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A Multi-Sectoral Approach to Financialisation

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Abstract

We present a multi-sectoral assessment of financialisation based on Input-Output analysis. Our main innovation consists in introducing financialisation as *an increase in financial content per unit of output produced*. In this way, we can investigate changes in relative importance of financial activities taking into account interactions among sectors. Using a 15 and 14-sector level of aggregation, we study the United States and Brazilian experiences for the period 1947-2015 and 1995-2011, respectively. Although methods focusing on the disaggregation of Input-Output tables have been largely explored in past decades, they have received limited attention in the literature on financialisation. We aim to refocus on multisectoral issues by offering a simple structure of analysis to assess the interconnections between the real and financial sides of the economy.

Keywords: Financialisation; Financial intermediation; Input-Output; United States; Brazil.

JEL: G20; O11; O14; O33

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1 Introduction

The term *financialisation* remains an unclear concept in social science. Over the years, it has been interpreted in varying ways, resulting in different research strands across a range of academic disciplines. Even though a precise concept varies considerably across analysis, the shared premise is that the relative size of the financial sector has grown significantly in the last three decades. Broader speaking, financialisation can be understood as an increase in prominence of finance in the economy, or the "increasing role of financial motives, financial markets, financial actors and financial institutions in the operations of the domestic and international economies" (Epstein, 2005, p. 3).

The recent financial crisis has reminded us that financial markets and intermediaries have significant effects on the real economy. From a multisectoral perspective, the financial sector matters because it connects the entire productive structure through financial intermediation. The interconnection between financial and non-financial structures is one of the mechanisms through which the strengths and vulnerabilities of economic activity are transmitted. Hence, understanding how those interdependencies differ across sectors and time is essential to a better comprehension of the financialisation process itself.

Early discussions on the relation between finance and the productive structure go back to classical economists such as Adam Smith and Karl Marx. Key subsequent contributions include Hilferding's (1910) view of an emerging fusion of financial and industrial motives, further extended by Hymer (1960) to an international set up. More recently, several studies have addressed the correspondence of the financial sphere with the macroeconomic environment (Keen, 1995; Skott and Ryo, 2008; Sordi and Vercelli, 2014), investment dynamics (Stockhammer, 2004; Orhangazi, 2008; Davis, 2017), income distribution (Lin and Tomaskovic-Devey, 2013; Jaumotte et al, 2013; Dünhaupt, 2017), and innovation (Mazzucato, 2003; Mazzucato and Tancioni, 2012).

This article presents a multi-sectoral assessment of financialisation based on Input-Output (IO) analysis. Our contribution joins other efforts to provide integrated financial information at the sectoral level in order to assess the interconnections between the real and financial sides of the economy. IO models have been used for many decades to measure sectoral interdependencies, compare the structure of economies, quantify structural and productivity changes, etc. Our main innovation consists in conceptualise financialisation as *an increase in the financial content in monetary terms of each unit of output produced*. In this way, we can investigate changes in relative importance of financial activities taking into account the interaction among sectors.

Using a 15 and 14-sector level of aggregation, we apply our methodology to the UnitedStates (US) and Brazil for the period 1947-2015 and 1995-2011, respectively. There is a certain consensus in the literature that the US has experienced a financialisation process after the 1980s. Nevertheless, our results show that once we move on to a more disaggregated set up two different dynamics emerge. First, traditional activities such as agriculture, mining or manufacture show an inverted-U relationship with a reduction in their financial content in recent decades. This contrasts with service industries for which there is a positive trend that increased its slope after the 1980s. Furthermore, once we aggregate all sectors, we can partially reproduce well know results indicating an increase in the importance of the financial sector in the last thirty-five years.

On the other hand, the literature on financialisation in developing countries is relatively has pointed out more complex phenomenon. While there is no consensus about Brazil going

or not through a financialisation process, our analysis shows that the Brazilian economy did not exhibit an increase in the financial content of its production. On the contrary, for most sectors, there is a reduction in their financial coefficients especially between 1995 and 1997. A possible explanation lies in the control of inflation that followed the macroeconomic stabilisation plan "Plano Real" which diminished the need for financial protection against inflation. Still, there is some degree of heterogeneity among sectors that emphasises the importance of analysis at a more disaggregated level.

Although methods focusing on the disaggregation of IO tables have been largely explored, they have received limited attention in the literature on financialisation. This article aims to refocus on multisectoral issues by offering a simple structure of analysis, and calling for a new wave of developments in this direction. The paper is organised as follows. In the next section, we present a brief review of the original IO model and the indicators we are going to use in our analysis. Section 3 brings our conceptualisation of financialisation. In section 4, we study the cases of the United States and Brazil. Some final considerations follow.

2 IO analysis

IO models (Leontief, 1936; 1941) have been used for many decades to measure from sectoral interdependencies and structural change to energy content of commodities, estimation of CO_2 emissions, etc.[1] In this section, we revisit some of the main elements of this framework giving particular emphasis to the indicators we are going to further use in our analysis.

The mathematical structure of an Input-Output system consists of a set of n linear equations with n unknowns. Denote by x_i total output of sector i, z_{ij} sector j's demand for inputs from sector i, and f_i total final demand of sector i, all of which in monetary terms. Therefore, for each given period, we have:

$$x_i = \sum_{j=1}^{n} z_{ij} + f_i \tag{1}$$

where Eq. (1) represents the way in which sector i distributes its product through sales to other sectors and to final demand.

There will be a similar equation for each of the n sectors so that the information on the distribution of each sector's sales can be summarised in matrix notation as:

$$\mathbf{x} = \mathbf{Z}\mathbf{i}_1 + \mathbf{f} \tag{2}$$

where $\mathbf{x} = \{x_i\}$ is a $n \times 1$ vector that stands for total production, $\mathbf{Z} = \{z_{ij}\}$ is a $n \times n$ matrix that captures the direct magnitudes of the inter-industry flows, $\mathbf{i}_1$ corresponds to a $n \times 1$ vector of 1's, and $\mathbf{f} = \{f_i\}$ is a $n \times 1$ vector of final demands.

[1] A comprehensive review of the fundamental structure of the Input-Output model and its main applications can be found in Miller and Blair (2009). IO models were to a Social Account Matrix (SAM) framework in order to incorporate households, financial and non-financial corporations, government, and the rest of the world. However, the main disadvantage of SAM tables is that only a few statistical offices provide them. Moreover, the use of fixed coefficients beyond the production sphere is also questionable (Polo and Valle, 2012). For this reason, our analysis uses the IO set up in its simplest form. Chen et al. (2005) provide a discussion about the inclusion of financial assets in the original IO model. A review of countries for which SAMs including financial institutions exist is available in Aray et al. (2017).

A fundamental assumption in IO analysis is that inter-industry flows from i to j for a given period depend entirely on total output of sector j for that same time period. Making use of z_{ij} and x_j, we define the respective technical coefficient as:

$$a_{ij} = \frac{z_{ij}}{x_j} \tag{3}$$

so that the sectoral use of inputs occurs in fixed proportions.[2] Each technical coefficient a_{ij} can be interpreted as the direct content of any particular sector i for each dollar produced of j. Suppose, as an example, that sector j used \$250 of goods from sector i to produce \$1000 of sector j's output. Hence, the direct content of i in j is $250/1000 = 0.25$.

However, this does not tell us much about the total content of each productive activity because pure technical coefficients do not take into account the interaction between sectors, i.e. direct and indirect effects. Define $\mathbf{A} = \{a_{ij}\}$ the $n \times n$ matrix of technical coefficients as in Eq. (3). Therefore, we can rewrite Eq. (2) as $\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{f}$. As long as $\det(\mathbf{I} - \mathbf{A}) \neq 0$, it immediately follows that:

$$\mathbf{x} = \mathbf{L}\mathbf{f} \tag{4}$$

where $\mathbf{L} = \{l_{ij}\} = (\mathbf{I} - \mathbf{A})^{-1}$ is known as the Leontief inverse or total requirements matrix. Contrasting with $\mathbf{A}$, the Leontief inverse captures both direct and indirect magnitudes of inter-industry flows. Each element of $\mathbf{L}$ corresponds to total input by industry required (directly and indirectly) in order to deliver one dollar of industry output to final users.

There are many useful applications in which the IO table is divided into two or more strategic industry groups. In the present study, we are interested in the relation of the financial sector with the remaining sectors of the productive structure. Using Miyazawa (1976, p. 59-65) partition method, the matrix $\mathbf{A}$ can be decomposed as follows:[3]

$$\mathbf{A} = \begin{bmatrix} \mathbf{A}_{RR} & \mathbf{A}_{RF} \\ \mathbf{A}_{FR} & \mathbf{A}_{FF} \end{bmatrix} \tag{5}$$

where $\mathbf{A}_{RR}$ is a $(n-1) \times (n-1)$ matrix of direct coefficients showing non-financial inputs used by non-financial industries; $\mathbf{A}_{RF}$ is a $(n-1) \times 1$ vector that captures non-financial inputs used by the financial sector; $\mathbf{A}_{FR}$ corresponds to a $1 \times (n-1)$ vector showing direct financial content in the remaining industries, and $\mathbf{A}_{FF}$ gives financial requirements of the financial sector. It can be showed that the matrix of direct and indirect contents becomes:

$$\mathbf{L} = \begin{bmatrix} \mathbf{L}_1 & \mathbf{L}_2 \\ \mathbf{L}_3 & \mathbf{L}_4 \end{bmatrix} \tag{6}$$

with

$$\begin{aligned} \mathbf{L}_h &= \mathbf{L}_h\left([\mathbf{I} - \mathbf{A}_{RR}]^{-1}, \mathbf{A}_{RF}, \mathbf{A}_{FR}, [\mathbf{I} - \mathbf{A}_{FF}]^{-1}\right) \\ \frac{\partial \mathbf{L}_h}{\partial (\mathbf{I} - \mathbf{A}_{RR})^{-1}} &> 0; \quad \frac{\partial \mathbf{L}_h}{\partial \mathbf{A}_{RF}} > 0; \quad \frac{\partial \mathbf{L}_h}{\partial \mathbf{A}_{FR}} > 0; \quad \frac{\partial \mathbf{L}_h}{\partial (\mathbf{I} - \mathbf{A}_{FF})^{-1}} > 0 \\ h &= \{1, 2, 3, 4\} \end{aligned}$$

[2] The underlying production function is given by $x_j = \min\left\{\frac{z_{1j}}{a_{1j}}; ...; \frac{z_{ij}}{a_{ij}}; ..; \frac{z_{nj}}{a_{nj}}; v_j\right\}$, where v_j corresponds to value-added payments. For $a_{ij} \neq 0$ these ratios will all be the same and equal to x_j. On the other hand, $a_{ij} = 0$ imply that $\frac{z_{ij}}{a_{ij}}$ will be infinitely large and, hence, will be overlooked in the process of searching for the smallest among the ratios.

[3] A similar application of Miyazawa partition method to a SAM framework that includes the financial sector is provided by Leung and Secrieru (2012).

The last two sub-matrices, $\mathbf{L}_3$ and $\mathbf{L}_4$, correspond to total (direct and indirect) financial requirements to produce one unit of output of each productive sector and the financial sector, respectively. Even though the disaggregation itself is quite tedious from the algebraic point of view, it comes with an important economic intuition. First, we have that total financial content is a positive function of total requirements of the financial sector itself, $(\mathbf{I}-\mathbf{A}_{FF})^{-1}$. Secondly, the interaction between finance and the remaining industries matters (see $\mathbf{A}_{FR}$ and $\mathbf{A}_{RF}$). Third, the interactions among industries net of finance, $(\mathbf{I}-\mathbf{A}_{RR})^{-1}$, also have a positive relationship with total financial content. Finally, the correspondence between each of those components has to be taken into account. This means that total financial content might increase even if direct content remains constant (or decreasing!) as long as there is an increase in the interaction between the other sectors.

Pure indirect requirements can be obtained multiplying direct by total content:

$$\mathbf{B} = \mathbf{A}(\mathbf{L} - \mathbf{I}) \tag{7}$$

with $\mathbf{B} = \{b_{ij}\}$ as the respective matrix of indirect requirements.

When a particular sector increases its production, there is an increase in demand for inputs from other sectors. We refer to this demand as backward-linkages. A sector with comparatively higher backward-linkages indicates that an expansion of its production induces a higher increase in other productive activities. This is easy to see looking to the columns of the Leontief inverse matrix. Formally, for a given sector j the magnitude of its backward linkages can be computed as:

$$backward_j = \sum_{i=1}^{n} l_{ij} \tag{8}$$

that is, the sum of rows of column j from the total requirement matrix, also refereed as "output multiplier".[4]

On the other hand, an increase in production by other industries leads to additional output required from each sector. We refer to it as forward-linkages. A relative higher index of forward-linkages indicates that production in that sector is more sensitive to changes in other sector's output. Formally, for a given sector i the magnitude of its forward linkages can be represented by:

$$forward_i = \sum_{j=1}^{n} l_{ij} \tag{9}$$

that is, the sum of columns for row i from the Leontief inverse matrix.

A slight modification of Eq. (4) allows us to identify how activities of each sector i are distributed among industries j. Define $\mathbf{C} = \{c_{ij}\}$ as a $n \times n$ operator matrix that rearranges the right side of (4) so that each element of $\mathbf{C}$ corresponds to the interaction of the respective element of the technical coefficient matrix with final demand. That is:

$$\mathbf{C} = \mathbf{L}\widehat{\mathbf{f}} \tag{10}$$

[4]One should mention that this is not the only way to estimate backward and forward linkages and different indicators have been proposed in the literature. A comprehensive discussion is provided by Miller and Blair (2009, p. 555-565). For a recent application see Borghi (2017).

where $\widehat{\mathbf{f}}$ is the diagonal matrix of final demands. Dividing c_{ij} by the sum of columns of its respective row i, we have:

$$d_{ij} = \frac{c_{ij}}{\sum_{j=1}^{n} c_{ij}} \tag{11}$$

The $n \times n$ matrix $\mathbf{D} = \{d_{ij}\}$ indicates how activities of each sector i are distributed among industries j. Suppose, as an example, that $d_{ij} = 0.3$ or 30%. This means that 30% of the activities of i are concentrated in j. It follows that the diagonal of $\mathbf{D}$ indicates the level of vertical integration of the branch. The production process takes place entirely within the branch itself the closer the value of d_{ii} is to 1. Needless to say, each row of the matrix adds to one. The interpretation is similar to the subsystem approach put forward by Momigliano and Siniscalco (1982) and recently rescued by Montresor and Marzetti (2010; 2011).[5]

In the next section, we use the indicators revisit here to understand financialisation from a multi-sectoral perspective. Such structure of analysis can be employed to study different varieties and financialisation paths.

3 From financial content to financialisation and structural change

As in the case of globalisation, industrialisation, and many other words terminating with the suffix "-isation", financialisation designates a particular type of structural change characterised by increasing weight and importance of the thing or quality preceding the suffix, in this case, the financial sector (Vercelli, 2013). Such transformation frequently is attributed to a process that involves the liberalisation of financial markets, the increasing complexity of financial intermediation, the rise of shareholder value orientation, changes in policy orientation, etc (see, for example, Epstein, 2005; Palley, 2013).

One should notice, however, that methods focusing on sectoral disaggregation have received limited attention in the financialisation literature. This is quite surprising given that the interconnection between financial and non-financial structures is a mechanism through which the strengths and vulnerabilities of economic activity are transmitted. Understanding how those interdependencies differ across sectors and time might prove relevant to a better comprehension of the financialisation process itself. Moreover, data on IO tables are available for a large number of countries which allows valuable comparisons between different economic systems.

[5]Notice that $\mathbf{D}$ does not depend on relative prices. Denoting with $\bar{\mathbf{x}}$, $\bar{\mathbf{A}}$, and $\bar{\mathbf{f}}$ values expressed in physical quantities while $\hat{\mathbf{p}}$ is a a diagonal matrix of prices, we can rewrite it as:

$$\begin{aligned}
\mathbf{D} &= \hat{\mathbf{x}}^{-1}(\mathbf{I} - \mathbf{A})^{-1}\hat{\mathbf{f}}^{-1} \\
&= \left(\hat{\bar{\mathbf{x}}}^{-1}\hat{\mathbf{p}}^{-1}\right)\left(\mathbf{I} - \hat{\mathbf{p}}\bar{\mathbf{A}}\hat{\mathbf{p}}^{-1}\right)^{-1}\left(\hat{\mathbf{p}}\hat{\bar{\mathbf{f}}}\right) \\
&= \left(\hat{\bar{\mathbf{x}}}^{-1}\hat{\mathbf{p}}^{-1}\right)\hat{\mathbf{p}}(\mathbf{I} - \bar{\mathbf{A}})^{-1}\hat{\mathbf{p}}^{-1}\left(\hat{\mathbf{p}}\hat{\bar{\mathbf{f}}}\right) \\
&= \hat{\bar{\mathbf{x}}}^{-1}(\mathbf{I} - \bar{\mathbf{A}})^{-1}\hat{\bar{\mathbf{f}}}
\end{aligned}$$

Therefore, $\mathbf{D}$ is invariant to relative prices.

Following the recent contributions of Krippner (2005) and van der Zwan (2014), one could differentiate between four main approaches to financialisation. On the one hand, there is a traditional perspective on long-term economic change concerned with what is produced in the economy. On the other hand, financialisation can be treated as a regime of accumulation of its own in which profits accrue primarily through financial channels. A third approach examines the role of shareholder value orientation as a guiding principle of corporate behaviour. Finally, a last group of scholars has adopted a cultural perspective, emphasising the encroachment of finance in the realms of everyday life.

In this section, we provide a simple structure of analysis that aims to capture the rise mentioned above of financial activities taking into account the interactions between sectors embedded in the IO tables. To the extent that we investigate financialisation through the lens of IO tables and interpret the latter as reflecting the technology available and used at a specific moment by a particular economy, our contribution belongs to the first group. Still, we do not claim that our approach is more fundamental or superior to existing ones though it indeed emphasises two main elements (i) changes in relative importance, and (ii) interactions among sectors.

We conceptualise financialisation as *an increase in the financial content in monetary terms of each unit of output produced*. Our motivation is quite simple. If we are to capture the relative importance of the financial sector looking at the productive structure of the economy, one should investigate the interrelations among firms and industries about possible trends towards certain combinations. Every dollar generated on each particular sector reflects a combination of inputs from other sectors. Assessing these combinations permit us to investigate their relative importance in production.[6]

Let us consider, for example, an agricultural society. The respective IO table displays the low degree of complexity of its productivity structure, with few interactions among industries and mostly concentrated in primary activities. In a traditional setup, as this society moves on to an industrial arrangement, the interconnections among sectors are expected to increase, and production starts to rely more on manufacture activities. This, of course, is followed by an increase in the importance of manufacture inputs per unit of output produced. Agriculture input flows might continue to rise, but its relative importance reduces over time.

Analogously, it is quite reasonable to expect the rise of services to re-shape the economic system in such a way that each dollar produced reflects those changes. Still, services are a vast category that aggregates very different activities. There is no reason to believe *a priori* that the relative importance of different service industries should change in similar ways, and probably there are also different implications regarding growth, employment, labour productivity, etc. Given the importance of the financial sector in interconnecting different productive activities through financial intermediation, assessing how much this economy relies on financial inputs might tell us something about the relative importance of the financial sector to this economy. In this respect, the IO framework is useful because

[6]Variations in the financial side of economic decisions could be addressed using the methodology currently applied in the deindustrialisation/tertiarisation literature that focuses on the effects of inter-sectoral linkages on employment and output shares (e.g Peneder et al, 2003; Montresor and Marzetti, 2011; Ciriaci and Palma, 2016; Peneder and Streicher, 2017). However, we make the case that the two of them reflect more profound changes in the composition of production itself since, from the IO model, they are the result of changes in technical coefficients and final demand. Therefore, even though recognising the importance of those contributions, we take a different route.

it provides the tools to investigate those relations.

Different sectors use financial services in different proportions, and their content might vary differently over time. Hence, we are particularly interested in the dynamics behind matrices **A** and **B** introduced in the previous section. While from the former it is possible to obtain the direct content of financial services in each productive sector, the latter allows us to measure indirect requirements to deliver one dollar of industry output to final users. In this respect, our exercise shares many similarities with the so-called Structural Decomposition Analysis (SDA) defined in the nineties as "the analysis of economic change by means of a set of comparative static changes in key parameters in an input-output table" (Rose and Chen, 1991, p. 3).[7]

Direct and indirect content measures are technical coefficients, and as such, reflect the technology available and used by a particular economy at a specific moment in time. An increase in financial content means that the correspondent production technique has become more financial-dependent using more intensively financial inputs. Such an increase in how much production depends on finance is what we address as financialisation.

In the next section, we apply the structure of analysis developed here to the United States and Brazilian economies. There is some consensus that the US has gone through a financialisation process in the second half of the twentieth century. Applying our conceptualisation to this case enables us to show how it reproduces well-known results as well as the novelties that come with it. In what concerns the Brazilian economy, our outcomes are entirely new.

4 An application to the US and Brazil

Financialisation research has focused initially on the United States experience, but the concept has been increasingly applied to emerging economies. There is abundant literature stressing the particularities of individual country experiences and some recent attempts to compare trajectories also with developing economies (e.g. Bonizzi, 2013; Karwowsky and Stockhammer, 2017). Throughout this article, by the financial sector, we mean finance, insurance, and real estate activities that form the FIRE acronym. We chose to work with the entire FIRE industries because a substantial part of the financialisation literature uses it as the primary reference.

The widespread availability of digital computers has made the use of the IO framework a widely applied tool for economic analysis. Our database takes 15-sector level of aggregation for the US and comprehends the period 1947-2015. For the Brazilian economy, we use a 14-sector level of aggregation for the period 1995-2011. We consider that this level of aggregation allows us to address sectoral heterogeneity while keeping the analysis as simple as possible. Differences in the number of sectors between the US and Brazil correspond to "Wholesale and Retail trade" that in the former constitute two different sectors while in the latter they are a single one.

Data was provided by the Bureau of Economic Analysis (BEA) and the Organisation for Economic Co-operation and Development (OECD). We use Input-Output tables that

[7] In most of SDA formulations, changes in the Leontief matrix are described as some "technological change", which is often interpreted to include any factor that causes a change in a technical coefficient (Rose and Casler, 1996). This includes true technological change, technical substitution in response to input price changes, scale effects, etc.

rely on matrices of inter-industrial flows of goods and services produced domestically and imported. The time span was chosen given data availability. Because changes in technical coefficients take long periods of time, one should expect a more clear picture of the main trends for the United States. This was indeed the case though we were still able to capture significant changes for Brazil during the 17 years for which data was available.

OECD and BEA Input-Output tables are not directly comparable for at least two reasons. First, they use a different structure of aggregation. Secondly, they also have a different price structure. OECD uses basic prices while BEA makes use of production prices. In order to overcome the first problem, we adjust OECD data to approximate the BEA format. The correspondence criteria between both sources are provided in the appendix. Unfortunately, we do not address the second issue here.[8] Hence, comparisons between both countries require some caution.

We begin establishing the main trends and trajectories observed at a sectoral level for the United States and Brazil. The lowess non-parametric procedure with a bandwidth of 0.25 emphasises the main trends. Aggregate results are also provided weighting each industry accordingly to its share in total output. Last but not least, we investigate how financial activities are distributed among the productive structure.

4.1 *Some comments on data distortions*

How to measure the participation of finance in production is an interesting topic considering that modern economies produce less measurable outputs than the traditional manufacturing, mining, and agriculture (Nakamura, 2010; Pagano, 2014). For instance, Mazzucato and Shipman (2014) have recently shown that the increased size and influence of financial institutions has widened the scope of divergence between value-creation and value-added. Distortions are mainly due to overstating the financial sector's value-added or counting some purely rent-seeking activity as productive.

In the United States and Brazil, the official System of National Accounts (SNA) includes as financial activities: financial intermediation, insurance, pension funds, and other activities such as administration of financial markets. Assa (2016) provides a comprehensive narrative on the treatment of financial services in national accounting and the distortions created by financialisation in the US. Precisely, in what concerns financial services, three types of activities are performed by the financial industry, namely (i) services for which banks explicitly charge a fee; (ii) financial intermediation resulting in net interest income; and (iii) capital gains or dealing profits from spot trading.

These three major types of financial services also received different treatments in national accounts. The first of them is considered productive and is included as value-added. The second one is treated as an input to other industries while the last one is excluded *a priori* from the production accounts. There seems to be a consensus regarding the exclusion of capital gains from value-added accounting since there is no productive activity associated with them. The other two groups, however, are more controversial. In his book,

[8]The alternative would be to use OECD tables for Brazil and US. However, this implies a massive loss of data since the OECD series are available only after 1995. Still, we should mention that even though not straightforward comparable in levels, cautious comparisons of trends might be useful. This is particularly true in the case of financial concentration (matrix $\mathbf{D}$) which is independent of relative prices, as showed in Section 2.

Assa argues that the inclusion of services for which banks charge fees as value-added is responsible for inflating Gross Domestic Product (GDP) by the same amount.

The total output of a sector j is given by the sum of its valued-added and inputs used in production. As briefly discussed in the previous paragraphs, distortions in national accounts seem to be related to how we measure financial value-added. This brings some interesting implications. Divide the IO table between financial and non-financial sector. From Eq. (5), and making use of (3), technical coefficients are such that:

$$\mathbf{A}_{RR} = \mathbf{Z}_{RR}\hat{\mathbf{x}}_R^{-1} \tag{12}$$
$$\mathbf{A}_{RF} = \mathbf{Z}_{RF}\mathbf{x}_F^{-1} \tag{13}$$
$$\mathbf{A}_{FR} = \mathbf{Z}_{FR}\hat{\mathbf{x}}_R^{-1} \tag{14}$$
$$\mathbf{A}_{FF} = \mathbf{Z}_{FF}\mathbf{x}_F^{-1} \tag{15}$$

where $\mathbf{Z}_{RR}$ is a $(n-1)\times(n-1)$ matrix that captures direct magnitudes of inter-industry flows outside the financial sector; $\mathbf{Z}_{RF}$ corresponds to a $(n-1)\times 1$ vector for non-financial inputs used by the financial sector; $\mathbf{Z}_{FR}$ is a $1\times(n-1)$ vector that stands for inter-industry flows going from the financial sector to the remaining sectors of the economy; $\mathbf{Z}_{FF}$ gives financial inputs used by the financial sector itself; $\mathbf{x}_R$ is a $1\times(n-1)$ vector of non-financial total output such that $\hat{\mathbf{x}}_R$ stands as the respective $(n-1)\times(n-1)$ diagonal matrix; and finally, $\mathbf{x}_F$ corresponds to financial total output. Furthermore:

$$\mathbf{x}_R = \mathbf{i}_2^T\mathbf{Z}_{RR} + \mathbf{Z}_{FR} + \mathbf{V}_R \tag{16}$$
$$\mathbf{x}_F = \mathbf{Z}_{RF}^T\mathbf{i}_2 + \mathbf{Z}_{FF} + \mathbf{V}_F \tag{17}$$

such that $\mathbf{V}_R$ is a $1\times(n-1)$ vector that captures value-added of non-financial activities and $\mathbf{V}_F$ corresponds to financial value added. Finally, $\mathbf{i}_2$ corresponds to a $(n-1)\times 1$ vector of 1's.

Suppose the aforementioned critique is correct and $\mathbf{V}_F$ has been overvalued in the SNA. This means that the true $\mathbf{V}_F$ and $\mathbf{x}_F$ are lower. Hence, technical coefficients $\mathbf{A}_{RF}$ and $\mathbf{A}_{FF}$ are potentially biased downwards. This is clear if we substitute Eqs. (17) in (13) and (15), and compute the partial derivative on $\mathbf{V}_F$:

$$\frac{\partial \mathbf{A}_{RF}}{\partial \mathbf{V}_F} = -\mathbf{Z}_{RF}[(\mathbf{Z}_{RF}^T\mathbf{i}_2 + \mathbf{Z}_{FF} + \mathbf{V}_F)^{-1}]^2 < 0 \tag{18}$$
$$\frac{\partial \mathbf{A}_{FF}}{\partial \mathbf{V}_F} = -\mathbf{Z}_{F}[(\mathbf{Z}_{RF}^T\mathbf{i}_2 + \mathbf{Z}_{FF} + \mathbf{V}_F)^{-1}]^2 < 0 \tag{19}$$

If distortions are increasing in time, financial value-added is expected to exhibit a positive trend bias which in turn implies that direct and indirect financial content would have a negative trend bias. This means our exercise comes with a disadvantage and an advantage. First, if we do not find an increase in financial content, this does not necessarily mean that there is no financialisation. Nevertheless, whenever we can find an increase in financial content, we can ascertain that something significant is going on deep in the structure of the economy that requires careful analysis. That is, for those cases in which we do find an increase in financial content, we can say more confidently that there is an increase in the importance of the financial sector *vis* a *vis* the rest of the economy.

Naturally, the existence of such distortions is also debatable and one might disagree about the relevance of the critique. In that case, if there is no distortion in $\mathbf{V}_F$, our

coefficients are strictly correct. Still, one might speculate how different financial content trajectories would be if we give a different treatment to financial value added. Hence, in order to provide a more robust analysis, we investigate some implications of manipulating $\mathbf{V}_F$. Motivated by the discussion provided by Assa (2016), we repeat our exercise making all FIRE incomes as intermediate inputs to the rest of the economy.

Our strategy consists in redistributing financial value-added – as reported in the SNA – so that it enters the IO table exclusively as inputs. In this way, we are artificially setting financial value-added to zero while we are able to maintain the consistence of IO tables. The three crucial variables to change are $\mathbf{Z}_{FR}$, $\mathbf{Z}_{FF}$, and $\mathbf{V}_F$, that are now given by:

$$\begin{aligned}\tilde{\mathbf{Z}}_{FR} &= \mathbf{Z}_{FR} + \mathbf{Z}_{FR}\hat{\mathbf{s}} \\ \tilde{\mathbf{Z}}_{FF} &= \mathbf{Z}_{FF} + \mathbf{Z}_{FF}s_{ii} \\ \tilde{\mathbf{V}}_F &= 0\end{aligned}$$

where $\hat{\mathbf{s}} = \{s_{ij}\}$ is a $(n-1) \times (n-1)$ diagonal matrix with $s_{ii} = \mathbf{V}_F / \sum_{j=1}^{n} z_{Fj}$, i.e. the ratio between FIRE's value-added and the sum of all financial inputs before redistribution. We expect this second modified set up to deliver greater financial content coefficients. It corresponds to an extreme scenario that has a complementary role in our analysis showing if, in the limit, distortions in $\mathbf{V}_F$ have more influence in levels or trends. Finally, notice that independently of the treatment given to financial value-added, our concentration and vertical integration indicators remain the same (see matrix $\mathbf{D}$). This is quite obvious from Eq. (11) where we can see that this manipulation multiplies numerator and denominator by the same value.

4.2 *United States*

Different sectors present different trajectories for the evolution of financial content per unit of output. We identify two main trends and divide the productive structure accordingly into two groups. The first of them – formed by traditional activities such as "Agriculture, forestry, fishing and hunting" (from now on just Agriculture), "Mining", "Utilities", "Construction", and "Manufacture" – seems to follow an inverted-U path. On the other hand, the remaining sectors form a second group of mainly service industries with an almost permanent increase in financial content. Therefore, we divide our analysis into two parts. After covering the trajectories of both groups, we aggregate the economy and further investigate the degree of vertical integration of the financial sector.

4.2.1 *Traditional activities*

Direct content Let us start with the first group of industries. In what concerns direct content, Fig. 1 shows that "Agriculture" experienced an increase from the 1960s to late 1980s that was entirely afterwards. A similar trajectory is observed for "Mining" but with a peak in the early 1960s. "Construction" showed its higher financial content around 1983 while "Utilities" and "Manufacture" presented an increase in direct content until the beginning of the twenty-first century. In this last two cases, such a positive trend was dramatically reversed after 2001. After the global financial crisis of 2007, direct content returned to its 1950s levels.

[FIGURE 1]

One should also pay attention to the magnitudes involved. Looking at our preferred measure of direct financial content, coefficients for "Agriculture" were close to 0.05 until 1962. In the next twenty years, there was an increase to 0.08. Such trajectory was reversed with a similar speed so that, by 2000, direct content had returned to its initial levels. "Mining"started from a similar position with its coefficient increasing up to 0.15, the highest of the group. From the 1970s onward, this technical coefficient has been shrinking to even lower magnitudes than in 1950. "Utilities'"direct content only started to grow in the 1990s jumping from 0.02 to 0.07 and returning to its initial value by 2010. Finally, "Construction"and "Manufacture"present the lowest content for the whole sample. Still, the former one rose from 0.02 to 0.05 and then fell to 0.03. The later exhibited minimal variations starting around 0.01, peaking in 0.025 and falling back to its previous levels.

The story does not change significantly for our modified indicator of direct financial content. There is an evident difference in levels, but the trajectories are pretty much the same. Coefficients are 2 to 3 times greater in comparison to our preferred indicator. We can still visualise the previously reported inverted-U relationship. "Agriculture" doubles its technical coefficients from 0.1 in 1950 to 0.2 in 1980 when it reached its peak. "Mining"jumped from 0.15 to 0.4 in the sixties going back to 0.1 afterwards. "Utilities", "Construction", and "Manufacture"continue to achieve their maximum values in the 2000s – when they reached 0.25, 0.12, and 0.06, respectively – falling afterwards.

Indirect content Indirect content magnitudes, on the other hand, are much more similar across sectors though there are some differences between our two treatments to financial value-added. Fig. 2 plots the main trends. For our preferred indicator, there is a shared starting initial value close to 0.03 which increased until the dot-com crisis of 2001 when it reached the 0.06-0.08 interval. Nevertheless, there is significant heterogeneity after that. "Agriculture" went back to 0.06, "Manufacture "and "Construction"to 0.05, and the remaining sectors fell to 0.02. These remarkable similarities, also regarding the year of the peak, are the result of the interaction between sectors from the Leontief inverse. Indirect requirements in all of those cases peaked in the early 2000s coinciding with the dot-com bubble.

[FIGURE 2]

If we move on to our modified indicator of financial content, there are some differences worth to discuss. Shortly, the main trajectories are the same, but coefficients are significantly higher. This is particularly true for "Agriculture", "Mining", and "Utilities"which presented values in some moments 20 times higher than our preferred indicator. On should also notice that "Manufacture" peaks twice, first in the 1980s and again in the 2000s. Finally, "Agriculture" peaks in the 1980s instead of the 2000s as in our previous case.

Despite those differences, an inverted-U relationship for direct and indirect content indicates that those sectors experienced an intensive financialisation process that is no longer in progress. In other words, it is not possible anymore to refer to financialisation in those activities in the terms put forward in this paper. One should notice that for some

sectors such as "Mining", coefficients not only returned to their 1950 values but went below that. Even though there are some deviations among trajectories for different treatments to financial value-added, the main trends do not change. Furthermore, as a result of the interactions among sectors, indirect content seems to fall slightly less than direct content.

4.2.2 *Services activities*

Direct content We proceed by reporting the trajectories of the remaining ten industries. Looking first to our preferred set up, they are divided into two subgroups. A first one – formed by "Wholesale trade", "Retail trade", "Information", "Educational services, health care, and social assistance" (from now on just Education and Health), and "Other services" – did not experiment an increase in direct content until the 1980s. All other sectors show a positive trend for direct content for the whole period. We plot trajectories in Fig. 3. Furthermore, after 2007 some sectors seem to have experienced a reduction or stabilisation of their financial content. Nevertheless, the magnitude of those reductions is quite small in comparison to what was observed in Fig. 1.

As it will become clear, for this group of industries it is possible to refer to an ongoing financialisation process, or at least this was the case until the 2001 dot-com and 2007 financial crisis. If we contrast it with the previous group, the 1980s configured a transitional period in which financial content in traditional industries was already (or about to) losing space while services were (or about to) rising. This means that in the last twenty to thirty years the burden has fallen basically on service activities. That is, our analysis suggests that recent financialisation has been to a great extent of a *service-led* type.

This last finding is particularly interesting if we consider that such increases in financial content have happened in a context marked by a rise in the use of personal computers and the internet. They both have introduced a visible revolution in the "Information" sector but not only there. The Internet altogether with more recent tools such as machine learning are dramatically changing the logistics in business, and are deeply related to the development of financial markets.

[FIGURE 3]

Some comments on the magnitudes of direct financial content follow. There is significant heterogeneity across sectors that, as we will show, contrasts with more similar coefficients for indirect content. Regarding our preferred financial content measure, sectors such as "FIRE", "Education and Health", and "Other services"started from different initial values – 0.11, 0.07, and 0.04, respectively – but converged to a 0.13-0.16 interval. Those correspond to the higher magnitudes of the group and are comparable to "Mining"when it reached its peak. On the other extreme, "Wholesale trade", "Transportation and Warehousing", "Information", "PROF", "Arts and Entertainment", and "GOV"departed from smaller technical coefficients – between 0.01 and 0.04 – and did not go further than 0.04-0.08. In that sense, "Retail trade"is some intermediary case since its direct financial content grew from 0.06 to 0.1.

When we move on to our second set up, there are three critical features. First, coefficients are on average between two and three times higher than in the previous case. However, "FIRE"differentiates itself from the rest with coefficients 4-6 times higher. Even though this might not seem to be a significant distinction, it is worth to mention because

it reflects the fact that we set financial value-added to zero, thus, especially increasing this coefficient.

The two other differences are more interesting. For instance, "FIRE"now depicts an inverted-U path with a peak in 1980. Our preferred indicator does point out to a small reduction in direct financial content of the financial sector after 2000. In the modified indicator case, however, such reduction happened 20 years before and is much stronger. Finally, "Wholesale trade", "Retail trade", and "PROF"experienced a small episode of financialisation of their own with a peak in the 1960s. This was particularly strong for "Retail trade"where the peak was similar in magnitude to current values of financial content. Still, the main trends are preserved and indicate a generalised increase in financial content of service activities, especially between 1980 and 2007.

Indirect content Indirect financial content for this second group of sectors has a positive trend for the whole sample with an increase in its slope around 1980. Similarly to the first group, initial values for our preferred measure were around 0.01-0.03 and converged to something between 0.04-0.06. Our results indicate that the maximum values for financial content in traditional and service activities are very similar, though they happened in different moments on time. We report the main trends in Fig. 4.

[FIGURE 4]

On the other hand, our modified indicators of indirect financial content presented a similar story with some crucial differences. The main trends are maintained which gives some robustness to our analysis. However, "Retail trade"once more exhibited a peak in the 1960s similar in magnitude to current values of financial content. Moreover, "Wholesale trade", "Retail trade", and "PROF"showed relatively stable coefficients after the 1980s. Finally, "FIRE" repeats the inverted-U shape reported for direct content. These results contrast with trajectories in our preferred measure of financial content that exhibited a more consistent positive trend with an increase in slope after the 1980s.

4.2.3 *Aggregate results*

Aggregating the economy using the shares of each sector in total output gives us a positive trend for both direct and indirect financial content, as depicted in Fig. 5. In what concerns direct content, our preferred indicator shows an increase in the slope of the curve in 1980 as suggested by the literature on financialisation. If we instead look to indirect content, a similar increase happened in the mid-1990s and is interrupted a couple of years before the financial crisis in 2007. In the last fifty years, financial coefficients have doubled their value which corresponds to an increase of 100% of financial content.

However, when we redistribute FIRE's value-added so that it enters the IO table exclusively as inputs, things change. Despite differences in magnitudes, we observe a continuous increase of direct content the whole sample with some stability after 2000. A similar positive trend follows when we look to indirect content though trajectories become stable after 1980. In order to understand such differences in trends, it might be useful to assess what these coefficients are measuring.

[FIGURE 5]

As previously discussed in the last subsection, the SNA considers services for which banks explicitly charge a fee as financial value-added, while financial intermediation resulting in net interests income is included as intermediate inputs. However, since in our modified scenario we redistribute all FIRE's value-added so that it enters the IO table exclusively as inputs, we expect our preferred indicators of financial content to rely more on the dynamics behind interest rates and the stock of debt than our modified measures.

According to Palley (2013), the defining feature of financialisation in the US has been an increase in the volume of debt. He reports that between 1973 and 1989 interest rate payments rose from 25% to 60% of profits, as a result of the high-interest rates that prevailed in the 1980s. This is in line with our preferred results that point out to a sharp increase in the slope of direct financial content in that period. He continues showing that by 2007 corporate interest payments as a share of profits had fallen back to 1973 levels, reflecting the low-interest rates that prevailed in the 2000s. Our coefficients also capture this last change though the magnitude of the reduction in financial content is relatively small. This could be the result of the high volume of debt accumulated in the period. A disaggregated analysis indicates that in the last thirty years this trend was lead mainly by service industries.

Modified financial content points out to a more continuous phenomenon. The increase in relative importance of the financial sector in the US has been gradual going back at least to 1950. Initially, it was lead by traditional industries while in the last years this role has been played mainly by services. Modified direct content seems to get stable by the end of the 1970s though it jumps afterwards returning to its main previous trend. For indirect content, things changed in 1980 with coefficients stabilising and fluctuating slightly above one.

With these results in mind, we move on to the evolution of backward and forward linkages. Fig. 6 brings some new insights on some characteristics of the change mentioned above in importance of the financial sector. The central element is the marked increase in forward-linkages that contrasts with relatively stable backward linkages. In our preferred scenario, the former rose sharply from 2 in the 1950s to 3.3 at the beginning of the 2000s falling to 2.8 afterwards. Setting financial value added to zero increased indirect content levels which explain the higher magnitudes in our second scenario. In this case, forward linkages went from 10 to 20 in the first forty years of the sample, stabilising with a small negative trend until 2015 when they reached 15. Despite differences in the time of the peak, both suggest a significant net increase in forward-linkages.

Backward-linkages, on the other hand, are much more stable. Fig. 6 on the left shows that until 1980 there was a reduction in this coefficient from 1.5 to 1.4, going to 1.68 in the 2000s and decreasing to 1.58 in 2015. Magnitudes involved in the second case are higher, but variations are still comparatively small. There is a positive trend from 1950 to 1980 with a marked decrease afterwards. This reflects a characteristic of the financial sector: a follower more than an inducer. Furthermore, the sharp increase in forward-linkages indicates that the financial sector has become increasingly more sensitive to changes in the production of other sectors.

[FIGURE 6]

As important as the rise of finance in the aftermath of 1980s, our indicators seem to point out to a second structural break after the dot-com and 2007 financial crisis. From

figures 3 and 4, we were able to identify a reduction of direct and indirect financial content in service activities after 2001. Because financialisation seems to be in a sense *service-led*, this was reflected in our aggregate indicators including the backward and forward linkages. However, it is not clear if coefficients will continue to rise or if they have reached some new steady-state.

4.2.4 *Vertical integration*

Finally, we can see how financial industries have been distributed among productive activities. Fig. 7 depicts that finance has engaged a clear process of vertical integration. The share of FIRE activities that takes place entirely within itself has grown from 20% to 55% in the last fifty years. "Education and Health", and "PROF" follow as sectors that experienced a strong increase in this indicator. At the beginning of the period "Education and Health" received only 1% of all financial activities, which increased to 17% in 2015. Similarly, "PROF" increased from 0.5% to 5.5%. This movement contrasts with the dramatic reduction experienced by "Manufacture". In the 1950s, "Manufacture" concentrated almost half of financial activities and was reduced to less than 5% by 2015. Negative value shares in "Mining" are the result of negative values of final demand in this sector given the high trade deficit in particular after the oil crisis.

An increase in the vertical integration of financial activities suggests an increasing separation of the financial from the real sides of the economy. If financial activities are supposed only to intermediate the allocation of resources between investors and those who save, why almost 60% of the "FIRE" sector is concentrated on itself? This does not mean that the productive structure relies less on the financial sector but might indicate finance is increasingly relying less on the rest of the productive structure. FIRE has become more sensitive to changes in the output of other sectors, and at the same time increasingly vertical integrated.

[FIGURE 7]

Such interpretation finds some echo in the literature on financial crises *a la* Minsky. As discussed by several scholars, Minsky's theory rests on the bifurcation of an economy's price system. On the one hand, there is the price system for goods and services. On the other hand, there is a wholly separate price system for assets. It is here where stability leads to asset price inflation, then a build-up in debt, and eventually a crisis (see, for example, Wray, 2015). Though it is not the goal of this paper, one could conjecture to which extend an increasing separation of the financial from the real sides of the economy could precisely lead to an increase of financial fragility in Minskyan terms.

Overall, it is possible to observe a positive trend in service activities that suggests that the financial sector is leaving traditional sectors and moving towards the tertiary sector. For instance, "Agriculture " and "Construction " had a reduction from 3% to 1% that is still significant, though not comparable to the dramatic reduction in "Manufacture". On the other hand, "Mining" and "Utilities " basically fluctuated around zero. These results are in line with the tertiarisation process experienced by the US economy during the second half of the twenty century. Still, notice that the concentration of finance in our second group of "service industries" is not unanimous. "Retail trade" did experience a reduction

from 15% to 5% during the first thirty years of the sample and maintained that level after 1980.

As we will see in the next subsection, a concentration of FIRE services does not necessarily follow tertiarisation. The Brazilian case corresponds to an example of a country that is also going through deindustrialisation (tertiarisation) process but with a reduction in FIRE's vertical integration. We conclude the subsection emphasising our main results:

- Inverted-U trajectories of financial content in traditional activities;
- Increasing financial content in service activities, especially after 1980s;
- Increase in vertical integration of the financial sector;
- Stable backward-linkages with a marked increase in forward-linkages;
- The dot-com crisis of 2001 and the financial crash of 2007 are two important structural breaks for financial content;

4.3 *Brazil*

The literature on financialisation in developing countries is relatively new and has pointed out to a more varied and complex phenomenon than in developed ones. Karwowski and Stockhammer (2017), for instance, have outlined at least six different interpretations that include financial deregulation and integration to global markets, shifts from bank-based to market-based financial systems, increased involvement of households in finance, etc. Ironically, a concept that remains unclear to developed countries seems to be even more disperse for developing economies.

Among those authors who claim that there is an ongoing financialisation process in the Brazilian economy, two explanations stand out. On the one hand, Kaltenbrunner (2010, p. 296) argued that Brazil has experienced rising "international financialisation", defined as increased participation of foreign investors in short-term domestic assets. More recently, Kaltenbrunner (2017) has shown critical structural changes in Brazil's financial integration in the form of currency internationalisation and financialisation, mediated through a hierarchic international monetary system.

A second group of scholars has brought to attention the growing ratio between financial assets and productive capital indicating that Brazilian financialisation is centred in high-interest rates rents associated to public debt (e.g. Bruno et al., 2011; Araújo et al., 2012). In both cases, results contrast with those presented by Karwoski and Stockhammer (2017) who concluded that Latin American economies - including Brazil - have seemed a relatively weak (if any) financialisation.

It is our purpose in this subsection to verify if it is possible to refer to financialisation in Brazil from a multisectoral perspective. Our exercise is not in conflict with those previous interpretations. On the contrary, it explores a different side of the phenomenon that emphasises sectoral interactions and might be preferable in some cases for the reasons already explained. Furthermore, providing that financialisation in developing countries is a more varied and complex phenomenon, we consider it is important to apply the conceptualisation put forward in this paper also to a developing economy. If we are to understand financialisation as an increase in relative importance of the financial sector, we do not see why this should not be the case for an economy like Brazil.

The period for which data is available is considerably shorter but coincides with what Bruno and collaborators refer to as "financeirização pela renda de juros" (2011, p. 740). Since changes in technical coefficients take several years, we are not able to capture large movements like for the United States. Nevertheless, some patterns still appear. For exposition purposes, we follow a similar structure as in the previous subsection and divide sectors between "traditional activities" and "mainly services".

4.3.1 *Traditional activities*

Direct content Fig. 8 plots the sectoral evolution of financial direct content for "Agriculture", "Mining", "Utilities", "Construction" and "Manufacture". There is a strong reduction in technical coefficients between 1995 and 1997. Over the whole period, direct financial content fell in at least 50%. Comparing our preferred and modified indicators, we have minimal differences regarding trends. Nevertheless, the magnitudes involved are significantly higher in the latter, being around 2 to 3 times greater.

For instance, "Agriculture" experienced a substantial reduction of direct content between 1995 and 1997, going from 0.06 to 0.01 in our preferred scenario and from 0.15 to 0.04 in the modified set up. "Utilities"and "Construction" followed a similar trajectory with technical coefficients shrinking from 0.05-0.13 and 0.08-0.16, respectively, to 0.02-0.05, depending on which measure we use. The story is slightly different for "Mining"and "Manufacture" because those sectors presented a more continuous path. Our preferred measure indicates that, in the former, there is a steady reduction from 0.12 to 0.06 between 1995 and 2006, while in "Manufacture"coefficients fell from 0.06 to 0.03 during the same period. On the other hand, modified financial content points out to a reduction from 0.3 to 0.15 for "Mining", and from 0.14 to 0.1 for "Manufacturing".

[FIGURE 8]

Indirect content Indirect content also follows a negative trajectory for this group of industries as we showed in Fig. 9. Once more, our two measures of indirect content deliver similar results concerning trends though this is not the case for levels. Because of the interactions among sectors from the Leontief matrix, redistributing financial value-added as intermediate inputs significantly increase coefficients. In "Mining"and "Manufacturing" they are up to 10 times greater while in "Construction" this difference is even higher.

[FIGURE 9]

Our preferred indicator fluctuates very little for "Agriculture" and "Utilities" with modest reductions from 0.05 to 0.04 and 0.055 to 0.045, respectively. Reductions are more substantial for "Mining", "Construction", and "Manufacture". The first one went from 0.1 to 0.055, the second from 0.07 to 0.045 and the later from 0.1 to 0.07. Notice that there seems to be a convergence to values closer to the ones reported for the US, especially at the moment those sectors peaked. Regarding our second measure of financial content, reductions are more pronounced. "Agriculture" fell from 0.7 to 0.3; "Mining" went from

1.2 to 0.5; "Utilities"started close to 0.7 and by 2010 almost reached 0.3; "Construction" fell from 1 to 0.4; and "Manufacturing" basically experienced a linear reduction from 1 to 0.6 in the first ten years of the sample.

4.3.2 *Service activities*

Direct content We proceed by reporting financial content trajectories of the remaining nine industries. In general, we observe strong reductions in direct and indirect content in the first two years of the sample. Six out of nine sectors presented such behaviour. The three exceptions are "Wholesale and retail trade", "Arts and entertainment", and "GOV". The first of them displayed an increase in direct content that went from 0.03 to 0.05 in our main set up. That corresponds to a net increase of more than 65%. We will come to this point later. The other two seem to follow an inverted-U path but considering the magnitudes involved one could make the case that they have been stable. We plotted trajectories in Fig. 10.

[FIGURE 10]

Focusing first on our preferred scenario, industries such as "Information","FIRE", "PROF", and "Other services"exhibited the strongest reductions of the group, with coefficients falling from 0.2 to 0.05, 0.1 to 0.07, 0.1 to 0.04, and 0.08 to 0.02, respectively. This does not mean that reductions in other sectors were less significant. "Transportation and warehousing", for instance, started with values close to 0.08 that by the end of the sample were in the neighbourhood of 0.05. Finally, "Education" presented small variations. Still, a reduction from 0.05 to 0.04, for example, corresponds to a decrease of 20% in financial content.

Magnitudes involved in our second scenario are greater while the main trends were preserved. For this indicator, the strongest reductions were in "Information", "PROF", and "Other services". In 1995, coefficients were 0.35 in the former, 0.25 in the second, and 0.2 in the later. By 2011 they were 0.15, 0.1, and 0.05, respectively. "Transportation and warehousing" follows with an important reduction in coefficients from 0.18 to 0.12. "FIRE"and "Education"close the list with smaller decreases. The former started in 0.65 in 1995 and continuously decreased to 0.55 in 2011. The latter went from 0.13 to 0.1.

Indirect content From Fig. 11, it is possible to observe a marked decrease in indirect financial content concentrated in the first years of the sample. The two exceptions are "Wholesale and retail trade" and "Transportation and warehousing". Recall that when we assessed direct content trajectories, the first of them was already reported to follow very particular dynamics. "Transportation and warehousing", on the other hand, displayed divergence between our preferred and modified indicators. While in the former there was initially a decrease in financial content that was partially compensated after 2000, the modified scenario indicated a continuous negative trend for the whole period.

If we focus first on our main measure of indirect content, no sector showed an initial value lower than 0.035, see "FIRE", and most of them were close to 0.06 and 0.07. The financial sector also presented the lowest indirect content by 2011, equal to 0.02. Leaving aside "Wholesale and retail trade" and "Transportation and warehousing"- that experienced an

increase or little change in indirect content - the remaining seven sectors have shown a reduction of indirect content of almost 40% on average.

Our second scenario depicts negative trends for all sectors but "Wholesale and retail trade". This last industry also presented a small reduction after 2000 with its coefficient going from 0.45 to 0.35. However, given that from 1995 to 1999 there was an increase in financial content from 0.35 to 0.45, over the whole sample, one could argue that this coefficient was quite stable. There seems to be some convergence in six of the remaining industries. "Transportation", "Information", "PROF", "Art and entertainment", "Other services", and "Government" had very different starting points but by 2011 reached values close to 0.5. Finally, "FIRE"and "Education"also presented strong reductions going from 2.2 and 0.7 to 1.2 and 0.3, respectively.

Because magnitudes involved in our preferred set up are much lower, coefficients are more homogeneous across sectors, and it is not clear if they are indeed converging to a certain value. Still, it is worth noting that "Information", "Arts and entertainment", and "Other services"went from 0.08, 0.06, and 0.07, respectively, to a common value close to 0.05. Indirect content in "FIRE" was 0.03 in 1995 and went to 0.02 by the end of the sample. "PROF" experienced a reduction from 0.065 to 0.04 while "Education"and "GOV"went from 0.05 to 0.03. In any case, both direct and indirect financial content coefficients seem to suggest that the Brazilian economy has experienced a reduction in financial content since 1995.

[FIGURE 11]

4.3.3 *Aggregate results*

At an aggregate level, Fig. 12 presents a significant negative trend for financial content from 1995 until 2000-05 with stability afterwards. Trajectories are pretty much the same between our preferred and modified measures which gives some robustness to our analysis. The main difference is the continuous decline of indirect content in the modified set up that is more clear when we directly compare *lowess* curves.

In our basic framework, direct content fell from 0.07 in 1995 to 0.045 in 2004, becoming relatively stable afterwards. On the other hand, indirect content followed closely direct technical coefficients going from 0.065 to 0.045. Such changes indicate a reduction of near 35% in financial content.

As previously discussed, our second scenario delivers similar trends though magnitudes involved are different. Financial direct content in Brazil shrank from 0.22 to 0.16 between 1995 and 2011. All this reduction happened before 2005 with coefficients remaining constant afterwards. Moreover, indirect content went from 1 to 0.5. In this case, reductions were more continuous over time though still concentrated in the period before 2005. Overall, we have a reduction in financial content of 30% and 50%, respectively.

[FIGURE 12]

Given that no industry shows a continuous positive trend in financial content, it is not possible to refer to a financialisation process in Brazil in the terms put forward in this

article. Furthermore, one still has to find an explanation for these reductions. While in the United States an increase in financial content could be related to the dynamics of interest payments, we do not think this is the case of Brazil because firm indebtedness has been historically relatively low in this country. A decrease in financial content, especially in the first two years of the sample, could be explained by the control of inflation that followed "Plano Real".

Bruno et al. (2011) argued that during the years of high inflation, Brazil developed an inflationary financial-monetary regime in which an increase in inflation rates was associated with a greater share of the financial sector in GDP. Under high or explosive increases in prices, firms and consequently productive activities needed specific financial services to protect themselves against inflation. After 1994, these were not necessary any longer and could explain the observed reduction in financial content of production.

In fact, in 1995 the government released the "Programa de Estímulo à Reestruturação e ao Fortalecimento do Sistema Financeiro Nacional"(PROER) in order to avoid a collapse of Brazilian financial system as a result of the control of inflation. At the time, several banks were specialised in using the institutional mechanism of monetary correction and price indexation to make profits. Hyperinflation was also used to cover illegal operations and balance sheet issues. Once prices were under control, some of them faced severe problems and were about to break. PROER divided those institutions between "good" and "bad" allowing the former to be purchased by another bank while the Central Bank liquidated the latter.

At this point, we can also make some caution comparisons between Brazil and the United States. One should keep in mind that we are dealing with very different economic systems and also the time span of our analysis is different between the two of them. Still, some patterns appear. For example, Brazil's direct financial content in 2010 was very similar to the US in 1950 while the US in 2010 approximates Brazil in 1995. A similar situation occurs regarding indirect content, regardless if we are in the preferred or modified scenario. In the light of the concepts developed in this paper, Brazil is not going through a financialisation process, but the financial sector used to be as important as it is to the US nowadays (after at least 35 years of financialisation!).

Backward and forward-linkages reinforce the main conclusions described so far. Let us begin with our preferred measures of financial content. On the one hand, backward linkages show some stability for the whole sample, fluctuating around 1.4 as depicted in Fig. 13 (on the left). On the other hand, forward linkages exhibited a declining trend between 1995 and 2001 followed by a period of relative stability. Still, forward linkages were reduced almost 50% between 1995 and 2011.

Fig. 13 (on the right) reveals trajectories when we set financial value added to zero so that total financial output equals the sum of inputs used by the financial sector. In this case, we obtain a negative trend for both backward an forward linkages, basically for the whole sample. Still, notice that decreases in forward-linkages are stronger with coefficients going from 18 to 10. This contrasts with reductions in backward-linkages that went from 6 to 5 in fifteen years. The same figure also reports the respective lowess curves. The financial sector in Brazil has proved to be a follower more than an inducer. Furthermore, its response to a stimulus from other sectors has been reduced over time. That is, the financial sector has become less sensitive to changes in output from other sectors.

[FIGURE 13]

4.3.4 *Vertical integration*

We proceed by investigating if there have been important modifications in how financial activities are distributed among sectors. For instance, an increase in vertical financial integration could also suggest an increasing separation from the real side of the economy. As we will see, this is not the case.

Three interesting features can be extracted from Fig. 14. First, "Manufacture" heavily concentrates financial intermediation with a share of 50% of "FIRE", similar in magnitude to the United States in the 1950s. Financial content in manufacture activities remained constant the whole period despite the ongoing and well-known deindustrialisation process visible both in employment and GDP statistics. Secondly, "Wholesale and retail trade" have experienced an important increase in a two-wave process, going from 1% to almost 10% of financial intermediation. The first wave can be attributed to the increase in consumption that followed the control of inflation during the Social-Democrat administrations, while the second wave coincides with the expansion in consumption during the Labour Party governments.

A reduction in inflation and the expansion of credit and consumption help to explain the increase in financial content reported for "Wholesale and retail trade". While direct and indirect coefficients fell for all other industries, "Wholesale and retail trade" increased in two waves. The first started in 1995 and lasted until 2000 with financial content doubling its figures. From 2003 to 2006 those coefficients dropped in our main set up from 0.06 to 0.04 for direct content, and from 0.03 to 0.025 for indirect content. A second wave started at that moment with a recovery of financial content per unit of output.

We want to emphasise a third characteristic that deserves special attention and corresponds to the "Mining" sector. Until 2005, its share was negative or close to zero basically because final demand in this sector was negative. The reason for this is that sectoral imports where higher than the sum of consumption, investment and exports. The situation changed after 2006 with the boom of commodities and the autonomy in oil production obtained in the same period. As a result, there has been an important increase in the share of financial activities going to "Mining" even though it continues to be relatively small.

These last results indicate the financial sector still heavily relies on traditional activities such as manufacture and has responded positively to consumption and natural resources booms. Surprisingly, after a brief increase in the first years of the sample, "FIRE" showed a reduction in the level of vertical integration of the branch from 25% to 15% that contrasts with the opposite trend in the United States.

Straightforward comparisons between Brazil and the US are possible in this case because, as demonstrated in section 2, our concentration indicator does not depend on the price index. Hence, two observations follow. First, notice that in the two countries there is an increase in the share of financial activities that go to government services. Moreover, the magnitudes involved in Brazil are much higher. By 2011, around 15% of "FIRE" went to "GOV" in Brazil contrasting with less than 10% in the US. Secondly, financial intermediation on "Education and health" did not change significantly in Brazil after 1995. This also contrasts with the US that exhibited a continuous increase. By 2011 it was almost three times greater than in Brazil.

[FIGURE 14]

We conclude this subsection emphasising our main results:

- Decrease in financial content or "De-financialisation" associated with Plano real and the control of inflation;
- In terms of financial content, Brazil in 2010 was very similar to the US in 1950 while the US in 2010 shares features with Brazil in 1995;
- Financial vertical de-integration;
- Stable backward-linkages that contrast with decreasing forward-linkages;
- The financial sector heavily relies on traditional activities such as manufacture and has responded positively to consumption and natural resources booms;

5 Final Considerations

The recent financial crisis has reminded us that financial markets and intermediaries have significant effects on the real economy. From a multisectoral perspective, the financial sector matters because it connects the entire productive structure through financial intermediation. The interconnection between financial and non-financial industries is one of the mechanisms through which the strengths and vulnerabilities of economic activity are transmitted. Hence, understanding how those interdependencies vary across sectors and time is essential to a better comprehension of the financialisation process itself.

This article presented a multi-sectoral assessment of financialisation based on Input-Output analysis. Our contribution joins other efforts to provide integrated financial information at the sectoral level in order to assess the relationship between the real and financial sides of the economy. We conceptualised financialisation as *an increase in the financial content in monetary terms of each unit of output produced*. Such definition allowed us to introduce a structure that can be employed to study different varieties and financialisation paths.

We applied our conceptualisation to the United States and Brazil for the period 1947-2015 and 1995-2011, respectively. In the US, our results show that once we move on to a more disaggregated set up two different dynamics emerge. First, traditional activities such as agriculture, mining or manufacture presented an inverted-U relationship with a reduction in their financial content in recent decades. This contrasts with service industries in which there is a positive trend for the whole sample that increased its slope after the 1980s. Therefore, current financialisation has been a phenomenon mainly of the non-tradable sector or *service-led*.

This last finding is particularly interesting if we consider that a *service-led* type of financialisation fits in a context marked by the rise of the internet and the use of personal computers. More recent developments such as machine learning are introducing profound changes in the logistics of business. Overall, the information revolution is deeply related to the development of financial markets and our indicators seem to capture this transformation, at least in the United States.

Moreover, the financial sector has increased the vertical integration of the branch. The production process that takes place entirely within itself has grown from 20% to almost 60% in the last fifty years. The evidence provided gives some support to the idea of an

increasing separation of the financial from the real sides of the economy in the US. In the light of Minskyan theories of the financial cycle, this could be related to an increase of financial fragility. We consider that further research in that direction is required.

Aggregating the economy, we were able to reproduce well-known results. For instance, it is evident that the 1980s stand as a major structural break with an increase in the slope of the financialisation process. It is also clear that the dot-com bubble and the financial crisis of 2007 have left an important mark in the US productive structure. Overall, direct and indirect coefficients have doubled in the last fifty years indicating that financial content per unit of output has increased by 100%.

On the other hand, Brazil did not exhibit an increase in the financial content of its production. On the contrary, most sectors showed a reduction in their financial content especially between 1995 and 1997. This could be explained by the control of inflation that followed the macroeconomic stabilisation plan "Plano Real" which diminished the need for financial instruments for protection against hyperinflation. Furthermore, the financial sector still heavily relies on traditional activities such as manufacture and has responded positively to consumption and natural resources booms. Still, there is some degree of heterogeneity among sectors that emphasises the importance of the analysis at a more disaggregated level.

Our results also contrast differences regarding backward and forward-linkages for both countries. Forward-linkages are greater than backward-linkages, reinforcing the intuition that this sector is a "follower" more than an "inducer". Furthermore, forward-linkages also exhibited opposite trends for Brazil and the United States. In terms of our preferred scenario, the former experienced a substantial reduction from 3 to 2.2. The latter shows an increase in the indicator from 2 to 3. On the other hand, backward-linkages were much more stable fluctuating around 1.4 and 1.5.

While there are still many questions left unanswered, we have aimed to provide a different starting point to an intensively studied topic. For instance, it will be interesting to understand the implications of changes in financial content per unit of output to economic growth, income distribution, and other sectors of the economy. Further research in that direction is required and encourage.

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Appendix

The following correspondence is stablished between OECD and BEA IO tables in order to increase the degree of comparability between Brazil and United States results. The only sector that does not have a direct correspondent and also the reason why we deal with a 15-sector level of aggregation for the US and 14-sector for Brazil is Wholesale and Retail trade. They form together one unique industry in the OECD database while in the BEA

database they are independent industries.

OECD	BEA
Agriculture, hunting, forestry and fishing	Agriculture, forestry, fishing, etc
Mining and quarrying	Mining
Food products, beverages and tobacco	Manufacturing
Textiles, textile products, leather and footwear	Manufacturing
Wood and products of wood and cork	Manufacturing
Pulp, paper, paper products, etc	Manufacturing
Coke, refined petroleum products, etc	Manufacturing
Chemicals and chemical products	Manufacturing
Rubber and plastics products	Manufacturing
Other non-metallic mineral products	Manufacturing
Basic metals	Manufacturing
Fabricated metal products	Manufacturing
Machinery and equipment, nec	Manufacturing
Computer, Electronic and optical equipment	Manufacturing
Electrical machinery and apparatus, nec	Manufacturing
Motor vehicles, trailers and semi-trailers	Manufacturing
Other transport equipment	Manufacturing
Manufacturing nec; recycling	Manufacturing
Electricity, gas and water supply	Utilities
Construction	Construction
Wholesale and retail trade; repairs	-
Hotels and restaurants	Arts, accommodation, food etc
Transport and storage	Transportation and warehousing
Post and telecommunications	Information
Financial intermediation	FIRE
Real estate activities	FIRE
Renting of machinery and equipment	FIRE
Computer and related activities	PROF
R&D and other business activities	PROF
Public admin. and defence	GOV
Education	Educational services, health care, etc
Health and social work	Educational services, health care, etc
Other community, social and personal services	Other services, except government

Figures

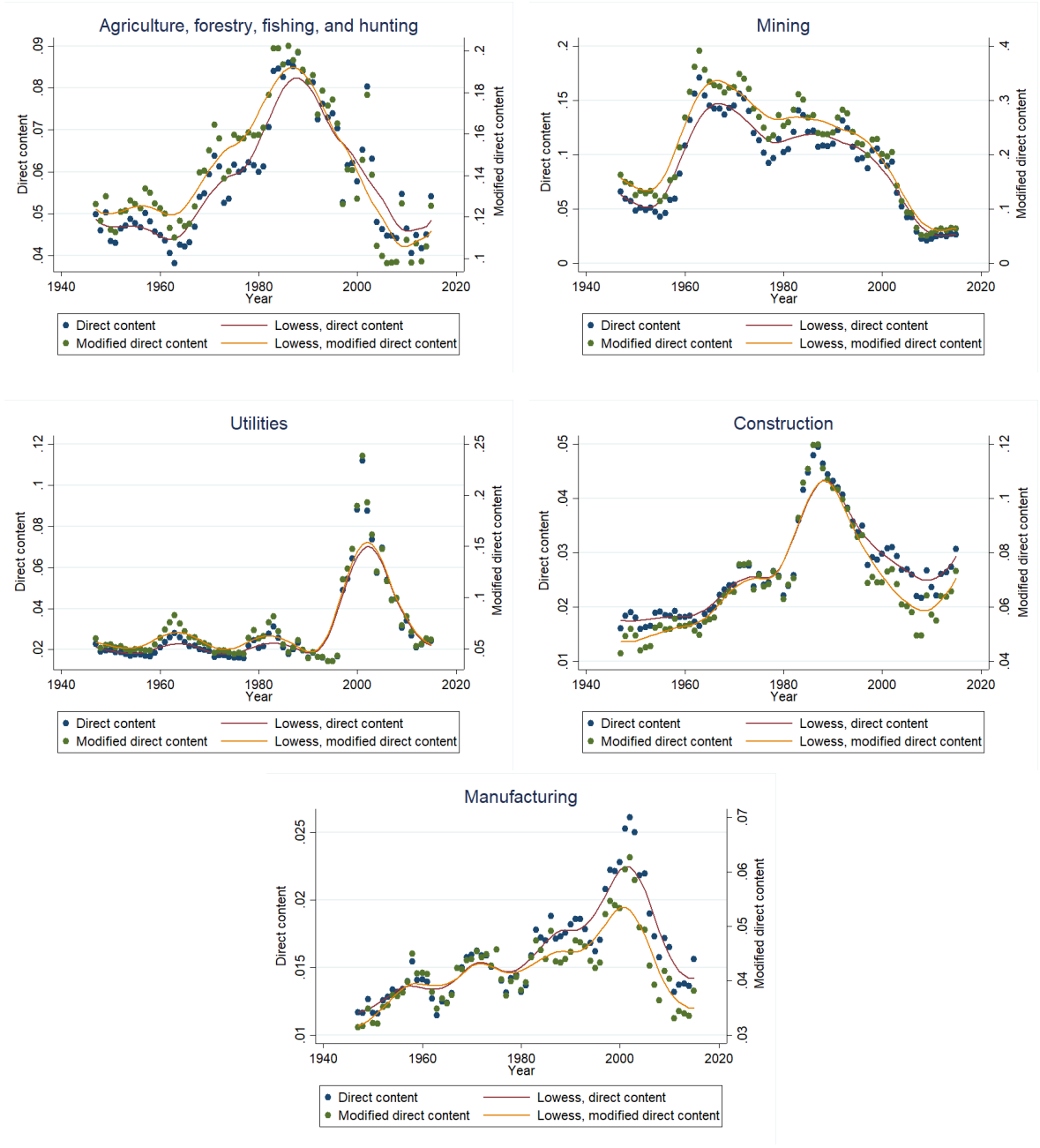


Figure 1: Direct financial content in traditional activities, US

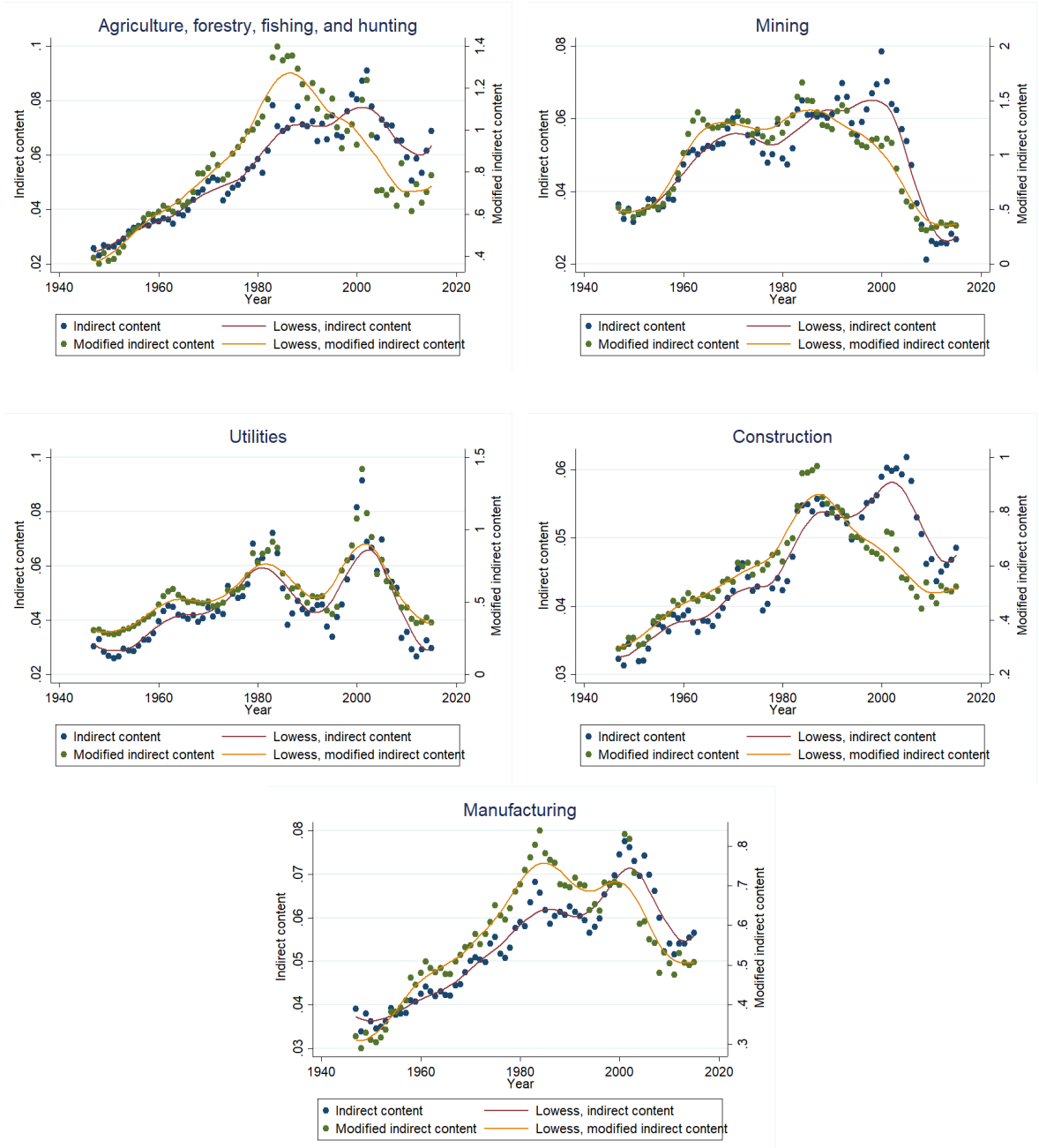
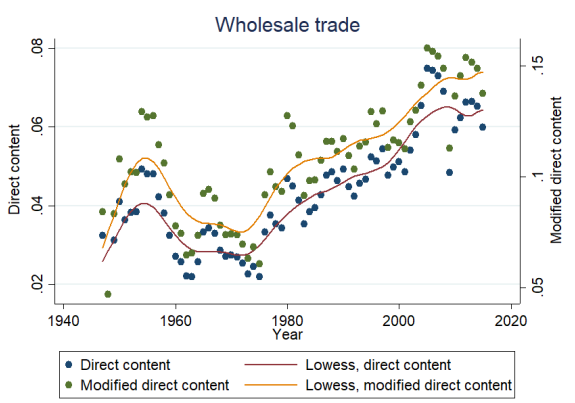
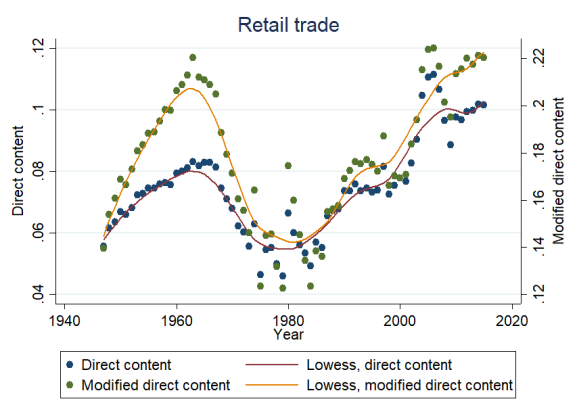
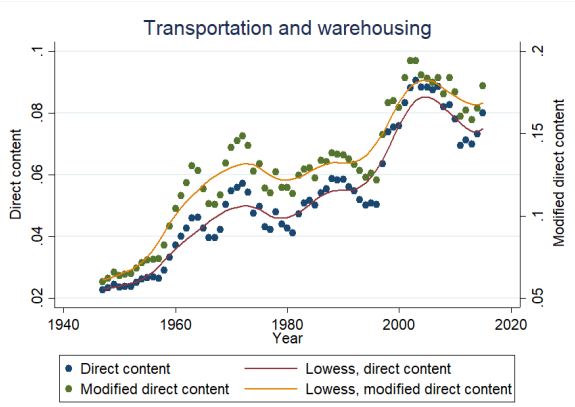
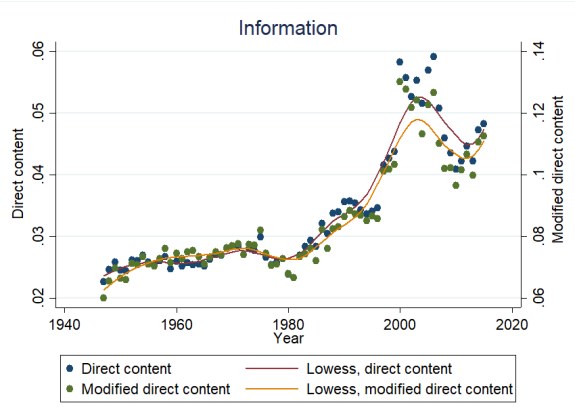


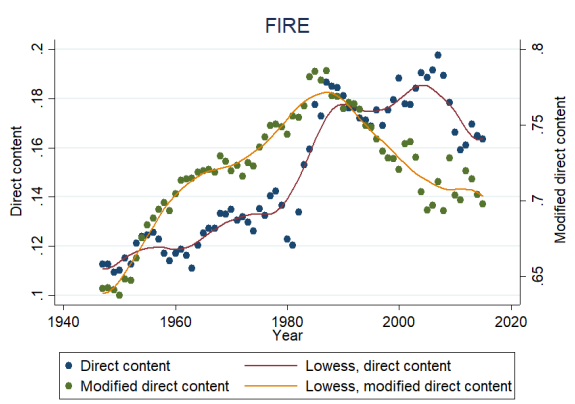
Figure 2: Indirect financial content in traditional activities, US


Wholesale trade
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Retail trade
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Transportation and warehousing
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Information
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


FIRE
Direct content
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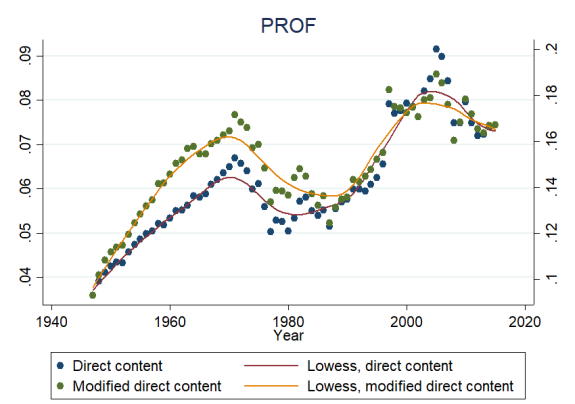
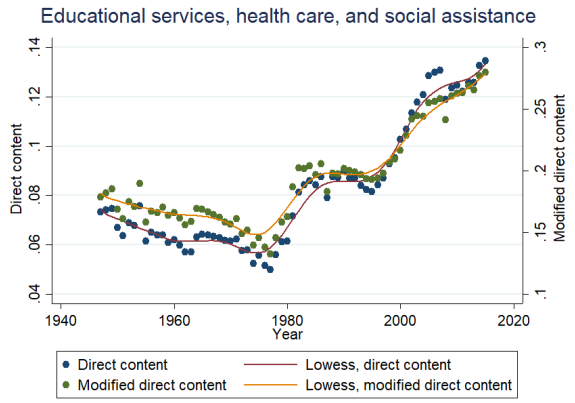
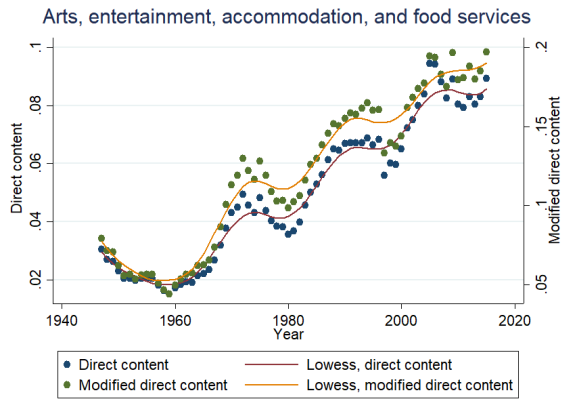
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


PROF
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Educational services, health care, and social assistance
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Arts, entertainment, accommodation, and food services
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content

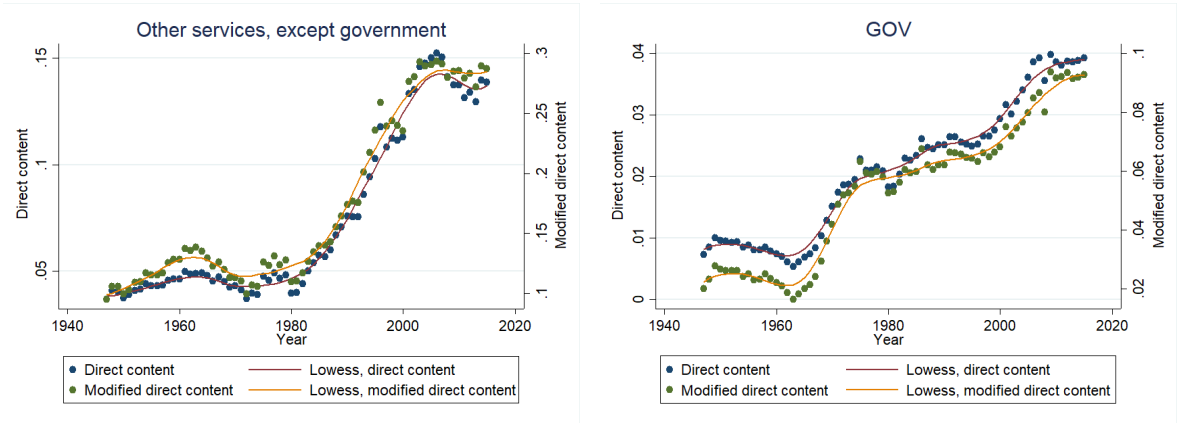
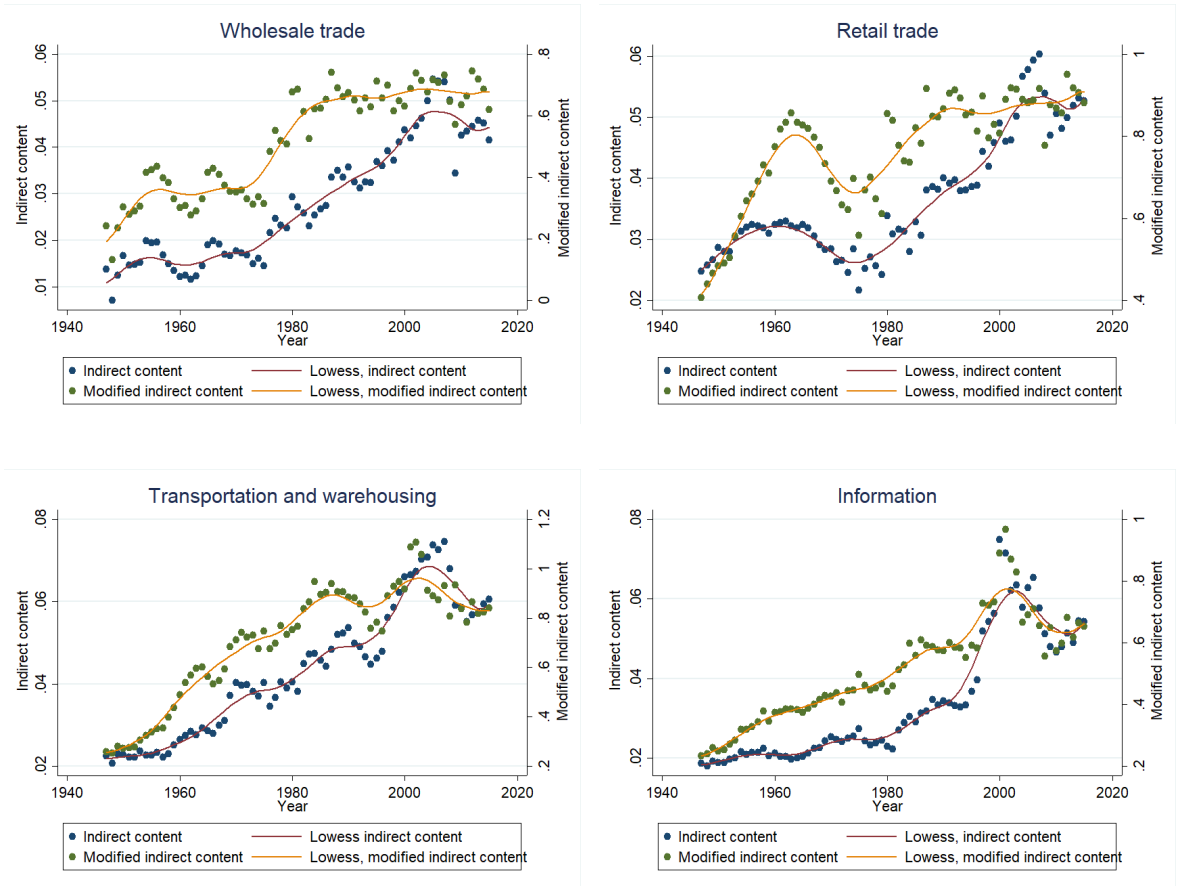


Figure 3: Direct financial content in services, US



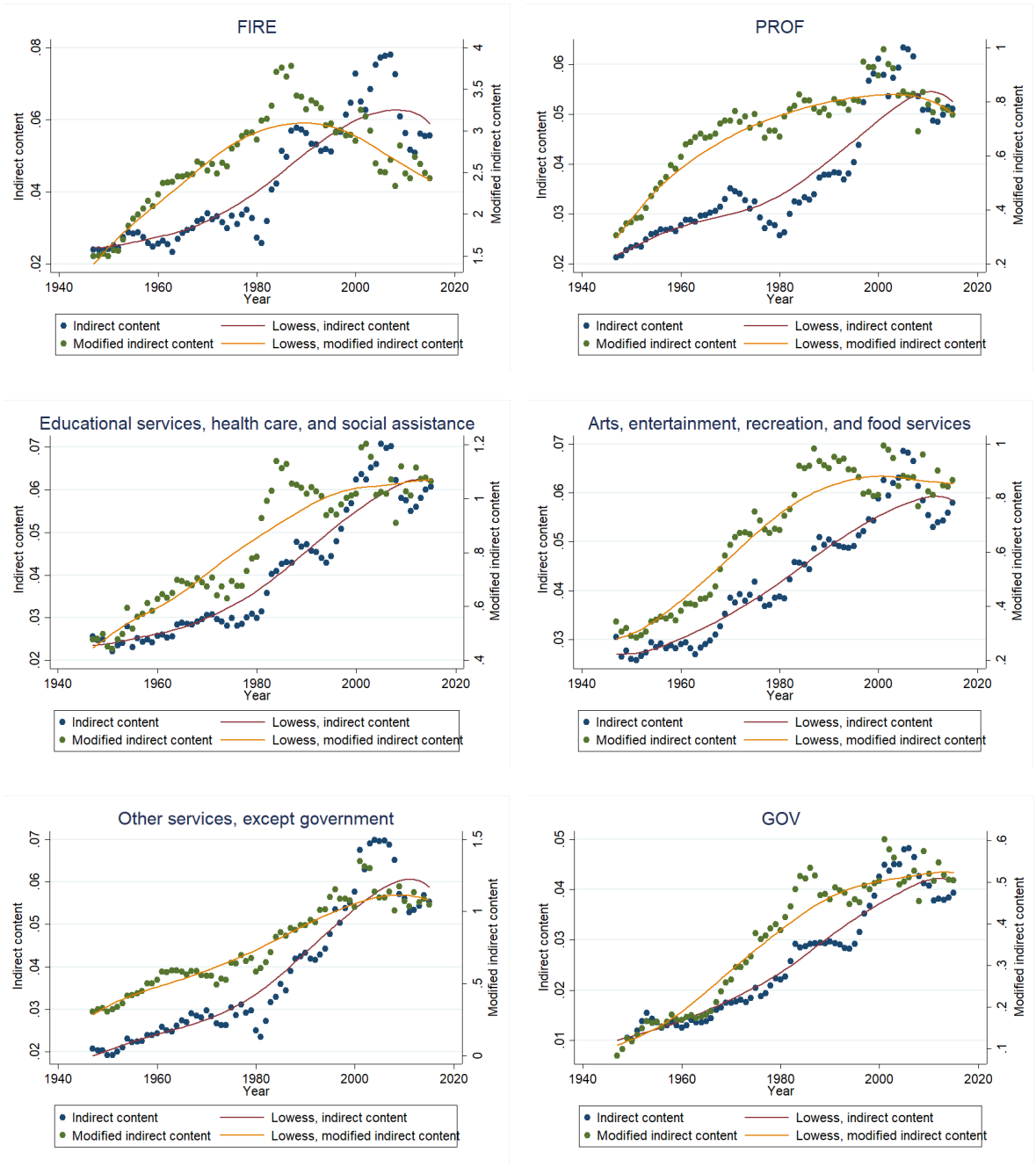


Figure 4: Indirect financial content in services, US

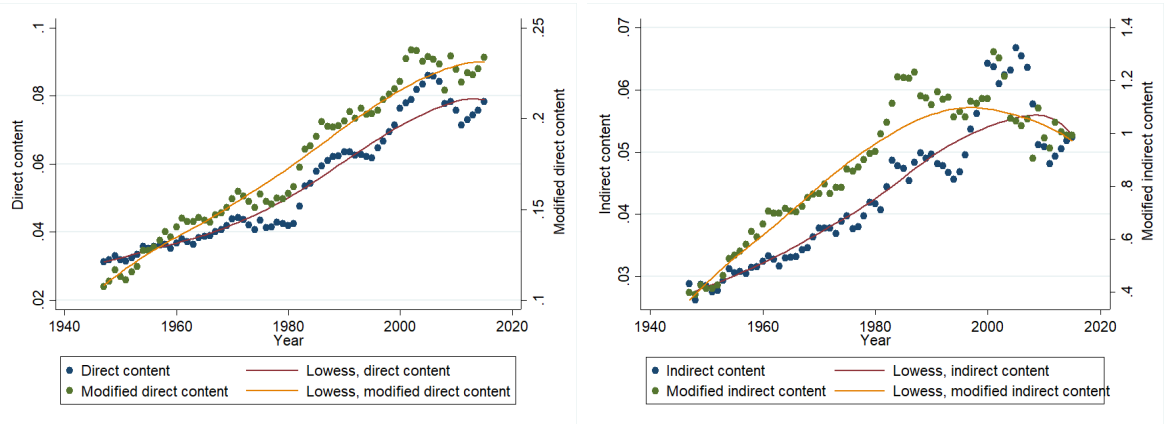


Figure 5: Aggregate direct (left) and indirect (right) financial content, US

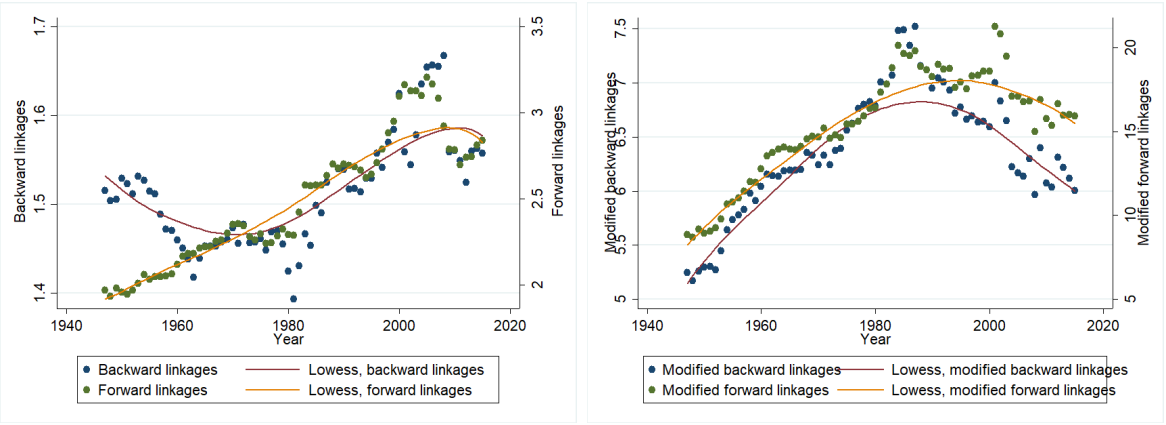
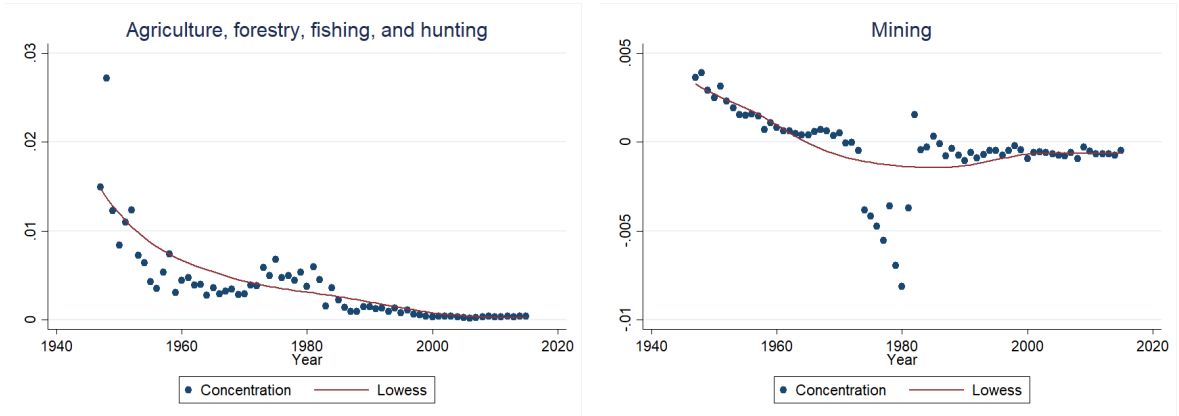
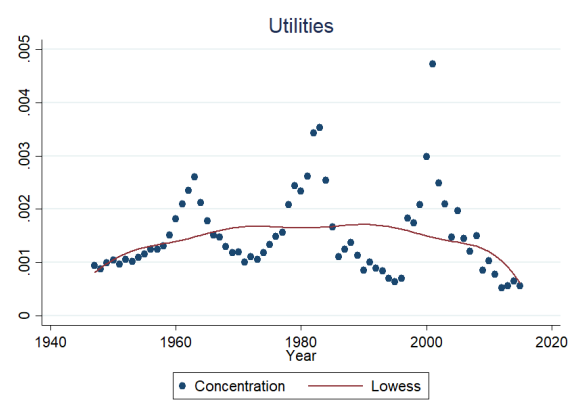
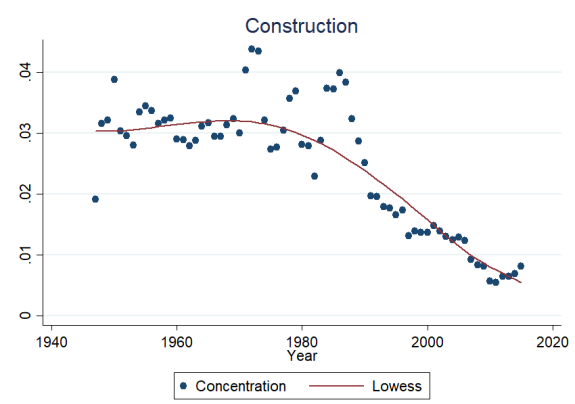
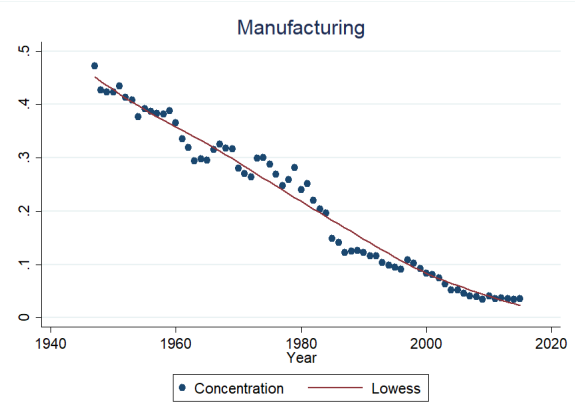


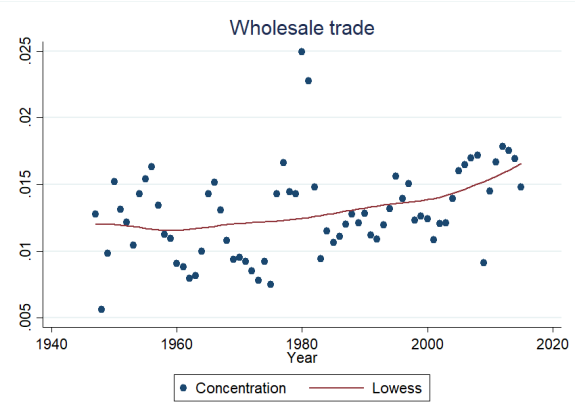
Figure 6: Backward/forwad linkages (left) and index (right), US

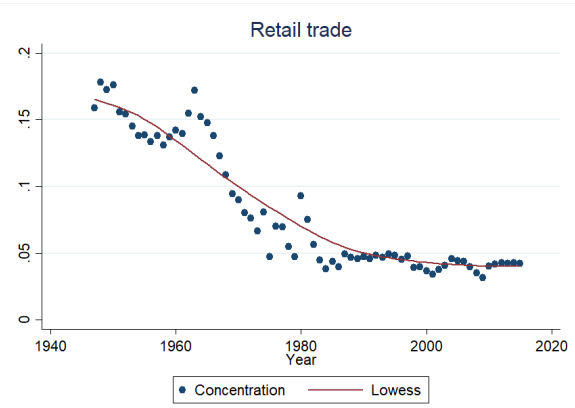


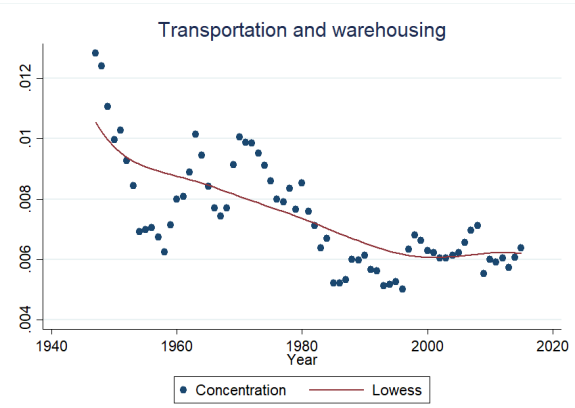

Utilities
0
.001
.002
.003
.004
.005
1940
1960
1980
2000
2020
Year
Concentration
Lowess

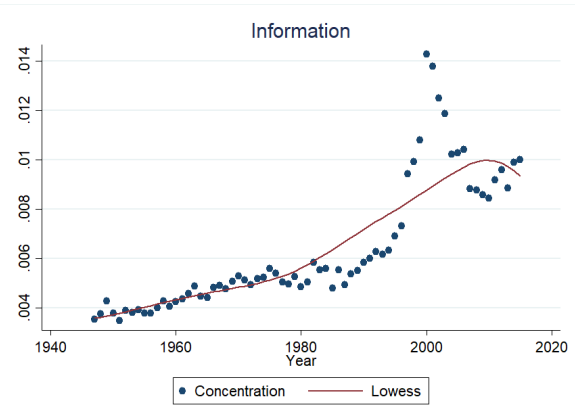

Construction
0
.01
.02
.03
.04
1940
1960
1980
2000
2020
Year
Concentration
Lowess


Manufacturing
0
.1
.2
.3
.4
.5
1940
1960
1980
2000
2020
Year
Concentration
Lowess


Wholesale trade
.005
.01
.015
.02
.025
1940
1960
1980
2000
2020
Year
Concentration
Lowess


Retail trade
0
.05
.1
.15
.2
1940
1960
1980
2000
2020
Year
Concentration
Lowess


Transportation and warehousing
.004
.006
.008
.01
.012
1940
1960
1980
2000
2020
Year
Concentration
Lowess


Information
.004
.006
.008
.01
.012
.014
1940
1960
1980
2000
2020
Year
Concentration
Lowess

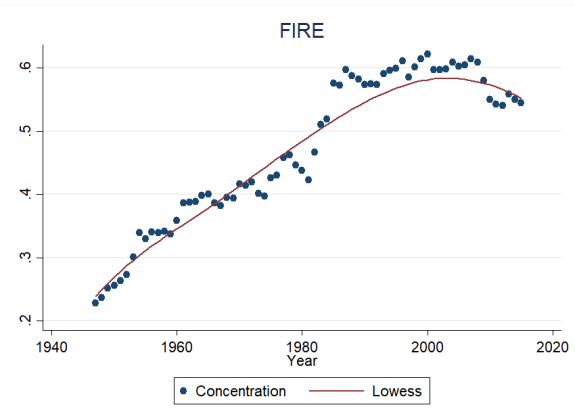

FIRE
.2
.3
.4
.5
.6
1940
1960
1980
2000
2020
Year
Concentration
Lowess

Figure 7: Concentration and sectoral distribution of FIRE, US

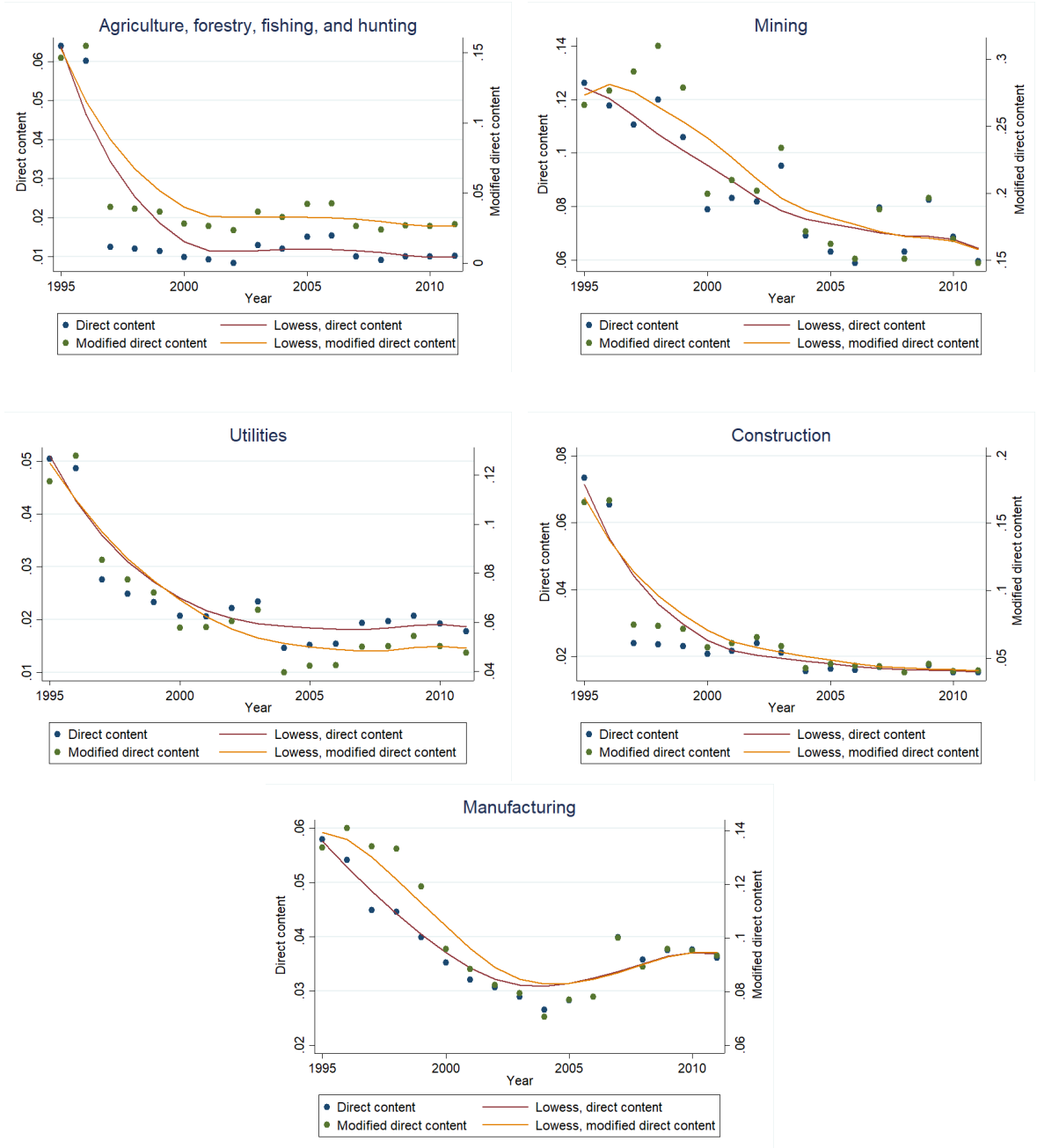


Figure 8: Direct financial content in traditional activities, Brazil

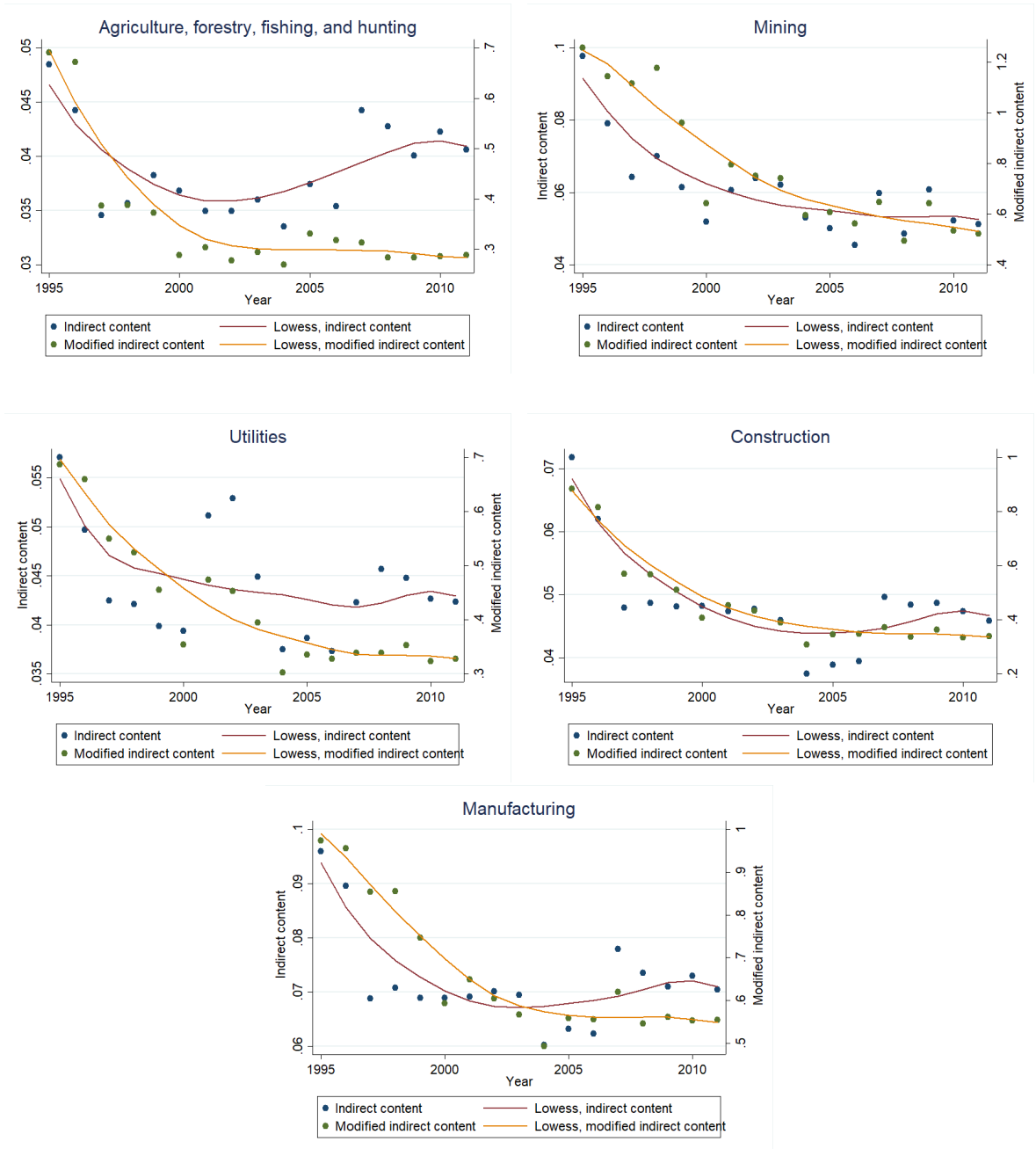
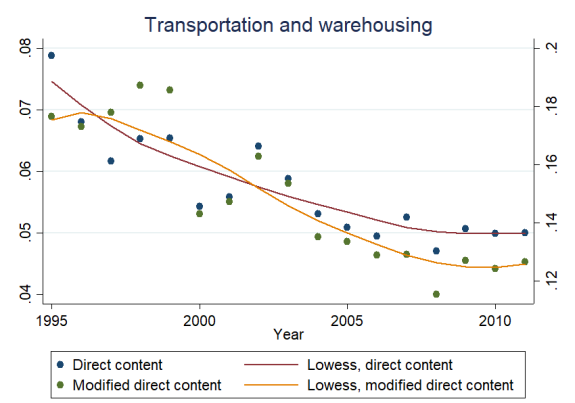
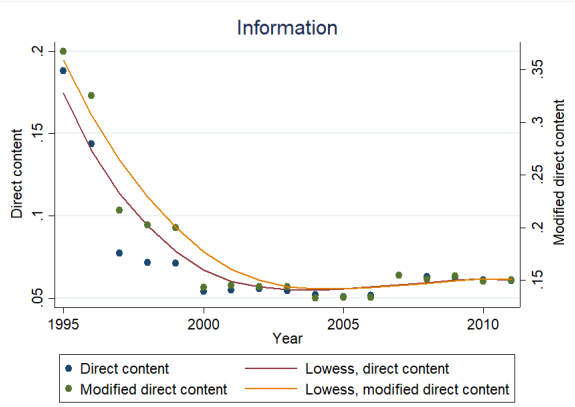
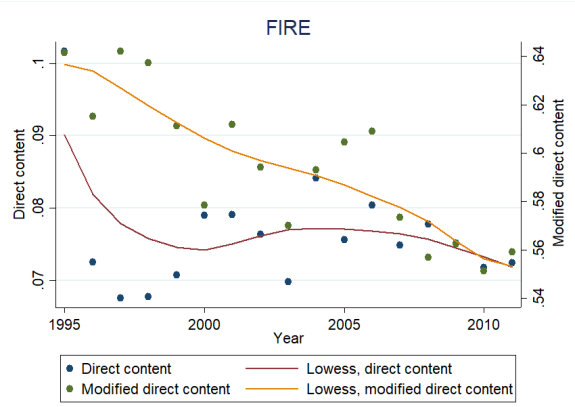


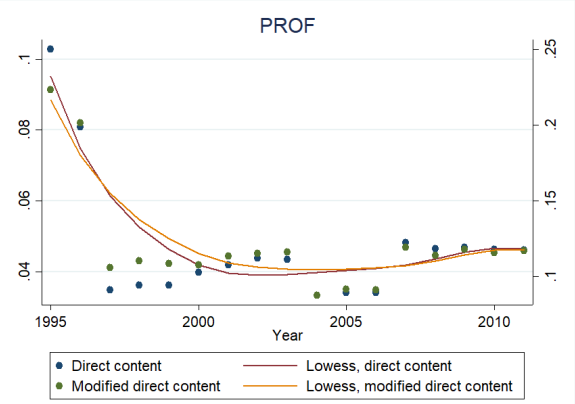
Figure 9: Indirect financial content in traditional activities, Brazil

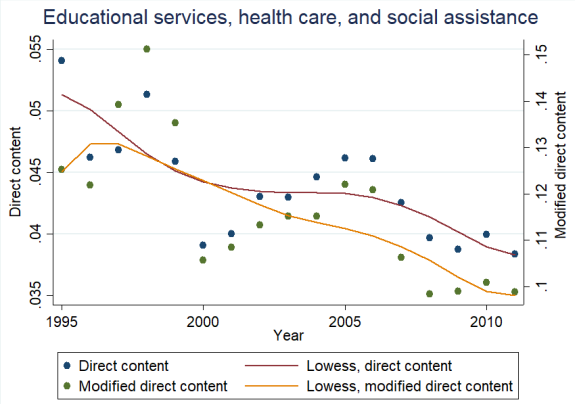

Wholesale and retail trade
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content

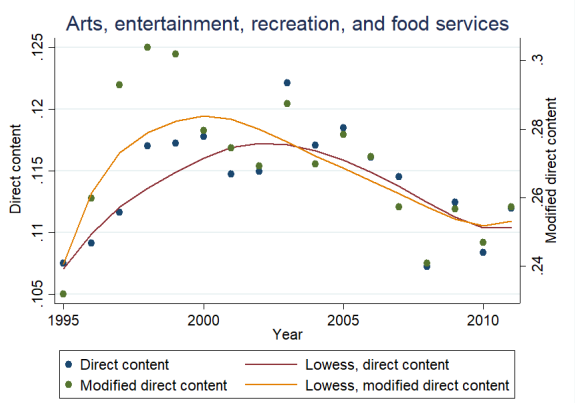

Transportation and warehousing
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content

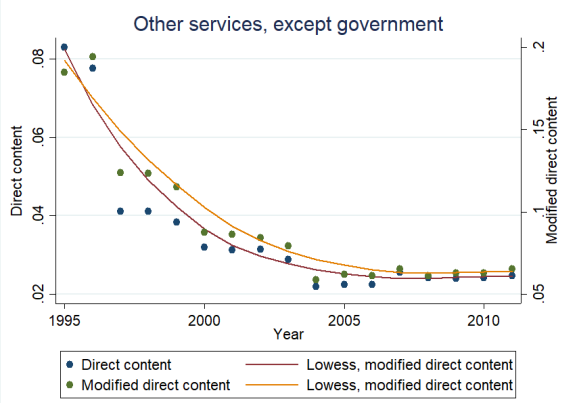

Information
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


FIRE
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


PROF
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Educational services, health care, and social assistance
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Arts, entertainment, recreation, and food services
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, direct content
Lowess, modified direct content


Other services, except government
Direct content
Modified direct content
Year
Direct content
Modified direct content
Lowess, modified direct content
Lowess, modified direct content

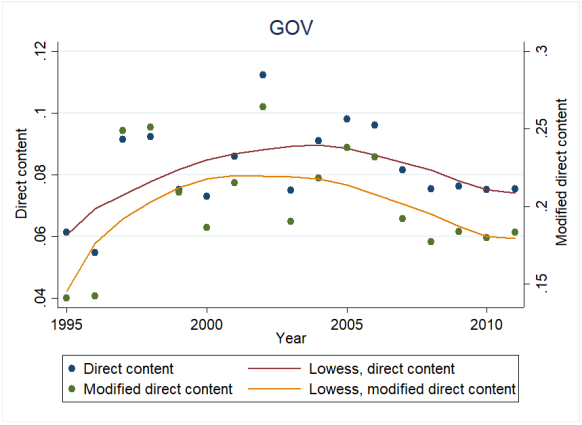
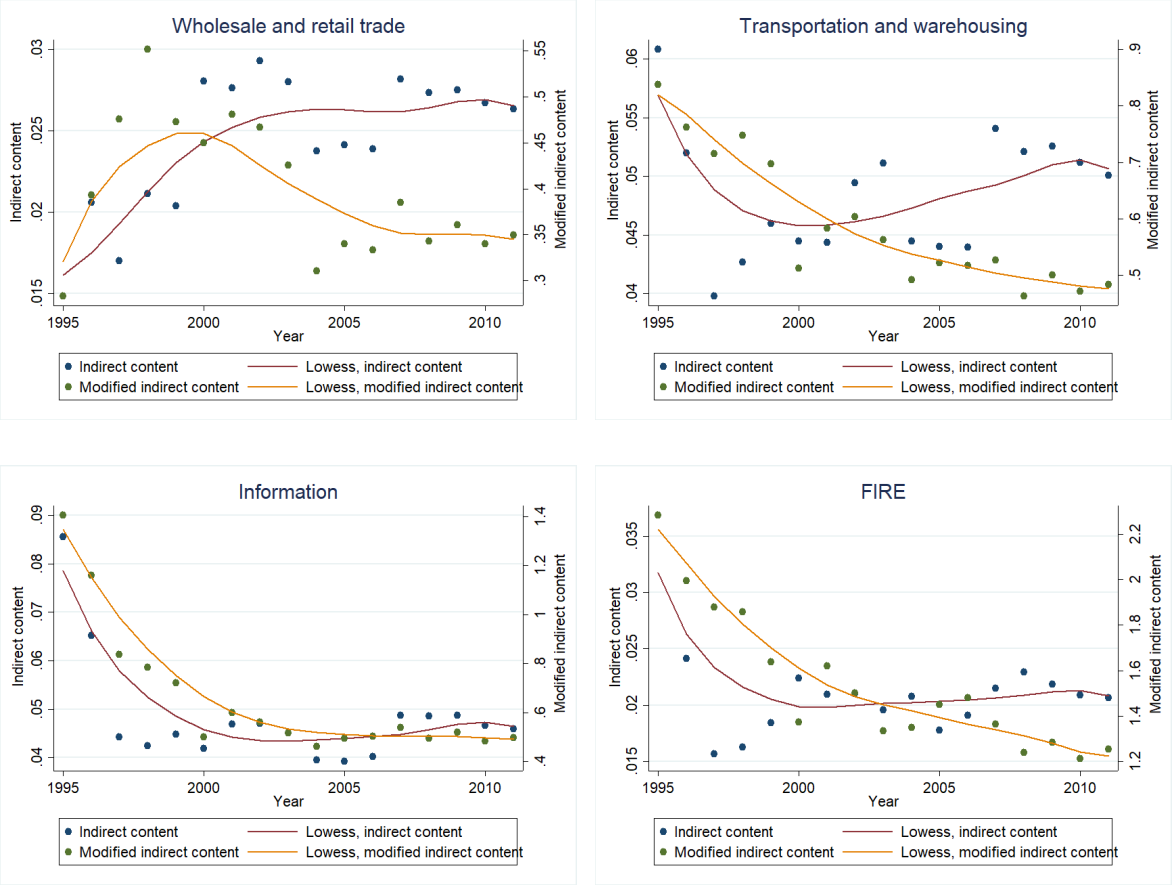


Figure 10: Direct financial content in service activities, Brazil



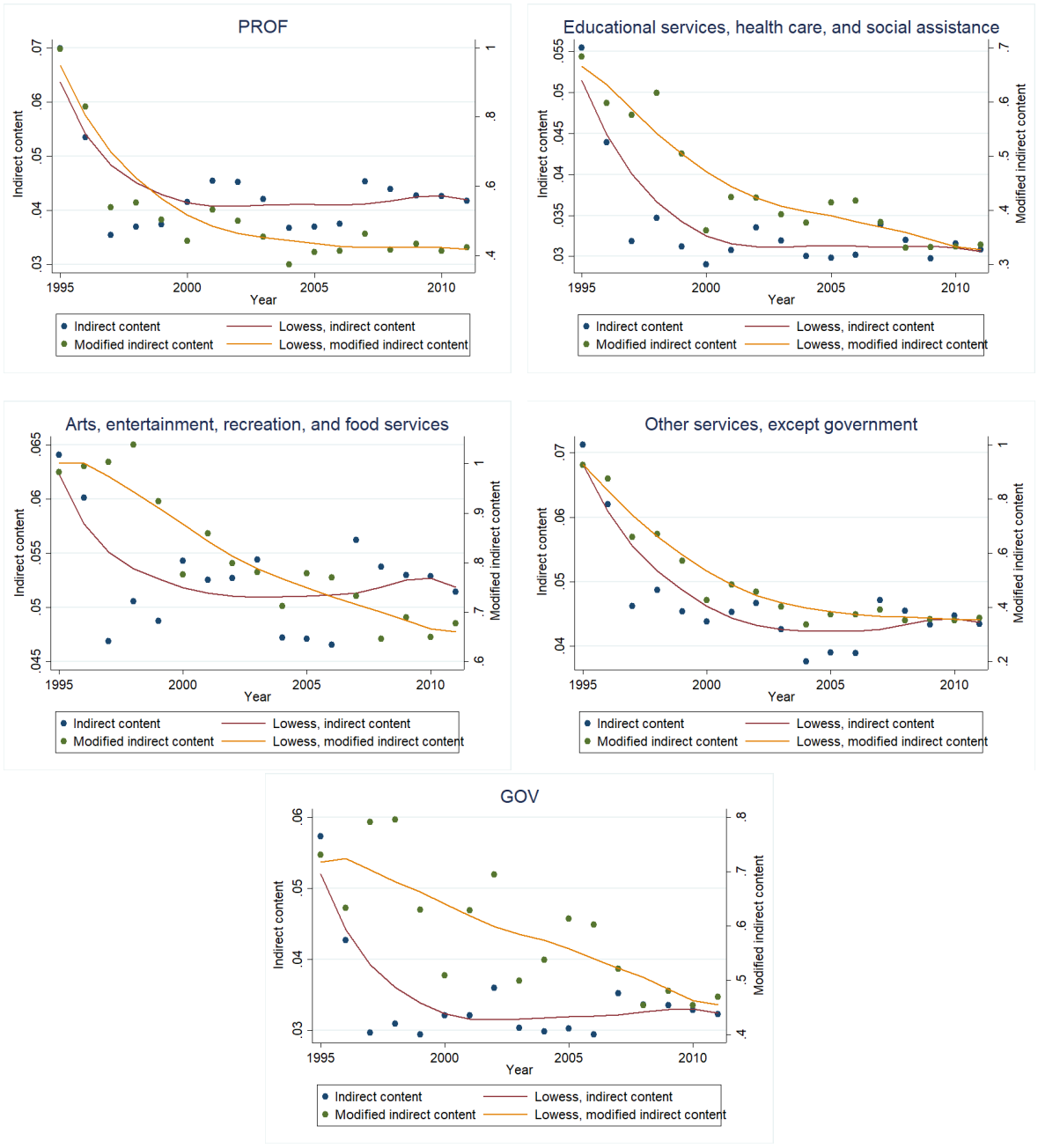


Figure 11: Indirect financial content in service activities, Brazil

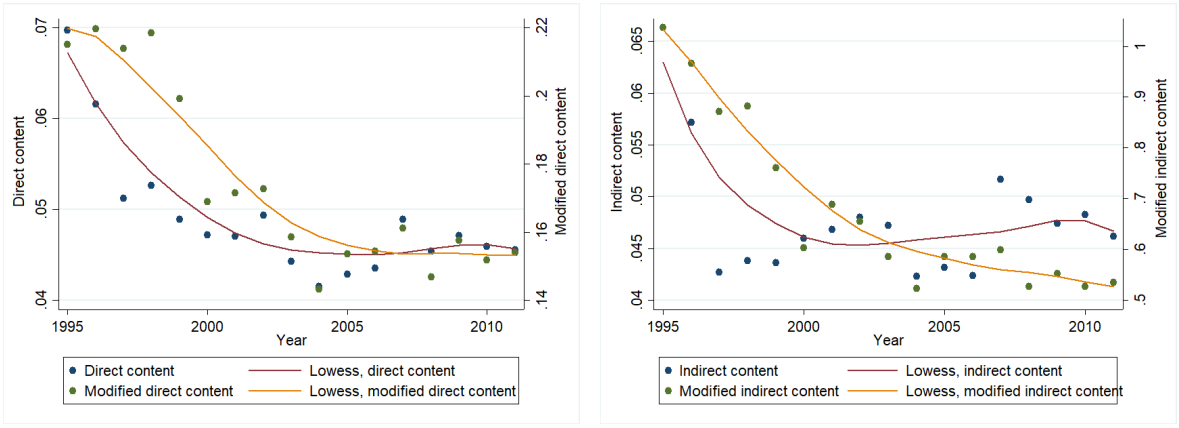


Figure 12: Aggregate direct (left) and indirect (right) financial content, Brazil

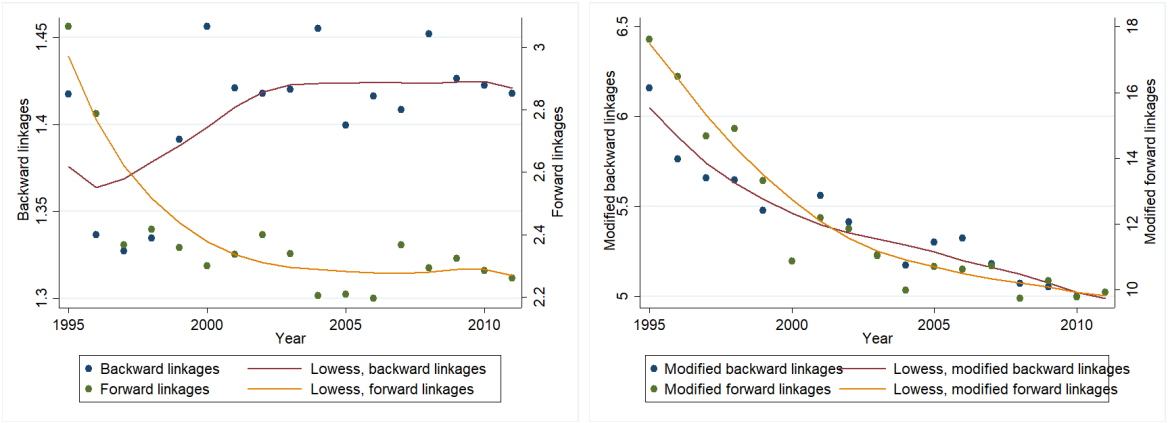
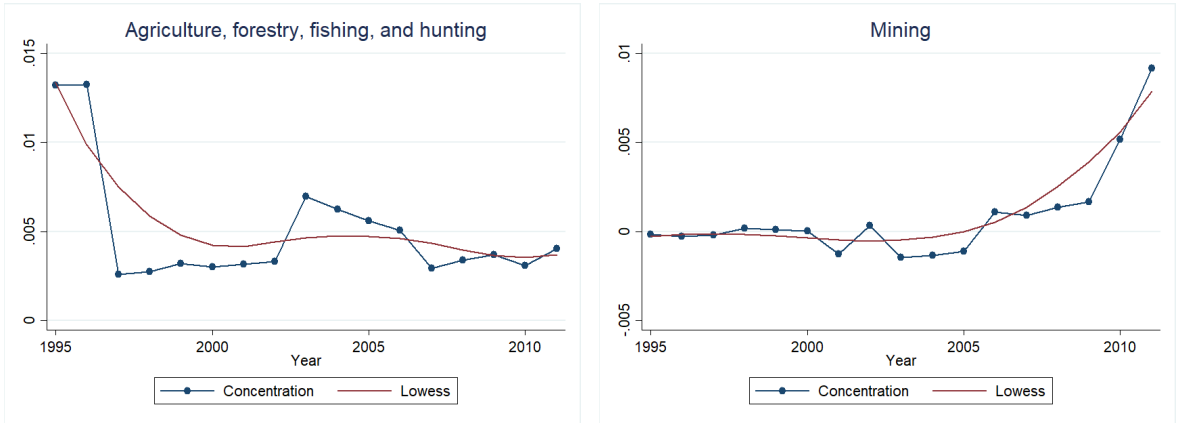
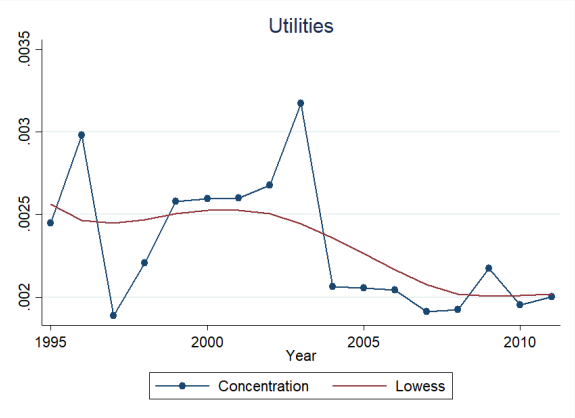
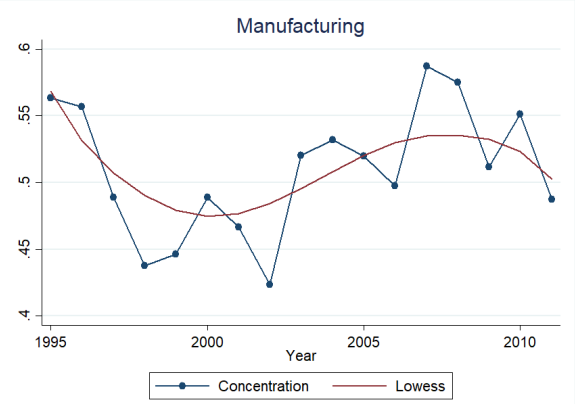


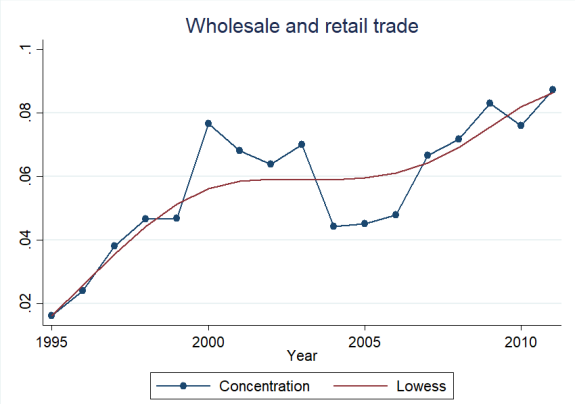
Figure 13: Backward/forward linkages (left) and index (right), Brazil

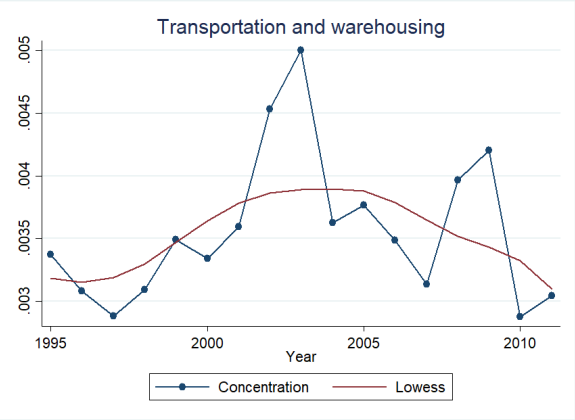


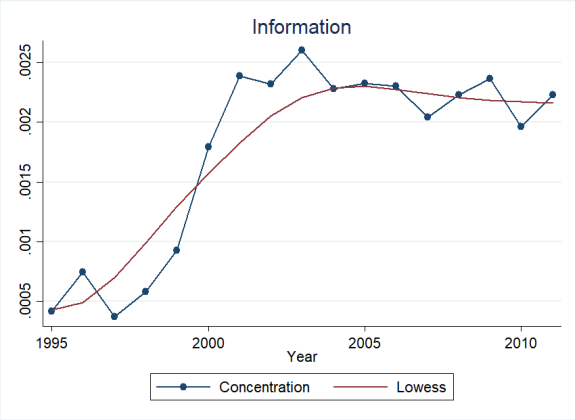

Utilities
.002
.0025
.003
.0035
1995
2000
2005
2010
Year
Concentration
Lowess

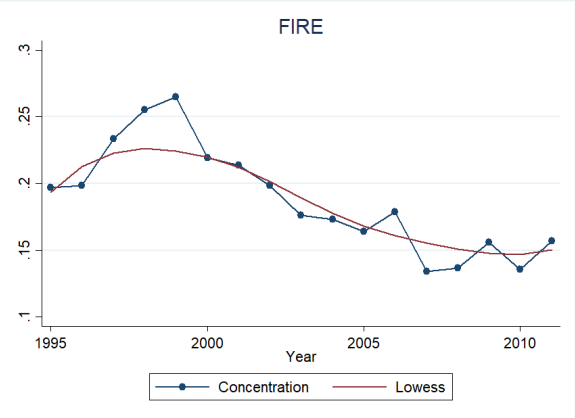

Construction
.01
.02
.03
.04
.05
1995
2000
2005
2010
Year
Concentration
Lowess

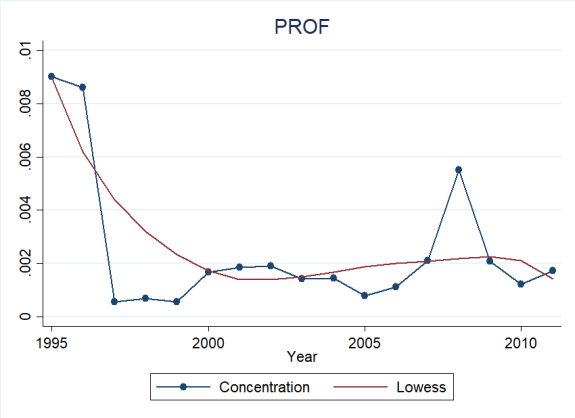

Manufacturing
.4
.45
.5
.55
.6
1995
2000
2005
2010
Year
Concentration
Lowess


Wholesale and retail trade
.02
.04
.06
.08
.1
1995
2000
2005
2010
Year
Concentration
Lowess


Transportation and warehousing
.003
.0035
.004
.0045
.005
1995
2000
2005
2010
Year
Concentration
Lowess


Information
.0005
.001
.0015
.002
.0025
1995
2000
2005
2010
Year
Concentration
Lowess


FIRE
.1
.15
.2
.25
.3
1995
2000
2005
2010
Year
Concentration
Lowess


PROF
0
.002
.004
.006
.008
.01
1995
2000
2005
2010
Year
Concentration
Lowess

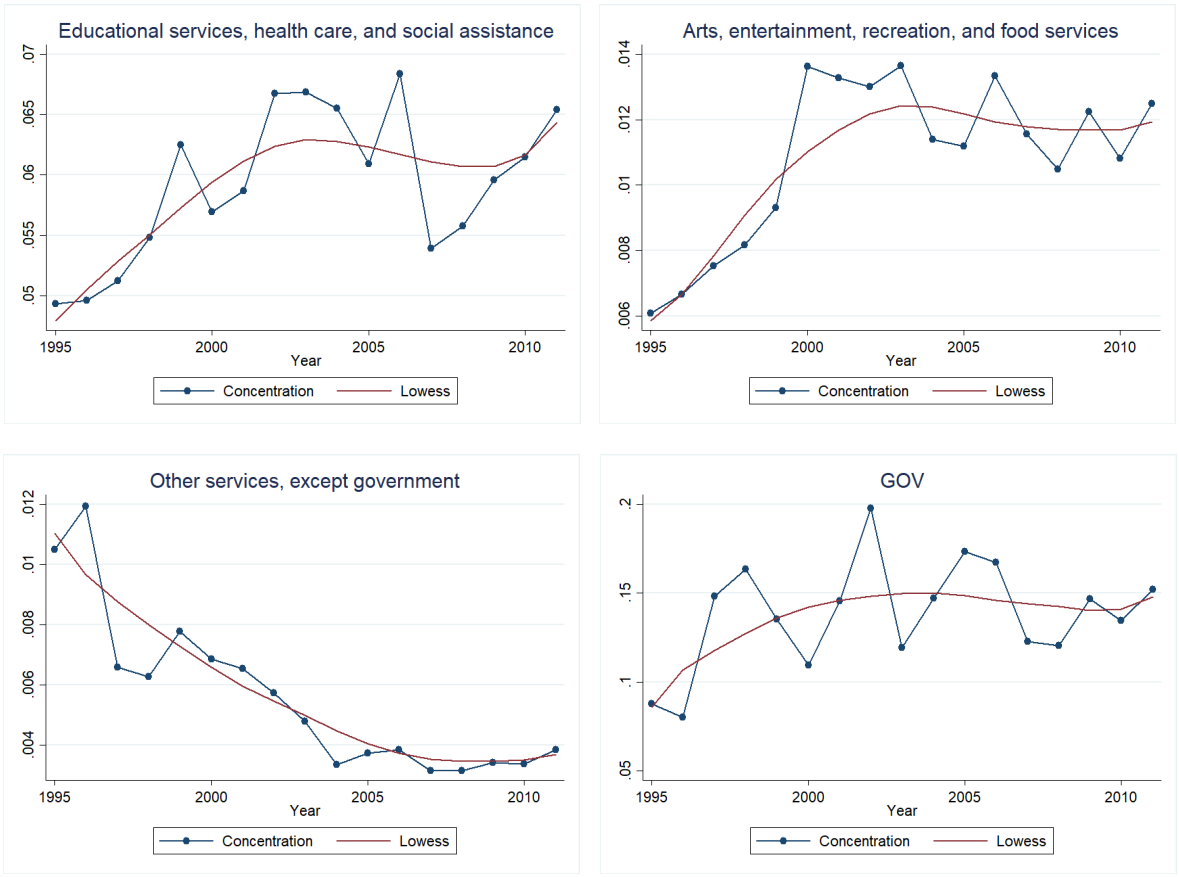


Figure 14: Concentration and sectoral distribution of FIRE