



BUSINESS CYCLES SYNCHRONIZATION: THE CASE OF EUROPEAN  
MICROSTATES

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*Abstract*

*The present paper is presenting the case of five European microstates (Andorra, Lichtenstein Malta, Monaco and San Marino) respectively under the spectral analysis framework we compare the larger business cycle frequencies deployed under our knowledge (58 years 1960-2017) to a set of four sized neighboring countries (France, Italy, Spain and Switzerland) in order to define if the microstates cycles are synchronized due to country's size, to adjoining country or possible participation on international organizations such as European Economic Area or European monetary Union. The results show that the link to the adjacent state is stronger than the one with the same acreage or possible union counterpart due to monetary and import dependence bonds.*

*Index Terms – Microstate, balance of payments, monetary policy, spectral analysis.*

## I. INTRODUCTION

Europe has a long history of very small countries limited to geographic or demographic limitations. The term “microstate” though is not really clear. A definition given by Dumieny (2014) can conclude that they are “Currently established and sovereign states who gave part of their authority to stronger and grater nations, in order to protect their economic, political and social prosperity and extend them out of their limited breadth. Under this framework we can name five microstates on the European continent (Malta, Monaco, Lichtenstein, San Marino and Andorra). The present manuscript is presenting the business cycles patterns for these countries answering some important questions related to the size and the importance of these countries to the international economic system. Do they follow the cycles of the other microstates? Can any similarities have been found to other members of the participating monetary unions? Are they depended to their vast neighbors’ patterns or not? The paper is structured as follows: The first part is an introduction to the present work framework and research questions. The importance and significance of business cycle analysis and the previous studies are cited on the second part. The methodology, the data used its link to the questions and its transformation is given on the



third part as long and as long as the analysis of the spectrograms and the results. On the final part we proffer our conclusions based on present analysis.

## II. THEORETICAL BACKGROUND

The business cycles seem to have great significance for the country's entire economic process. The cycle's length seems to be extremely significant for the state's strong political and economic stability. Higher frequency is a sign for possible turbulence or financial problems related to possible external or internal motives or structuring problems. The mortgage crisis begun in 2008 at United States and its aftermath spread to a small country exposed to international financial risk (Iceland), a vulnerable link at eastern Europe (Hungary) and led to the Euro crisis in several risk exposed countries.

The initial analysis and its aftermaths begun by Van Ewijk (1982) where the Kondratiev cycles theory has been typically reinvented. The original referred research to long term cycles where an economy reaches all four economic cycle stages within 50 years. Smaller business cycles also conclude all these stages but their effects are less obvious. Kydland and Prescott (1991) have quantified this process and managed to express it through econometric models based on periodicity of the phenomenon and possible feedback process in order to stabilize it. Financial side of the cycle is presented by Minsky (1993) where tranquility is busted by speculating and leads to financial bust inspiring following scholars.

The mortgage crisis in 2008 temporarily stopped the advancement of international trade among countries developed by WTO polices in the past two decades. A common place to explain possible synchronized countries 'cycles has been introduced by Reyes (2003). His past time analysis has indicated that the international trade had reached a peak in the middle 80's and latter a small decline occurred until a further development occurred at early 90's. Monetary base raise as a trade and a business cycle development has been assumed on Kose, Meredith and Towe (2004) latent factor analysis. They also declared that possible permanent macroeconomic decisions and policies can lead to stabilization and synchronization and not possible temporary decisions related to monetary policy. Their 22 years (1980-2002) sample has emphasized on the case of Mexico which has a rich history in crises and also has joined NAFTA within this period. The macroeconomic and intra- business trade fundamentals are analyzed along with possible political and security references within the country.

A Minsky's model variation has been released by Clements and Krolzig (2001) where level of financial freedom as a positive effect on robustness has been introduced. On a similar analysis Cruz (2005) has also adjusted the original model with the existence of activity plans and possible feedback on organization effect. These remedies will reduce the time when economy inclines and increase development or tranquility phases.

Beyond Mexico EU also attracted interest. Altavilla (2004) using Hamilton- Markov switching models analyzed the Eurozone countries business cycles concluding that there are differences among the countries cycles length and possible lags despite similarities or times of synchronizing cycles. Similarly (Benalal et. al. 2006) for the same sample have headlined on GDP structure changes as possible parts of a synchronized EU policy. They assumed that there was no major



change between 1970 and 2004 in yearly or quarterly frequency the possible demographic structural changes had already occurred. Bergman (2004) for EU sample has analyzed the integration effects with selective possible connections within the Union. Using band pass filter analysis, he is expecting long term economic scaling relationship. When turbulence in exchange rate markets is high a possible link is shown as a “safe port” and cooperation is more significant. Latter Palley (2011) has pinpointed on time effect. When the 50-year period comes close to an end without fulfilling all possible phases and end to a Ponzi scheme it will gradually happened. A set of studies introduced in 2013 Evangelopoulos and Dapontas compared 9 EU members and four non-members business cycles for a long period (1950-2012). The early years of integration countries seem to have smaller cycles than previous period. Later the cycle gets equal at 20-25 span and larger after the equal cycle period. This effect which is similar to the J curve known of the international trade theory. The J curve is an effect of production specialization within Union. The non-participating countries didn't face the same effect. Dapontas (2016) Presents also the case of Eastern African Community, initially created and dissolved and recreated. The effects of disintegration had to do with the national industries strength and the economic development of the country. Developed countries generally face less difficulties on these incidents.

### III. SPATIAL ANALYSIS MODEL

The spectral analysis is widely used to explain the cyclical effects of possible time series. It's ability to simplify a complex series evolving time, trend and cyclical components to a set of functions (sine and cosine respectively). Finding the cyclical part, the trend is analyzed. The first looked random walk now seems to be explained. We have chosen the model due to extended positive references (Sella (2008), Pollock (2008), Brock and Sayers (1998), Altissimo and Volante (1998) and Serletis (1996) estimate that business cycles can be clearly understood only under the lights of spectral analysis. The wave length is expressed as frequency (cycles per unit time) which in our case is annual. The smallest period is defined as the ratio  $T=1/f \Rightarrow T=1/12 \Rightarrow T=0.083$

Sine and Cosine is expressed as a liner regression process, where dependent variable is the observed time series and discrete functions are the independent variables. The model can be expressed as follows (Eq.1):

$$x_t = a_0 + \sum [a_k * \cos(\lambda_k * t) + b_k * \sin(\lambda_k * t)] \text{ (for } k = 1 \text{ to } q)$$

Classical spectral analysis has the effect of  $2\pi * f(k)$  where the constant  $\pi = 3.14$  and  $f_k = \frac{k}{q}$ .

Cosine and sine effects (there number is abbreviated as q) can express the level of correlation to the data. The upper limit of functions is equal to the size of sample. Thus, if there are N data points there will be  $(N/2) + 1$  cosine and  $(N/2) - 1$  sine functions. If there is a large correlation between them we can end that the periodicity of the sample is high. Sine and cosine are independent, we can sum that periodogram can calculated as (Eq.2):

$$P_k = (\text{sine coeff } f_k^2 + \text{cosine coeff } f_k^2) * \frac{N}{2}$$



Where  $P_k$  is the periodogram value at frequency  $f$  and  $N$  is the overall length of the series. The periodogram values can be interpreted in terms of variance of the data at the respective frequency or period. The periodogram values are generally plotted against the frequencies or periods. On the other hand, periodograms are variable to random walk effect. Spectral density is simply a smoothed version of the periodogram. It eliminates the noise from a periodogram, allowing the underlying structure to be more clearly isolated. We will have to clearly define sine or cosine function and smooth the series through weighted average function. The moving average window  $m$  proposed by references and the most popular (Priestley 1981) is Tukey - Hanning window. The weights are as follows (Eq.3):

$$W_k = 0.54D_p(2\pi f_k) + 0.25D_p(2\pi f_k + \frac{\pi}{p}) + 0.23D_p(2\pi f_k - \frac{\pi}{p}) \text{ where } k=0\dots p.$$

$P$  is the integer part of number of the spans divided by 2,  $D_p$  is Dirichlet kernel of order  $p$ .

#### IV. DATA SETS AND RESULTS

The sample consists of five microstates (Malta, Monaco, Lichtenstein, San Marino and Andorra) respectively along with a set of comparing countries (France, Italy, Spain and Switzerland) for a 57-year period (1960-2017). The annual growth of GDP is used as a series variable in order to explain level of economic development. We deployed as resources the Conference board and Groningen Growth and development center database, the world bank statistics database, Eurostat as long as national statistical offices. Quarterly data was also available but the series noise was really high. The statistics software used was IBM SPSS™ for the spectral analysis and Tukey - Hanning weight window. The smallest span size (3) has been deployed which is the closer odd integer higher than the one-year period. The spectrogram results are given bellow:

#### SPECTRAL ANALYSIS RESULTS FOR MICROSTATES

Country	Years of cycle
Andorra	18.3
Malta	14.5
Monaco	14.5
Lichtenstein	11
San Marino	9.5



TABLE II. SPECTRAL ANALYSIS RESULTS FOR NEIGHBOUR COUNTRIES

Country	Years of cycle
France	14.7
Italy	14.7
Spain	11
Switzerland	10.8

As we can see of the results the microstates have similar cycles compared to their neighbor countries with the exception of San Marino where its cycle lays over 9.5 years smaller compared to all other under examination countries. Andorra has the largest cycle of the investigated economies (18.5) thus and the most stable economy. These two countries are the exception of the other three microstates which seem to follow the abundant country. The small size of these states can make them really flexible and less exposed to the international trade they are also relatively rich countries on terms of per capita GNP compared to the bigger bystanders. Finally, they are a possible "safe port" for possible speculating capitals and individuals due to their favor policy. On the other hand, they can be easier manipulated by possible speculators where an attack in a case of possible loose or irresponsible policy can be more successful than a larger country. They can also become back fire on a possible successful attack on a bigger neighbor.

On the other question we can see that there is synchronization to the span compared to the sizeable countries. Switzerland and Lichtenstein, Malta to Italy and Monaco to France seem to synchronize their series. That effect can be explained due to common monetary policy. San Marino, Andorra and Monaco adopted the Euro under an agreement to the EU and Malta is a full member of Euro. They historically adopted the currency of the spacious country. Switzerland and Liechtenstein have also the same joint policy of Swiss franc. Minting national currency for these countries can be difficult or impossible for them. Thus, they will have to follow the greater pattern. The immense country is also the major trading partner for all these countries. Any change in their balance of payments is guided by the substantial country. Finally, they don't have any type of large scale production and they are almost fully depended on spacious neighbor imports.

Among these countries frequencies we can see that there are no similarities with the exception of Malta and Monaco. The bond with the larger country seems to be stronger than the possible size effect. There is no union or possible official cooperation between them except their partial agreements to the EU scheme. Even within a united Europe concord they are major asymmetries among them. In our research San Marino has double span compared to Andorra. An agreement among them can synchronize their possible economic development and business cycle.





## V. CONCLUSIONS

As we have seen on the present work microstates economies and especially economic development seem to follow and be bonded to their surround country's' economic situation and prosperity which can be explained by the monetary channel where the common currency dictates also the state's fiscal policy and balance of payments especially on first and secondary sector where the production is relatively low due to third sector orientation and their economy counting on sized partner imports.

There is no evidence that there is synchronization among their cycles under a possible coordinated policy way or a common interest goal as could happened under the EMU scheme. The link to the sized state is generally high compared to them. A possible action could take place under an official synergy agreement of promoting their possible further integration within the European monetary union or the European Economic Area in the future.

## VI. RECOMMENDATIONS

Based on current research where discussion for possible business cycles synchronization on the base of cooperation a possible future work can be guided of the current study as follows -

- Someone could expand this research by investigating other similar states situations in other continents and possibly under different economic and political situations. The fact is that the dependent cycles of microstates discussion has now open and every possible road is open to the cases explanation and possible policy suggestion.

## REFERENCES

- [1] G. Allen and L Sella, „Old and new spectral techniques for economic series”. Dipartimento di Economia S. Cognetti de Martiis Working Papers Series.2008.
- [2] C. Altavilla, “Do EMU members share the same business cycle?” Journal of common market studies, 425).2004.
- [3] F. Altissimo and G.L. Violante, “Nonlinear VAR: Some Theory and an Application to U.S. GNP and Unemployment”, Banca d'Italia - Temi di Discussione, 338.1998.
- [4] C. Baum, “Time series filtering techniques in STATA™”. Working Papers, Department of Economics, Boston College.2006.
- [5] N. Benalal, J. Luis Diaz Del Hoyo, B. Pierluigi, and N. Vidalis, “Output growth differentials across the Euro area countries some stylized facts”. ECB Occasional Paper No.45.2006.
- [6] M. Bergman, “How Similar Are European Business Cycles”. Working Papers, Department of Economics, Lund University.2004.



- [7] R.B. Blackman, and J. W. Tukey, "The measurement of power spectra". New York: Dover.1958.
- [8] M. Bordo, and M. Helbling, "Have National Business Cycles become more synchronized?" NBER Working Papers 10130.2003.
- [9] W. Brock, and C. Sayers, "Is the business cycle characterized by deterministic chaos?" *Journal of Monetary Economics*, Elsevier, 221), 71-90.1988. 71-90.
- [10] P. Chasin, and L. Ouliaris, " | Key features of Australian business cycles". IMF Working Paper.2001.
- [11] M. Clements, and H.M. Krolzig, "Modeling business cycle features using switching regime models". Working Paper University of Oxford no.58.2004.
- [12] M.Cruz, "The business cycle in a financially deregulated context: Theory and evidence". University of Manchester.2005.
- [13] Z. Dumniensky, "Microstates as Modern Protected States: Towards a New Definition of Micro-Statehood", Occasional Paper. Centre for Small State Studies.2014.
- [14] D. Dapontas and P. Evangelopoulos, "Has the foundation affected business cycles length? An introduction". *Scientific Annals of the „Alexandru Ioan Cuza” University of Iași Economic Sciences*, 60 1), 2013, DOI 10.2478/aicue-2013-0013. 2013. 57-66
- [15] D. Dapontas, "Can Eastern African Monetary Union Become a successful OCA? Comparisons with the Euro zone case", *Global Advanced Research Journal of Economics, Accounting and Finance*, March 2016, vol. (4), 1 2016. 011-014.
- [16] P. Evangelopoulos, and D. Dapontas, "Has the E.U. accession affected business cycles?" *Theoretical and Applied Economics*, 2579. 2013. 7-22.
- [17] G. Filis, C. Floros, C. Leon, and C. Beneki, "Are EU and Bulgarian business cycles synchronized?" *Journal of money, investment and banking*, 14.2010.
- [18] M. Frank and T. Stengos, "The stability of Canadian macroeconomic data as measured by the largest" Lyapunov exponent, *Economics Letters*, Elsevier, 271), 11-14.1988. 11-14.
- [19] T. Hill, T. and P. Lewicki, "Statistics: Methods and applications", Statsoft, Inc.2005.
- [20] M. Kose, G. Meredith, and C. Towe, "How has NAFTA affected the Mexican economy: review and evidence?" IMF Working Paper.2004.
- [21] F. Kydland, and E. Prescott, "The econometrics of the general equilibrium approach to business cycles". *Scandinavian Journal of Economics*, 932), 161-178.2003. 161-178.
- [22] M. V. Lee, "Economic fluctuations", Homewood: Illinois Richard D. Irwin. 1955.
- [23] H.P. Minsky, "Financial Integration and National Economic Policy". Paper presented at the Post Keynesian Workshop. Knoxville: University of Tennessee. 1993.
- [24] S. Neftci, "Are Economic Time Series Asymmetric over the Business Cycle?" *Journal of Political Economy*, University of Chicago Press, 922)1984. 307-328.
- [25] T. Palley, "A theory of Minsky super-cycles and financial crises", *Contributions to Political Economy*, New America Foundation.2011.1-16.
- [26] D. S. G., Pollock, "The frequency analysis of the business cycle". Working paper 08/12, University of Lester, Lester UK.2008.



- [27] M.B. Priestley, "Spectral analysis and time series. vol. 1 and 2", London: Academic press. 1958.
- [28] L. Punzo, "Cycles, growth and structural change: theories and empirical evidence". Sienna: Routledge.1988.
- [29] M.O. Ravn, and H.Uhlig, "On adjusting the Hodrick - Prescott filter for the frequency observations". Review of economics and statistics, no 84.2002. 371-375.
- [30] J. A. Schumpeter, "History of Economic Analysis". London.1954.
- [31] A.Serletis, "Government Activities and Tests of the Long-Run Implications of the Neoclassical Growth Model for Canada", Canadian Journal of Economics, Canadian Economics Association, 29(3), 635-642.1996.