided by the Central Bank of Brazil (BCB), which we merge with the GDP information for each Brazilian municipality gathered from the Brazilian Institute of Geography and Statistics (IBGE). Lastly, we combine the previous databases with the Municipal Human Development Index (HDI-M), computed for the 2000 census, used as our measure of human capital development throughout the country.

We find that an increment of 1% in the outstanding credit, on average, is correlated with 0.16% economic growth in the Brazilian GDP. Since the average three-year real credit growth in this country during the sample period is about 16%, this result represents an association of the credit expansion observed in Brazil with 2.62% three-year real economic growth, on average. Therefore, this outcome is economically meaningful and in accordance with the related literature. This effect is more pronounced in regions with intermediate levels of human capital development, which is in accordance with the perception that finance may trigger economic growth after a given threshold of physical and human capital accumulation is achieved. Additionally, the results also imply this progress loses momentum after human capital development reaches a yet higher given level.

Further, we provide additional discussion concerning the relationship between credit and economic growth in Brazil. We examine the heterogeneity of this correlation through different credit channels/recipients and by levels of human capital development. We find the same pattern observed in the relationship between total credit and economic growth for the credit provided by private banks, credit funded with freely established sources of funding, credit for specific purposes, and credit extended to individuals.



In regard to the governmental participation in the provision of credit, we observe the credit provided by government-owned banks is not correlated with economic development, while earmarked credit lines, given their underlying subsidies, have a positive association with more intense economic activity in regions characterized by low levels of human development. With respect to the effects of credit lines with different purposes on economic growth, our findings corroborate the expectation that granting money to specific objectives is more important to economic growth than providing credit to consumption. Lastly, when it comes to the distinction between types of borrowers, contrary to intuition, personal credit has higher correlation with economic growth than credit to firms, especially in regions with medium and high levels of human capital development.

Our contributions to the literature are twofold. First, we introduce human capital development as a relevant measure to account for the non-homogeneous relationship between financial intermediation and economic growth. Second, we investigate the relation between finance and growth by means of four different credit channels or recipients, and how they vary in accordance to the levels of human capital development in different Brazilian regions.

Our findings may hold important implications for policymakers who intend to promote economic growth with the support of financial intermediation. First, the outcomes concerning governmental participation in credit suggest it might be more effective in poor areas by means of earmarked credit rather than as a result of the intervention of state-owned banks. Second, governments, aware of the correlation between economic growth and credit to specific purposes, could motivate the use of these credit lines as a mechanism to promote economic activity. Finally, the prevalence of higher correlation between personal credit and economic growth may reflect a short-run economic conjecture, which can motivate a demand-pull inflation and harm future economic development.

The remainder of this paper is organized as follows. In Section 2, we provide a review of the literature concerning the link between the quality of past institutions and the variables used to address the non-homogeneity between finance and growth in the short run. In section 3, we present the theoretical background that undergirds the formulation of our testable hypotheses. In Section 4, we describe data sources, report descriptive statistics and provide an overview of the data evolution across Brazilian meso-regions. In Section 5, we explain

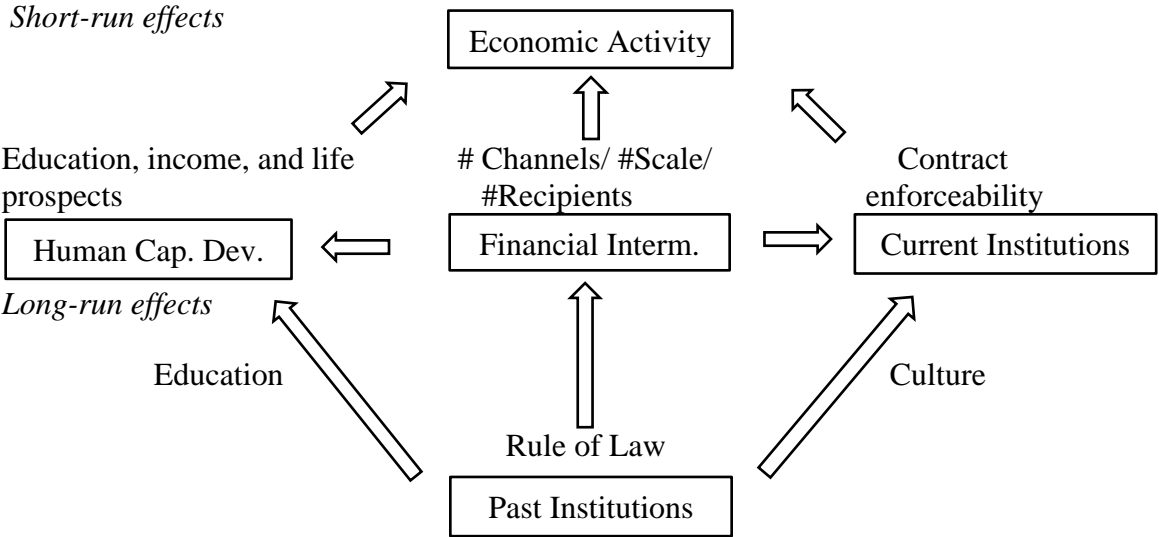
the methodology used in this analysis and the respective results. Section 6 provides robustness checks, and Section 7 concludes.

**2. Literature review**

The nonlinearities of the finance-growth relationship have been already addressed through different standpoints, such as the economies of scale of financial intermediation, the ratio of financial development to economic output, and the quality of institutions. We employ a new variable to account for the non-homogenous effect of finance on growth – human capital development. Our reasoning for the use of this new measure relies initially on the findings that connect all the mentioned variables used to establish a threshold in the effect of finance on economic activity to a common “ancestor” – the quality of past institutions.

Based on the related literature, Diagram 1 illustrates the link between the quality of past institutions and the current indicators of financial intermediation, quality of institutions, human capital development, and economic activity. The longer and shorter arrows demonstrate the long- and short-run relationships, respectively.

**Diagram 1 – Long- and short-run dynamics of the effects of Institutions on Economic Activity**



Concerning long-run relationships, Acemoglu et al. (2014) show that past institutions are the basis for the long-run economic development, which runs through higher levels of productivity, human and physical capital accumulation. Accordingly, Tabellini (2010), who studies the impact of culture on economic growth, points out political institutions and past literacy rates are correlated with cultural characteristics, which they claim are the mechanism through which the quality of institutions is preserved over time. Moreover, Monastério and Lopes (2018) exploit a similar idea, showing that municipalities in Brazil with higher shares of non-Iberian immigrants' descendants, identified by their surnames, have relatively higher income *per capita* today. Still, Levine et al. (2000) find that the rules supporting creditors' rights and contract enforcement lead to more levels of financial intermediation.

When it comes to the short-run dynamics, we focus on the potential nonlinearities in the relationship between financial intermediation and economic growth. This non-linear pattern may happen in different ways, depending on the variable used as parameter. We start with the effect of finance on economic growth in accordance to economies of scale of financial intermediation. In this regard, some authors point out the positive effect of more financing might be positive only after a given threshold is achieved. For instance, Acemoglu and Zilibotti (1997) argue that more profitable projects require a minimum size and cannot be divided, demanding sufficient funds to finance them. Saint-Paul (1992) and Bencivenga and Smith (1991) emphasize the positive effect of larger financial systems in the provision of liquidity services and risk diversification. Furthermore, larger financial systems also reduce the average cost of selecting profitable projects and screening borrowers (Greenwood and Jovanovic, 1990). Lastly, a reasonable scale may be important for the acquisition of information by lenders in a process of learning-by-doing (Lee, 1996).

However, the theoretical literature also gives support to potential diminishing returns of scale after the level of financial intermediation reaches a certain point. Greenwood and Jovanovic (1990) develop a model which shows that at final stage of financial and economic development the distribution of income stops to widen, saving rate drops, and economic growth converges, potentially with negative marginal effects, to the level observed at initial stages of development. Concerning the channels through which these diminishing or negative effects happen, an important stream of the literature links the size of financial systems to

more risk-taking behavior and volatility, which might lead to lower economic growth (Minsky, 1974; Kindleberger, 1978).

Additionally, there exists also an extensive literature on the impact of each component of the Human Development Index (HDI) – education, average income, and longevity – on economic growth. Education, usually measured by school attainment, is associated with more skilled workers and higher individual earnings, with positive externalities on social returns, including economic growth (Becker, 1964; Mincer, 1974). Higher income *per capita* enables households to save and invest in productive activities (Loayza et al., 2000). Lastly, better life prospects (good health quality and lower mortality risks, for instance) may stimulate productivity and entrepreneurial behaviors, especially those in which returns are realized in the long run (Chakraborty, 2004).

### **3. Testable hypotheses**

#### *3.1. Basic assumption*

The hypotheses concerning the non-homogeneity of financial intermediation and economic growth by level of human capital development are based on the following assumption: levels of human capital development, financial intermediation, and quality of institutions are intrinsically correlated in the short run, given their common root – the quality of past institutions. This postulation is important because we share theoretical formulations of these three variables in the buildup of the hypotheses.

#### *3.1. Financial intermediation and economic growth*

We consider three different levels at which there could be a variation in the relationship between financial intermediation and economic growth: low, intermediate, and high levels of human capital development. In regions with low levels of human capital development, the lack of scale of projects may prevent the financing of larger projects, contributing to a relatively small effect of financial deepening on economic growth. Consequently, we expect the impact of finance on economic activity in these regions occurs mainly through capital accumulation (Rioja and Valev, 2004b). At intermediate levels of human capital development, financial intermediation may reach a threshold after which its

impact on economic growth starts to take off. In these regions, the effect of finance on growth is felt more through productivity improvements than through capital accumulation (Beck et al., 2000). Lastly, in areas with high levels of human capital development, we assume the impact of financial intermediation on economic activity may start to converge to its initial effects, presenting diminishing scale effects on economic growth.

### *3.2. Channels*

Besides the examination of the nonlinearities of the overall connection between finance and economic growth according to differences in human capital development, we also investigate this unbalanced relationship through the lens of different channels. We consider four mechanisms through which finance, measured by credit, can have different correlations with economic activity: bank ownership, type of credit, credit purpose, and type of borrower.

#### *Bank ownership*

We start with the investigation of the relationship between the credit provided by private and state-owned banks and economic growth. We base our reasoning regarding the non-homogeneity of the relationship between finance and growth by bank ownership on: *i.* the attractiveness of private banks to operate at a given locality, depending on levels of institutional quality (Andrianova et al., 2008); *ii.* the theoretical role of state-owned banks; and *iii.* the assumption that human capital development is correlated with the quality of institutions in the short run<sup>5</sup>.

According to Andrianova et al. (2008), in localities with low institutional quality, the lower expected profitability undermines the attractiveness of these regions to private banks. In localities whose institutional development falls in the medium range, both private and state-owned banks coexist. Finally, in localities with high institutional quality, state-owned

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<sup>5</sup> Although we assume the quality of institutions is correlated with human capital development in the short run, since both are related to the quality of past institutions, the variation of the HDI throughout Brazil might be higher than the variation in the current quality of institutions. This is because different regions in Brazil have distinct levels of education, income and life expectancy but share most part of the national legal system, for instance. Then, it could be the case that the level of institutions and human capital development across the country have neither perfect nor even significant correlation, which is a potential caveat of the paper.

banks are present in the market only with the introduction of subsidies or lower profit margins.

In areas with low levels of human capital development, we assume financial institutions, in general, may be an instrument to mitigate the credit restrictions felt by poor individuals or constrained firms (Beck et al., 2007). This social role is carried out mainly by state-owned banks, with the purpose of correcting market failures (Atkinson and Stiglitz, 1980; Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1986, Stiglitz, 1993). Consequently, we expect a positive correlation between credit and economic growth for both private and state-owned banks in these regions.

In localities with intermediate levels of human capital development, the incoming of private banks may trigger the positive relationship between financial intermediation on economic growth, since these banks are supposedly more efficient than government-owned institutions (La Porta et al., 2002; Barth et al., 2004; Micco et al., 2007; Lin and Zhang, 2009). The role of state-owned banks in these regions is mixed, since they may be still important for overcoming credit constraints in areas with lower quality of institutions but may also have lower incentives to allocate capital efficiently in areas within these regions that have higher quality institutions, according to agency (Tirole, 1994) and political theoretical views (Shleifer and Vishny, 1994; Sapienza, 2004). Therefore, we expect a more pronounced relationship between the credit granted by private banks and economic growth in these regions, whereas low or even no association between the credit provided by state-owned banks and economic activity.

Lastly, in regions with high levels of human capital development and quality of institutions, theoretically, only private banks should be present. However, state-owned banks may also participate by granting subsidized credit or by reducing profit margins. In these areas, we expected the diminishing scale effects of finance on growth would reduce the correlation between the credit granted by private banks and economic growth. Conversely, the credit provided by state-owned banks may have null or even negative correlation with growth, given the potentially more accentuated effects associated with the agency view of these institutions in these localities.

### *Type of credit*

We now consider the existence of two different segments in the Brazilian credit market, each one with its own dynamics: earmarked credit, with interest rate and sources of funding defined by law (real estate, agribusiness, and infrastructure sectors); and non-earmarked credit, in which there are no pre-established rules. Even though the distinction between earmarked and non-earmarked credit is a special feature of the Brazilian credit market, it is an interesting way to test the connection between government-driven credit and economic activity. Since interest rates are previously defined by law and sources of funding are mostly provided by the Brazilian Treasury, by especial saving deposits or special funds<sup>6</sup> provided with employers'/employees' contributions, the earmarked credit in Brazil can be classified as a type of subsidized credit.

In this regard, Banerjee and Newman (2004) develop a model for exporting firms which shows that financial subsidies can mitigate credit market imperfections in less developed countries if the credit is allocated to financially constrained firms. However, subsidized credit may be captured by firms with more political influence (Rajan and Zingales, 2003; Johnson and Mitton, 2003) or by politicians to favor politically attractive regions (Carvalho, 2014). Still, lower market discipline, given by explicit public guarantees behind subsidized credit, may also limit the effects of this public policy on economic growth (Bonomo and Martins, 2016).

Then, although earmarked credit lines are not necessarily provided by state-owned banks, since private banks may act as intermediaries, the underlying motivations and setbacks of the participation of government in the provision of credit remain. Therefore, while earmarked credit might be important to overcome problems of malfunctioning credit markets in areas with low human capital development, these credit lines may also experience agency and political problems in localities with intermediate and high levels of human capital development, presenting null or even negative correlation with economic growth in these regions.

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<sup>6</sup> For instance, FGTS (Fundo de Garantia por Tempo de Serviço), administrated by CEF, is used to fund real-estate and infrastructure credit operations; and FAT (Fundo de Amparo ao Trabalhador), administrated by BNDES, is used to fund economic development programs in Brazil.

### *Credit purpose*

Next, we turn to the investigation of different purposes for the use of credit in the link between finance and economic growth. We classify the credit into two types depending on their main objectives: *i.* specific purposes, namely the credit granted for the purchase of vehicles, for real estate or to finance education in the case of personal credit, and the credit provided to finance the acquisition of equipment, new projects and real estate assets, in the case of firms; and *ii.* general purposes, such as overdraft and consumption-oriented credit lines for individuals, and overdraft and working capital lines to enterprises.

The distinction between credit to specific purposes and credit to general purposes aims at capturing the externalities of each type to economic growth. Although both credit purposes may enhance economic growth, we hypothesize the use of credit in more labor- and capital-intensive goods, such as vehicles, real estate properties and new equipment, may contribute more to economic activity than the credit to consumption or the credit used to fund firms' short-run liquidity issues. This is because the potential spillover effects of employment and income may be triggered by the use of credit to finance productive activities.

Concerning the association of credit purposes with economic growth by levels of human capital development, we base our hypothesis regarding the destination of credit in regions with low levels of human capital development on two insightful papers related to the use of microcredit in poor populations. First, Banerjee et al. (2015) use data from India to show that households cut expenditures in consumption (“temptation”) goods and increase the acquisition of durable goods after having access to credit, which they deem to be a short-run behavioral change among small entrepreneurs. Second, Crépon et al. (2011) find that this effect is valid for those entrepreneurs who use the credit to enlarge a pre-existent economic activity, and not to start a new business.

Accordingly, we expect a positive association between credit lines to specific purposes and economic growth in areas with low human capital development, whereas the relationship between credit to general purposes and economic growth may be still positive but lower. Concerning regions with intermediate and high levels of human capital development, we assume the correlation between both credit purposes and economic growth



will experience similar movements expected for the overall credit, increasing at intermediate levels and converging to initial values at high levels of human capital development.

#### *Type of borrower*

Next, we differentiate the credit granted to individuals and the credit provided to firms, regardless of their respective purposes. We expect both credit provisions are important to economic activity. However, they may contribute to economic growth depending on the stage of human capital development.

Concerning the credit to individuals, it is reasonable to suppose the credit provided to these borrowers will have relatively more correlation with economic growth than the credit to firms in regions with low levels of human capital development, given the lack of physical and human capital accumulation that prevents the flourishing of firms in these regions. Oppositely, we hypothesize the credit to firms has a deeper connection with economic activity in regions of intermediate and high human capital development, given that more prominent effect of productivity gains in these localities. Nevertheless, despite of the prevalence of the correlation of one type of credit recipient, we expect the relationship of both with economic growth will follow the overall pattern of increasing scale effects in regions with intermediate levels of human capital and diminishing effects in regions with high levels of human capital development.

## **4. Data**

### *4.1. Sources*

We use data from three different sources. First, we obtain credit information extracted from the SCR<sup>7</sup>, a unique and comprehensive dataset administrated by the BCB. For confidentiality reasons, the data is aggregated by municipality, and further divided into bank ownership type (state or privately owned), type of credit (earmarked or non-earmarked), credit purpose (general or specific), and type of borrower (personal or corporate credit).

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<sup>7</sup> SCR gathers information on all outstanding loans above 5,000 Brazilian Real (BRL) before March 2012, and above 1,000 BRL after that point, for all banks operating in Brazil.

Second, we collect macroeconomic and social variables for each Brazilian municipality from the IBGE. This dataset contains also the classification of each locality into more comprehensive social-economic and political-administrative regions (micro-regions, meso-regions, and Brazilian states). Lastly, we combine the previous databases with the HDI-M<sup>8</sup> computed for the 2000 census<sup>9</sup>. The HDI-M is composed of the geometric average of three sub-indices, which take into account social and economic dimensions: life expectancy<sup>10</sup>, education<sup>11</sup>, and income<sup>12</sup>.

For the purposes of this paper, we choose to use the information at the meso-region level<sup>13</sup>, for two reasons. First, Brazil has many lightly populated municipalities, especially in less developed areas, which can make subsamples based on the HDI-M less accurate and bias the average HDI-M downwards. Second, Brazilian municipalities have a high degree of spatial dependence, resulting in spillover effects from the financial and economic development of a central locality to its neighbors that need to be taken into account (da Silva, 2015).

Our final sample consists of balanced panel data comprising 137 Brazilian meso-regions that runs from 2004 to 2016. This time window encompasses a period of extraordinary credit growth in Brazil. Since we consider four periods of three-year growth rates, our dataset comprises 548 observations, which allow us to observe cross-sectional and time variation in the data and test the relationship between financial intermediation and economic development by different levels of human capital development.

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<sup>8</sup> This indicator was developed by the Institute for Applied Economic Research (IPEA) jointly with the United Nations Development Program (UNDP Brazil) and João Pinheiro Foundation.

<sup>9</sup> Although the HDI-M is also available for the 2010 census, we choose to work with the 2000 census, before the sample period. It avoids the correlation between the HDI measure and the financial and economic development variables.

<sup>10</sup> Life expectancy at birth.

<sup>11</sup> Obtained by combining the geometric average of the frequency of children and young individuals attending school, with a weighting of 2/3, and the index of education of the adult population, with a weighting of 1/3.

<sup>12</sup> Income *per capita*.

<sup>13</sup> According to the IBGE, a meso-region is a collection of neighboring municipalities with economic and social similarities within a given Brazilian state.

## 4.2. Summary statistics

We provide in Table 1 the summary statistics for the dependent variable and independent variables (*per capita* and in three-year real growth rates) and for the locality information used in this study. While the average GDP three-year real growth rate from 2004 to 2016 in Brazil is 7.82%, the overall credit grows at slightly more than twice this rate – 16.2%. This credit expansion is more prominent to state-owned banks, whose outstanding credit grows additional 2.7% percentage points, on average, than private banks' credit growth. We also highlight that earmarked credit, credit to fund general purposes, and credit to firms present higher growth rates, on average, than their respective counterparts.

## 4.3. Data overview

### 4.3.1. Human capital development

We provide in this section the statistics for the level of human capital development across Brazilian municipalities and meso-regions measured by the HDI-M for the 2000 Census, which varies from 0 to 1. The higher this indicator, the higher the development of human capital in a given locality. Figure 1 shows the distribution of frequency (histogram) of the HDI-M for Brazilian municipalities considering bins of 0.05. Using the standard classification of the United Nations Development Programme (UNDP)<sup>14</sup>, 2.4% of Brazilian municipalities was classified as high or very high HDI-M, 26.1% as medium HDI-M, and 71.5% as low or very low HDI-M in 2000<sup>15</sup>.

Since we focus on meso-region information in our empirical tests, we create the variable HDI-Meso, calculated by the weighted average, by municipality population, of the HDI-M for each of the 137 meso-regions in Brazil. Figure 2 shows the histogram for the HDI-Meso<sup>16</sup>. In order to assess how human capital development is distributed across Brazil,

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<sup>14</sup> The UNDP classifies localities according to the HDI as follows: very low, from 0 to 0.499; low, from 0.5 to 0.599; medium, from 0.6 to 0.699; high, from 0.7 to 0.799; and very high, from 0.8 to 1.

<sup>15</sup> The 2010 Census shows the progress of human capital development in Brazil. There was a considerable increase in the number of municipalities with high and very HDI-M and a reduction in the number of localities with low or very HDI-M in the 2010 report, as follows: 33.9% of Brazilian classified as high or very HDI-M, 40.1% as medium HDI-M, and 24.6% as low or very low HDI-M.

<sup>16</sup> When we group the information by meso-regions, we observe the following composition, in accordance with the standard classification of the UNDP: 21.2% of Brazilian meso-regions classified as high or very high HDI-Meso, 23.4% as medium HDI-Meso, and 55.4% as low or very low HDI-Meso.

we separate the data into distinct levels of HDI-Meso, dividing it in three groups by its respective terciles: “low HDI-Meso” contains 46 meso-regions with HDI-Meso below the 1<sup>st</sup> tercile; “intermediate HDI-Meso” gathers 46 meso-regions with HDI-Meso between the 1<sup>st</sup> and 2<sup>nd</sup> terciles; and “high HDI-Meso” refers to the 45 meso-regions with HDI-Meso above the 2<sup>nd</sup> tercile. Figure 3 illustrates the map of Brazil divided by meso-regions, which are classified by these levels of HDI-Meso.

We notice an expressive concentration of the intermediate and high HDI-Meso regions in the Midwest, Southeast, and South Brazilian macro-regions. The only other places where these levels are found are the metropolitan areas in the North and Northeast macro-regions surrounding the respective state capitals. Intermediate and high HDI-Meso regions reflect mainly localities with intense economic activities (agriculture, livestock, mining, industries, financial services, and public administration). On the other hand, low HDI-Meso regions consist mostly of meso-regions located in the Amazon Rainforest (North) and in drought areas (Northeast) of the country.

Brazil is an interesting setting in which to perform the analysis of the relationship between finance and economic growth by levels of human capital development. The country has an HDI-Meso range<sup>17</sup> of 0.328 point and standard deviation of 0.095 (Table 1). For comparison, the EU28<sup>18</sup>, for instance, had in 2000 HDI range of 0.188 and standard deviation of 0.052. Extending this sample to all European countries, the range (0.320) and the standard deviation (0.076) become compatible with the scenery seen in Brazilian meso-regions, although almost all countries in Europe are sorted as high or very high in the human development index. Thus, Brazilian regional imbalances offer the possibility of investigating a significant degree of variation in the HDI within a single country, with the advantages of the same regulatory environment, and similar historical background and institutional context.

#### *4.3.2. Economic growth and financial development*

We present in Table 2 the evolution of total outstanding credit in Brazil, considering the whole country and the different levels of human capital development. Interestingly, we

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<sup>17</sup> Range stands for the difference between the highest and the lowest observation in the data.

<sup>18</sup> The EU28 refers to the 28 countries that make up the European Union.

notice the volume of credit grows an extraordinary sevenfold, in nominal terms, during the sample period<sup>19</sup>. Approximately 3/4 of this credit, on average, is targeted at regions with higher HDI-Meso, while 20% goes to intermediate HDI-Meso regions and only about 5% to low HDI-Meso localities.

Figure 4 puts these variables into perspective. We deflate total credit information and set 2008 as the baseline. We can observe two interesting patterns: first, the outstanding credit granted in low and intermediate HDI-Meso localities increases relatively more than the credit granted in high HDI-Meso regions in the aftermath of the 2008 international financial crisis; and second, this pattern is triggered from 2012, especially in municipalities with low HDI-Meso, when the role of government-owned banks increases.

Further, to give some clues as to how credit could have affected economic activity across the country, we analyze the evolution of the outstanding credit growth in Brazil from different standpoints. Starting with bank ownership, Figure 5A shows the progress of the amount of credit provided by state-owned<sup>20</sup> and private banks<sup>21</sup>, respectively. We observe government-owned banks increase their credit growth path in the wake of the 2008 global financial crisis as a counter-cyclical measure (Coleman and Feler, 2015)<sup>22</sup>. Subsequently, state-owned banks further expand their market share in the Brazilian credit market because of credit programs aiming at increasing the supply of credit to individuals and SME in March 2012.

Figures 5A, 5B, and 5C illustrate how the outstanding credit granted by state-owned and private banks, respectively, evolved depending on levels of human capital development in different parts of Brazil. To facilitate the comparison, all three graphs have the same scale. Interestingly, we confirm the two patterns verified before are closely related to the behavior of state-owned banks but differ according to levels of human capital development. While the counter-cyclical credit granted by state-owned banks from 2008 to 2011 focuses on regions

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<sup>19</sup> Consumer prices, measured by the IPCA (Broad National Consumer Price Index), rose 114.2% during the same period, implying an average credit growth of 267.2%, or 11.5% p.a., in real terms.

<sup>20</sup> State-owned banks refer to federal and states' government commercial banks plus the BNDES, a federal government development bank.

<sup>21</sup> In this paper, private banks comprise private domestic, foreign-controlled and foreign-share banks.

<sup>22</sup> Especially BNDES, whose desimbursements to support BNDES' Investment Maintenance Program played an important role.

with intermediate and high HDI-Meso, the subsequent credit expansion by means of financial institutions owned by the Brazilian government is relatively more prominent in low HDI-Meso areas of the country.

Since Brazil has two distinct segments of credit differentiated by their sources of funding, we then analyze the dynamics of credit in Brazil through this lens. In the earmarked credit market interest rates and sources of funding are legally established and credit must be directed to the real estate, agribusiness, and infrastructure sectors. In contrast, banks have autonomy to decide the type of the credit and the associated interest rates in the non-earmarked credit market.

Figure 6 presents the evolution of outstanding credit of these two segments. We observe the increment in the credit growth from 2008 is due mainly to earmarked credit, especially because of the expressive reimbursements of loans provided by the *Banco Nacional de Desenvolvimento Econômico e Social* (BNDES<sup>23</sup>) from 2009 to 2014. Figures 6A, 6B, and 6C confirm the focus of earmarked credit on intermediate and high HDI-Meso regions in the aftermath of the 2008 global crisis, and an increase of both segments as a result of federal banks' credit programs launched in 2012.

Next, we compare in Figure 7 the outstanding credit provided for specific purposes (financing of vehicles, equipment, and real estate) and credit granted for general purposes (working capital, loans, and other credit). We observe credit for general purposes rises relatively more since 2012, as a result of federal banks' credit programs to stimulate credit. Interestingly, this shift towards credit without a specific orientation is greater the lower the level of HDI-Meso, as shown in figures 7A, 7B, and 7C.

## **5. Empirical methodology and results**

### *5.1. Identification strategy*

Unlike most of the literature concerning the impact of financial deepening on economic growth, which relies on cross-country analyses, we use a panel dataset containing

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<sup>23</sup> BNDES is a federal government-owned development bank, which finance its operations with subsidized sources of funding. All credit granted by the BNDES is classified as earmarked.

locality and time variation within a single country. Brazil offers an interesting setting for this study, since it exhibits an uneven distribution of human capital development, financial inclusion, and economic development, which allows us to exploit the cross-sectional and time variation of these variables within the same regulatory environment and similar historical background and institutional context.

In this setup, we need to deal with the classical endogeneity problems caused by the simultaneity between finance and economic growth. Scholars usually follow the seminal papers of La Porta et al. (1997; 1998), which introduced legal origin as a valid instrumental variable for the degree of financial intermediation in different countries, or else rely on the system generalized method of moments (GMM) estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).

Concerning the instrumental variable approach, we recognize that finding an acceptable and external instrumental variable for the relationship between financial intermediation and economic growth within the same country whose localities share the same regulatory environment is challenging. When it comes to the use of dynamic panel estimation, we expect economic growth to be a cyclical variable, which does not justify the inclusion of a lagged dependent variable in the regression model. Consequently, the system GMM estimator does not fit to our setup.

Given that we cannot adequately disentangle the simultaneity between financial development and economic growth, we choose to perform a panel data model. Although we control for locality and time fixed-effects, the outcomes of this model provide only correlations, which are still insightful for the purposes of our study. Additionally, to take into account differences in the business cycles between Brazilian meso-regions, we follow the literature and use the average growth of the dependent and independent variables. Although the standard in this literature is to use five-year non-overlapping average growth, we use three-year non-overlapping average growth because of the short time span of our sample, which runs from 2004 to 2016. We end up with four periods of economic and credit growth and 137 meso-regions, which still allows us to convey important information about the association between credit, and its channels/recipients, and economic growth throughout Brazil.

Our basic specification is the following:

$$\Delta \ln GDP_{i,t} = \beta_0 + \beta_1 \Delta \ln credit_{i,t} + \lambda_i + \delta_t + \varepsilon_{i,t}, \quad (1)$$

where the indicators  $i$  and  $t$  stand for each meso-region in Brazil and time periods, respectively;  $\Delta \ln GDP_{i,t}$  is logarithmic approximation for the growth rate of the nominal GDP *per capita*<sup>24</sup>;  $\Delta \ln credit_{i,t}$  is logarithmic approximation for the growth rate of the nominal outstanding credit *per capita*;  $\lambda_i$  is a locality fixed effect which accounts for unobserved factors that may influence the locality's nominal economic growth, such as different levels of public spending by regions across the country, distinct relative prices, weather conditions or the intrinsic characteristics of each region and its main sectors;  $\delta_t$  is a time fixed effect to control for common time trends, such as the national inflation rate, and shocks as the 2008 global financial crisis and the credit programs to stimulate credit launched by Brazilian federal government-owned banks in 2012, for instance; lastly,  $\varepsilon_{i,t}$  is the error term.

To address the potential differences of the relationship between credit and economic growth by levels of human capital development, we create two dummy variables: *interm<sub>i</sub>*, which takes the value 1 for meso-regions with intermediate levels of human capital development, and 0 otherwise; and *high<sub>i</sub>*, which takes the value 1 for meso-regions with high levels of human capital development, and 0 otherwise. We use these two indicator variables in the following specification, in which regions with low levels of human capital development are the control group:

$$\Delta \ln GDP_{i,t} = \beta_0 + \beta_1 \Delta \ln credit_{i,t} + \beta_2 \Delta \ln credit_{i,t} * interm_i + \beta_3 \Delta \ln credit_{i,t} * high_i + \lambda_i + \delta_t + \varepsilon_{i,t} \quad (2)$$

## 5.2. Results

### 5.2.1. Overall credit

We start with the investigation of the relationship between overall outstanding credit growth and economic development in Brazil from 2004 to 2016. We perform the panel data

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<sup>24</sup> We use the nominal GDP because we do not have information on real GDP in Brazilian meso-regions. Additionally, both GDP and credit data are in nominal terms.



model illustrated in equation (1) and present the results in Table 3. In column 1, we take into account the results for the entire country. Then, in order to enable us to make inferences about our hypothesis, we divide the sample into three groups by levels of HDI-Meso and rerun the regression model for each of them. The respective outcomes are illustrated in columns 2, 3, and 4. In column 5, we show the coefficients for equation (2), in which we test the difference between the coefficients using dummy variables. Finally, we perform the Hausman Test for the correlation between the error term and regressors in order to decide between fixed and random effects. As long as the specific coefficients are not correlated with the error term, we choose the random effects model.

We find that an increment of 1% in the outstanding credit, on average, is correlated with 0.16% growth in the Brazilian GDP from 2004 to 2016. Since the average 3-year real credit growth in Brazil during the sample period is about 16%, this result represents an association of the credit expansion with 2.62% 3-year real economic growth<sup>25</sup>, on average. Therefore, this outcome is economically meaningful and in accordance with the related literature<sup>26</sup>.

Concerning the subsamples' analyses, the outcome for regions with low levels of human capital development shows that credit has a small but positive correlation with economic growth in these localities, which corroborates the view in which access to credit might be important to alleviate financial restrictions of firms and households in poorer areas. In regions with intermediate levels of human capital, the results are positive, highly significant and statistically larger than the correlation we find in low HDI-Meso regions. Consequently, these results are in line with the perception that finance may trigger economic growth after a given threshold of physical and human capital is achieved. Lastly, in regions with high human capital development, although the coefficient for the subsample is positive and statistically significant, it is not different from the coefficient in low HDI-Meso regions.

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<sup>25</sup> This ratio is equivalent to 0.87% economic growth on yearly basis.

<sup>26</sup> Levine and Zervos (1999) find that a one-standard deviation increase in credit leads to 0.7 higher percentage point in economic growth per year. In Levine et al. (2000), an improvement in private credit in India to the level of developed countries would have an impact of 0.6 additional percentage point on growth per year. Lastly, in Beck et al. (2000), an increase in Mexican private credit up to the sample mean would result in additional 0.4 percentage point in growth.

This confirms the theoretical prediction of convergence to initial effects and diminishing scale effects of finance on growth in areas with higher development.

### 5.2.2. *Other channels*

In this section, we address the relationship between finance and growth by means of four different mechanisms and how they vary in accordance to levels of human capital development in Brazilian regions. We split the variable that accounts for financial development – total credit – into the following channels: type of bank ownership, which considers the different effects on the economy of credit provided by private and state-owned banks; type of credit, which takes into account the difference between earmarked and non-earmarked credit; credit purpose, which differentiates the credit extended for specific objectives from the credit oriented to short-run activities or consumption; and the type of borrower, in which we separate the credit provided to firms from the credit to individuals.

#### *Bank Ownership*

We start with the investigation of credit granted by state-owned banks and credit provided by private banks, either domestic or foreign ones, in the link between finance and growth. To perform this analysis, we run equations (1) and (2) distinguishing  $\Delta \ln credit_{i,t}$  into two components: one related to the outstanding credit growth of state-owned banks ( $\Delta \ln govbanks_{i,t}$ ), and the other one to the outstanding credit growth of private banks ( $\Delta \ln privbanks_{i,t}$ ). Table 4 shows the respective results for the whole country, for the three regions divided by levels of human capital development, and for the full sample regression with dummy variables.

We find that the association between credit and economic growth is larger<sup>27</sup> for private banks in comparison with state-owned banks. Since we do not aim at establishing a causal relationship, this difference might arise because higher economic growth attracts the presence of private banks or because private banks have better credit selection and screening, contributing more to economic growth. This link between economic growth and the credit

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<sup>27</sup> The difference between private and state-owned banks' coefficients is positive and statistically significant at the 5% level.

granted by private banks is observed in all levels of human capital development but especially in regions with intermediate and high levels of human capital development, whose difference from low HDI-Meso regions is only statistically different for intermediate HDI-Meso regions.

Regarding the results for state-owned banks, our findings are in accordance with the hypothesis that the presence of these financial institutions in the economy has unclear effects. The regression outcomes do not confirm the expected positive correlation with economic growth of the credit granted by state-owned banks in regions with low human capital development. In regions with intermediate and high human capital development, although we find a slightly positive coefficient, they are not statistically significant. Overall, the credit provided by government-owned institutions has indeterminate connection with economic activity all over the country, irrespective of the level of human capital development.

#### *Type of credit*

We now address the different correlations between earmarked and non-earmarked credit with economic growth. We separate  $\Delta \ln credit_{i,t}$  in equations (1) and (2) into the following variables to account for these two types of credit:  $\Delta \ln earmarked_{i,t}$  and  $\Delta \ln non-earmarked_{i,t}$ . Table 5 shows the results.

We find that the association between credit and economic growth is larger<sup>28</sup> for non-earmarked credit in comparison with earmarked credit lines. We observe the non-earmarked credit has positive correlation with economic growth in regions with intermediate and high levels of human capital development but only the coefficient for intermediate HDI-Meso regions is statistically different from the coefficient for low HDI-Meso regions. This result is similar to the link between the credit provided by private banks and economic growth, which implies credit granted by profit-oriented financial institutions and credit with sources

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<sup>28</sup> The difference between non-earmarked and earmarked coefficients is positive and statistically significant at the 1% level.

of funding and interest rates freely established by market agents are more connected to economic growth.

Concerning the earmarked segment, we find that earmarked credit lines have a positive correlation with economic growth only in regions with low levels of human capital development, which can be explained by the effects of socially oriented subsidized credit lines in these less developed areas. This coefficient is statistically different from the coefficient of intermediate HDI-Meso regions' subsamples, which suggests the governmental social motivation in granting credit is more effective by means of earmarked credit in poorer areas than as a result of state ownership of banks.

### *Credit purpose*

Next, we test the different correlations between credit with specific and credit with general purposes with economic growth. We split  $\Delta \ln credit_{i,t}$  in equations (1) and (2) into the following variables to account for these two uses of credit:  $\Delta \ln specific_{i,t}$  and  $\Delta \ln general_{i,t}$ . Table 6 shows the results.

We find that the credit granted to specific purposes has significant correlation with economic growth in Brazil, whose difference is positive and statistically significant<sup>29</sup> from credit to general purposes, which has no connection with economic activity. The link between credit for specific objectives and economic growth is noticeable in regions with intermediate and high levels of human capital development, following the same pattern observed for the credit provided by private banks and non-earmarked credit lines. Differently from these other sample cuts, however, both differences between the coefficients for intermediate and high HDI-Meso regions and the coefficient for low HDI-Meso are positive and statistically significant. These results suggest either credit to specific purposes has spillover effects on economy or individual and firms in intermediate and high HDI-Meso regions have more access to these credit lines, given their higher capacity of payment and possibility to offer collaterals. In regard to public policies, governments, aware of the correlation between

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<sup>29</sup> The difference is significant at the 1% level.

economic growth and credit to specific purposes, could motivate the use of these credit lines as a mechanism to promote economic activity.

### *Type of borrower*

Lastly, we discuss the results for the different relationship between personal credit and credit to firms and economic development. We divide  $\Delta \ln credit_{i,t}$  in equations (1) and (2) into the following variables to account for these two credit recipients: ( $\Delta \ln personal_{i,t}$  and  $\Delta \ln firms_{i,t}$ ). Table 7 shows the results.

Although both personal and corporate credit are positively associated with economic growth, we find an unexpected higher correlation between personal credit and economic growth in comparison to credit to firms<sup>30</sup>. Following the pattern verified in the previous sample cuts, the credit provided to individuals has a prominent association with credit growth in regions of medium and high levels of human capital development, whose both coefficients are statistically different from the coefficient for low HDI-Meso regions. Concerning the credit granted to firms, we observe positive and statistically significant coefficients in low and high HDI-Meso regions, which are indistinct from each other.

These results are not in accordance with our expectation. We conjecture these outcomes could reflect a short-run economic activity, as long as the credit oriented to individuals stimulates the demand for products but does not seem to increase the supply of them in the same magnitude. This circumstance may give rise to a higher utilization of productive capacity and, consequently, to a demand-pull inflation. Since interest rates tend to rise to restrain the consumption of goods and further increase in inflation rates, this scenario may not contribute to long-term economic growth.

## **6. Robustness checks**

Since the symmetric distribution of the HDI in Brazil may not adequately represent the effects of financial intermediation on economic growth, we use the UNDP classification

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<sup>30</sup> The difference is significant at the 5% level.

to sort Brazilian meso-regions. According to UNDP categories, there were, in 2000, 41 Brazilian meso-regions with very low levels (from 0 to 0.499), 35 with low levels (from 0.5 to 0.599) and 61 with medium or high levels (above 0.599) of HDI. Then, we rerun specification (2) replacing the dummy  $interm_i$  by  $low_i$ , which takes the value 1 for meso-regions with low levels of human capital development, and 0 otherwise; and the dummy  $high_i$  by  $med\_high_i$ , which takes the value 1 for meso-regions with medium and high levels of human capital development, and 0 otherwise.

We report the results for robustness checks in Appendix I, Tables 8 to 12. Overall, the magnitude of results does not change substantially with the new classification. However, the tests for statistically significant differences between meso-regions with low and medium or high levels of HDI in comparison to very low HDI meso-regions present some variation. Specifically, all differences between medium- and high-HDI meso-regions and very low HDI meso-regions are statistically different for the subsamples of private banks, non-earmarked credit, credit with specific purposes, and credit to individuals.

These results might be explained by the fact that we concentrate on medium-HDI meso-regions, in which the effects of financial intermediation on growth are more prominent, in one category. It may have amplified the magnitude of differences between medium- and high- HDI meso-regions and very low- HDI meso-regions, while softening the differences between low- and very low-HDI meso-regions. Nevertheless, since we have very few observations of high-HDI meso-regions, these outcomes do not invalidate the perception that the effects of finance on growth is larger in regions with intermediate levels of human capital development.

## **7. Conclusion**

This paper revisits the extensive literature on the relationship between financial intermediation and economic growth, highlighting its potential non-homogeneity. We examine this phenomenon from the standpoint of human capital development, a measure that is intimately associated with the quality of past political institutions. We perform a single-country study relying on a period of exceptional growth of the credit market in Brazil, from

2004 to 2016. Additionally, we also address four other ways by which finance may have higher correlation with economic activity: type of bank ownership, type of credit, credit purpose, and type of borrower.

Our findings confirm the positive relationship between finance and growth. This pattern is more pronounced in regions with intermediate level of human capital development, which supports the argument that there is a minimum threshold required for finance (credit) to trigger the economic progress. The results also imply this progress loses momentum after human capital development reaches a yet higher given level. We find the same pattern observed in the relationship between total credit and economic growth for the credit provided by private banks, credit funded with freely established sources of funding, credit for specific purposes, and credit extended to individuals.

Still, our findings may convey important information to policymakers who intend to promote economic growth with the support of financial intermediation. First, we find that the credit provided by government-owned banks is not correlated with economic development, while earmarked credit lines, given their underlying subsidies, have a positive association with more economic activity in regions characterized by low levels of human development. These results suggest the governmental credit in poorer regions may be more effective by means of earmarked credit rather than as a result of the intervention of state-owned banks. Second, the credit provided to specific purposes has a much deeper connection with economic activity than the credit to general purposes. Consequently, policymakers could motivate the use of credit to specific purposes as a mechanism to promote economic growth. Finally, contrary to intuition, personal credit presents higher correlation with economic growth than credit to firms, especially in regions with medium and high levels of human capital development. Governments, aware of this, could stimulate the use of credit to increase the aggregated supply of goods and avoid a potential inflationary scenario of a higher utilization of the installed productive capacity triggered by credit expansion.

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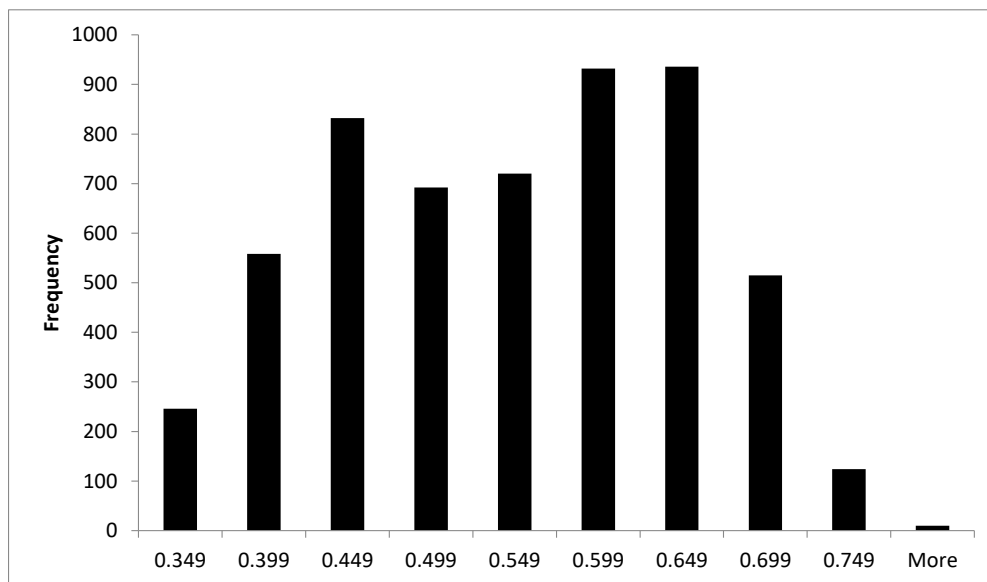


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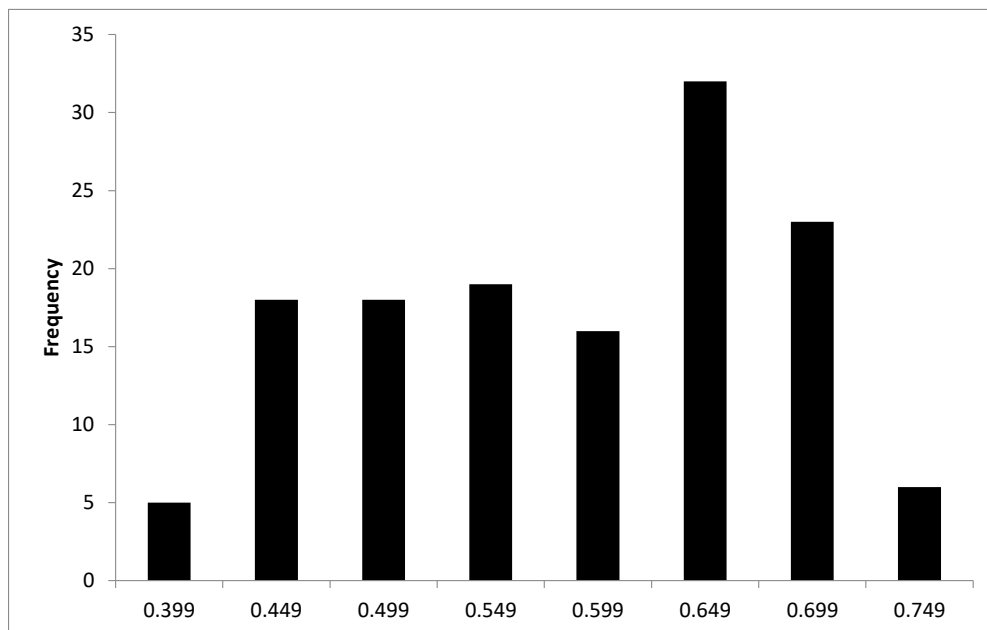
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**Figure 1 - Histogram of the Human Development Index for Brazilian municipalities**



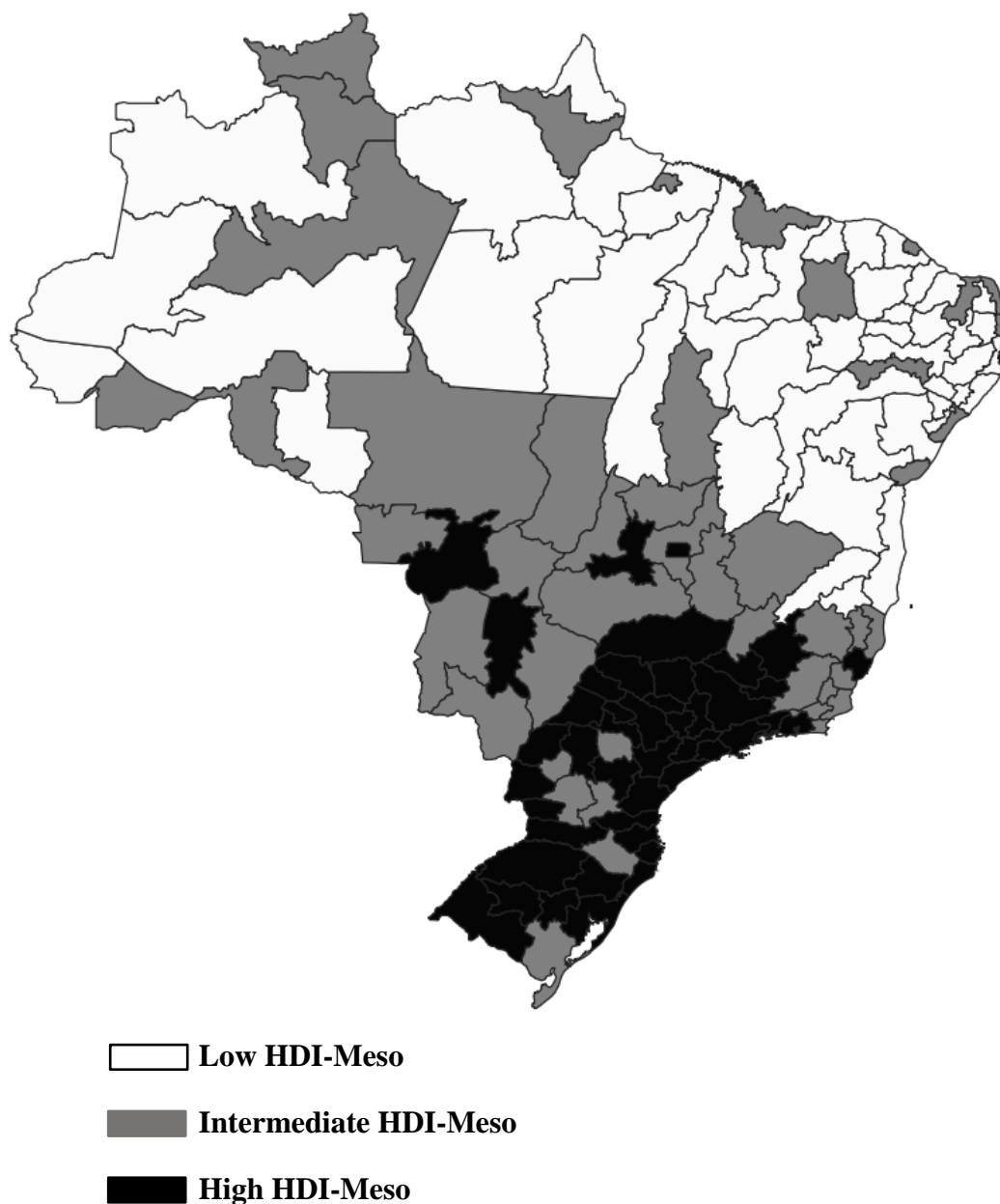
*Notes:* in Figure 1, we present the distribution of frequency (histogram) of the Human Development index for Brazilian municipalities (HDI-M) computed in the Brazilian 2000 Census. We consider bins of 0.05.

**Figure 2 - Histogram of the Human Development Index for Brazilian meso-regions**



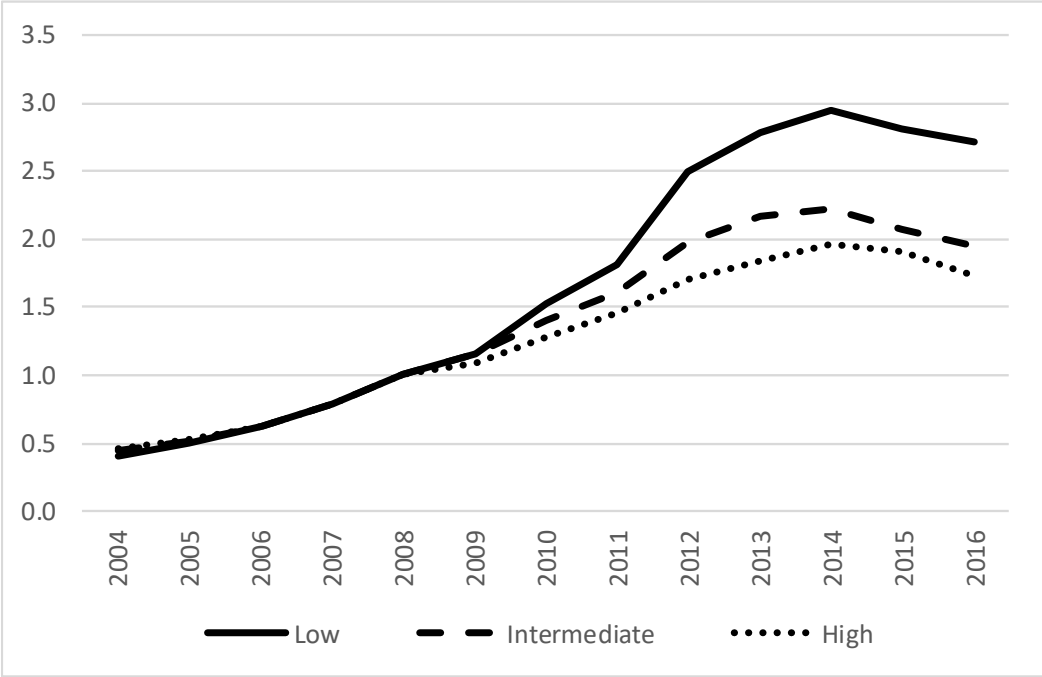
*Notes:* in Figure 2, we present the distribution of frequency (histogram) of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. We consider bins of 0.05.

**Figure 3 – Human capital development across Brazil (by levels of Human Development Index computed for Brazilian meso-regions)**



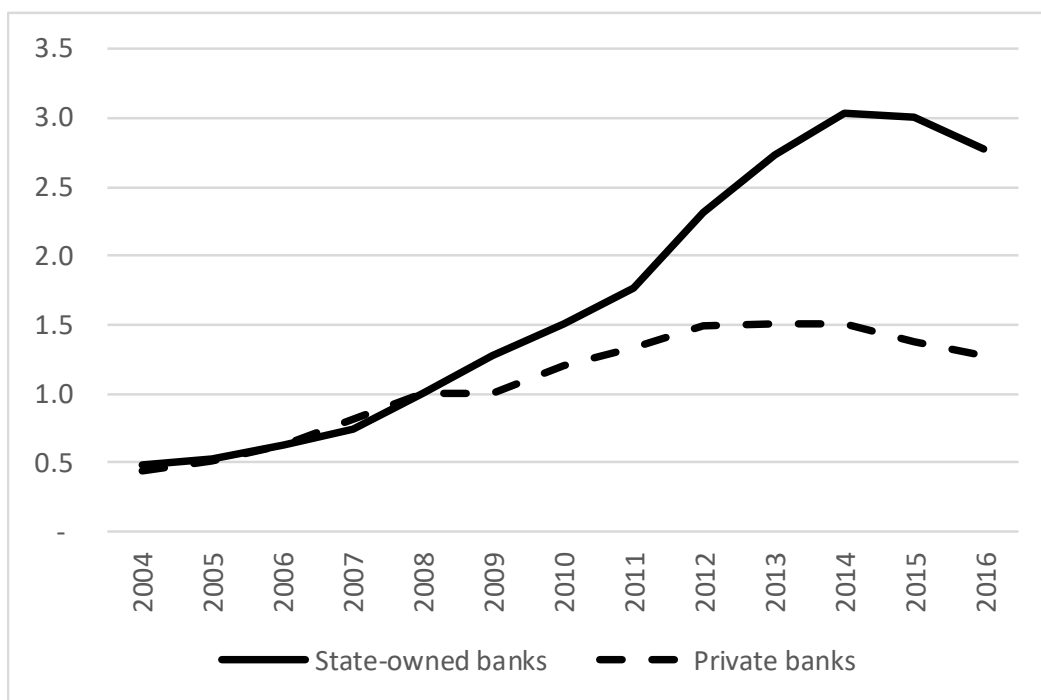
*Notes:* in Figure 3, we illustrate the map of Brazil according to different levels of human capital development, measured by the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. We divide the sample in three groups using the respective terciles, as follows: the “Low HDI-Meso” group contains 46 meso-regions with HDI-Meso below the 1st tercile; the “Intermediate HDI-Meso” group gathers 46 meso-regions with HDI-Meso between the 1st and 2nd terciles; and the “High HDI-Meso” group comprises 45 meso-regions with HDI-Meso above the 2nd tercile.

**Figure 4 – Total credit by levels of Human Development Index computed for Brazilian meso-regions**



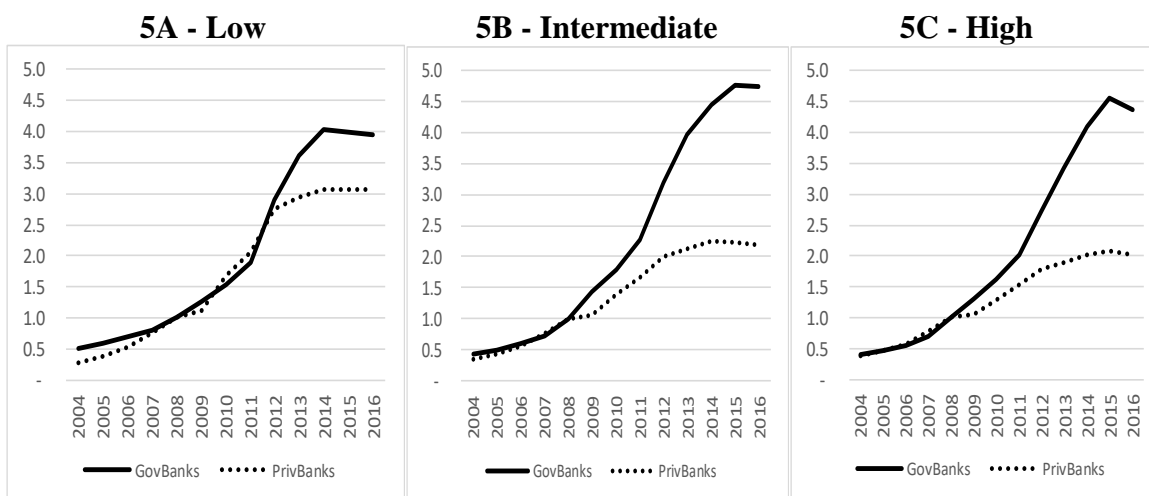
*Notes:* in Figure 4, we present the evolution of the total outstanding credit in Brazil, in constant 2004 prices, from 2004 to 2016. We consider the different levels of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. To facilitate the comparison, we set 2008 as 1.

**Figure 5 – Evolution of total outstanding credit, by bank ownership**



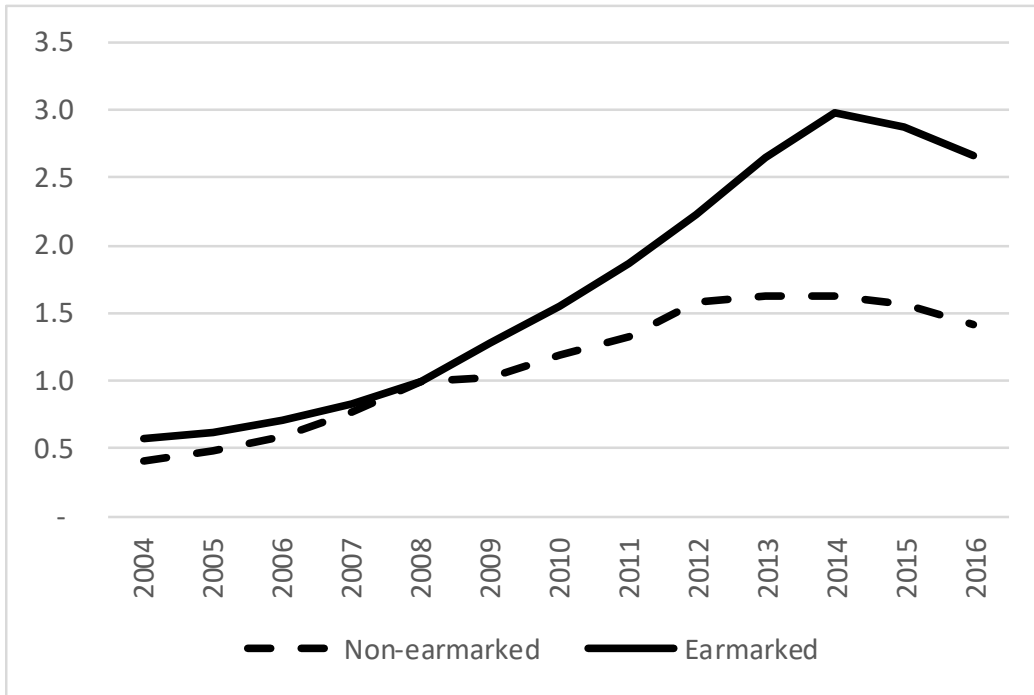
*Notes:* in Figure 5, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by bank ownership (state-owned banks and private banks). To facilitate the comparison, we set 2008 as 1.

**Figures 5A, 5B and 5C – Evolution of total outstanding credit, by bank ownership, at different levels of HDI for Brazilian meso-regions**



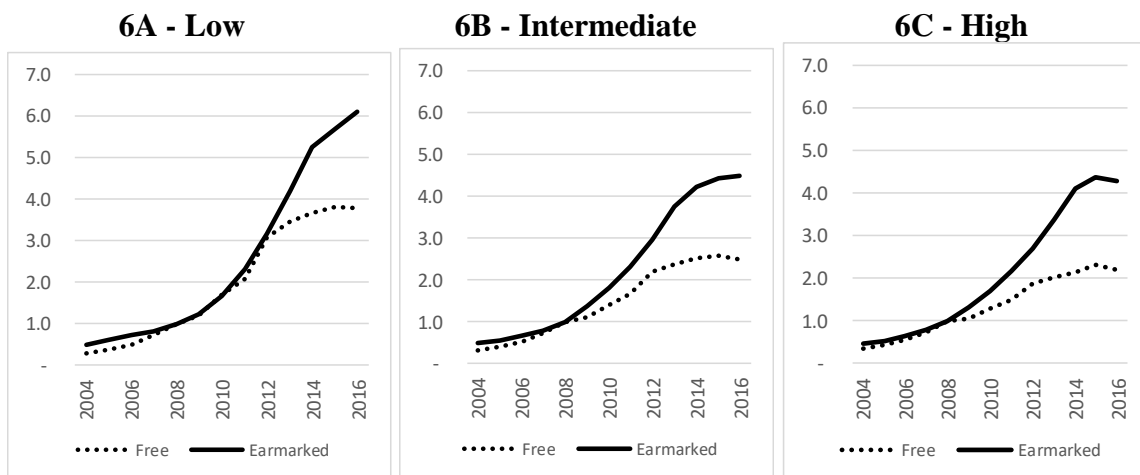
*Notes:* in Figures 5A-5C, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by bank ownership (state-owned banks = “GovBanks” and private banks = “PrivBanks”) for each level of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. To facilitate the comparison, we set 2008 as 1 and keep the same scale in all three graphs.

**Figure 6 – Evolution of outstanding credit, by type of credit**



*Notes:* in Figure 6, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by type of credit (non-earmarked and earmarked credit). To facilitate the comparison, we set 2008 as 1.

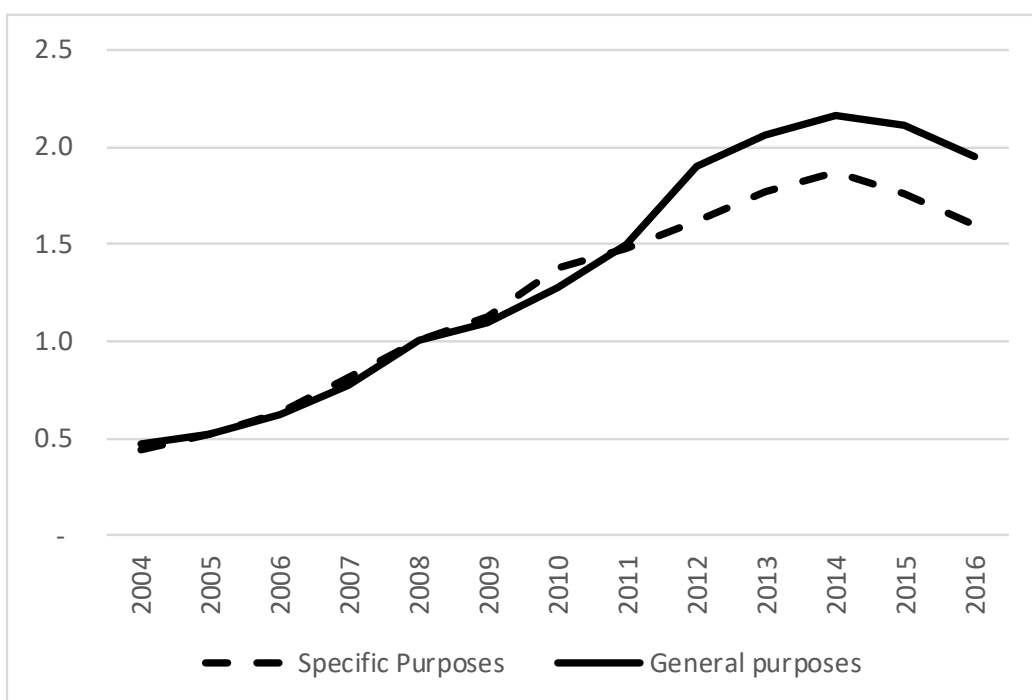
**Figures 6A, 6B and 6C – Evolution of outstanding credit, by type of credit, at different levels of HDI computed for Brazilian meso-regions**



*Notes:* in Figures 6A-6C, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by type of credit (non-earmarked = “Free”) for each level of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. To facilitate the comparison, we set 2008 as 1 and keep the same scale in all three graphs.

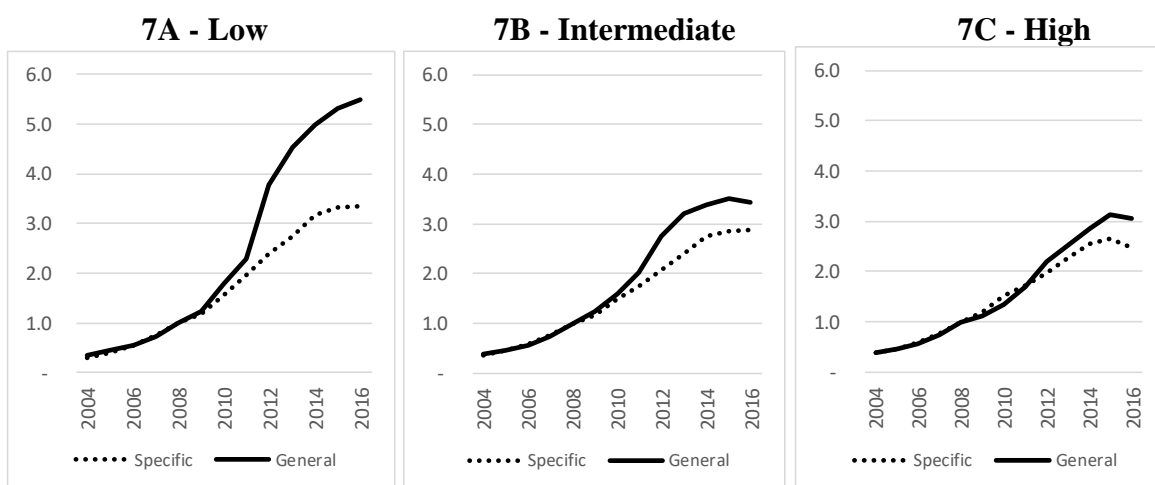


**Figure 7 – Evolution of outstanding credit, by credit purpose**



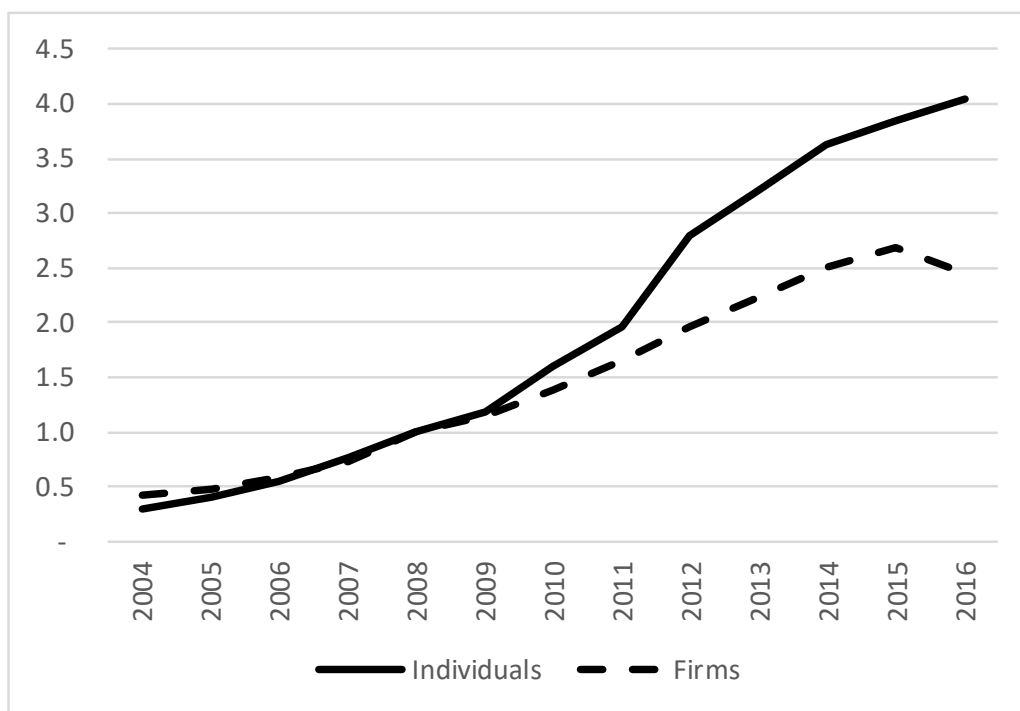
*Notes:* in Figure 7, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by credit purpose (specific purpose and general purpose). To facilitate the comparison, we set 2008 as 1.

**Figures 7A, 7B and 7C – Evolution of outstanding credit, by credit purposes, at different levels of HDI computed for Brazilian meso-regions**



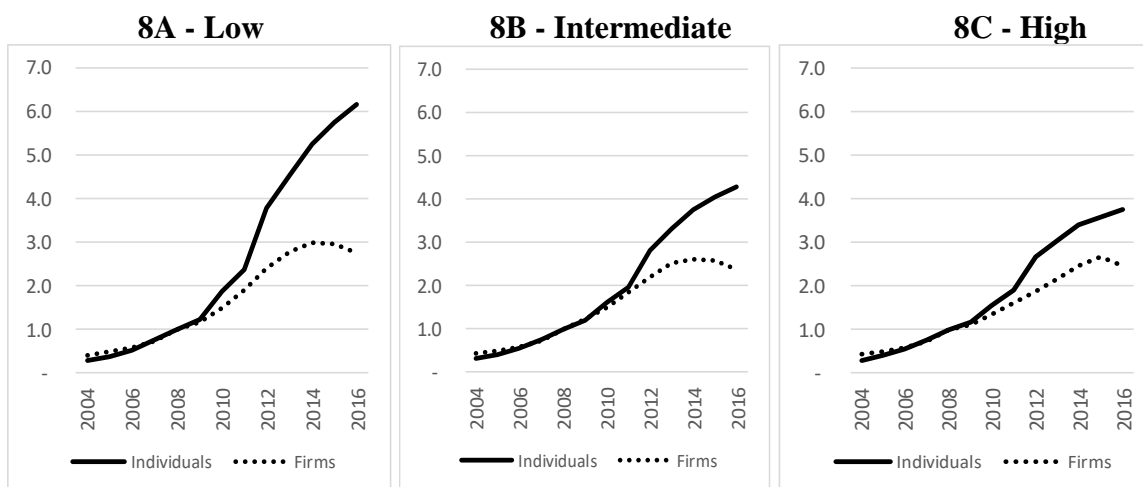
*Notes:* in Figures 7A-7C, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by credit purpose for each level of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. To facilitate the comparison, we set 2008 as 1 and keep the same scale in all three graphs.

**Figure 8 – Evolution of outstanding credit by type of borrower**



*Notes:* in Figure 8, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by type of borrower (individuals or firms). To facilitate the comparison, we set 2008 as 1.

**Figures 8A, 8B and 8C – Evolution of outstanding credit, by type of borrower, at different levels of HDI computed for Brazilian meso-regions**



*Notes:* in Figures 8A-8C, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in constant 2004 prices, by type of borrower for each level of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. To facilitate the comparison, we set 2008 as 1 and keep the same scale in all three graphs.

**Table 1 – Summary statistics**

Variables	Statistics				
	N	mean	sd	min	max
<i>Dependent variable (per capita, real growth rate)</i>					
GDP	548	0.0782	0.0391	-0.2178	0.2273
<i>Independent variables (per capita, real growth rates)</i>					
Total credit	548	0.1619	0.0910	-0.0439	0.4660
Credit granted by state-owned banks	548	0.1764	0.0966	-0.0661	0.6150
Credit granted by private banks	548	0.1491	0.1150	-0.0659	0.5098
Credit with non-earmarked sources of funding	548	0.1614	0.1074	-0.0452	0.4443
Credit with earmarked sources of funding	548	0.1660	0.1043	-0.2854	0.6853
Credit to specific purposes	548	0.1477	0.0911	-0.1577	0.5310
Credit to general purposes	548	0.1732	0.1052	-0.0837	0.5373
Credit to individuals	548	0.1929	0.0922	0.0226	0.4330
Credit to firms	548	0.1275	0.1144	-0.2430	0.6247
<i>Locality indicator</i>					
HDI-M (meso-regions) – 2000 Census	137	0.5631	0.0950	0.3669	0.7250

*Notes:* in Table 1, we provide the summary statistics for the dependent variable and independent variables (per capita and in 3-year real growth rates) and the locality information (Human Development index for Brazilian meso-regions - HDI-Meso – computed for the Brazilian 2000 Census) used in this study.

**Table 2 – Evolution of the total outstanding credit in Brazil from 2004 to 2016 (BRL billions)**

Year	Brazil	HDI – Meso		
		Low	Intermediate	High
2004	0.389	0.016 4.21%	0.077 19.77%	0.296 76.01%
2005	0.468	0.021 4.53%	0.093 19.99%	0.353 75.48%
2006	0.582	0.027 4.70%	0.117 20.13%	0.437 75.18%
2007	0.763	0.036 4.80%	0.151 19.80%	0.575 75.40%
2008	1.020	0.049 4.79%	0.204 19.94%	0.770 75.27%
2009	1.180	0.059 4.99%	0.245 20.73%	0.878 74.28%
2010	1.480	0.082 5.54%	0.314 21.13%	1.090 72.34%
2011	1.800	0.104 5.78%	0.386 21.44%	1.310 71.78%
2012	2.290	0.150 6.55%	0.501 21.87%	1.640 71.58%
2013	2.640	0.178 6.74%	0.581 22.02%	1.880 71.24%
2014	2.950	0.200 6.77%	0.635 21.49%	2.120 71.74%
2015	3.150	0.211 6.70%	0.659 20.92%	2.280 72.38%
2016	3.060	0.216 7.04%	0.653 21.28%	2.200 71.68%

*Notes:* in Table 2, we present the evolution of the total outstanding credit in Brazil from 2004 to 2016, in nominal prices, for the whole country and for each level of the Human Development index for Brazilian meso-regions (HDI-Meso) computed in the Brazilian 2000 Census. Additionally, we also show the respective percentage of total outstanding credit granted in each HDI-Meso region in relation to Brazil as a whole.

**Table 3 – The impact of credit on economic growth in Brazil**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Low	(3) Interm	(4) High	(5) Diff.
$\Delta \ln \text{credit}_{i,t}$	0.158*** (0.026)	0.116*** (0.036)	0.226*** (0.068)	0.205*** (0.045)	0.106*** (0.041)
$\Delta \ln \text{credit}_{i,t} * \text{interm}_i$					0.110* (0.065)
$\Delta \ln \text{credit}_{i,t} * \text{high}_i$					0.089 (0.083)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	184	184	180	548
Adjusted R-squared	0.285	0.267	0.248	0.495	0.304

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 3 presents the results concerning the correlations between total outstanding credit and economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rate of the outstanding credit granted by banks in Brazil. Both variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with low, intermediate, and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth by levels of human capital development by means of two dummy variables:  $\text{interm}_i$  and  $\text{high}_i$ .

**Table 4 – The impact of credit on economic growth in Brazil – by bank ownership**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Low	(3) Interm.	(4) High	(5) Diff.
$\Delta \ln \text{govbanks}_{i,t}$	0.035 (0.023)	0.051 (0.032)	0.011 (0.052)	0.048 (0.031)	0.051 (0.035)
$\Delta \ln \text{govbanks}_{i,t} * \text{interm}_i$					-0.040 (0.053)
$\Delta \ln \text{govbanks}_{i,t} * \text{high}_i$					0.002 (0.062)
$\Delta \ln \text{privbanks}_{i,t}$	0.124*** (0.024)	0.067** (0.044)	0.231*** (0.064)	0.186*** (0.046)	0.067** (0.037)
$\Delta \ln \text{privbanks}_{i,t} * \text{interm}_i$					0.163*** (0.061)
$\Delta \ln \text{privbanks}_{i,t} * \text{high}_i$					0.118 (0.083)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	184	184	180	548
Adjusted R-squared	0.288	0.266	0.262	0.503	0.314

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 4 presents the results concerning the impact of financial development, by bank ownership, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rate of the outstanding credit granted by private banks and state-owned banks in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with low, intermediate, and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit, by bank ownership, and economic growth across different levels of human capital development using two dummy variables:  $\text{interm}_i$  and  $\text{high}_i$ .

**Table 5 – The impact of credit on economic growth in Brazil – by type of credit**

Independent Variables	Dep. var: $\Delta \ln gdp_{i,t}$				
	(1) Brazil	(2) Low	(3) Interm.	(4) High	(5) Diff.
$\Delta \ln \text{earmarked}_{i,t}$	0.024 (0.017)	0.063*** (0.024)	-0.014 (0.035)	0.037 (0.027)	0.063*** (0.026)
$\Delta \ln \text{earmarked}_{i,t} * \text{interm}_i$					-0.077** (0.037)
$\Delta \ln \text{earmarked}_{i,t} * \text{high}_i$					-0.025 (0.051)
$\Delta \ln \text{non\_earmarked}_{i,t}$	0.152*** (0.026)	0.059 (0.042)	0.303*** (0.064)	0.187*** (0.045)	0.059 (0.046)
$\Delta \ln \text{non\_earmarked}_{i,t} * \text{interm}_i$					0.244*** (0.067)
$\Delta \ln \text{non\_earmarked}_{i,t} * \text{high}_i$					0.128 (0.085)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	184	184	180	548
Adjusted R-squared	0.294	0.277	0.290	0.500	0.331

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 5 presents the results concerning the impact of financial development, by type of credit, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit lines with earmarked and non-earmarked sources of funding in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with low, intermediate, and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit, by type of credit, and economic growth across different levels of human capital development using two dummy variables:  $\text{interm}_i$  and  $\text{high}_i$ .

**Table 6 – The impact of credit on economic growth in Brazil – by credit purpose**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Low	(3) Interm.	(4) High	(5) Diff.
$\Delta \ln \text{general}_{i,t}$	0.031 (0.022)	0.040 (0.031)	0.033 (0.056)	0.040 (0.034)	0.040 (0.034)
$\Delta \ln \text{general}_{i,t} * \text{interm}_i$					-0.007 (0.054)
$\Delta \ln \text{general}_{i,t} * \text{high}_i$					-0.000 (0.066)
$\Delta \ln \text{specific}_{i,t}$	0.173*** (0.028)	0.088** (0.042)	0.229*** (0.056)	0.264*** (0.049)	0.088** (0.046)
$\Delta \ln \text{specific}_{i,t} * \text{interm}_i$					0.140** (0.062)
$\Delta \ln \text{specific}_{i,t} * \text{high}_i$					0.176* (0.093)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	184	184	180	548
Adjusted R-squared	0.306	0.264	0.280	0.541	0.329

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 6 presents the results concerning the impact of financial development, by credit purpose, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit to specific and general purposes in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with low, intermediate, and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit, by credit purpose, and economic growth across different levels of human capital development using two dummy variables:  $\text{interm}_i$  and  $\text{high}_i$ .



**Table 7 – The impact of credit on economic growth in Brazil – by type of borrower**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Low	(3) Interm.	(4) High	(5) Diff.
$\Delta \ln \text{personal}_{i,t}$	0.150*** (0.029)	0.039 (0.048)	0.239*** (0.062)	0.279*** (0.062)	0.039 (0.053)
$\Delta \ln \text{personal}_{i,t} * \text{interm}_i$					0.200*** (0.070)
$\Delta \ln \text{personal}_{i,t} * \text{high}_i$					0.240** (0.116)
$\Delta \ln \text{firms}_{i,t}$	0.055*** (0.018)	0.058*** (0.021)	0.061 (0.048)	0.096*** (0.028)	0.058*** (0.023)
$\Delta \ln \text{firms}_{i,t} * \text{interm}_i$					-0.003 (0.043)
$\Delta \ln \text{firms}_{i,t} * \text{high}_i$					0.038 (0.052)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	184	184	180	548
Adjusted R-squared	0.293	0.261	0.276	0.531	0.325

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 7 presents the results concerning the impact of financial development, by type of borrower, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit granted to individuals and the credit to firms in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with low, intermediate, and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit, by type of borrower, and economic growth across different levels of human capital development using two dummy variables:  $\text{interm}_i$  and  $\text{high}_i$ .

## Appendix I – Robustness Tests’ Tables

**Table 8 – The impact of credit on economic growth in Brazil**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Very low	(3) Low	(4) Medium and High	(5) Diff.
$\Delta \ln \text{credit}_{i,t}$	0.158*** (0.026)	0.121*** (0.038)	0.216*** (0.065)	0.190*** (0.059)	0.121*** (0.042)
$\Delta \ln \text{credit}_{i,t} * \text{interm}_i$					0.094 (0.072)
$\Delta \ln \text{credit}_{i,t} * \text{high}_i$					0.068 (0.072)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	164	140	244	548
Adjusted R-squared	0.285	0.256	0.289	0.308	0.300

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 8 presents robustness checks concerning the correlations between total outstanding credit and economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rate of the outstanding credit granted by banks in Brazil. Both variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with very low, low, and medium and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth using the very low-HDI group as reference.

**Table 9 – The impact of credit on economic growth in Brazil – by bank ownership**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Very low	(3) Low	(4) Medium and High	(5) Diff.
$\Delta \ln \text{govbanks}_{i,t}$	0.035 (0.023)	0.056* (0.033)	0.071 (0.055)	-0.000 (0.038)	0.056* (0.036)
$\Delta \ln \text{govbanks}_{i,t} * \text{interm}_i$					0.014 (0.061)
$\Delta \ln \text{govbanks}_{i,t} * \text{high}_i$					-0.057 (0.053)
$\Delta \ln \text{privbanks}_{i,t}$	0.124*** (0.024)	0.063* (0.035)	0.151** (0.063)	0.235*** (0.053)	0.063* (0.039)
$\Delta \ln \text{privbanks}_{i,t} * \text{interm}_i$					0.088 (0.068)
$\Delta \ln \text{privbanks}_{i,t} * \text{high}_i$					0.171*** (0.066)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	164	140	244	548
Adjusted R-squared	0.288	0.252	0.289	0.334	0.311

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 9 presents robustness checks concerning the impact of financial development, by bank ownership, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rate of the outstanding credit granted by private banks and state-owned banks in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with very low, low, and medium and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth using the very low-HDI group as reference.

**Table 10 – The impact of credit on economic growth in Brazil – by type of credit**

Independent Variables	Dep. var: $\Delta \ln gdp_{i,t}$				
	(1) Brazil	(2) Very low	(3) Low	(4) Medium and High	(5) Diff.
$\Delta \ln \text{earmarked}_{i,t}$	0.024 (0.017)	0.072*** (0.025)	0.007 (0.038)	-0.014 (0.029)	0.072*** (0.027)
$\Delta \ln \text{earmarked}_{i,t} * \text{interm}_i$					-0.065 (0.044)
$\Delta \ln \text{earmarked}_{i,t} * \text{high}_i$					-0.087** (0.040)
$\Delta \ln \text{non\_earmarked}_{i,t}$	0.152*** (0.026)	0.044 (0.044)	0.268*** (0.068)	0.245*** (0.052)	0.044 (0.049)
$\Delta \ln \text{non\_earmarked}_{i,t} * \text{interm}_i$					0.223*** (0.078)
$\Delta \ln \text{non\_earmarked}_{i,t} * \text{high}_i$					0.200*** (0.071)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	164	140	244	548
Adjusted R-squared	0.294	0.268	0.316	0.340	0.326

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 10 presents robustness checks concerning the impact of financial development, by type of credit, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit lines with earmarked and non-earmarked sources of funding in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with very low, low, and medium and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth using the very low-HDI group as reference.

**Table 11 – The impact of credit on economic growth in Brazil – by credit purpose**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Very low	(3) Low	(4) Medium and High	(5) Diff.
$\Delta \ln \text{general}_{i,t}$	0.031 (0.022)	0.039 (0.032)	0.019 (0.063)	0.041 (0.041)	0.039 (0.035)
$\Delta \ln \text{general}_{i,t} * \text{interm}_i$					-0.020 (0.067)
$\Delta \ln \text{general}_{i,t} * \text{high}_i$					0.001 (0.054)
$\Delta \ln \text{specific}_{i,t}$	0.173*** (0.028)	0.097** (0.043)	0.208*** (0.060)	0.250*** (0.052)	0.097** (0.047)
$\Delta \ln \text{specific}_{i,t} * \text{interm}_i$					0.111 (0.072)
$\Delta \ln \text{specific}_{i,t} * \text{high}_i$					0.153** (0.071)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	164	140	244	548
Adjusted R-squared	0.306	0.255	0.312	0.346	0.325

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

*Notes:* Table 11 presents robustness checks concerning the impact of financial development, by credit purpose, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit to specific and general purposes in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with very low, low, and medium and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth using the very low-HDI group as reference.

**Table 12 – The impact of credit on economic growth in Brazil – by type of borrower**

Independent Variables	Dep. var: $\Delta \ln \text{gdp}_{i,t}$				
	(1) Brazil	(2) Very low	(3) Low	(4) Medium and High	(5) Diff.
$\Delta \ln \text{personal}_{i,t}$	0.150*** (0.029)	0.036 (0.050)	0.196*** (0.059)	0.279*** (0.063)	0.036 (0.055)
$\Delta \ln \text{personal}_{i,t} * \text{interm}_i$					0.160** (0.077)
$\Delta \ln \text{personal}_{i,t} * \text{high}_i$					0.242*** (0.085)
$\Delta \ln \text{firms}_{i,t}$	0.055*** (0.018)	0.064*** (0.022)	0.065 (0.045)	0.076** (0.038)	0.064*** (0.024)
$\Delta \ln \text{firms}_{i,t} * \text{interm}_i$					0.001 (0.047)
$\Delta \ln \text{firms}_{i,t} * \text{high}_i$					0.011 (0.046)
Locality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	548	164	140	244	548
Adjusted R-squared	0.293	0.252	0.307	0.345	0.322

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Notes: Table 12 presents robustness checks concerning the impact of financial development, by type of borrower, on economic growth in Brazil from 2004 to 2016. The outcomes are related to the random effects panel data model applied to equations (1) and (2), in which the dependent variable is the 3-year average growth rate of the nominal GDP per capita, and the independent variables are the 3-year average growth rates of the credit granted to individuals and the credit to firms in Brazil. All variables are measured as a logarithmic approximation. In column 1, we present the results for the whole sample; in columns 2, 3, and 4, we report the results for the regions with very low, low, and medium and high human capital accumulation, respectively; finally, in column 5, we test the potential differences in the relationship between credit and economic growth using the very low-HDI group as reference.