FINANCIALIZATION VS. (DE)INDUSTRIALIZATION IN CROATIA: EVIDENCE OF A NONLINEAR BEHAVIOUR

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Abstract Increasing financialization in the EU over the last two decades rendered different macroeconomic stories in regard to growth rates, industrialization and innovation, institutional transformation, inequality and financial stability. In addition, monetary union has created a favourable environment for such process by increasing a market expansion of financial institution and increasing financial assets within companies. However, the process of financial liberalization has changed economic structure in many countries leading to an excessive increase in both private and public debt and subsequently to the process of deindustrialization. For example, deindustrialization lead to a significant reallocation of resources from the industrial sector to the service sector in Croatia. The Global economic crisis of 2008 has shortly devitalized excessive financialization, yet it did not contain it. The aim of this paper is to evaluate whether the two economic lanes, financialization and industrialization, are mutually related and do they follow same linear or non-linear process. Identification is based on Markow switching approach with time-varying transition probabilities and covers annual data from 1995 to 2018. The period covers and extends beyond the Global crisis, which facilitates our empirical logic on examining the regime switching behaviour for both economic processes. Obtained results suggest nonlinearity within, both financialization and industrialization processes, by identifying two distinct levels of behaviour before and after the Global crisis.

Keywords: Croatia, financialization, deindustrialization, switching regession, Markow switching approach.

University of Maribor Press

DOI https://doi.org/10.18690/978-961-286-442-2.68
ISBN 978-961-286-442-2

1 Introduction

Over the last two decades, the global economy has undergone a profound structural transformation, as few economic processes collided, creating different economic patterns and consequences for a lot of countries. On one side, increasing financialization rendered different macroeconomic stories in regard to growth rates, industrialization and innovation, institutional transformation, inequality and financial stability. This brought an overgrowth of the financial sector compared to all real sectors of the economy, changing in that way economic structure in many countries by leading to an excessive increase in both private and public debt and subsequently to the process of deindustrialization. The literature on financialization emphasizes the negative impact of such process on both the real and financial sides of the economy. Risks from an excessive reliance on financial processes, if not well considered, can cause immense damages to socioeconomic progress. The huge costs to the real economy, financial markets, social perspective and institutional stability that the Global economic crisis of 2008 served, manifested itself in lost employment, reduction in public goods, costly bailouts and stimulus packages that constrained economic growth. The crisis has shortly devitalized excessive financialization, yet it did not contain it. While in the past, financialization has been mostly considered to be a driver for growth and innovation, today there is ample evidence from empirical studies and theoretical arguments that seriously challenge the benefits of financialization and point to detrimental effects on innovation, growth and stability (Batiston et al., 2018).

On the other side, aforementioned deindustrialization is becoming a threat, especially for developing countries (even though the term is today mainly used to refer to the experience of advanced economies), as they are yet to yield their opportunities from technological developments and productivity increases, hence the term 'premature deindustrialization' is coined for that manner. Namely, despite a number of catching-up economies having registered fast economic growth during the last two decades, world industrial production has remained highly concentrated as fewer than twenty countries control 80% of the world manufacturing value-addition activities (Andreoni and Tregenna, 2018). As Rodrik states (2016), deindustrialization removed the main channel through which rapid growth has taken place in the past, therefore, it reduced the

economic growth potential and the possibilities for convergence with income level of the advanced economies. Even if it is impossible to draw unambiguous conclusions regarding the final effect of deindustrialization (positive or negative), particularly in the long-run, there is a one process that can be associated with it. While technological progress had a large detrimental part in employment deindustrialization for advanced countries with trade and globalization playing a bigger role for developing countries, financial liberalization appears to have a negative impact on unemployment, capital accumulation and growth for all countries. Authors like Epstein (2019), Batiston et al. (2018), Assa (2012), Freeman (2010), Palley (2007), Stockhammer (2004) and many others, accentuate that the process of excessive financialization of the global economy has a huge impact on the effects of growth, inequality and financial stability, and not always a positive one.

In Croatia, high orientation towards traditional industrial sectors and a low share of high value added activities (for example a low share of high technology products in exports) has indicated that the deindustrialization process is an even more challenging. This process was characterized by a reduction in the share of employment in the primary sector, by a growing employment in the secondary sector, but also by a significant reallocation of resources from the industrial sector to the service sector, additionally increasing the role of financial products and financial sectors relative to the industrial sector (Tomić and Stjepanović, 2017). The aim of this paper is to evaluate whether the two economic lanes in Croatia, namely financialization and industrialization, are mutually related and do they follow same linear or non-linear process. Identification is based on Markow switching approach with time-varying transition probabilities and covers annual data from 1995 to 2018. The period covers and extends beyond the Global crisis, which facilitates our empirical logic on examining the regime switching behaviour for both economic processes. Obtained results suggest nonlinearity within, both financialization and industrialization processes, by identifying two distinct levels of behaviour before and after the Global crisis.

2 Empirical background

In this part we will present only studies that directly or indirectly related Croatia with the processes of financialization and deindustrialization. On an international level, Davì (2018) analyzed the EU15 countries within the period 1994-2004 with a multivariate analysis indicating that main factors responsible of the dynamics of deindustrialisation have been efficiency and the scale of production processes in various manufacturing activities. Andreoni and Tregenna (2018) accentuated that premature deindustrialization is a threat to low- and middle-income countries as it shrinks their opportunities for technological development, and their capacity to add value in global value chains and tradable sectors, putting Croatia in a group of countries in which share of manufacturing in total employment decreased (2005-2015) and the share of manufacturing in total employment is higher than predicted.

Batiston et al. (2018) presented empirical evidence on the patterns of increasing financialization in the EU in the last two decades, an analysis of its possible adverse effects on several objectives of the EU 2030 agenda, including inclusive growth, innovation, inequality and financial stability. Gambarotto, Rangone and Solari (2019) suggested that liberalization and market reform policies have taken southern EU economies onto the path of a credit-based and passively-extroverted financialized economy that trap them into a low-cost-of-wages search of competitiveness and deindustrialization. Svilokos and Burin (2017) tried to evaluate the process of financialization and its impact on the process of deindustrialization in the EU by detecting the significant and negative impacts of the process of financialization on value added of industry sector, as well as on the employment in the industry sector. Svilokos, Vojinić and Šuman Tolić (2019) found that the real interest rate, real effective exchange rate and trade openness, influence the manufacturing value added as a percentage of national output so that the role of the financial sector is very important for the level of industrialisation in Central and East European countries. Stojčić and Aralica (2015) offered an interesting insight into the regional patterns of deindustrialization and determinants of reindustrialization in several Central East and South East European countries. Their results revealed spatial clustering of economic activity where the traits of deindustrialization are found in metropolitan areas and in regions on eastern belt of these countries, while other

regions revealed traits of a shift towards high technology intensive manufacturing.

Tomljanović, Grubišić and Kamenković (2018) indicated that the evident process of deindustrialization in Croatia is a challenge from the aspect of implementation of the concept Industry 4.0, which requires increased investment in research and development and the improvement of knowledge and ability of the population and their implementation in the economic sector. Jaklin et al. (2016) offered some thought on how to share re-industrialization in Croatia from 'left' political positions indicating the importance of adequate strategy implementations. Mihaljević (2013) depicted interesting historical facts about the process of deindustrialization suggesting that Croatia will be remise to a periphery of the EU. Penava and Družić (2015) stressed that the lack of structural changes and rapid deindustrialisation are the main reasons behind Croatia's failure in achieving its industrial potential. Namely, the development did not take the same role in the model of deindustrialisation of Croatia as it was the case in developed countries, investments do not have the expected impact, and international trade is not a significant variable in their model.

3 Methodology and data

3.1 Research methodology

Since the main goal of this paper is to evaluate the mutual relation between the process of (de)industrialization and financial development for Croatia, hence the dynamics of their behaviour, we opted to use the methodology that would enable us to reveal some hidden information about its movements and development. The trend of deindustrialization has been spread over countries leading to lower levels of income and economic growth compared to more developed countries. However, the economic crisis of 2008 warn the global economy that excessive reliance on financialization, i.e. financial liberalization does not always imply positive growth effects and can have a disastrous aftermaths, and therefore indirectly inclined the importance of (re)industrialization for economic development *per se*. Recent trends in data implicate such connotation (see *Figure 1*). This course of conclusions suggests that both, financialization and industrialization, in their interdependency, could be good candidates of for

Markov switching process (Tomić, 2016). In recent times, models such as Markov switching have played important role in analyzing dynamic variables in macroeconomics and financial economics, thus Markov switching approach became a powerful tool for modelling time series with evident changes in their behaviour. The main advantage of regime switching models is their flexibility, since they can capture average and variance changes in different regimes, unlike linear models and are capable of capturing more complex dynamics of chronological data sets. To define the basic Markov switching process we have to follow Hamilton's model. Hamilton (1989) has specified a two state Markov switching model MS(2) in which mean growth rate of gross national product is subject to regime switching and where the errors follow a regime invariant AR(4) process. He defines the process (y_t) in time t as an MS(2) process if it verifies the following equation:

$$y_t = \mu_{St} + \alpha_{1St} y_{t-1} + \ldots + \alpha_{pSt} y_{t+p} + \varepsilon_t \quad \varepsilon_t \sim iid(0,\sigma^2_i(S_t)),\ s_t=j,\ s_{t-1}=i,\ ij \in 1,2 \qquad (1)$$

where y_t represents variables whose temporal evolution we want to define, μ_{St} the rate of medium growth corresponding to the state S_t and ε_t is the white noise of variance $\sigma^2_i(S_t)$, which can be considered a state of dependence. For all t, the unobservable variable S_t has the value of 1 when the state is in regime 1 and the value of 2 when is in regime 2 so that state S_t follows a Markov chain characterizes by the property:

$$p_{ij} = P(S_t=j \mid S_{t-1}=i) \quad \sum^{N}{}_{1} p_{ij}=1, \quad \forall ij \in \{1,2\} \qquad (2)$$

where (p_{ij}) i, j are the transition probabilities. These last allow one to measure the probability of changing one regime to another. Furthermore, $\mu(S_t)$ *i* $\sigma^2(S_t)$ present the conditional average and conditional variance, depending on the state of nature. So, Markov regime switching models facilitate the identification of different regimes/states in the evolution of variable y_t. Estimation of model parameters is in addition based on maximum likelihood estimation. As Boudebbous (2015) points, these parameters allow one to get the smoothed and filtered probabilities of unobserved variable S_t. The determination of smoothed and filtered probabilities associated with each regime *de facto* allows the dating of change one regime to another. One limitation of Hamilton's model is that transition properties are fixed. Hence, the use of regime switching model that

allows for probabilities to change over time can yield more accurate estimates of the process. Filardo (1994) and Diebold et al. (1994) developed the Markov switching model with time-varying transitional probabilities in order to capture the systematic changes in the transitional probabilities before and after the turning points (Byrne, 2010).

Ultimately, we can endogenize probability of changes of regime by incorporating economic variables as their determinants so that transitional probabilities in such model could be expressed as:

$$p[s_t=1 \, I \, s_{t-1}=1] = p_{11}(z_t) \qquad p[s_t=2 \, I \, s_{t-1}=2] = p_{22}(z_t)$$
$$p[s_t=2 \, I \, s_{t-1}=1] = p_{12}(z_t) \qquad p[s_t=1 \, I \, s_{t-1}=2] = p_{21}(z_t) \qquad (3)$$

where z_t is the set of information variables. Thus, we will use the model with time-varying transitional probabilities in order to comprehend possible changes in the transitional probabilities within distinct regimes of behaviour.[1]

3.2 Data

Data on financialization and industrialization are observed on an annual base for the period 1995-2018 and are collected from the World Bank database. Data on financialization are presented as a domestic credit provided by the financial sector[2] (as a % of gross domestic product), whereas data on industrialization encompass value added industry with included construction (as a % of gross domestic product). Data were logarithmically transformed and finally we obtained variable ***LnFIN*** representing the process of financialization and variable ***LnIND*** representing the process of industrialization. Following the unit root tests (Augmented Dickey Fuller test, Phillips-Perron test and Kwiatkowski-Phillips-Schmidt-Shin test)[3], variables reveal a non-stationary behaviour. Accordingly, we differentiated variables in order to get their log difference and lay down the ground for two-state Markov switching models with time-varying transitional probabilities.

[1] For the analysis, EViews (IHS Global Inc., 2019) econometric software is used.
[2] Alternatively, data on domestic credit to the private sector could be used, however, in our case they yielded almost similar results.
[3] The results are not shown in order to preserve space.

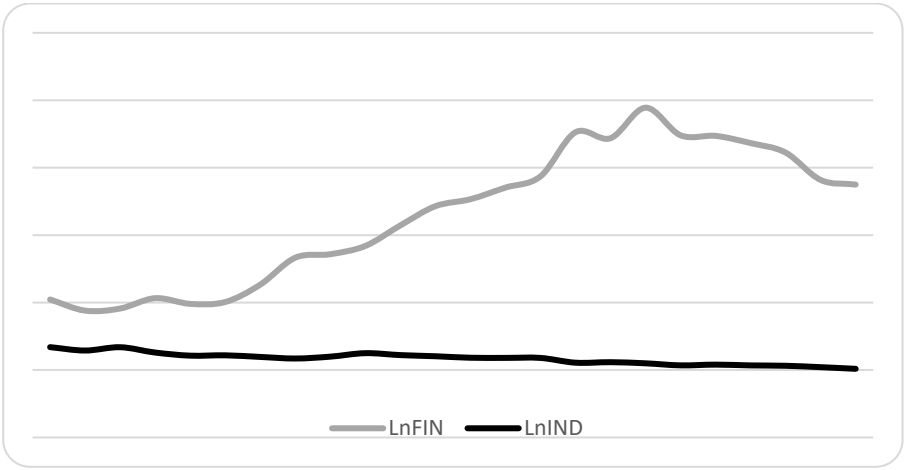

Figure 1: Financialization and industrialization trends in Croatia
Source: World Bank (2020).

When observing raw data (*Figure 1*) on these two processes we can clearly notice contrastive trends, hence one regime, before the Global crisis (considering the fact that Croatia started experiencing the effects of the crisis in the late 2009) with an increasing financialization and deindustrialization and on the other side similar trends after the 2009, suggesting that there is an evidence of new distinct regime. In the next part we will test these hypotheses.

4 The results

4.1 Markov switching model with time-varying transitional probabilities on financialization variable

First, we will present the results from two-state Markov switching model with time-varying transitional probabilities in which the variable financialization is subject to regime switching, where the errors follow a regime-invariant AR(4) process and we allowed an exogenous variable industrialization to explain evolution of transitional probabilities. Note that we have used the lag of the indicator variable as our probability regressor so that the period *t* data for the regressor corresponds to the values influencing the transitions for *t-1* to *t*. Therefore, we estimated MS(2)-AR(4) model based on the minimalization of Akaike and Hannan-Quinn information criteria (similar to Clements and Krolzig,

1998) and identified two different states ($S_t = 1$ or $S_t = 2$) where the switch between the states is governed by the transition matrix *P*. Meaning that financialization process could be in either its increasing path (regime 1) or decreasing path (regime 2) in relationship to the movements in industrialization process (*Table 1*). Simple observation and estimation suggests that financialization process in that way has nonlinearity. Similar to Benazić (2016), in addition, correlograms of standardized residuals and squared standardized residuals as well as histogram indicate stable and reliable model).[4]

Table 1: MS(2) on DLnFIN

Dependent Variable: DLnFIN				
Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Regime 1				
C	-0.031986	0.010233	-3.125644	0.0018
Regime 2				
C	0.084451	0.007398	11.41456	0.0000
Common				
AR(1)	-0.107973	0.227492	-0.474622	0.6351
AR(2)	-0.152782	0.145021	-1.053520	0.2921
AR(3)	-0.475544	0.112578	-4.224145	0.0000
AR(4)	0.526316	0.242398	2.171287	0.0299
LOG(SIGMA)	-3.877591	0.206976	-18.73448	0.0000
Transition Matrix Parameters				
P11-C	0.428337	1.463781	0.292624	0.7698
DLnIND(-1)	-75.46625	71.03046	-1.062449	0.2880
P21-C	-1.964051	1.276843	-1.538209	0.1240
DLnIND(-1)	-36.63362	32.63090	-1.122666	0.2616
Summary statistics				
Mean dependent	0.034687	S.D. dependent var.	0.076193	
S.E. of regress.	0.061689	Sum squared resid.	0.045667	
Durbin-Watson	1.744825	Log likelihood	34.03629	
Akaike	-2.424872	Schwarz criterion	-1.878092	
Hannan-Quinn	-2.332335			
Inverted AR R.	0.62	0.13-0.92i	0.13+0.92i	-0.99

Source: Research results.

[4] The results are not shown in order to preserve space.

Instead of focusing on the transition matrix parameters, the transition probabilities matrix and the expected duration of regimes are examined. Time-varying transition probability estimations from *Table 2* also indicated that two different states of financialization dynamics, with magnitudes that do not differ considerably, can be identified; regime 1 (μ_1 = – 0.03; indicating that DLnFIN and DLnIND are moving in opposite direction) with 0.69 probability of remaining within the increasing path, but with probability of 0.31 to transit to next regime, and regime 2 (μ_2 = 0.08; indicating that DLnFIN and DLnIND are moving in the same direction) with 0.82 probability of remaining in that stable decreasing path. Interestingly, corresponding time-varying expected duration of regime 1 is only around 14 years, whereas for regime 2 is high 8 years, which corresponds to previous interpretations of data. It means that variable industrialization clarifies the distinction between different states of financialization process, suggesting that it is in fact useful information variable.

Table 2: Transition probability matrix and time-varying expected duration of DLnFIN

Time-varying transition probabilities:			
P(i, k) = P(s(t) = k | s(t-1) = i) (row = i / column = j)			
(row = i / column = j)		Regime 1	Regime 2
Mean	1	0.686578	0.313422
	2	0.185085	0.814915
		1	2
Std. Dev.	1	0.259254	0.259254
	2	0.119393	0.119393
Time-varying expected durations:			
		1	2
Mean		13.88671	8.276740
Std. Dev.		37.45619	7.508109

Source: Research results.

According to Hamilton (1989), turning points are determined at the time when the smoothed regime probability exceeds the value of 0.5. The following *Figure 2* displays one-step ahead predicted, filtered and smoothed regime probability. It implies that Croatian economy was experiencing an increasing financialization (regime 1) with slight excess in the 2006 probably related to strong structural changes through EU expansion. According to the data, the model also recognized a potential turning point at the end of 2010, suggesting the end of

regime 1, however it was only a faint point. None the less, in 2012 the transit to regime 2 becomes more evident.

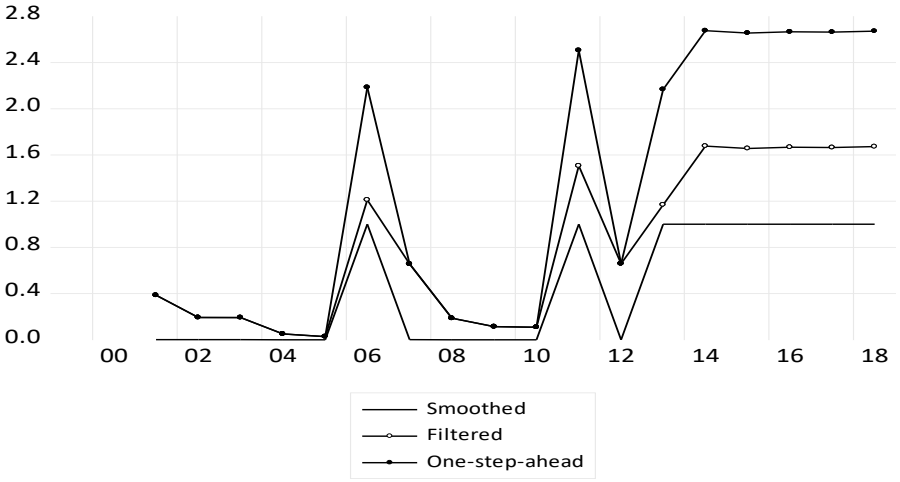

Figure 2: Regime probabilities (P(S(t)=1) on DLnFIN
Source: Research results.

4.2 Markov switching model with time-varying transitional probabilities on industrialization variable

Next, we will evaluate the results from two-state Markov switching model with time-varying transitional probabilities in which the variable industrialization is subject to regime switching, where the errors follow a regime-invariant AR(4) process and we allowed an exogenous variable financialization to explain evolution of transitional probabilities. The process of estimation is the same as in the previous case. Again, we obtained MS(2)-AR(4) model based on the minimalization of Akaike and Hannan-Quinn information criteria (and the basic quality of the model) with two different states ($S_t = 1$ or $S_t = 2$) where the switch between the states is governed by the transition matrix *P*. Suggesting that the industrialization process could also be in either its decreasing path (regime 1) or more stable path (regime 2) in relationship to the movements in the financialization process (*Table 3*). It implies that the industrialization process could also be nonlinear. Once more, correlograms of standardized residuals and

squared standardized residuals as well as histogram indicate stable and reliable model.[5]

Table 3: MS(2) on DLnIND

Dependent Variable: DLnIND				
Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Regime 1				
C	-0.023177	0.004833	-4.795789	0.0000
Regime 2				
C	0.012653	0.004482	2.822780	0.0048
Common				
AR(1)	0.842146	0.278248	3.026609	0.0025
AR(2)	-0.993325	0.297742	-3.336195	0.0008
AR(3)	0.687716	0.143050	4.807511	0.0000
AR(4)	-0.299857	0.183537	-1.633769	0.1023
LOG(SIGMA)	-4.824536	0.241584	-19.97041	0.0000
Transition Matrix Parameters				
P11-C	0.417102	1.058491	0.394054	0.6935
DLnFIN(-1)	-12.28119	14.57022	-0.842897	0.3993
P21-C	1.796103	1.942485	0.924641	0.3552
DLnFIN(-1)	-23.40911	20.36704	-1.149363	0.2504
Summary statistics				
Mean dependent	-0.009976	S.D. dependent var.	0.022322	
S.E. of regress.	0.018193	Sum squared resid.	0.003972	
Durbin-Watson	2.473836	Log likelihood	49.85166	
Akaike Info	-4.089649	Schwarz criterion	-3.542868	
Hannan-Quinn	-3.997112			
Inverted AR R.	0.50+.39i	0.50-.39i	-0.08-0.86i	-0.08+0.86i

Source: Research results.

Again, we focus more on the transition probabilities matrix and the expected duration. Time-varying transition probability estimations from *Table 2* indicated two different states of industrialization dynamics; regime 1 (μ_1 = – 0.02; indicating that DLnIND and DLnFIN are moving in opposite direction) with 0.49 probability of remaining within the decreasing path, but with probability of 0.50 to transit to next regime, and regime 2 (μ_2 = 0.01; indicating that DLnIND and DLnFIN are moving in the same direction) with 0.35 probability of remaining that path, however, with strong probability of 0.65 of reverting to the previous regime. Interestingly, corresponding time-varying expected durations of

[5] The results are not shown in order to preserve space.

both regimes are around 2 years, which casts some doubts on in interpretation of the data and the significance of the industrialization as a probability regressor. This is confirmed by the display of regime probabilities in *Figure 3*.

Table 4: Transition probability matrix and time-varying expected duration of DLnIND

Time-varying transition probabilities:			
P(i, k) = P(s(t) = k | s(t-1) = i) (row = i / column = j)			
(row = i / column = j)		Regime 1	Regime 2
Mean	1	0.493194	0.506806
	2	0.647762	0.352238
		1	2
Std. Dev.	1	0.202185	0.202185
	2	0.290730	0.290730
Time-varying expected durations:			
		1	2
Mean		2.435085	2.338086
Std. Dev.		1.393623	2.180494

Source: Research results.

One-step ahead predicted, filtered and smoothed regime probabilities display different point of change, hence it does not provide a clear break point of the change in the regime, again casting some doubts on the nonlinearity of the process of industrialization and the relevance of the variable financialization in explaining the change in the industrialization process.

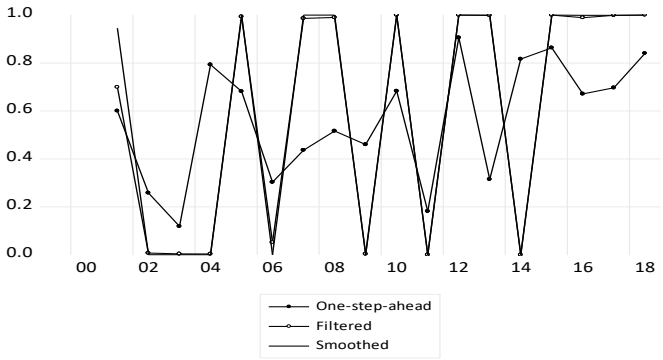

Figure 2: Regime probabilities (P(S(t)=1) on DLnIND

Source: Research results

Our results provide a new perspective on the relationship between the processes of financialization and (de)industrialization in Croatia by confirming possible nonlinearity in their dynamics, hence the mutual dependency in explaining turning point of the Global crisis in 2008 in which regime switching has occurred. Thought we find some interpretation problems when observing deindustrialization process, especially in the terms of clear identification of the turning point as well as the low probabilities for staying within specific regime, it is clear that both processes were moving in different regimes prior to 2008, but their dynamics seem to be more resemblingt afterwards.

4 Concluding remarks

Excessive financialization, liberalization of financial markets and deregulation, benevolent corporate behaviour, increased income inequality and wage stagnation, transfer of income from the real sector to the financial one, deindustrialization and finally the Global crisis of 2008 proved the necessity of firmly monitoring two important processes, namely increased financialization and (de)industrialization. Those trends have definitely taken place on a large scale in all countries, whether measured by the increase in the share of value-added coming from the financial sector or in decreased employment in an industry as a percentage of total employment. Some even blame these two processes for recent negative economic trends. The process of financial liberalization has changed economic structure in many countries leading to an excessive increase in both private and public debt and subsequently to the process of deindustrialization. For example, deindustrialization lead to a significant reallocation of resources from the industrial sector to the service sector in Croatia.

For that manner, aim of this research was to evaluate the dynamics of these two economic trends, with respect to their interdependence and the characteristics of the linearity within specific process. Analysis was based on Markow switching approach with time-varying transition probabilities with analyzed period covering and extending beyond the Global crisis, which facilitates our empirical logic on examining the regime switching behaviour for both economic processes. The results provided a new perspective for Croatia by confirming possible nonlinearity in the dynamics, hence the mutual dependency in explaining the turning point of the economic crisis in 2008 in which regime switching has

occurred. Thought we find some interpretation problems when observing deindustrialization process, especially in the terms of clear identification of the turning point as well as the low probabilities for staying within specific regime, we found contrasting trends, hence one regime, before the Global crisis with an increasing financialization and deindustrialization and on the other side similar trends afterwards, suggesting that there is an evidence of new distinct regime.

Though the analysis has some shortcomings (for example, annual data used for modelling purposes could be pervious to over-parameterization as the estimation period is relatively short and second model provides some ambiguous conclusions), hence obtained results should be taken with caution, we humbly accentuate that the conclusions made above are just mere observations and could/should be subject to revision in the future.

Acknowledgments

This paper is a result of scientific – research projects "Impact of Monetary and Fiscal Policy on Financial Markets and Institutions", "Accounting for the Future, Big Data and Economic Measurement" and "The Determinants and Challenges of Competitiveness" supported by the Faculty of Economics and Tourism „Dr. Mijo Mirković", Juraj Dobrila University of Pula. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the Faculty of Economics and Tourism „Dr. Mijo Mirković", Pula.

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