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THE EXTRACTION OF AGGREGATES IN SERBIA, 1973 - 2015, A STATISTICAL EXPLORATION***

Abstract

We contribute to the fields of mineral economics, environmental and economic history in two respects: first, we construct a novel time series data set for the levels of aggregates extraction in Serbia between 1973 and 2015; the second, we estimate a change point ordinary least squares regression to model the dynamics of aggregates extraction in the aforementioned period. Our cliometric estimates are in great accordance with the major business cycle facts of the Serbian economy in the last 40 years. The most important policy implication of our results pertains to the potential slowdown of aggregates extraction from the onset of the Great Recession.
Keywords: *aggregates, mineral economics, Serbia, cliometrics, change point regression*

1 INTRODUCTION

Aggregates (crushed stone, sand and gravel) are high bulk, low unit value granular materials used primarily in the construction industry. The use of aggregates in construction industry is primarily in the form of cement, asphalt, mixed and pre-cast concrete. They can also represent the end-products in the form of railroad ballast, armour stones, filter beds or flux materials. Transportation costs, i.e., the market location, is the most important factor in determining the value of aggregates.

Aggregates, as documented by Menegaki and Kaliampakos [15], represent the biggest branch of mining by production volume, and the second biggest branch of mining by production value, just after the sector of fossil fuels. They, hence, represent the most valuable non-fuel mineral commodity in the world. In addition, as Menegaki and Kaliampakos [15] note, their close conection with the construction industry places them among the most used materials worldwide, second only to water. Krausmann et al. [14] document how the total aggregates extraction in the XXth century has increased by a factor of 34.

Aggregates, apart from their importance for the construction industry, are also important from the standpoint of sustainable resource management. Bleischwitz and Bahn-Walkowiak [11] emphasize the environmental importance of aggregates extraction from two perspectives: 1) material intensity perspective-the relevance of aggregates for increasing resource productivity in the Euro

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pean Union (EU) as a part of the Lisbon strategy; 2) environmental intensity perspective-the relevance of aggregates for increasing the eco-efficiency and lowering the environmental impacts in the EU.

This paper is concerned with the analysis of aggregates extraction dynamics in Serbia between 1973 and 2015. T hecliometric estimates are in great accordance with the major business cycle facts of the Serbian economy in the last 40 years. The most important policy implication of our results pertains to the potential slowdown of aggregates extraction from the onset of the Great Recession.

We contribute to the fields of mineral economics, environmental and economic history in two ways. First, we construct a novel time series data set for the aggregates extraction in Serbia between 1973 and 2015. Bleischwitz and Bahn-Walkowiak [11], as well as Behrens et al. [9], acknowledge how the present data are fragmentary, incomplete and in most instances based on different definitions and classifications. Second, we estimate a change point ordinary least squares regression to capture the dynamics of aggregates extraction in the aforementioned period. Menegaki and Kaliampakos [15] analyse the extraction of aggregates in 26 European economies between 1997 and 2006. Their data set mainly deals with the advanced European economies, while their empirical estimates are mostly concerned in detecting the most important explanatory factors of aggregates extraction, such as population size, gross domestic product (GDP) and construction sector value added. Our approach is somewhat different, since we present a detailed single country study from emerging Europe with an emphasis on a much longer sample span.

The rest of the paper is organized as follows. Section II provides theoretical background for our subsequent cliometric estimates. Section III presents our novel time series data set, as well as the results of our change point regression model. Section IV concludes by providing some policy pre scriptions for the revival of aggregates extraction industry in Serbia.

2 CHANGE POINT REGRESSION MODEL

We base our cliometric estimates on the following change point ordinary least squares (OLS) regression model with m potential structural breaks $(T_1, T_2, \dots T_m)$:

$$Level_t = c_j + t_j + \varepsilon_t,$$
$$t = T\_(j-1) + 1, \dots T\_j \qquad \text{(II.1)}$$

in which $j = 1, 2, \dots m+1$, $T_0 = 0$ and $T_{m+1} = T$, c_j refers to the intercept coefficients with property $c_i \neq c_{i+1}$ $(1 \leq i \leq m)$, t_j refers to the linear time trend coefficients with property $t_i \neq t_{i+1}$ $(1 \leq i \leq m)$ and ε_t corresponds to the error term. $Level_t$ is a dependent variable, and refers to the levels of aggregates extraction measured in 000 of cubic meters (m^3).

Bai [5] was the first to derive the consistency, rate of convergence and asymptotic distribution of the OLS estimates of a change point regression model from equation (II.1). Building on the work of Bai (1997), Bai and Perron [6, 7, 8] have proposed two tests of the null hypothesis of no structural break against an unknown number of breaks given some upper bound *M*. The upper bound *M* for the number of breaks is inversely proportional to the size of trimming percentage ϵ, $\epsilon = h/T$, in which h represents the minimal length of each subregime. The OLS estimates are consistent even if the disturbances are heterogeneous across regimes. If the disturbances are autocorrelated, Bai and Perron [7] specify a quadratic spectral kernel based heteroscedasticity and autocorrelation consistent (HAC) covariance matrix using the pre-whitened disturbances. The kernel bandwidth is determined automatically using the Andrews AR (1) method.

In summary, Bai and Perron [6, 7, 8] propose the following algorithm for estimating the change point OLS regression model: 1) prespecify the upper bound for the number of breaks M by setting the value of trimming percentage ϵ; 2) test the null hypothesis of no structural break against the alternative of a prespecified number of breaks defined in step 1) using the double maximum tests of Bai and Perron [6, 7, 8]; 3) estimate the change point regression model via OLS method.

3 EMPIRICAL EVIDENCE

This section consists of two subsections. Subsection III.1 introduces a novel time series data set for the levels of aggregates extraction in Serbia between 1973 and 2015. It also discusses themajor stylised facts regarding the dynamics of aggregates extraction. Subsection III.2 presents the change point OLS regression model which captures stylized facts from Subsection III.1.

3.1 Data & Stylized Facts

Our study analyses the dynamics of aggregates extraction in Serbia between 1973 and 2015. The availability of official data determines both the beginning and the end of our sample span. Our data come from the Statistical Yearbooks of the Republic of Serbia between 1978 and 2016 published by the Statistical Office of the Republic of Serbia (*The Statistical Yearbooks of the Republic of Serbia for the indicated period can be downloaded in PDF format from the electronic library of the Statistical Office of the Republic of Serbia available at http://www.stat.gov.rs/WebSite/ Public/PageView.aspx?pKey=452)*. Data for Kosovo are not included from 1999. We focus on the levels of domestic aggregates extraction as in Behrens et al. [9]. We do not make distinction between used and unused domestic extraction due to data unavailability. [9] We express the levels of aggregates extraction in 000 of cubic meters (m^3). The conversion from cubic meters to metric tonnes is impossible, since we do not know the exact proportions of particular types of aggregates in the total of aggregates extraction. More precisely, from 1973-2002, aggregates encompass broken stone from silicate rocks, sand and gravel. From 2003-2015, aggregates encompass crushed and broken stone, round pebbles, natural sand and gravel. Table 1 reports our data set. The first column of the table refers to the levels of aggregates extraction, while the second column represents the annual percentage change in aggregates extraction.

Table 1 *The extraction of aggregates in Serbia, 1973-2015*

Year	Levels (000 of m^3)	Growth rates (%)
1973	9044	NA
1974	10091	11.58
1975	12183	20.73
1976	12421	1.95
1977	12909	3.93
1978	15649	21.22
1979	18268	16.74
1980	15623	-14.48
1981	13781	-11.79
1982	13808	0.20
1983	14043	1.70
1984	11984	-14.66
1985	12619	5.30
1986	11778	-6.66
1987	9580	-18.66

Continuation Table 1

1988	11209	17.00
1989	10702	-4.52
1990	9068	-15.27
1991	7473	-17.59
1992	5593	-25.16
1993	1783	-68.12
1994	1945	9.09
1995	2230	14.65
1996	3467	55.47
1997	2647	-23.65
1998	3302	24.74
1999	2020	-38.82
2000	2684	32.87
2001	1982	-26.15
2002	2088	5.35
2003	6260	199.81
2004	7058	12.75
2005	7556	7.06
2006	8633	14.25
2007	8734	1.17
2008	8667	-0.78
2009	5789	-33.21
2010	6951	20.07
2011	6533	-6.01
2012	6166	-5.62
2013	4590	-25.56
2014	5307	15.62
2015	6142	15.73

Sources: Authors' calculations and Statistical Yearbooks of the Republic of Serbia 1978-2016.

Table 2 shows the basic descriptive statistics for the levels and growth rates of aggregates extraction presented in Table 1. The mean and median represent the measures of central tendency of the respective empirical probability distributions, while the standard deviation quantifies how much, on average, the data points deviate from the mean. Maximum refers to the largest data point, while minimum refers to the lowest data point within our sample. Skewness measures the asymmetry of the empirical probability distribution from normal probability distribu tion, while kurtosis is the descriptor of the shape of empirical probability distribution which measures the combined weight of distributions' tails relative to the rest of the distribution. JB statistics combines the values of skewness and kurtosis to test whether a particular empirical probability distribution is normally distributed. While the null hypothesis of normal probability distribution is accepted in the case of levels of aggregates extraction (p=0.42), the opposite is true for the time series of growth rates (p=0.00).

Table 2 *Descriptive statistics for aggregates, 1973-2015*

	Levels	Growth rates
Mean	8147.91	4.10
Median	7556.00	1.83
Maximum	18268.00	199.81
Minimum	1783.00	-68.12
Standard Deviation	4430.89	37.81
Skewness	0.24	3.21
Kurtosis	2.14	18.47
JB statistics with p-values	1.75 (0.42)	491.04 (0.00)
Number of observations	43	42

Source: Authors' calculations. Levels-000 of m^3; growth rates-%. p-values are given in ().

Figure 1 presents the facts outlined in Table 2 graphically. The upper panel of Figure 1 depicts a time series for the levels of aggregates extraction, while the bottom panel of Figure 1 depicts a time series for the growth rates of aggregates extraction. The upper panel of Figure 1 displays 6 distinctive sub-periods in the dynamics of aggregates extraction between 1973 and 2015: the first sub-period spans from 1973 to 1979, the second sub-period spans from 1980 to 1988, the third sub-period spans from 1989 to 1994, the fourth sub-period spans from 1995 to 2002, the fifth sub-period spans from 2003 to 2008 and the sixth sub-period spans from 2009 to 2015.

The *first sub-period* from 1973 to 1979 witnessed sharp increase in the levels of aggregates extraction. The average annual growth rate of aggregates extraction was 12.7%. In 1979, the aggregates extraction reached its maximum level of around 18.3 million m^3. The upward trend in aggregates extraction is consistent with rapid economic growth in Serbia in the sub-period under consideration. In particular, Bićanić et al. [10] report the average annual growth rate of Serbian GDP of around 6.5% between 1952 and 1979. (*Bićanić et al. [10] explain in great length how they convert the values of social product into the long-run time series of GDP for Yugoslavia and its successor states. This discussion is beyond the scope of this paper. For details, see Bićanić et al. [10]*)

In great contrast with respect to the first sub-period, the *second sub-period* between 1980 and 1988 witnessed sharp decrease in levels of aggregates extraction. The average annual level of extraction of approximately 12.7 million m^3 was far below the 1979 maximum value of around 18.3 million m^3. The average annual growth rate of aggregates extraction entered negative territory in 1980, and hovered around -4.7% throughout the whole decade. The outlined patterns are again consistent with the overall political and macroeconomic developments in Serbia between 1980 and 1988. In particular, Bićanić et al. [10] report the average annual growth rate of Serbian economy of only 0.4% between 1980 and 1989. Moreover, they also identify the year 1980 as a structural break in the dynamics of GDP per capita in Yugoslavia, Serbia as well as all others successor states [10].

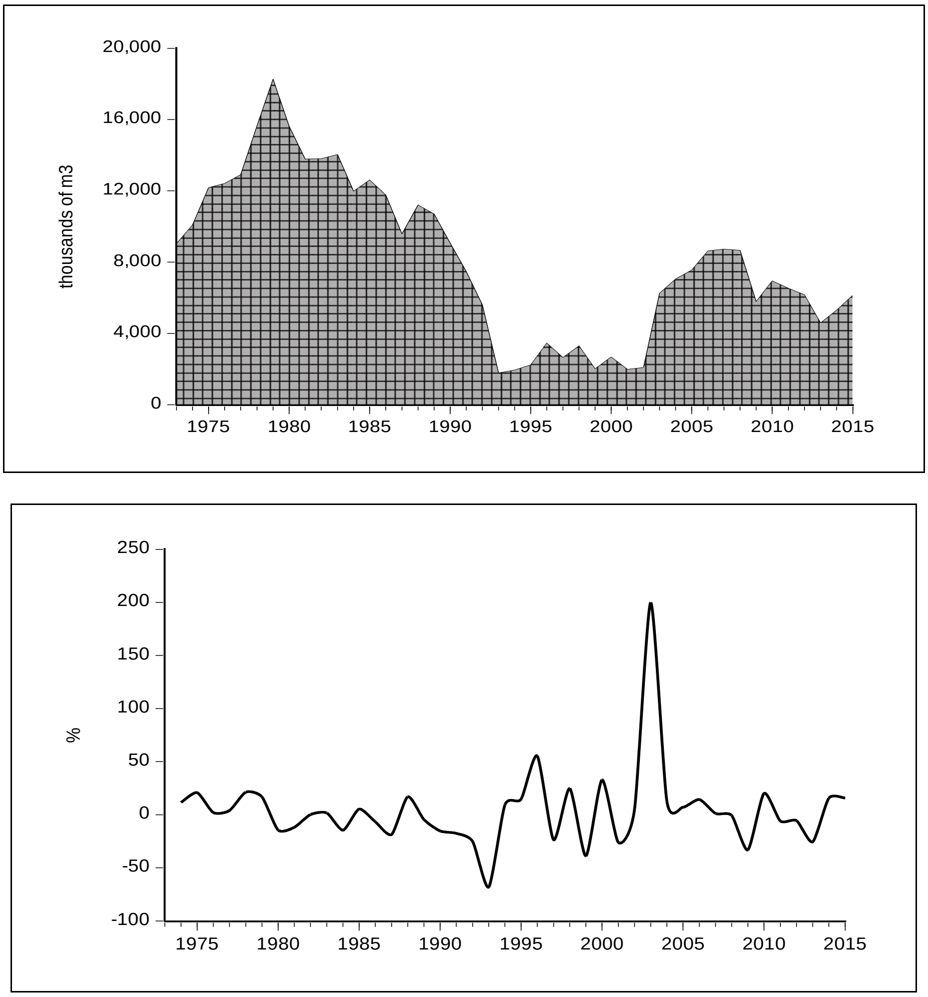

Figure 1 *Levels (upper panel) and Growth Rates (bottom panel) of Aggregates Extraction in Serbia, 1973-2015*

The most important political shock was the institutional power vacuum which emerged after the death of Josip Broz Tito, the first and only president of Socialist Federal Republic of Yugoslavia (SFRY). The Collective Presidency, which took the control over SFRY after Tito's death was unable to cope with the internal and external imbalances Yugoslav and Serbian economy were facing at the beginning of the 1980s.

The most important internal imbalance between 1980 and 1989 was the high cost-push inflation, which accelerated into a hyperinflation in the last quarter of 1989. Petrović and Vujošević [21] identify the public sector wage hikes as the main culprit behind the inflationary pressures in Yugoslav economy in the analyzed sub-period. The demands for higher public-sector wages stemmed from the labour-managed public enterprises which were primarily concerned with the wage maximization and employment protection (*The roots of the labour-managed, i.e. self-managed, economy lie in the 1965 economic and social reform. For details about this reform, and the evaluation of its impact on overall macroeconomic performance in Yugoslavia, see Bićanić et al.* [10]). The government then, in order to prevent potential social unrest, pressed the state banking system to extend highly subsidized loans at negative real interest rates to self-managed enterprises. The state banking sector, hence, monetized a quasi-fiscal deficit of the public enterprise sector violating the soft-budget constraint of the government.

The most important external imbalance between 1980 and 1989 was the balance of payments and external debt crisis which actually exacerbated already present internal imbalances. Petrović and Vujošević [21] show how the real devaluation of dinar led to a significant pass-through effect to prices, as well as to a decrease in real wages. The drop in real wages, consequently, gave an additional impetus to the demands for higher public-sector wages. The real devaluation of the dinar stemmed from chronic trade balance deficit which emerged in Yugo-slavia after the World War II. The trade balance deficit was a consequence of high absorption gap, since domestic absorption grew more rapidly than domestic production. Higher demand for consumer goods from abroad was the main determinant of absorption gap, since social planners in Yugoslavia were primarily concerned with the production of machinery and investment equipment. Higher demand from abroad was primarily financed with foreign loans and remittances. When the 1979 oil price shock hit the global economy, the supply of foreign loans dried up due to a world-wide global recession. In addition, central banks from all over the world started pursuing restrictive monetary policies in order to combat oil-induced price increases. Contradictionary monetary policies all around the world led to interest rates hikes, which pushed the costs of foreign borrowing even further. The maturity structure of foreign loans changed, since investors from abroad were willing to borrow only temporary due to high global economic uncertainty. Since the global borrowing conditions for SFRJ changed, the government, under the stand-by arrangement with the IMF, devalued the dinar and introduced import quotas to reduce the trade deficit as the main culprit behind high external debt. The stabilization program was unsuccessful in eliminating the external imbalances and led to an even deeper recession which spilled over to the construction and aggregates extraction industry.

The *third sub-period* between 1989 and 1994 witnessed even further deterioration in the levels of aggregates extraction. The average annual level of extraction dropped to only 6 million m^3. In 1993, the annual level of aggregates extraction reached historical minimum of only 1.8 million m^3. The average annual growth rate of aggregates extraction fluctuated around -20%, reaching the historical minimum in 1993 of staggering -68%. The devastating developments in the aggregates extraction industry were primarily a consequence of Yugoslav wars and international economic embargo. In addition, between 1992 and 1994, Yugoslavia experienced the second-highest and the second-longest hyperinflation in economic history, as documented by Petrović et al. [20]. Petrović et al. [20] state that, as the inflation gained pace, output in Yugoslavia halved leaving no room for any industrial and growth recovery.

The *fourth sub-period* between 1995 and 2002 witnessed a mild revival of aggregates extraction in Serbia. The average annual level of extraction increased above historical minimum attained in 1993, and oscillated around 2.6 million m^3. The average annual growth rate of aggregates extraction also recovered and levelled off around 5%. Unfortunately, political and macroeconomic developments curtailed a more robust recovery of Serbian aggregates extraction industry between 1995 and 2002.

The Kosovo War and the overthrown of Milošević regime were the main political shocks that destabilized the economy in 1999 and 2001, respectively. For instance, the growth rate of aggregates extraction dropped sharply in 1999 to the second lowest historical value of -39%, while in 2001 it equalled -26%.

Petrović [19] documents th emajor macroeconomic imbalances between 1994 and 2002 which stifled the overall industrial progress, and, hence, the progress of aggregates extraction industry. In particular, all nominal magnitudes (M1, base money, wages, inflation and the exchange rate) grew at the average rate between 40-50%. The real money demand, measured as the share of M1 in GDP, was only 6%, indicating how public at large perceived economic policies of the Serbian government. The estimated fiscal deficit was around 10% of GDP, while the tax system was highly distorted with 7 different retail sales tax rates. Approximately 40% of all retail goods and services were kept under direct price control. As a consequence of all aforementioned political and macroeconomic developments, the living standard during the 1990s decreased by over 50%. The unemployment rate in 2000 was around 30%, while the average net monthly wage was less than 45 euros. Arsić et al. [3] document how 35% of population lived below regional poverty line, and another 35% just above the poverty line. Petrović [19] finally reports how GDP per capita at the outset of democratic political reforms in 2001 only slightly exceeded GDP per capita from the second half of the 1980s.

The *fifth sub-period* between 2003 and 2008 witnessed a sharp recovery of aggregates extraction industry in Serbia. The average annual level of extraction jumped to 7.8 million m^3. The average annual growth rate of aggregates extraction increased from its previous sub-period value of 5% to approximately 39% between 2003 and 2008. In 2003, the average annual growth rate of aggregates extraction reached its historical maximum of 200%, which was related to the acquisition of three large cement plants by foreign investors. The sharp revival of Serbian aggregates extraction industry is a direct consequence of macroeconomic reforms after the year 2000. The backbone of macroeconomic stabilization program was the exchange rate based stabilization which led to adisinflation and stable currency (*For details see Arsić et al.* [3] *and Petrović* (2004) [19]). The government also, under the IMF surveillance, carried out a fiscal consolidation package of around 5% of GDP between 2002 and 2005, recording a fiscal surplus in 2005, as described in Andrić et al. [1, 2].

The *sixth sub-period* between 2009 and 2015 witnessed again another decrease in the levels of aggregates extracted. In particular, the average annual level of extraction returned to approximately 6 million m^3, the average level recorded between 1989 and 1994. The average annual growth rate of aggregates extraction again turned negative and floated around -2.7%, a drop of around 40 percentage points from the average growth rate between 2003 and 2008. In 2009, a year in which the Great Recession hit the Serbian economy, the average annual growth rate of aggregates extraction equalled -33%. After the arrival of the Great Recession to Serbia, the overall economic slowdown affected construction industry and, consequently, spilled over to aggregates extraction industry.

3.2 Results

The time variable in equation (II.1) serves as a proxy for the combined influence of all relevant economic factors on aggregates extraction in Serbia between 1973 and 2015. Moore et al. [16] follow a similar approach when they use linear time trend to capture the influence of intrasectoral shifts, material substitution and resource saving technologies in their study on economic growth and the demand for construction materials in the UK and the US between 1960 and 1992 [16]. Nelson and Kang [17] explore, however, the errors in regression models in which time is included as an explanatory variable under the deterministic trend assumption when in fact the time series belongs to the class of stochastic trend processes (*If the time series under question exhibits deterministic time trend, then we can forecast its value in period t given the information available in period t-1. On the other hand, if the time series under question exhibits stochastic time trend, then we cannot forecast its value in period t given the information available in period t-1.*) In addition to inspecting the graph of the series along with its autocorrelation function, Nelson and Kang [17] recommend the use of formal statistical tests for the nature of particular time trend (deterministic vs. stochastic).

Following the advice of Nelson and Kang [17], we first visually inspect the graph of the series along with its autocorrelation function, and then turn to formal statistical tests. First, the visual inspection of Figure 1 points to deterministic segmented time trend for aggregates extraction in Serbia between 1973 and 2015. Second, the inspection of autocorrelation function points to highly persistent temporal dependence, since the first lag autocorrelation coefficient equals 0.93. The positive autocorrelation, however, drops to zero after only 10 years when it becomes mildly negative. Finally, Table 3, which summarizes the results of our formal statistical tests, gives overall support to the deterministic trend hypothesis. The table, in particular, shows the results from tests proposed in Elliott et al. [12], as well as the results from tests proposed in Ng and Perron [18]. We detrend the data by the generalized least squares (GLS), since Eliott et al. [12] show how GLS detrending yields power gains for these tests by allowing for a more precise autoregressive spectral density estimate that is invariant to the parameters of the trend function. In addition, we determine the number of lags in testing regressions in accordance with the modified Akaike criterion (MAIC) in which we set the maximum number of lags to 8. (*The results are robust for different values of the maximum number of lags. They are also robust if we exclude the time trend from testing regression. All these findings are available from the authors upon request).* Ng and Perron [18] show how MAIC leads to size improvements over standard information criteria since it adapts to the analyzed sample even if the number of deterministic components increases.

Table 3 *Stochastic trend tests for aggregates, 1973-2015*

Tests	Statistics	Specification	Lags	Criterion
ERS	22.94***	Intercept & Trend	0	MAIC
$\mathbf{MZ}_{\alpha}$	-4.02	Intercept & Trend	0	MAIC
$\mathbf{MZ}_{t}$	-1.40	Intercept & Trend	0	MAIC
$\mathbf{MP}_{T}$	22.40***	Intercept & Trend	0	MAIC
MSB	0.35***	Intercept & Trend	0	MAIC

Notes: *** 1% level significance, ** 5% level significance, * 10% level significance.

Table 4 presents our estimates of the change point regression model for the period 1973-2015. The model estimates are in great accordance with major business cycle facts of the Serbian economy discussed in previous subsection. The breaks occurred in 1980, 1989, 1995, 2003 and 2009. The corresponding trend estimates across breaks have appropriate size, sign and statistical significance. The most important policy implication of our results pertains to the potential slowdown of aggregates extraction from the onset of the Great Recession, a result also obtained by Herrero et al. [13] in the case of Spain.

In obtaining the estimates from Table 4, we first specify the upper bound for the potential number of breaks by setting the value of trimming percentage ϵ to 15%. The chosen trimming percentage value of 15% corresponds to a maximum of 5 potential structural breaks. Second, we implement double maximum tests UDmax and WDmax to determine the actual number of structural breaks, given the ϵ - prespecified upper bound for the potential number of breaks. Both test statistics are statistically significant at 1% level and date breaks, as already stated, in 1980, 1989, 1995, 2003 and 2009. Finally, given the presence of breaks in aforementioned years, we estimate a change point regression models via OLS by allowing disturbances to differ across estimated breakpoints. We model the auto-co-rrelation in disturbances by specifying a quadratic spectral kernel with the Andrews automatic bandwidth and AR (1) pre-whitened residuals, as in Bai and Perron [7].

Table 4 *Change point ols regression for aggregates, 1973-2015*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
1973 - 1979 -- 7 obs				
Intercept	8704.21	291.05	29.91	0.00
Time trend	1411.21	197.37	7.15	0.00
1980 - 1988 -- 9 obs				
Intercept	19266.77	546.36	35.26	0.00
Time trend	-595.72	51.10	-11.66	0.00
1989 - 1994 -- 6 obs				
Intercept	41783.14	1337.66	31.24	0.00
Time trend	-1929.14	77.25	-24.97	0.00
1995 - 2002 -- 8 obs				
Intercept	5463.75	1035.95	5.27	0.00
Time trend	-114.17	37.68	-3.03	0.005
2003 - 2008 -- 6 obs				
Intercept	-9026.29	2441.38	-3.70	0.001
Time trend	518.29	79.49	6.52	0.00
2009 - 2015 -- 7 obs				
Intercept	11736.43	4490.31	2.61	0.01
Time trend	-149.00	119.12	-1.25	0.22
Number of Observations	43	**Standard Error of Regression**		746.43

Notes: *dependent variable*-levels of aggregates (000 of m^3); *estimation method*-OLS with heterogeneous errors across breaks as in Bai and Perron [7]; *break type*-UDmax/WDmax double maximum tests with 15% sample trimming percentage; *co-variance matrix specification*: HAC standard errors with quadratic-spectral kernel and Andrews automatic bandwidth with single pre-whitening lag.

Figure 2 confirms the appropriateness of our change point regression model. The left axis of the Figure 2 traces the actual and model estimated values of aggregates extra-ction, while the right axis traces the residual values of aggregates extraction, i.e., the va-lues equal to the difference between actual and model fitted estimates. The actual and model fitted values are almost identical pro-ducing normally distributed residual values

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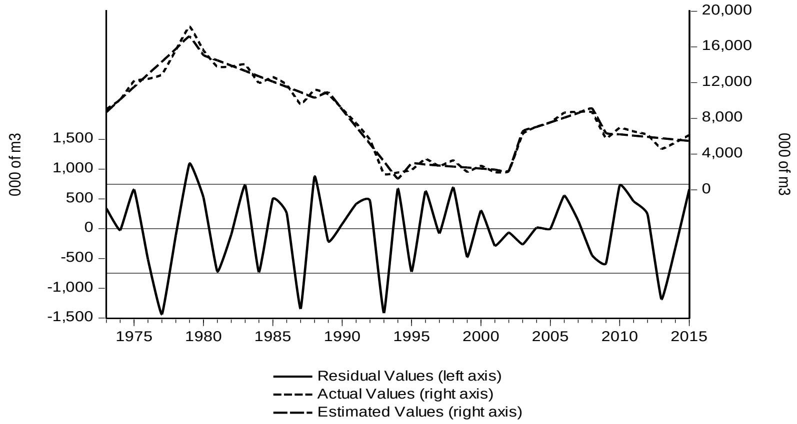

Figure 2 *The Actual, Estimated and Residual Values of Aggregates Extraction in Serbia, 1973-2015*

4 CONCLUSION

We have analyzed the dynamics of aggregates extraction in Serbia between 1973 and 2015. Our results are consistent with major business cycle fluctuations of the Serbian economy in the last 40 years. Although this paper bears a historical conno-tation, its results can, however, be of some assistance to policy makers in Serbia today, since the most relevant policy implication of our research refers to the potential slowdown of aggregates extraction from the onset of the Great Recession.

The question for policy makers, hence, becomes how to stimulate the revival of aggregates extraction industry in Serbia. The potential answer lies in increasing the share of infrastructure investment in GDP, especially if we take into account the relatively lower share of public infrastructure spending in Serbian GDP with respect to other emerging European economies. Bleischwitz and Bahn-Walkowiak [11], for example, report how the world-wide de-mand for aggregates rose approximately by 4.7% annually through 2007, driven primarily by infrastructure construction in countries such as China, India, Poland, Russia, Taiwan, Thailand and Turkey. Menegaki and Kaliampakos [15] support these findings in the case of 26 European economies between 1997 and 2006. On the other hand, since the seminal paper of Aschauer [4], the numerous empirical studies show how "core" infrastructure projects-streets, highways, airports, mass transit, sewers and water systems-have the greatest explanatory power for the overall growth rate of the national economy. The increase in infrastructure public spending, hence, can also have an indirect effect on the aggregates extraction industry via higher growth demand channel, if policy makers in Serbia succeed in minimizing political economy frictions in the realization of infrastructure projects.

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