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Financialisation and intangible assets in emerging market economies: evidence from Brazil

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Whereas previously scholars advocated a positive relationship between a growing size of the financial sector and economic growth, most recent evidence has shown that this might not be the case at all times. The financialisation literature has pointed to some of the mechanisms through which the increasing size and changing structure of the financial system might weigh negatively on growth through the changing financial relations of non-financial corporations (NFCs). This paper contributes to this debate on several grounds. First, rather than interrogating the relationship between finance and firms' tangible investments, it focuses on firms' intangible investments, arguably a sine-qua-non for innovativeness and productivity-enhancing structural change. Drawing on an emerging literature on intangible assets, innovation, and development studies, we highlight the important role of investment into *intangible assets*, in the context of developing economies. Second, by bringing together the literatures on access to finance, intangible assets, and financialisation, we delineate analytically *three specific channels* through which finance can affect intangible assets. Third, this is the first paper that tests empirically all three channels using the population of publicly listed manufacturing companies in an Emerging Market Economy, Brazil over the period 2011–2016. Our results confirm the potentially negative impact of financialisation on intangible assets through the *crowding-out channel*, that is, firm's increased tendency to hold financial assets reduces intangible assets. Our findings also confirm the *shareholder-value orientation channel*, that is, firm's payments of dividends reduce intangibles assets.

Key words: Intangible assets, Financialisation, Innovation-driven growth, Emerging Market Economies
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1. Introduction

The size and complexity of financial markets have increased substantially over recent decades, a process frequently summarised as 'financialisation'. Although emanating from developed economies, developing and emerging countries (DECs) have not been excluded from this secular change in the workings of the global economy: global capital flows to DECs have surged and domestic financial markets have continued to grow, frequently becoming more market based (Bonizzi, 2013; World Bank, 2013; Unctad, 2019). At the same time though, productive, high-value-added structural change and industrialisation—for many a cornerstone of economic development—has stalled in many DECs regions, in particular Latin America and Africa (Unctad, 2003, 2019; Castillo and Martins Neto, 2016; Rodrik, 2016; Haraguchi *et al.*, 2017).

Traditionally, financial and industrial developments were seen to go hand in hand as financial institutions (banks) provide the necessary savings to finance private investment, diversify risk, and exercise corporate control (Gerschenkron, 1962; King and Levine, 1993a, 1993b; Levine, 1997). Moreover, it was assumed that, as financial systems mature, financial markets, rather than arms-length bank lending, would be more effective in fulfilling these functions (Levine and Zervos, 1996, 1998). Developments since the financial crisis of 2008 inspired contributions that have empirically challenged elements of these views. Studies have shown that the relationship between measures of financial development and economic growth is non-monotonic, and that beyond certain thresholds economies may experience financial hypertrophy (Cecchetti and Kharroubi, 2012; Law and Singh, 2014; Arcand *et al.*, 2015). Others have argued that market-based financial systems may not always be better than bank-based ones (e.g. Beck *et al.*, 2014). This more critical view of finance is also reflected in the interdisciplinary literature on financialisation, which has shown that growing financial markets might weigh on investment, shorten the horizon of managers, and increase payments to financial markets at the expense of long-term investment (Stockhammer, 2004; Orhangazi, 2008; Van Treeck, 2008; Tori and Onaran, 2017).

This paper contributes to this crucial policy question by revisiting the link between financial development and economic growth through the financial operations of non-financial corporation (NFCs) in the context of DECs. It makes three contributions to the literature. First, in contrast to existing studies, which have predominantly focused on firms' tangible capital investment, it highlights the important nexus between those financial operations and firms' intangible investment, which boost innovativeness and productivity—arguably one of the most important prerequisites for productive structural change (Marrocu *et al.*, 2012; Bontempi and Mairesse, 2015; Montresor and Vezzani, 2016; Añón Higón *et al.*, 2017). Building on recent developments in the innovation and finance literatures, it focuses on firms' investments into *intangible assets.* Intangible assets are defined as a portfolio of diverse knowledge activities spanning from technological inputs (e.g. R&D, IT/software) to non-technological inputs (e.g. design, advertising) which, in turn, stimulate the firm's innovativeness and productivity (Eisfeldt and Papanikolaou, 2014; Bontempti and Mairesse, 2015; Peters and Taylor, 2017). Intangible assets have recently been conceptualised as an important antecedent of firms' innovativeness and productivity capabilities (Teece, 2000; Montresor and Vezzani, 2016) and leapfrogging in DECs (e.g. Lall, 1992; Dutrénit, 2000). This broad conceptualisation of innovativeness is consistent with how innovation occurs in DECs, which in this context is more about adapting foreign technologies into local production systems, rather than solely scientific breakthroughs that fall under the rubric of patents or R&D (Lall, 1992; Kesidou and Romijn, 2008). Using both technological and non-technological intangible assets, local firms upgrade and move up in global value chains (Bonizzi *et al.*, 2023).

Second, by bringing together the literatures on access to finance, innovation, and financialisation, we delineate analytically *three specific channels* through which finance can affect intangible assets and consequently innovativeness and productivity. The literature on *access to finance* indicates that external financing plays an important role in stimulating investments in intangible assets and inducing innovation (Brown *et al.*, 2009; Hsu *et al.*, 2014; Nanda and Kerr, 2015; Pellegrino and Savona, 2017). These studies emphasise that lack of access to external financing often constrains a firm's cash flow and consequently investments on intangible assets. This problem is exaggerated in DECs where financial markets are less developed (Hsu *et al.*, 2014).

On the other hand, financialisation scholars have argued that firms' increased exposure to financial markets might hinder rather than spur investments in innovation through shareholder value pressures, which increase financial payments at the expense of innovative activities, strengthen value extraction at the expense of value creation and shorten the horizon of managers (Lazonick, 2007, 2010; Lazonick and Tulum, 2011; Lazonick and Mazzucato, 2013; Dosi *et al.*, 2016). Indeed, recent empirical literature has shown a negative, rather than a positive link between financial development and innovation (e.g. Aristizabal-Ramirez *et al.*, 2017). In this vein, Dosi *et al.* (2016, p. 2) highlight an unexplored question that the literature needs to address is whether '…financialisation transformed the relationship between finance, innovation and growth, and through which channels'. To do so, drawing on the literature which investigates the negative impact of financialisation on firms' capital expenditure (Lazonick and O'Sullivan, 2000; Stockhammer, 2004; Epstein, 2005; Orhangazi, 2008; Davis, 2017), we complement the positive *access to finance hypothesis* with two further channels through which finance might affect firms' investments into intangibles negatively, namely, the *crowding-out hypothesis* and *shareholder-value orientation hypothesis.* The *crowding-out hypothesis* captures the increased tendency of large companies to hold financial assets and generate revenue from financial income at the expense of their underlying operations, including investments on intangible capital. The *shareholder-value orientation hypothesis* argues that increased pressures from shareholders have changed management behaviour to focus on short-term value extraction instead of long-term, productive value creation and have increased the payments to financial markets in the forms of dividends and share buybacks, thus reducing the resources available for investments on intangible assets.

Third, whereas a few papers have investigated empirically some of these channels on real capital investment in DECs (Demir, 2008; Tori and Onaran, 2017), we are the first study to test in a systematic way the effect of all three channels on intangible assets in a key DEC, Brazil. Brazil is one of the largest, financially integrated emerging economies. Recent evidence shows that Brazilian firms have become increasingly exposed to (international) financial markets, both on the asset side (e.g. through the holding of short-term financial assets and operations on the derivatives market), and the liability side (e.g. through borrowing on international financial markets; see Farhi and Borgi, 2009; Gottschalk and Torija-Zane, 2017; Kaltenbrunner, 2017). At the same time, the Brazilian economy has been undergoing a de-industrialisation trend over recent years, underscoring the importance of investigating the link between this trend and the financialisation phenomenon (see also Mantoan *et al.* 2021; Corrêa and Feijo, 2022).

We test these hypotheses using the population of publicly listed manufacturing companies in Brazil over the period 2011–2016. We apply the Arellano and Bond (1991) two-step difference generalised methods of moments (GMM) estimator. Our empirical strategy accounts for dynamic panel bias, firm fixed effects, time-related shocks, endogenous variables, autocorrelated disturbances and general forms of heteroscedasticity.[1]

Our results confirm the potentially negative relationship between financialisation and investments into intangibles through two channels: first, the *crowding-out channel*, that is, firm's increased tendency to hold financial assets reduces intangible assets, and second, the *shareholder-value orientation channel*, that is, firm's shareholder value orientation manifested as high payments of dividends reduces intangibles assets. We find the first effect to be stronger, potentially confirming the higher importance of the crowding-out channel for DECs, which are characterised by structurally higher interest rates and greater macroeconomic uncertainty than developed countries (see also Demir 2008, 2009b).

In the next section, we discuss the literature on the differential effects of access to finance and financialisation upon intangible assets. Section 3 elaborates the methodological approach and econometric estimation whereas Section 4 presents the empirical results. Finally, Section 5 provides the concluding remarks and contribution of the study.

2. Finance, financialisation and intangible assets nexus: three channels

2.1 Channel 1: access to finance and intangible assets

Intangible assets include both technological inputs (e.g. R&D, IT/software) and non-technological inputs (e.g. design, advertising). Early research in the field of the economics of innovation paid particular attention to technological forms of intangibles and in particular to investments on R&D or patents (Griliches, 1979). Recently attention is drawn to non-technological forms of intangibles such as advertising as it is emphasised that they facilitate the commercialisation of inventions (i.e. innovation) and they increase the appropriability of investments on R&D (Marrocu *et al*, 2012; Añón Higón *et al.*, 2017). Essentially, both technological and non-technological forms of intangibles work in tandem. They complement each other during the innovation process—from idea generation and creativity to R&D, invention, design, development, and commercialisation—strengthen firm's capabilities, improve manufacturing firm performance (Añón Higón *et al.*, 2017), and stimulate innovation-driven growth (Lev, 2001). The increasing importance of intangibles for firm performance in today's global economy has also been highlighted in a recent literature, which shows that it is the use of intangibles (e.g. branding, modern marketing techniques, the access to databases and related AI technologies), rather than tangible capital assets, which allows lead firms in Global Value Chains to enhance their market power (Durand and Milberg, 2020).

Prior literature has shown that access to finance plays an important role in stimulating investments in intangible assets and inducing innovation (King and Levine, 1993a, 1993b; Brown *et al.*, 2009; Hsu *et al.*, 2014; Nanda and Kerr, 2015; Pellegrino and Savona, 2017). The Modigliani–Miller (1959) theorem in corporate finance states that returns to different types of investment are independent of the way a corporation

[1] Our results are also robust to alternative model specifications.

finances these investments. This implies that a corporation's capital structure (i.e. whether capital is drawn from external or internal sources) would not affect the rate of return of a project that involves investments on physical assets or investments on intangible assets. Yet, the literature on the economics of innovation points out that financing innovation (e.g. investing on intangible assets) using capital from sources external to the firm is constrained due to market failures (Hall, 2002). Specifically, market failure for R&D investment arises from asymmetric information, moral hazard, and the incompleteness and inefficiency of capital markets (Hall, 2002).

Firstly, asymmetric information between an external lender and a borrower arises due to the difficulty in describing an innovation without giving it away (Leland and Pyle, 1977; Myers and Majluf, 1984; Canepa and Stoneman, 2008). This in turn, makes it more difficult to calculate the probability of success of such projects and to estimate the returns to investments on intangible assets. Secondly, the separation of ownership (i.e. shareholders) and control (i.e. management) generates moral hazard when, for example, financing R&D requires reduction of dividends (Canepa and Stoneman, 2008). More importantly, highly innovative projects have in general low probability of success, which makes the returns to investments in such projects very uncertain (Brealey *et al.*, 1977; Carpenter and Petersen, 2002). Thirdly, capital market incompleteness and inefficiency, such as the problems of measuring risk, impose further constraints in the financing of innovation (Arrow, 1962). Finally, investments on intangible assets, which lie behind innovative projects, cannot be used as collateral to acquire external financing (Bester, 1985; Lev, 2001). For example, more than 50% of the expenditure on a R&D project are mostly on wages of scientists (Hall, 2002), which do not offer a firm any collateral (Berger and Udell, 1990).

Empirical evidence indicates that small and newly funded firms are externally constrained (Levenson and Willard, 2000). For instance, studies in the context of the US point out that financing of R&D does not rely on debt but rather on internal sources (Hall, 1992; Himmelberg and Petersen, 1994).

Prior studies in the context of DECs indicate that access to external financing stimulates firm innovation (Ayyagari *et al.*, 2011). Evidence from cross-country studies points out that countries with well-developed financial markets, and therefore higher access to external finance, are more innovative (Hsu *et al.*, 2014). Overall, based on the review of the literature we would expect that firms that are able to borrow externally would also invest more on intangible assets. Thus, the *access to finance* hypothesis 1 states:

Hypothesis 1. Firms with higher access to external finance invest more on intangible assets.

2.2 Financialisation and intangible assets

Whilst external access to finance, that is financial liabilities, can support investments on intangible assets by helping companies to access credit for innovative projects, recent changes in the relations of large corporations with financial markets, a phenomenon also known as the financialisation of NFCs, might weigh negatively on firms' intangible assets.[2]

[2] According to the literature, financialisation has affected a variety of different economic actors ranging from households and banks to the state and NFCs. Given their role for private innovation, we focus on the latter category in this paper.

The financialisation of NFCs is observed in the literature as the tendency of NFCs to increase the holding and generation of profits from financial assets (Crotty, 2003; Stockhammer, 2004; Krippner, 2005), and their rising payments to financial markets in the form of interest, dividends and stock buybacks (Boyer, 2000; Lazonick and O'Sullivan, 2000; Duménil and Lévy, 2004). The sources of these changes are either located in the productive sector itself, as increased competition and monopolisation have led to a declining rate of profit and increased the attractiveness of financial investments (Boyer, 2000; Brenner 2004; Duménil and Lévy, 2004), or changes in institutional governance and financial market policies. These institutional changes refer particularly to the rising threat of hostile takeovers and the shift from 'retain and reinvest' to creating shareholder value (Froud *et al.*, 2000; Lazonick and O'Sullivan, 2000).

The financialisation literature has shown empirically the potentially negative impact firms' increased exposure to financial markets might have for investment on physical capital by diverting companies' activities from productive investments to short-term financial profit-seeking activities (Stockhammer, 2004; Orhangazi, 2008; Van Treeck, 2008; Tori and Onaran, 2017).[3] Yet, very little is known about the impact of financialisation upon intangible investments. This paper makes a first step in filling this gap by investigating the link between NFCs' financial relations and their investments in intangibles (an antecedent of innovation). More concretely, based on the financialisation literature we propose two more channels through which firms' exposure to finance might affect their investment in intangible assets: the *crowding-out hypothesis* and the *shareholder-value orientation hypothesis*.

2.2.1 *Channel 2: the crowding-out hypothesis* The *crowding-out hypothesis* assumes that, given a fixed supply of financial sources (either internal or external),[4] real and financial assets are held in proportions depending on their relative yields (Davis, 2017). This means that an increase in the return of financial assets can lead to a replacement of tangible investments if their returns lag that of the financial assets. Prior research (Demir, 2008, 2009b) shows that this effect could be assumed stronger in DECs given their lower access to internal funds (due to lower profitability) and external funds (due to more shallow financial markets).

A key distinction between tangible and intangible investments is that investment in intangibles is riskier than tangible investments, given the collective, cumulative, and uncertain nature of the innovation process (Lazonick, 2007; Lazonick and Mazzucato, 2013; Bontempi, 2016), and is more associated with asymmetric information, moral hazard and market incompleteness. This problem is exacerbated if one considers that the returns to investments on intangible assets, which are key determinants of innovativeness and productivity, are only manifested in the long run. This is because of the time lag that exists from expenditure on intangible assets to innovativeness and productivity, and from innovation to commercialisation. For example, the median lag from R&D to innovation is estimated to be three years (Hall *et al.*, 2010). Thus, we

[3] Though Davis (2017) also notes that the results depend fundamentally on the financialisation indicator used and the country under consideration. Moreover, there might be a potential reverse causality where low investments, and hence less certain profits, require holding more liquid assets to maintain confidence of the financial markets and bankers. We have tried to control for this reverse causality by using lagged values and a GMM estimator.

[4] Thus, this argument would not apply in the presence of a horizontalist money supply, where banks freely accommodate firms' demand for credit.

anticipate a stronger negative effect of financialisation upon investments in intangibles in general, and in particular a stronger *crowding-out effect,* whereby higher risk innovative activities compete with liquid, high-yielding financial assets. This, we hypothesise further, might be particularly the case in DECs characterised by higher (macroeconomic) uncertainty and structurally higher interest rates. Thus, the *crowding-out* hypothesis 2 states:

Hypothesis 2. Highly financialised firms that allocate a high proportion of their assets on financial assets invest less on intangible assets.

2.2.2 *Channel 3: the shareholder-value orientation hypothesis* The *shareholder-value orientation hypothesis* attributes the falling of real investment to the increased emphasis paid by firm managers on shareholder value. This in turn, increases the short-termism or myopic management behaviour and raises the attention to financial performance indicators like earnings per share (Stockhammer, 2004). Also, attention to shareholder value changes the corporate strategy from one aiming to 'retain and reinvest' to that of 'downsizing and distributing' (Lazonick and O'Sullivan, 2000) and more generally raises payments to financial markets in the form of interests, dividends, and share buybacks. For example, a growing literature demonstrates that the recent rise in indebtedness in US companies has been linked to rising financial payments as companies have borrowed to buy back their own shares (Lazonick, 2007; Duménil and Lévy, 2011; Fiebiger, 2016). Overall, these changes in managerial behaviour and increased payments to financial markets lower the resources available for capital expenditures.

A recent, though still very small literature, argues that this negative impact of financialisation processes also holds for firm innovation (Lazonick, 2007; Mazzucato, 2013; Gleadle *et al*, 2014; Dosi *et al.*, 2016).[5] For example, Lazonick and Mazzucato (2013) argue that increased shareholder-value pressures divert resources from R&D investments to financial payments (primarily dividends and stock repurchases), and change managerial preferences from those focused on 'value creation' to those driven by 'value extraction'. As to the latter, the authors argue that in today's managerial economies, we see a stronger separation between economic actors who take the risk to innovate and those who reap the rewards and extract the value from the innovation activities (e.g. managers, venture capitalists, bankers, and hedge fund managers). Stock markets strengthen those focused on value extraction processes through broadening the array of financial sources available and hence liquidity (the cash function), and providing the option of corporate stock as remuneration for employees and managers (the compensation function). Moreover, increased managerial short-termism induced by stock markets is seen to weigh particularly on innovative activities, which bear higher risk (Edmans *et al.*, 2013; Dosi *et al.*, 2016). Thus, we formulate our third channel between finance and intangibles as:

Hypothesis 3. Highly financialised firms that are exposed to pressures from shareholders invest less on intangible assets.

[5] So far, the innovation literature has focused mainly on the impact of shareholder value orientation on firms' innovative activities (Dosi *et al.*, 2016). We are not aware of any study which also discusses the crowding out effect on innovation.

So far, prior research has not tested via a systematic econometric methodology the impact of *all three channels* on intangible assets. Lazonick and Sakinç (2010) show empirically that rather than generating new products, American biotech firms and large pharmaceutical corporations have channelled government funding and Initial Public Offering (IPO) capital into stock market speculation. Montalban and Sakinç (2013) document that financialisation has contributed to a restructuring of the productive model of large pharmaceutical companies to blockbuster models based on an 'innovation and volume' strategy. Though not negatively affecting the size of R&D expenditures, the authors show a reduction in big pharma's research productivity (approximated with approved new molecular entity and biological licence applications). Carpenter and Lazonick (2017) show in a detailed case study analysis for the telecommunication sector that more financialised companies have shown less capacity to develop innovative capabilities, measured through granted patents. Finally, Goda and Larrahondo Domínguez (2022) show for a large sample of developed and developing countries that, over the 2010–2018 period, dividend payouts had a substantial negative impact on the R&D expenditures of publicly listed firms.

Econometric evidence that shareholder value pressures might reduce innovation are presented in a recent finance and business literature. For example, using an instrumental variable approach and patent-based metrics Bernstein (2015) found a decline in the innovative novelty of firms and both an exodus of skilled investors and a decline in the productivity of the remaining ones after firms' Nasdaq IPO. Similarly, Aggarwal and Hsu (2013) show that firms undergoing a public offering experience a boost in forward patent citations in the short-term, but a decline in the medium and long-term. Focusing on production introduction this is also confirmed by Wies and Moorman (2015), who present evidence that while the size and variety of innovations increases after going public, they are less risky, characterised by fewer breakthrough innovations and fewer innovations into unfamiliar categories. Lee *et al.* (2020) show for thirty-one developed countries that as financialisation advanced (approximated by the contribution of financial and insurance activities to total value added and the ratio of stock market capitalisation), the radicalness of technological innovation (measured by the number of times a certain patent has been cited) declined, while the number of patent registrations (quantitative indicator of innovation) increased.

However, this literature does not engage conceptually with the structural process of *financialisation*, and does not examine the impact of *all three channels* upon intangibles. This paper fills these gaps and presents a detailed econometric study of how finance affects the accumulation of intangible assets.

3. Methodology

3.1 Developing and emerging countries context

A small, but growing interdisciplinary literature shows that NFCs from DECs have started to adopt similar practices, relations and balance sheet characteristics to those in developed economies. On the asset side, several authors have pointed to the increased importance of financial investments, both for hedging and speculative purposes (Araujo *et al.*, 2012; Levy-Orlik, 2012; Seo *et al.*, 2012; Powell, 2013). NFCs in DECs have substantially increased their holding of cash and very liquid short-term financial assets, including those on local derivatives markets (Kalinowski and Cho, 2009; Correa *et al.*, 2012; Karwowski, 2012; Farhi and Borghi, 2009; Rabinovich and Pérez Artica, 2022). On the funding side, large DEC firms have started to substitute market funding for bank borrowing, frequently offshore and mostly in foreign currency (IMF, 2014; McCauley *et al.*, 2015; BIS, 2015).

Previous studies show that these financialisation phenomena have impacted real capital investments negatively also in the DECs context, and that this impact might be exacerbated by higher uncertainty and structurally higher interest rates (Demir 2009a, 2009b; Tori and Onaran, 2022; Kaltenbrunner *et al.* 2023). For example, Demir (2009a) shows in his seminal paper on the portfolio decisions of Argentine, Mexican, and Turkish firms, that the rates of return gap between financial and fixed investment assets had an economically and statistically significant negative effect on real investment in all three countries. Tori and Onaran (2022) find a strongly significant negative effect of financial payments (interest and dividend payments) on real investment in DECs. Interestingly, whereas the impact of financial income on firm investment is insignificant for the whole sample, it becomes significant and positive for larger NFCs. So far there is only one paper which investigates the impact of financialisation on innovation in a DEC context. Seo *et al.* (2020) show for the case of Korea that financialisation payout indicators have a negative relation with innovation, quantitatively and qualitatively (approximated with the number and radicalness of patents). Though estimation by firm size reveals that the hypothesis of managerial myopia leading to short-termism of innovation strategy is valid only for conglomerates.

So far, there is no empirical literature which investigates the link between *all three channels* of *financialisation* and *intangible assets* in emerging economies. Our study fills this gap in the case of Brazil. As indicated in the introduction, Brazil is one of the largest, financially integrated emerging economies, which has been exposed to large and volatile capital flows over recent years, often independent of domestic economic conditions (Kaltenbrunner and Painceira, 2017). Portfolio liabilities as a share of GDP increased from around 5% in the 1990s to 26% in 2007 (just before the global financial crisis), contracted to 8% in 2008, and rose again to 22% in 2009. Similarly, stock market capitalisation as a share of GDP increased from 34% in the early 2000s, to nearly 100% in 2007, contracted to 34% in 2008, and rose again to more than 80% in 2009 (Lane and Milesi-Ferretti, 2017; World Bank, 2021). Both indicators have been on the decline since (portfolio liabilities % GDP averaged 12% between 2011 and 2015 and stock market capitalisation averaged 40% of GDP), yet remain at historically higher levels.

3.2 Data

This paper uses annual balance sheet data for 94 Brazilian manufacturing firms over the 2011–2016 period. The data are from Economatica, a database that provides balance sheet data for publicly listed companies in Latin America. In total, there are 120 publicly listed manufacturing firms in Brazil, but 26 firms are excluded from the analysis because they had fewer than 50% observations for either intangibles assets or total assets. The sample period begins in 2011 because Brazilian publicly listed companies adopted the International Financial Reporting Standards (IFRS) in 2010.[6] Our sample covers 18 two-digit SIC sectors within manufacturing (See Appendix A).

[6] IFRS are a set of accounting standards developed by the International Accounting Standards Board (IASB).

3.3 Operationalising key variables

3.3.1 *Intangible assets* The International Financial Reporting Standards (IFRS), set out the criteria for identifying and measuring intangible assets. Companies are required to disclose this information in their financial accounts. The IFRS defines intangible assets as an identifiable[7] non-monetary asset without physical substance. They specify the intangible assets that companies should include when measuring their investments on intangibles, these are: 'Identifiable intangible assets include patents, copyrights, licences, customer lists, brand names, import quotas, computer software, marketing rights and specialised know-how'[8] (Wiley IFRS, 2017, p. 201). Recent research points out that 'investment in intangible capital, which includes R&D and the software component of ICT, is largely investment in innovation' (Corrado *et al.*, 2012; p. 4; Teece, 1986).

Prior studies on innovation have solely focused on measuring innovation via measures such as patents, technological investments such as R&D, or via self-reported surveys on binary outputs of whether a company innovates or not (e.g. Community Innovation Survey).[9] Although research based on these proxies generated valuable insights, there are certain caveats associated with such measures, for example, not all patents are turned into commercially viable innovations; not all firms invest on formal R&D, especially in DECs; and there is an increased bias of self-reported surveys. The advantage of adopting a measure of innovativeness via a company's accounts on investments in intangible assets is that it captures not only technological activities such as R&D and patents, but a broader range of activities that contributes to innovation such as ICT, advertising, design, copyrights, brand names etc. A recent report that examines the returns on investment on science and innovation acknowledges that such investments are not limited to R&D but also include a range of 'intangible investments' (BIS, 2015). This expansive understanding of innovativeness aligns with the way innovation unfolds in DECs. It primarily involves the adaptation of foreign technologies into local production systems, wherein local firms upgrade in global value chains through the integration of complementary non-technological inputs (Lall, 1992; Kesidou and Romijn, 2008; Bonizzi *et al.*; 2023). This contrasts with the sole focus of research in advanced economies on scientific breakthroughs that are typically associated with patents or R&D.

The importance of intangibles for productivity growth has been initially recognised via the work of Corrado *et al.* (2005, 2009, 2012, 2013). Using a Solow-Jorgenson-Griliches growth model, Corrado and Hulten (2010) show that intangible capital has surpassed tangibles as the largest source of growth. The analysis of these studies was largely at the aggregate level of country or sector. Recent progress in research on intangibles in both innovation and finance literatures, focuses on the micro level and uses company accounts to measure intangibles at the firm level (Arrighetti *et al.*, 2014;

[7] Note that in order to identify an intangible asset such asset needs to be separable, or to arise from contractual or other legal rights. This is because separable assets can be sold, transferred, licensed, etc. (Wiley IFRS, 2017).

[8] Goodwill is not included in the financial accounts that measure investments on intangible assets. This is because external goodwill, acquired in a business combination (e.g. during a merger), is outside the scope of investments on intangible assets. On the other hand, internally generated goodwill is within the scope of intangible assets but is not recognised as an asset because it is not an identifiable resource (Wiley IFRS, 2017).

[9] Patents and R&D are not available in our sample. For robustness, we collected manually patent data and re-run our analysis. The results remain robust, confirming H2.

Eisfeldt and Papanikolaou, 2014; Bontempi and Mairesse, 2015; Montressor and Vezzani, 2016; Peters and Taylor, 2017).

In sum, investments on intangible assets have been increasingly acknowledged of strategic importance for innovation and productivity in both innovation and finance literatures as it captures the commitment of the company to innovation and organic growth (Corrado *et al.*, 2012). Here, we consider that intangible assets[10] reflect the breadth and depth of a firm's technological and non-technological innovativeness. We calculate the logarithm of intangibles assets (in millions of US$).

3.3.2 *Access to finance and financialisation* Table 1 summarises the finance and financialisation indicators we use and their relation to the theoretical mechanisms set out in Section 2. All variables are measured in millions of US $. To test the effect of access to external finance, that is, *H1*, we measure external financing as firms' Financial Liabilities (FL), namely firms' total short-term and long-term debt, as a percentage of firms' Total Assets (TA). This measure is denoted (FL/TA). A positive impact of this proxy upon intangibles will confer support to *H1*.

To test the effect of financialisation on intangible assets via the *crowding-out* channel, that is, *H2*, we use two proxies: First, Financial Assets (FA) as a percentage of Total Assets (TA), denoted (FA/TA). Higher values of this proxy indicate that companies favour financial investments. Second, Financial Profits (FP) as a percentage of Total Profits (TP), denoted (FP/TP). Higher values of this variable imply that companies make more revenues from financial channels rather than from their underlying innovation or operational activities. We expect both measures to exert a negative influence on intangibles assets.

To test the effect of financialisation on intangibles assets via the *shareholder-value orientation* channel, that is, *H3*, we use two proxies: First, Dividend Payments as a percentage of Total Equity, denoted (Dividend/Equity). Second, Stock repurchases as a percentage of Total Equity, denoted (Stock repurchase/Equity). We expect a negative effect for both proxies, as higher dividend payments and expenditure for the repurchase of equity reduce resources available for the continued accumulation on intangibles assets.

3.4 Model specification and estimation

3.4.1 *Empirical models* We investigate *H1, H2 and H3* by estimating the following model.

$$\log\,(\text{intangibles})_{i,t} = \beta_0 + \beta_1 (FL/TA)_{i,t-1} + \beta_2 (FA/TA)_{i,t-1} + \beta_3 (FP/TA)_{i,t-1} + \beta_4 (Dividens/Equity)_{i,t-1} + \beta_5 (\text{Repurchase}/Equity)_{i,t-1} + \beta_6 (Interest\,payments/TA)_{i,t-1} + \beta_7 \log\,(TA)_{i,t-1} + d_t + \varepsilon_{i,t}, \quad (1)$$

where the dependent variable is the logarithm of firms' intangible assets. *(FL/TA)* is financial liabilities as a percentage of total assets; this variable captures the *access to finance* hypothesis *(H1)*. (FA/TA) is financial assets as a percentage of total assets and (FP/TP) is financial profits as a percentage of total profits; both variables capture the *crowding-out* channel of financialisation *(H2)*. $Dividends/Equity$ is dividend payments

[10] We also conduct robustness analysis whereby we use an alternative dependent variable, intangible intensity, that is, the ratio of intangible assets over total assets. Our results remain fairly consistent.

Table 1. *Finance, financialisation and intangible assets nexus: concepts and measurement*

	Underlying conceptual mechanism	Measurement	Indicator
Dependent Variable Intangible assets		**Intangibles assets**: we measure a firm's total intangibles assets at cost, not at fair market value (intangibles). This is the total expenditure on assets including patents, copyrights, licences, customer lists, brand names, import quotas, computer software, marketing rights and specialised know-how (excluding goodwill). We divide intangibles with total assets (TA).	**Intangible assets:** log(intangibles)
Hypothesis 1. Firms with higher access to **external finance** invest more on **intangible assets**.	*Access to finance channel*: firms that are able to borrow externally would also invest more on intangible assets.	**External finance**: we measure external financing as firms' financial liabilities (FL). This is the total short-term and long-term debt. Further we divide FL with total assets (TA).	**External finance:** (FL/TA)
Hypothesis 2. Highly financialised firms that allocate a high proportion of their assets on **financial assets** invest less on **intangible assets**.	*Crowding-out channel*: firms make portfolio decision between investing in financial assets or intangible assets. An increase in financial assets and/or financial profits will crowd out investments on intangible assets. We consider that this is manifested via an asset allocation mechanism (via financial assets) and/or a return on investment mechanism (net financial profits).	**Financial assets:** we measure financial assets as the sum of current assets, including cash and cash equivalents, short-term account receivables, and all other short-term investments excluding goodwill and intangibles (FA). We divide FA with total assets (TA).	**Financial assets:** (FA/TA)
		Financial profit: we measure net financial profits (before taxes) as the sum of dividend income from subsidiaries, interest income and gains from other financial investments, net of all expenses associated with such operations (FP). We divide FP with total profit (before taxes). Total profits is the sum of pre-tax net operating profit, financial profit and net equity (TP).	**Financial profit**: (FP/TP)

Table 1. *Continued*

	Underlying conceptual mechanism	Measurement	Indicator
Hypothesis 3. Highly financialised firms that are exposed to **pressures from shareholders** invest less on **intangible assets**.	*Shareholder value orientation channel*: pressures from shareholders change management behaviour. They strengthen value extraction over value creation, increase dividend and financial payments, and cause stock buybacks. As a result, investments on intangible assets drop.	**Dividend payments**: we measure dividend payments (dividends) as a percentage of total equity (equity). **Stock repurchases**: we measure stock repurchases (repurchase) as a percentage of total equity (equity).	**Dividend payments**: (dividends/ equity) **Stock repurchases**: (repurchase/ equity)

Source: Authors.

as a percentage of total equity, *Repurchase/Equity* is firms' repurchase of equity as a percentage of total equity; these variables capture the *shareholder value orientation* channel of financialisation *(H3)*.

We control for the size of the firm using the logarithm of firms' total assets (TA). We also control for the firm's interest payments as a percentage of total assets $(Interest\ Payments/TA)$, since higher interest repayments may lead to lower real investments and is potentially correlated with payments for dividends and for the repurchase of equity. We include a vector of time dummies, d_t, to account for time-specific unobserved common shocks, such as economic recessions, changes in regulation affecting the Brazilian manufacturing sector, financial crises, and other macroeconomic shocks. We use one-year lags of all the variables because the accumulation of intangibles assets may only respond to changes in companies' asset and income structure with a delay.[11] $\varepsilon_{i,t}$ is the error term.

3.4.2 *Estimation methods* To estimate (1), we employ two methods: a Fixed Effects estimator, and a Difference GMM estimator.[12] We first estimate the following fixed effects model:

$$y_{i,t} = \beta_0 + \beta X_{i,t-1} + d_t + \alpha_i + \varepsilon_{i,t}, \tag{2}$$

where $y_{i,t}$ is the logarithm of intangible assets, $X_{i,t-1}$ is a vector of lagged explanatory variables in equation (1), d_t is a vector of time dummies, $\varepsilon_{i,t}$ is the error

[11] In unreported regressions, we estimate the effects of both contemporaneous and lagged values of the variables. We find that financial assets have a negative contemporaneous and lagged effect, but dividends do not. Hence, crowding out may be instantaneous but shareholder orientation takes some time.

[12] We also first explore a simple pooled ordinary least squares (POLS) estimator. The results from this model indicate that access to finance as well as all measures of financialisation exert a negative and statistically significant effect on intangibles assets. The POLS model thus shows no support for *H1*, whilst it supports *H2* and *H3*. Given that this model does not account for firm-specific effects, we use fixed effects and GMM models as our main specifications.

term, α_i represent firm dummies that capture time invariant firm effects, and all other variables are as previously defined. Incorporating firm fixed effects is important because it allows us to account for endogeneity resulting from unobservable, time-invariant factors that may affect both the accumulation of intangible assets and the financialisation behaviour of the firm, such as its location or its organisational culture. This fixed effects model, however, does not account for other sources of endogeneity that are independent of fixed effects, such as reverse causality and simultaneity between the dependent and explanatory variables. Indeed, intangibles assets, financial assets, financial profits and financial liabilities may be jointly determined; firms' investment decisions are not independent and are often made with similar performance-related outcomes in mind. Moreover, investing in or profiting from one asset may encourage or reduce investments in other assets, raising the potential for reverse causality. Even though we rule out contemporaneous reverse causality by using one-year lags of the explanatory variables, this only makes them predetermined with respect to intangibles assets, but they are not independent of past realisations of intangibles assets: they are not strictly exogenous (Roodman, 2009). In addition, the fixed effects model is unsuitable for a dynamic panel specification, which allows current realisations of intangibles assets to be influenced by past ones.[13] This is important because innovation is a cumulative and persistent process, such that past levels of intangibles would reinforce future levels.

To address these concerns, we employ the Arellano and Bond (1991) Difference GMM estimator.[14] This estimator allows consistent estimation of a dynamic panel model where the lagged dependent variable is included in the model. The Difference GMM estimator first transforms the regression equation in (1) into first differences (Roodman, 2009). The transformed variables are then instrumented with their past levels:

$$\Delta\, y_{i,t} = \theta\, \Delta\, y_{i,t-1} + \beta\, \Delta\, X_{i,t-1} + d_t + \Delta\, \varepsilon_{i,t}, \quad (3)$$

where $\Delta\, y_{i,t-1}$ is the first differenced one-year lagged intangibles assets (i.e. growth in intangibles), $\Delta\, X_{i,t-1}$ is the vector of first differenced explanatory variables in equation (1), d_t is a vector of time dummies and $\Delta\, \varepsilon_{i,t}$ is the differenced error term. Since all the right-hand side variables in (4) are predetermined, then in the absence of second-order serial correlation, the past levels of these variables should only be correlated with the errors dated $t-j,\ j \geq 2$, and not with current disturbances (Roodman, 2009; Baum, 2013). At the same time, these past levels should be strongly correlated with the first differenced variables in (4), so they make good instrumental variables. The validity of this identification strategy depends crucially on the absence of second-order serial correlation and on the exogeneity of the instruments. We test the former using the Arellano–Bond test for second-order serial correlation, and the latter using Hansen J statistic of overriding restrictions.

[13] In a dynamic specification, the fixed effects estimator is biased because the lagged dependent variable will be correlated with the current error term, introducing a new source of endogeneity. Without a large time dimension to average out the effects of this correlation, the endogeneity problem persists. Kiviet (1995) finds that the bias is 20% of the coefficient even when $T = 30$.

[14] We prefer the difference GMM to the system GMM approach, because the latter requires many more instruments and, with our relatively small sample size, this results in an instrument proliferation issue (see Roodman, 2009).

We use $2 \leq t \leq 3$ lagged level values of the variables as well as the level time dummies as instruments. We use the two-step GMM estimator that is robust to general forms of heteroskedasticity and autocorrelation in the error term, and Windmeijer (2005) corrected cluster-robust standard errors that limit the downward bias of robust two-step estimation in small samples. This robust estimation requires the absence of cross-section correlation across the errors. To guard against contemporaneous cross-section correlation across firms (Roodman, 2009), and to account for time-related common shocks, we include a full set of time dummies. We further estimate the long-run effects implied by equation (4), as these are directly comparable to the fixed effects estimates in (2) and (3).

We also estimate the long-run effects of financialisation on intangibles assets as implied by the GMM model. When a lagged dependent variable is included in the model, as in GMM, the coefficient estimates reflect only short-run (instantaneous) effects on the dependent variable. Greene (2012) states: '*Adding dynamics to a model in this fashion creates a major change in the interpretation of the equation. Without the lagged variable, the "independent variables" represent the full set of information that produce observed outcome* y_{it} *[*as with Fixed Effects*]. With the lagged variable, we now have in the equation the entire history of the right-hand-side variables, so that any measured influence is conditioned on this history; in this case, any impact of* x_{it} *represents the effect of new information*' (p. 536). One can obtain the long-run estimates in the usual way by dividing the coefficients of the independent variables by the one minus the coefficient of the lagged dependent variable.

In sum, we use a two-step difference GMM estimator with Windmeijer-corrected standard errors and a full set of time dummies. This estimator accounts for firm fixed effects, dynamic panel bias, endogenous explanatory variables, heteroskedastic and autocorrelated errors and time-specific common unobserved shocks.

3.5 Descriptive analysis

Table 2 shows the descriptive statistics of the variables. The average level of intangibles assets over the sample period is \$294.3 million (about 5% of total assets). The average firm size in terms of total assets is about \$3 billion. On average, firm liabilities are about 36% of total assets and financial assets account for an average of 29% of total assets. Firms make, on average, financial losses of about 11% of total profits, but the median level of financial profit is 9.5% of total profits. The average dividend payment is 3% of total equity. Most firms in our sample do not repurchase equity, although those that do engage in repurchases do so consistently. The highest payment for equity repurchases over the period is 33% of total equity. Interest payments are, on average, 14.5% of total assets. Appendix A provides a discussion of sectoral variations in intangibles assets and financialisation variables. Figure 1 shows that over our sample period, intangible assets as a proportion of total assets increased, whereas the average financialisation indicators related to financial assets and dividends decreased in line with the macroeconomic scenario described above. On the other hand, average financial liabilities and equity repurchases increased over the sample period.

Although data from previous firm-level research on financialisation in DECs contexts is limited, it is noteworthy that most of our overall sample averages in Table 2 are similar to those reported in other contexts, including in advanced economies. As a recent analysis by the OECD, Demmou *et al.*, 2021 point out US firms invest 4.5% of total assets into intangibles. Similarly, a recent working paper by the Bank of England (Karmakar et al., 2022) reports that intangibles are 4.8% of total assets among UK firms. Soener (2021) shows that financial assets (including cash, short-term investments, total current receivables, other financial assets)/total assets for 37 economies that were ever among the largest 40 economies globally since 1988 started at around 30% in 1991 and declined to around 28% in 2017. These are similar values to ours. With regards to firm liabilities as a share of total assets, Davydov (2016) shows that the mean book value of the total debt to total assets ratio for Brazil, Russia, China and India between 2003 and 2012 was 65%. This is higher than our value, which could be explained by the inclusion of China and Russia and the different time period under consideration.

Table 3 shows the pairwise correlation coefficients between the variables. There appears to be little correlation between the various financialisation measures.

Table 2. *Descriptive statistics*

Variable	N	Mean	SD	Min	Max
log(intangibles)	410	1.93	3.47	−8.09	8.81
FL/TA	410	0.36	0.51	0.00	4.59
FA/TA	410	0.29	0.15	0.00	0.81
FP/TP	410	−0.11	7.29	−96.23	26.35
Dividends/equity	407	−3.44	5.99	−63.33	0.00
Repurchase/equity	402	−0.004	0.02	−0.33	0.00
Interest payments/TA	402	−0.14	0.15	−1.81	0.00
log(TA)	410	6.29	2.03	0.39	10.35

Source: Authors calculations using balance sheet data for Brazilian manufacturing firms.

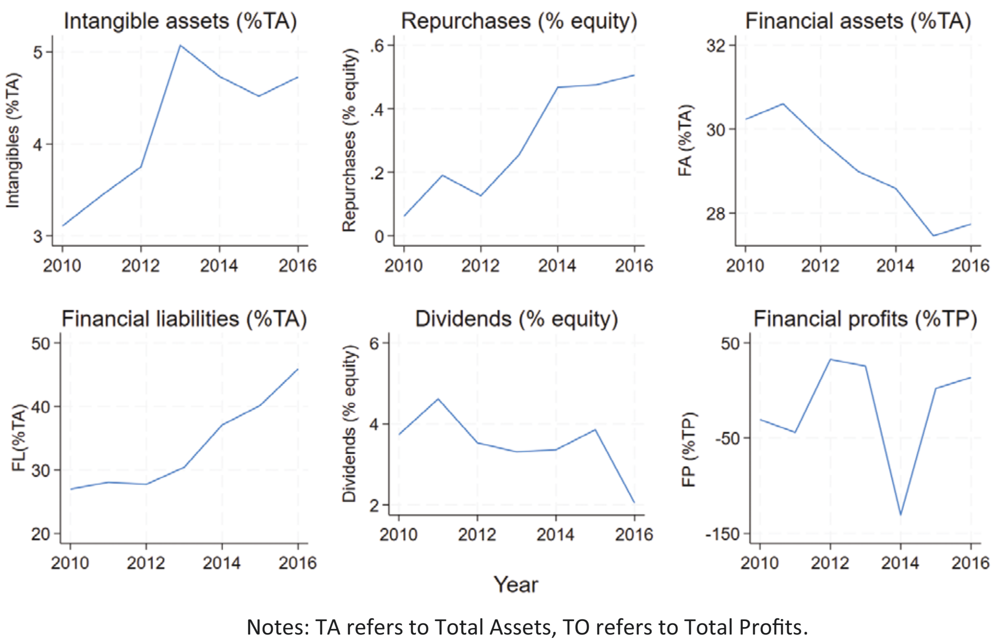

Fig. 1. *Evolution of intangibles assets and financialisaton measures over time, (2010–2016)*

Source: Authors calculations using balance sheet data for Brazilian manufacturing firms.

Table 3. *Pairwise correlation coefficients*

	Variables	1	2	3	4	5	6	7	8
1	log(intangibles)	1							
2	FL/TA	−0.15*	1						
3	FA/TA	0.05	−0.05	1					
4	FP/TP	−0.04	0.01	0.03	1				
5	Dividends/equity	−0.26*	0.15	−0.21*	0.02	1			
6	Repurchase/equity	−0.08	0.01	−0.09	0.00	0.06	1		
7	log(TA)	0.84*	−0.19*	−0.06	−0.02	−0.23*	−0.06	1	
8	Interest payments/TA	−0.12	−0.08	−0.05	0.02	−0.03	0.11*	−0.02	1

Source: Authors calculations using balance sheet data for Brazilian manufacturing firms.
* Significance at the 1% or 5% level.

4. Results and discussion

The first column of Table 4 shows results from the Fixed Effects model denoted in equation (2). Here, firm's access to external finance, that is, financial liabilities, has a positive impact on intangibles assets, conferring support for *H1*, that is, *access to finance*. Specifically, a 1% increase in financial liabilities relative to total assets increases intangibles assets by 0.5%. The fixed effects model also shows strong support for *H2*, that is, the *crowding-out hypothesis*. Specifically, a 1% increase in financial assets relative to total assets reduces intangibles assets by 4.1%, and a 1% increase in financial profits relative to total profits reduces intangibles assets by 0.09%. The fixed effects model also supports *H3*, that is, the *shareholder value orientation hypothesis*. A 1% increase in dividends paid relative to total equity reduces intangibles assets by 1.3%. Similarly, a 1% increase in repurchase relative to total equity reduces intangibles assets by 1.9%. Taken together, the fixed effects model supports *H1, H2 and H3*.

Next, we consider results from GMM estimates that allow for a dynamic panel specification, enabling us to account for previous levels of intangibles assets. The second and third of Table 4 show the results from short-run and long-run GMM estimates implied by equation (3). The coefficient of the lagged dependent variable is positive and statistically significant. This supports the view that the accumulation of intangibles assets is a cumulative and persistent process, so that previous levels of intangibles assets reinforce future intangibles. Here, firms' access to external finance, that is, financial liabilities have a positive but insignificant impact in both the short-run and long-run. In contrast to the fixed effects model, this implies no support for *H1*. The GMM model supports *H2* via the impact of financial assets. We find that a 1% increase in financial assets relative to total assets reduces intangibles assets by 3.8%. However, financial profits relative to total profits have no significant impact on intangibles assets. The GMM model also supports *H3* through the impact of dividends payments: a 1% increase in dividend payments relative to total equity reduces intangibles assets by 1.3%. The long-run estimates of the GMM model are much larger than those from the fixed effects model; here, a 1% increase in financial assets relative to total assets reduces intangible assets by 7.7%, and a 1% increase in dividend payments relative to total equity reduces intangibles assets by 2.7%.[15] Financial profits and equity repurchases

[15] It is expected that the long-run coefficients will be larger than the short-run coefficients because intangibles assets are quite persistent in our data, with a coefficient of 0.5. Given the formula above, the long-run

Table 4. *Estimation of the effects of financialisation on intangibles assets*

		log(intangibles)			log(intangibles/TA)		
	(1)	(2)		(3)	(4)		
		FE	GMM		FE	GMM	
			Short run	Long run		Short run	Long run
$Log(intangibles)_{t-1}$		0.504***					
		(0.092)					
$Log(intangibles/TA)_{t-1}$					0.492***		
					(0.114)		
H1—Access to finance channel							
$(FL/TA)_{t-1}$	0.005*	0.001	0.002	0.004	0.001	0.001	
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.007)	
H2—Crowding-out channel							
$(FA/TA)_{t-1}$	−0.041**	−0.038**	−0.077**	−0.039**	−0.036***	−0.071***	
	(0.020)	(0.017)	(0.030)	(0.019)	(0.013)	(0.021)	
$(FP/TP)_{t-1}$	−0.0008**	−0.000	−0.000	−0.0008**	−0.000	−0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
H3—Shareholder value orientation channel							
$\left(\frac{Dividends}{Equity}\right)_{t-1}$	−0.013*	−0.013*	−0.027*	−0.011*	−0.013***	−0.026**	
	(0.007)	(0.007)	(0.014)	(0.006)	(0.005)	(0.012)	
$\left(\frac{Repurchase}{Equity}\right)_{t-1}$	−0.019***	−0.044	−0.088	−0.012	−0.042*	−0.082	
	(0.007)	(0.029)	(0.057)	(0.008)	(0.025)	(0.053)	
Controls							
$\left(\frac{Interest\ Payments}{TA}\right)_{t-1}$	0.005	−0.002	−0.004	0.003	−0.002	−0.003	
	(0.006)	(0.005)	(0.011)	(0.006)	(0.006)	(0.011)	
$Log(TA)_{t-1}$	1.280***	0.148	0.298	0.740**	0.153	0.301	
	(0.374)	(0.644)	(1.308)	(0.363)	(0.769)	(1.518)	
2011		0.120			0.007		
		(0.331)			(0.377)		
2012	0.067	0.230		0.122	0.163		
	(0.115)	(0.387)		(0.101)	(0.401)		
2013	0.253	0.280		0.367**	0.274		
	(0.179)	(0.447)		(0.168)	(0.448)		
2014	0.169	0.042		0.339**	0.106		
	(0.161)	(0.298)		(0.157)	(0.330)		
2015	−0.186	−0.267		0.283*	0.060		
	(0.168)	(0.237)		(0.167)	(0.262)		
2016	0.320			0.461**			
	(0.236)			(0.231)			
Observations	410	304		410	304		
R-squared	0.265			0.175			
Arellano–Bond test for AR(1)		−1.75*			−1.69*		
Arellano–Bond test for AR(2)		1.411			1.233		
Hansen j statistic		63.35			55.29		
Hansen p value		0.428			0.714		
Number of instruments		77			77		

Notes: Robust standard errors in parentheses.
Source: Regression analyses based on balance sheet data for Brazilian manufacturing firms.
*** $p < 0.01$,
** $p < 0.05$,
* $p < 0.1$.

remain insignificant in the long-run. The GMM model therefore confers support for H2 and H3 primarily via strong negative effects of financial assets and dividend payments on intangibles assets. It is important to note that these results reflect both inter-firm and inter-temporal dynamics. From an inter-firm perspective, our results show that firms which hold more (less) financial assets and make higher (lower) dividend payments, have lower (higher) intangibles. Inter-temporally, our results indicate that the reduced financial activities of Brazilian firms between 2011 and 2016, particularly in terms of financial assets and dividend repurchases, are associated with the higher levels of investment in intangibles observed during this period (see Figure 1).

The third and fourth columns of Table 4 explore the robustness of our results to an alternative parameterisation of the dependent variable, where we consider intangibles intensity, that is, the logarithm of intangibles assets as a proportion of total assets. The results are broadly consistent with our main results in columns (2) and (3) except that repurchases are now significant in the short-run GMM models, conferring further support for *H3*. Our results are therefore robust to normalising intangibles assets by total assets. In Appendix B, we further show the robustness of the model to normalising all variables by total assets and removing total assets as a control variable; again, the results remain consistent across specifications.

The lower panel of Table 4 shows the tests for the validity of our identification strategy in the GMM model. The Arellano–Bond AR(1) tests shows that, for both parameterisation of our dependent variable, there is statistically significant evidence of first-order serial correlation. This is consistent with the model's assumptions; it validates the transformation of the data and the assumption that the unobserved effects are eliminated in a way that introduces an autoregressive structure, thus lending support to the validity of the instruments.[16] The Arellano–Bond AR(2) tests show no evidence of second-order serial correlation in the data; again, this is consistent with the model assumptions, showing the absence of first-order serial correlation in the level variables (Roodman, 2009). The Hansen's J statistic cannot reject the null hypothesis that our instrument sets are exogenous. The number of instruments is 77, which is less than the number of firms. As discussed in Roodman (2009), this is the general rule of thumb for determining the appropriate number of instruments, since too many instruments can bias the coefficients.[17] Overall, our econometric results, robust to alternative methods and specifications, suggest that (i) external finance has no impact on intangibles assets; (ii) financialisation, through high investments in short-term financial assets, crowds out intangibles assets and (iii) financialisation, through shareholder value orientation manifested as high payments of dividends, also reduces intangibles assets.[18]

effect increases with the size of the coefficient of the lagged dependent variable. If the model inherently has no dynamics, then the long-run and short-run estimates will be identical. Thus, the persistence in intangibles means the long-run impact of the variables is larger than the short-run impact.

[16] We are grateful to an anonymous reviewer for highlighting this point.

[17] In unreported regressions, we also find that our GMM model is robust to using orthogonal deviations rather than first differencing, and to reducing the instrument count through collapsing the instrument set (see Roodman, 2009).

[18] It is worth noting the influence of outliers in our data. We found outlier observations for financial profits and dividend payments. Financial profits had a negative and significant effect prior to removing outliers, which became insignificant when outliers were removed. Dividend payments continued to exert a negative influence on intangibles even after the removal of outliers. All the results presented in the paper are those estimated without outlier observations.

4.1 Ancillary analyses: exploring similarities and differences in the effects of financialisation on intangibles and patents

Next, we explore the effects of financialisation on firm's patenting activities. As previously discussed, intangibles capture a broader base of firm's innovativeness, whereas patents have been traditionally used to measure technological innovation especially in manufacturing sectors and in advanced economy contexts. It is therefore important to explore any differences and similarities in the ways in which financialisation influences intangible assets and patents in the DEC context. To do this, we collected patent data manually from the World Intellectual Property Organisation, consisting of the number of patent applications made by each company in a given year. Table 5 shows the descriptive statistics for the patent data. Firms had applied for about 2.6 patents on average, corresponding to about 1% of industry total. The highest number of patent applications for a single firm was 193, corresponding to about 63% of industry patent applications in that year.

The first three columns of Table 6 show our main results from FE and short and long-run GMM models with the logarithm of intangible assets as the dependent variable, as in Table 4. The last column shows results from an OLS regression, where the dependent variable is the total number of patents a firm has applied for in each year as a proportion of the total number of patents applied for by the firms in our sample that are in the same 2-digit industry sector. This measures patent intensity relative to the industry. For consistency with our main regressions, we use one lag of all independent variables.[19,20]

For access to finance the patent results show a positive, but insignificant impact of financial liabilities on patent intensity. For the crowding out channel, the results show that financial assets have a negative, but insignificant impact on patent intensity and financial profits have no impact. For shareholder value orientation, the patents regression shows a negative, but insignificant impact of dividends and a positive, but insignificant impact of repurchases on patent intensity. We use similar control variables as in our main models; these show a negative and significant impact of interest payments, and a positive but insignificant impact of total assets on patent intensity.

Table 5. *Descriptive statistics of patents*

	Mean	SD	Min	Max
Total patents	2.65	14.60	0	193
Patent intensity[a]	0.99	3.18	0	63

[a] Patents as a % of industry total.
Source: Authors calculations using data from the World Intellectual Property Organisation.

[19] In unreported regressions, we use contemporaneous and up to two-year lags of all independent variables, here recognising that it may take longer for financial decisions to be reflected in patent applications. The results are broadly consistent with the ones reported herein, showing no significant relationship between financialisation and patent intensity. We report the model with one lag for consistency and ease of comparison with our main specification.

[20] Results from tobit models for patent intensity show similar results.

Table 6. *The effects of financialisation on patents: exploring differences with intangibles*

	FE	log (Intangibles) GMM Short run	Patent intensity GMM Long run	Patent intensity OLS
log(intangibles)t−1		0.504***		
		(0.092)		
H1—Access to Finance channel				
(FL/TA)t−1	0.005*	0.001	0.002	0.004
	(0.003)	(0.003)	(0.006)	(0.003)
H2—Crowding-out channel				
(FA/TA)t−1	−0.041**	−0.038**	−0.077**	−0.003
	(0.020)	(0.017)	(0.030)	(0.007)
(FP/TP)t−1	−0.0008**	−0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
H3—Shareholder value orientation channel				
(Dividends/equity)t−1	−0.013*	−0.013*	−0.027*	−0.004
	(0.007)	(0.007)	(0.014)	(0.014)
(RepurchaseEquity)t−1	−0.019***	−0.044	−0.088	0.042
	(0.007)	(0.029)	(0.057)	(0.030)
Controls				
(Interest paymentsTA)t−1	0.005	−0.002	−0.004	−0.010***
	(0.006)	(0.005)	(0.011)	(0.003)
log(TA)t−1	1.280***	0.148	0.298	0.388
	(0.374)	(0.644)	(1.308)	(0.341)
2011		0.120		
		(0.331)		
2012	0.067	0.230		0.359
	(0.115)	(0.387)		(0.296)
2013	0.253	0.280		0.817**
	(0.179)	(0.447)		(0.346)
2014	0.169	0.042		0.252
	(0.161)	(0.298)		(0.267)
2015	−0.186	−0.267		0.135
	(0.168)	(0.237)		(0.344)
2016	0.320			0.071
	(0.236)			(0.323)
Observations	410	304		497
R-squared	0.265			0.043
Arellano–Bond test for AR(1)		−1.75*		
Arellano–Bond test for AR(2)		1.411		
Hansen j statistic		63.35		
Hansen *p* value		0.428		
Number of instruments		77		

Notes: Robust standard errors in parentheses.
Source: Regression analyses based on balance sheet data for Brazilian manufacturing firms and data from the World Intellectual Property Office.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Overall, the results suggest that in Brazil patent intensity is not influenced by our indicators of financialisation, at least in the short term. This is in contrast to intangible assets, which are negatively and significantly affected by financialisation, both through the crowding out and shareholder value orientation channel. Previous studies in developed economy contexts have found mixed effects of financialisation on patents. For example, as discussed above, in a sample of thirty-one developed economies, Lee *et al.*, (2020) find that patent quality (measured by citations) declined with financialisation whereas patent quantity (measured by the number of patent registrations) increased. More generally, our results indicate that in the DEC context, patent intensity remains unaffected by financialisation in the short term. As discussed above, this might reflect the different nature of innovation in DECs. Rather than scientific breakthroughs measured with patent data, innovation in DECs involves a wide array of capabilities that enable firms to adapt foreign technologies into local production systems and upgrade them with complementary non-technological inputs (Lall, 1992; Kesidou and Romijn, 2008; Bonizzi *et al.*, 2023).

5. Conclusions

This paper tests the hypothesis that *financialisation*, that is, companies' increased tendency to hold financial assets and generate revenue from financial income rather than their underlying operations, discourages the accumulation of intangible assets. Whilst the phenomenon of financialisation has attracted the attention of political economists, only recently economists of innovation questioned whether '…financialisation transformed the relationships between finance, innovation and growth, and through which channels' (Dosi *et al.*, 2016, p. 14). The empirical literature, which does exist, has largely focused on the impact of finance on the quantity and quality of patents, rather than intangibles, which reflect a much broader and comprehensive measure of innovativeness capabilities more attune to the DEC context.

This paper addresses these gaps by demonstrating that financialisation impacts the accumulation of intangible assets negatively in the context of DEEs, whereas periods of lower financialisation indicators create room for higher-risk expenditures into innovativeness capabilities. The results of the empirical analysis show that both the *crowding-out* channel of financialisation, measured as financial assets relative to total assets, and the *shareholder-value orientation* channel of financialisation, measured as dividend payments relative to equity, have an inverse relationship with the accumulation of intangible assets in Brazil. We find no evidence in support of the *access to finance* channel, namely firms' external debt has no significant impact on intangibles.

The results of this research also suggest that the economic impact of the *crowding-out* channel is larger than the *shareholder-value orientation* channel in the context of Brazil. The accumulation of intangibles is high risk and generates uncertain returns over the long run, whereas investments on financial assets provide short-term returns at lower risk (Arrow, 1962). This negative impact of financialisation on the accumulation of innovative and productive assets might be particularly detrimental for DEEs characterised by structurally higher interest rates and macroeconomic uncertainty, and where high value added, technology-intensive industrial production is essential for the catching up process.

These results, and our finding that periods of lower financial activities by firms might create more room for innovative, capability-creating expenditures, have important implications for policy making. They show that measures that dis-incentivize or restrict such financial activities—including measures that reduce macroeconomic volatility such as capital account management techniques—are an important counterpart to industrial policy in enabling investments into higher-risk, long-term innovative expenditures that promote productive structural change. This research extends our understanding of the constraints on innovation-driven growth in DECs by incorporating insights from the financialisation literature. However, as also highlighted by Davis (2017) in her review of the literature on the financialisation–investment nexus, we still know very little about the underlying behavioural relations and mechanisms, which might cause this negative relationship. Future research should tackle this issue.

Another limitation of our approach is that the ancillary analysis exploring the effects of financialisation on patents did not confirm *H1–H3*, indicating that in Brazil—in contrast to intangibles—patent intensity is not influenced by financialisation. Our research assumes that these differences between financialisation and patents, and financialisation and intangibles, might reflect the different nature of innovation in DECs. Rather than focusing solely on scientific breakthroughs measured with patent data, innovation in DECs involves a wide array of capabilities that enable firms to adapt foreign technologies into local production systems and upgrade them with complementary non-technological inputs (Lall, 1992; Kesidou and Romijn, 2008; Bonizzi *et al.*, 2023). An alternative explanation for these differences could also be the sample size, which might be too small to identify statistically significant effects. Prospective research is needed to confirm the validity of these novel findings.[21]

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Appendix A: Sectoral variations in intangible assets and financialisation variables

There is a good variation of the levels of intangible assets, as well as the financial variables across sectors (see Table A1). Sectors with relatively high intangible assets, on average, are miscellaneous manufacturing (13%) and food manufacturing (10%). Firms engaged in the manufacturing of leather, furniture, paper, beverages and tobacco, and transport equipment all have levels of intangible assets of 3–6% of total assets, consistent with the overall sample average (5%).

For financialisation variables, firms engaged in the manufacturing of Computer and Electronic products and Textiles have the highest level of financial liabilities, more than double their total assets; sectors with the lowest financial liabilities are Beverage and Tobacco (5% of total assets) and Electrical Equipment (3% of total assets). Sectors with highest financial assets are those engaged in the manufacturing of Leather (50% of total assets) and Machinery (47% of total assets). Sectors with the lowest level of financial assets are Paper manufacturing (16% of total assets) and Wood manufacturing (14% of total assets). The highest levels of financial profits relative to total assets are in Apparel manufacturing (163%), Wood manufacturing (87%) and Food manufacturing (85%); sectors with the greatest financial losses are Machinery manufacturing and Paper manufacturing, both making average financial losses of around five times their total assets over the sample period. Sectors that paid the most dividends, on average,

Table A1. *Means of variables by two-digit SIC sector*

Two digit SIC sector	Frequency	% of total	Intangibles/ TA	FL/TA	FA/TA	FP/TP	Dividends/ equity	Repurchase/ equity	Interest payments/TA	log(TA)
Apparel manufacturing	30	7.32	0.031	0.254	0.243	1.631	−0.042	−0.002	5.945	−0.198
Beverage and tobacco product manufacturing	6	1.46	0.051	0.048	0.212	−0.134	−0.192	−0.004	10.157	−0.062
Chemical manufacturing	28	6.83	0.048	0.277	0.269	0.338	−0.032	0	6.692	−0.127
Computer and electronic product manufacturing	5	1.22	0.001	2.262	0.205	0.141	0	−0.066	4.08	−0.132
Electrical equipment, appliance, and Co	6	1.46	0.001	0.032	0.37	−1.674	−0.031	0	3.922	−0.008
Fabricated metal product manufacturing	46	11.22	0.026	0.297	0.296	0.511	−0.021	−0.002	4.818	−0.14
Food manufacturing	50	12.2	0.098	0.35	0.285	0.848	−0.026	−0.013	7.466	−0.197
Furniture and related product manufacturing	9	2.2	0.055	0.204	0.25	−1.711	−0.036	−0.001	6.851	−0.055
Leather and allied product manufacturing	27	6.59	0.058	0.266	0.51	0.218	−0.057	−0.003	6.27	−0.172
Machinery manufacturing	8	1.95	0.009	0.385	0.467	−5.854	−0.069	−0.004	7.964	−0.153
Miscellaneous manufacturing	43	10.49	0.129	0.292	0.351	0.038	−0.03	−0.006	5.508	−0.155
Non-metallic mineral product manufacturing	11	2.68	0.007	0.21	0.27	−1.917	−0.079	0	5.648	−0.174
Paper manufacturing	25	6.1	0.052	0.34	0.157	−4.603	−0.025	−0.001	7.969	−0.092

Table A1. *Continued*

Two digit SIC sector	Frequency	% of total	Intangibles/ TA	FL/TA	FA/TA	FP/TP	Dividends/ equity	Repurchase/ equity	Interest payments/TA	log(TA)
Plastics and rubber products manufacturing	3	0.73	0.002	0.153	0.238	0.587	0	0	4.875	−0.045
Primary metal manufacturing	21	5.12	0.012	0.215	0.245	0.246	−0.018	−0.002	7.483	−0.083
Textile mills	23	5.61	0.005	1.027	0.251	0.254	−0.012	0	4.145	−0.16
Transportation equipment manufacturing	62	15.12	0.049	0.399	0.305	0.174	−0.04	0	6.583	−0.153
Wood product manufacturing	6	1.46	0.000	0.137	0.139	0.875	−0.002	0	6.595	−0.08
Total	410	100	0.052	0.361	0.295	−0.113	−0.034	−0.004	6.29	−0.145

are Beverage and Tobacco (19% of total assets), Non-metallic Mineral Products (8% of total assets), and Machinery manufacturing (7% of total assets); sectors that paid no dividends over the sample period are Plastics and Rubber manufacturing and Computer and Electronic product manufacturing. Sectors with the highest equity repurchases are Computer and Electronic Product manufacturing (6.6% of total assets) and Food manufacturing (1.3% of total assets), whereas various sectors made no repurchases over the sample period, including those engaged in the manufacturing of Non-metallic Mineral Products, Electrical Equipment, Textiles, Wood and Plastics and Rubber.

Appendix B: Robustness to normalising by total assets

	FE			GMM					
	(1)	(2)	(3)	(4)		(5)		(6)	
	Log intangibles	Log (intangibles/TA)	Fully normalised by TA	Log intangibles		Log (intangibles/TA)		Fully normalised by TA	
				Short run	Long run	Short run	Long run	Short run	Long run
$Log(intangibles)_{t-1}$				0.504*** (0.092)					
$Log(intangibles/TA)_{t-1}$						0.492*** (0.114)		0.447*** (0.130)	
$(FL/TA)_{t-1}$	0.005* (0.003)	0.003 (0.002)	0.001 (0.002)	0.001 (0.003)	0.002 (0.006)	0.001 (0.003)	0.001 (0.007)	0.001 (0.003)	0.002 (0.005)
$(FA/TA)_{t-1}$	−0.041** (0.020)	−0.039* (0.021)	−0.037* (0.021)	−0.038** (0.017)	−0.077** (0.030)	−0.036*** (0.013)	−0.071*** (0.021)	−0.038** (0.017)	−0.069*** (0.022)
$(FP/TP)_{t-1}$	−0.0008** (0.000)	−0.0008** (0.000)		−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)		
$(FP/TA)_{t-1}$			−0.000 (0.000)					−0.000 (0.000)	−0.000 (0.000)
$\left(\frac{Dividends}{Equity}\right)_{t-1}$	−0.013* (0.007)	−0.012* (0.006)		−0.013* (0.007)	−0.027* (0.014)	−0.013*** (0.005)	−0.026** (0.012)		
$\left(\frac{Dividends}{TA}\right)_{t-1}$			−0.030 (0.019)					−0.030* (0.017)	−0.054 (0.037)
$\left(\frac{Repurchase}{Equity}\right)_{t-1}$	−0.019*** (0.007)	−0.018** (0.008)		−0.044 (0.029)	−0.088 (0.057)	−0.042* (0.025)	−0.082 (0.053)		
$\left(\frac{Repurchase}{TA}\right)_{t-1}$			−0.055** (0.024)					−0.116 (0.090)	−0.210 (0.155)
$\left(\frac{Interest\ Payments}{TA}\right)_{t-1}$	0.005 (0.006)	0.003 (0.006)	0.005 (0.006)	−0.002 (0.005)	−0.004 (0.011)	−0.002 (0.006)	−0.003 (0.011)	−0.001 (0.004)	−0.001 (0.007)

	FE			GMM					
	(1)	(2)	(3)	(4)		(5)		(6)	
	Log intangibles	Log (intangibles/TA)	Fully normalised by TA	Log intangibles		Log (intangibles/TA)		Fully normalised by TA	
				Short run	Long run	Short run	Long run	Short run	Long run
$Log(TA)_{t-1}$	1.280***	0.465*		0.148	0.298	0.153	0.301		
	(0.374)	(0.265)		(0.644)	(1.308)	(0.769)	(1.518)		
2011				0.120		0.007		0.064	
				(0.331)		(0.377)		(0.125)	
2012	0.067	0.122	0.091	0.230		0.163		0.216**	
	(0.115)	(0.101)	(0.106)	(0.387)		(0.401)		(0.102)	
2013	0.253	0.367**	0.306*	0.280		0.274		0.321**	
	(0.179)	(0.168)	(0.159)	(0.447)		(0.448)		(0.156)	
2014	0.169	0.339**	0.230	0.042		0.106		0.139*	
	(0.161)	(0.157)	(0.166)	(0.298)		(0.330)		(0.081)	
2015	−0.186	0.283*	0.135	−0.267		0.060		0.085	
	(0.168)	(0.167)	(0.175)	(0.237)		(0.262)		(0.070)	
2016	0.320	0.461**	0.069						
	(0.236)	(0.231)	(0.193)						
Observations	410	410	410	304		304		304	
R-squared	0.265	0.144	0.132						
Arellano–Bond test for AR(1)				−1.75*		−1.69*		−1.66*	
Arellano–Bond test for AR(2)				1.411		1.233		1.180	
Hansen j statistic				63.35		55.29		55.50	
Hansen p value				0.428		0.714		0.418	
Number of instruments				77		77		68	

Notes: Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.