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A QUARTERLY COINCIDENT INDICATOR FOR THE CAPE VERDEAN ECONOMY

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CONTENTS

ABSTRACT

The objective of this study is to construct a quarterly coincident indicator for the Cape Verdean economy, using the Conference Board methodology and the method of principal component analysis. It uses quarterly qualitative business data surveys for several sectors of the economy published by the National Institute of Statistics (INE) from the period of 2002 to 2010. The results show that, even with limited quarterly qualitative observations, the coincident indicator has a behavior that closely monitors the various cycles of activity.

Keywords: *economic cycles, economic activity, leading indicator, coincident indicator, lagging indicator, principal components.*

1. INTRODUCTION

Nowadays, any modern society is interested in knowing the current state of its economy and what it will be in the future. The return on any investment and the related decision depend on the macroeconomic context and its outlook. So entrepreneurs and individuals have interest in knowing the state of the economy. Governments also have the same interest because they need to define budgets and to carry out interventionist policies. For this fact, it becomes crucial to track down ongoing economic developments. However, the assessment of the economic situation can be challenging when the policymaker is confronted with data providing mixed signals about the current state of the economy. The economic variable that more closely approximates the state of the economy is real *GDP*, since it is the most comprehensive measure of economic activity as a whole. Nevertheless, real *GDP per se* presents several drawbacks: The first is because it is affected by measurement errors. Second it is available only on a quarterly basis for the most countries[1] and the first estimate, which is typically subject to revisions, is released with delay. Therefore, one must to look to other available data in order to have a clear and timely economic picture on a more frequent basis. The information contained in other available data lead us to construct a composite index reflecting the current state of economy.

[1] Cape Verde releases *GDP* estimates on an annual basis with years of lag.

The goal of this study is to construct a composite coincident indicator for the Cape Verdean economy that may be used as an analytical tool to allow an improved and easier monitoring of the Cape Verdean economy. It is obtained by aggregating a set of indicators, as a brief and readily available measure that describes the current state of the economic activity. This important analytical tool, usually called coincident economic indicator (CI) is commonly used in several developed countries and international organizations. This study represents the first time this method has been applied to the Cape Verdean case.

This paper is organized as follows. Section II presents an overview of leading, coincident and lagging indicators and their relationship with economic activity; section III presents the methodology; section IV discusses the data, V presents the estimation results and, finally, section VI concludes.

2. A COMPOSITE INDICATOR OF ECONOMIC ACTIVITY

A composite indicator of economic activity consists of several economic series aggregated in to one indicator index. It allows for short-term analysis of economy activity and can be a useful tool for econometric forecasting models. Depending on their relationship with the current state of the economy, composite indicators can be classified as leading, coincident or lagging indicator. Leading indicators are those whose trend precedes the economy cycles, that is, they provide information about the future cyclical evolution. Generally, these indicators include flow and price variables that are very sensitive to the economic movement. When composite indicators reflect the current state of economic activity they are referred to as coincident indicators; they basically measure the current state of economic activity. Finally, lagging indicators are those that change after cycle, confirming the turning point and generally are stock variables that are very stable.

The identification of each type of indicator is important because each one has its own magnitude lag relatively to the economic evolution. The analysis of this lag allows for better forecasting future progress of the economy. Nevertheless, the identification of each lag is not static because structural changes in the economy can define a new timing. For example, Zarnowitz [1992] says that an increase of the weight of services sectors can define a narrowing of lag between employment (in non

agricultural sectors) and economic cycles. Although there are several theories and a lot of literature about economic cycles, it is not possible to conclude that there is a unique reason or theory for cyclical fluctuation and therefore it is not possible to analyze the economic cycle with a single indicator. It is necessary to use a general indicator that reflects the global movement in the economy.

3. COMPOSITE INDEX METHODOLOGIES

The first step to estimating a composite index of coincident economic indicators is to determine a reference series for the state of the economy. As mentioned above, the economic variable that more closely approximates the state of the economy is real *GDP*. However, unlike in other countries, real *GDP* in Cape Verde is available only on an annual basis and with years of lag. Therefore it is necessary to rely on other series as reference for economic activity. An indicator that is frequently used as the reference series for building monthly/quarterly composite indices of coincident indicators is the industrial production index (IPI). For example, the NBER and OECD methodologies use it as a reference series for the state of the economy. The problem in this case is that in Cape Verde there is no data for IPI.

Therefore, the main constraint in the construction of an economic activity index for Cape Verde is the lack of data and absence of a long historical series to allow for analysis of the cyclic behavior of the economy. This makes it impossible to use many methods to construct the economic activity index. For this fact, this study attempts two different methodologies, as described below.

3.1 - The Traditional Methodology

The first methodology is actually used by *The Conference Board, TCB*. It is called the traditional methodology and it consists of four distinct steps:

I - Calculate quarter-to-quarter changes, W_{it}, and $i = 1, \cdots, K$, and $t = 1, \cdots, T$ for each component selected, X_{it}, $i = 1, \cdots, K$ and $t = 1, \cdots, T$. If component X_{it} is in percentage form or rate, then $W_{it} = X_{it} - X_{it-1}$ and in all other cases a symmetric percent change formula is used:

$$W_{it} = 200 \frac{X_{it} - X_{it-1}}{X_{it} + X_{it-1}}$$

II - Adjust the quarter-to-quarter changes by multiplying them by the component's standardization factor F_{it}, where $F_{it} = \frac{1}{\kappa \sigma_w}$; $\kappa = \sum_x \frac{1}{\sigma_x}$ and σ_w is the standard deviation of W_{it}. So, the adjust series is given as:

$$A_{it} = \frac{W_{it}}{k \sigma_x} = F_{it} . W_{it}$$

III - Add the adjusted quarter-to-quarter changes (across the components for each quarter) to obtain the growth rate for the current quarter.

$$S_t = \sum_{i=1}^{K} A_{it}$$

IV – With the previous quarter's index level, use the trend-adjusted growth rate S_t to compute the updated level of index. The index is calculated recursively starting from an initial value of 100 for the first month of the sample period. The subsequent months is given as $I_t = I_{t-1}\frac{(200+S_t)}{(200-S_t)}$ recursively to compute the index levels for each month that data are available.

3.2 - The first principal component as a coincident indicator of economic activity

According to Burns and Mitchell [1946], one of the stylized facts of economic cycles is that they occur in a larger number of economic sectors and so they are general phenomena. In this sense, to measure economic activity we must look at the aggregation of a broad set of variables. Since we are interested in short term economic activity, then the common information of these variables becomes useful. Karl Pearson [1901] described the technique of principal component analysis (common information) and much later Hotelling [1993] proposed practical computing methods. The idea behind the technique is that for any *K* variables $X_1, X_2, \cdots, X_K$ it is possible to produce uncorrelated indexes[2] $Z_1, Z_2, \cdots, Z_K$ as a linear combination of the first. So, the index Z_i can be written as follow:

[2] The Z_i are also called the principal component or common information.

$$Z_i = \sum_{j=1}^{K} V_{ji} X_j \; ; \; j = 1,2,\cdots,K \text{ and } i = 1,2,\cdots,r$$

with V_{ji} being the *ij* elements of the corresponding eigenvector associated to the biggest eigenvalues of the symmetric var-covariance matrix of the original variables, $\sum_X$, and X_j the element *j* of vector $K \times 1$ of the original variables. The indices are ordered so that $Var(Z_1) \geq Var(Z_2) \geq \cdots \geq Var(Z_p)$ [3] so the variation of the data set can be adequately described by a few common factors, $r < p$, with variances that are not negligible and the results are better when the original variable, X_j, are highly correlated. In this sense, we can see the first principal component as an indicator of economic activity since it contains the most of information of panel data. However, the principal component analysis is very sensitive to the unit of measurement in which the data is expressed. In fact, before computing the common components the original variables were standardized to have mean zero and unit variance.

[3] $Var(Z_i)$ denote the variance of Z_i, principal components that are the eigenvalues of the sample covariance matrix $\sum_X$.

4. DATA DESCRIPTION

The composition of the data panel is crucial when computing the composite index for economic activity. If the panel contains a disproportionate number of variables from a particular part of the economy, for example the traded goods sector or the labour market, then the factors are likely to bear a closer resemblance to that part of the economy than the overall economy. So, we seek to cover all sectors of the economy such as trade, construction, tourism, transport and manufacturing. In particular, the results of qualitative business surveys for several sectors of the economy are released 1 to 2 weeks after the end of each quarter. The data are published by the National Institute of Statistics (INE) as the difference between the percentage of positive and negative answers. Table 4.1 contains the discription of the variables used for each sector and the coresponding standard factors[4] obtained by the traditional methodology, and figure 4.1 below shows the behavior of each series in the data panel.

Appendix AI presents the correlation matrix between *GDP* and the components and most of them present a positive correlation with GDP. In order to verify whether the series are coincident, we analyzed the cross-correlations between quarterly *GDP*[5] with the components used in this study at

[4] The standard factors are the weights corresponding to each variable

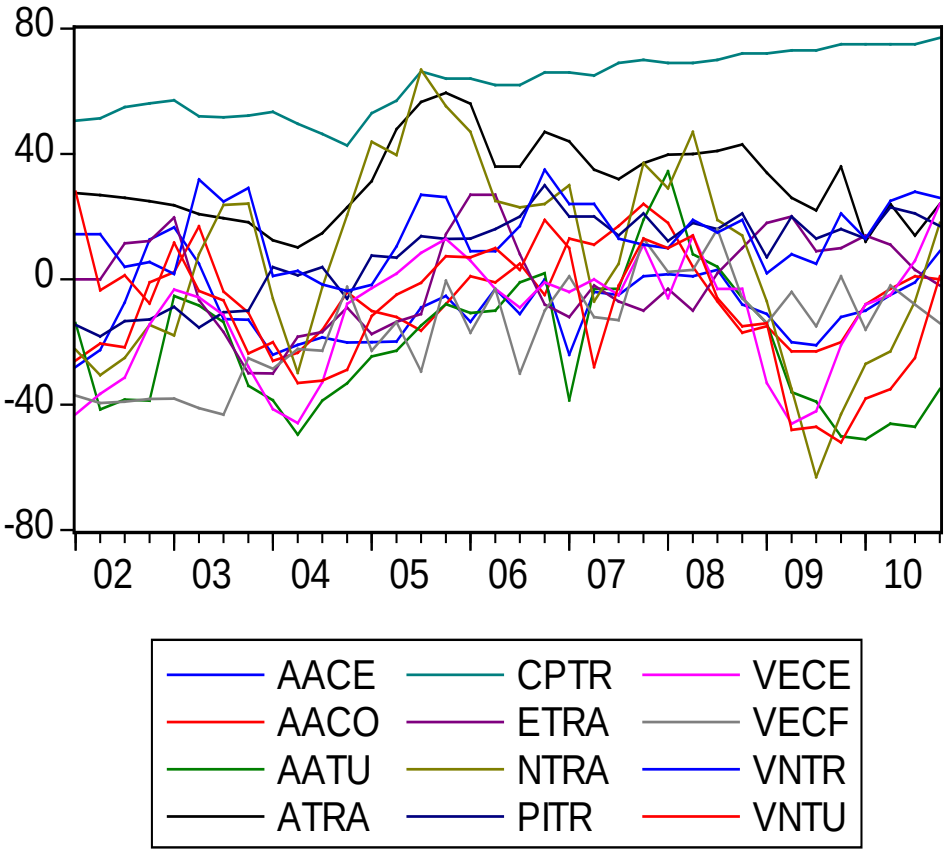
[5] Quarterly GDP was recently estimated by the staff of BCV.

contemporary level, lagged up to 10 quarters and advanced up to 10 quarters. The highest correlation between *GDP* and the components occurs when they are taken contemporaneously (see Appendix AII).

Tabel 4.1 – Variable definition and the corresponding Standard Factor

SECTOR		COMPONENTS	STAND. FACTOR
TRADE	Establishment	Sales (VECE)	0,060439
		Current activity (AACE)	0,079034
	Fair	Sales (VECF)	0,054018
TOURISM		Sales (VNTU)	0,049773
		Current activity (AATU)	0,049241
CONSTRUCTION		Current activity (AACO)	0,080530
MANUFACTURING		Production (PITR)	0,110128
		Sales (VNTR)	0,068807
		Capacity of production used (CPTR)	0,246504
TRANSPORT		Sales (NTRA)	0,038814
		Employment (ETRA)	0,073893
		Current activity (ATRA)	0,088820

Figure 4.1- Plot of the series



5. RESULTS

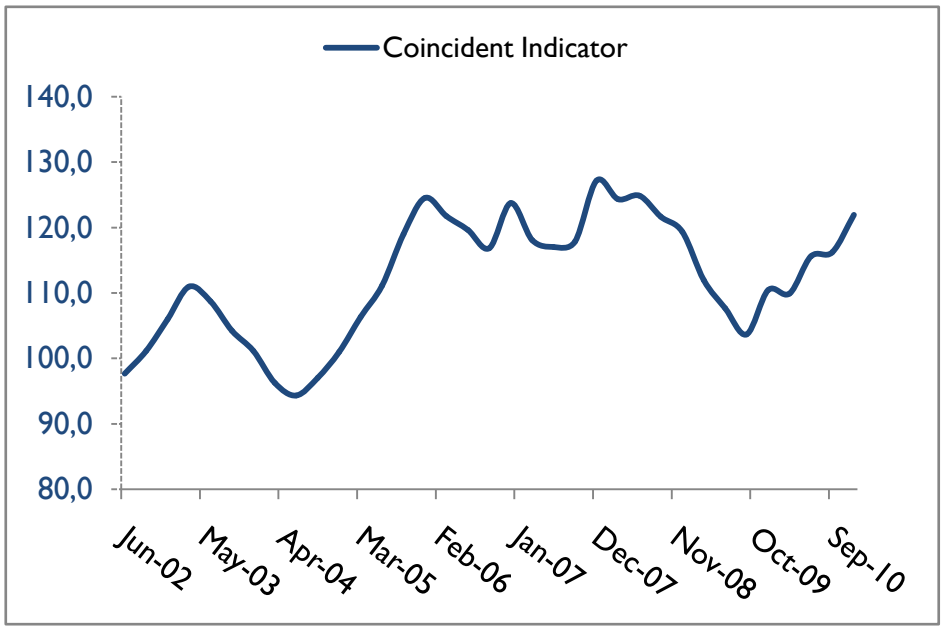
In this section we present the coincident indices constructed with quarterly data from 2002Q1–2010Q4 using the Conference Board methodology and the principal component analysis. Figure 5.1 depicts the coincident index for the Cape Verdean economy and the table 5.1 presents, numerically, coincident index, percent change of coincident index and the diffusion index[6]. The result of the first principal component appears in figure 5.2 (with inverted scale). Figure 5.3 shows the coincident indicator constructed by The Conference Board methodology and by the technical of component analysis. Both methods offer very similar results. The figure suggests a decline of economic activity from 2007Q4 to 2009Q3 and a turning point in the third quarter of 2009.

Table 5.2 presents information contained in the first five principal components. The first principal component contains only 38.5% of the information contained in the series due to a weak correlation between the series. The advantage of these two indices is the fact that they are linear combinations of

[6] Diffusion indices measure the proportion of the components that is rising in each quarter. Components that rise more than 0.05 percent are given a diffusion value of 1.0, components that change less than 0.05 percent are given a diffusion value of 0.5, and components that fall more than 0.05 percent are given a diffusion value of 0.0. The different values are added for each quarter and multiplied by 100 and divided by the number of components for that quarter. For example, if the coincident index has ten components, a diffusion index value of 50 would indicate that five of the ten components were rising.

economic series released soon after the reference period, which makes a reference to monitoring economic activity. However, given little information in the first principal component, we adopt the coincident indicator constructed with traditional methodology for monitoring the economic activity of Cape Verde. Figure 5.4 plots the coincident indicator and the GDP growth rate; the behavior is quite close.

Figure 5.1 – Plot of composite coincident indicator



Tabel 5.1 – Summary of composite coincident indicator

	2002Q1	2002Q2	2002Q3	2002Q4	2003Q1	2003Q2	2003Q3	2003Q4
Coincident indexes	100,0	97,7	101,2	106,0	111,0	108,7	104,2	101,1
Percentage change		-2,3	3,5	4,8	5,0	-2,3	-4,5	-3,1
Diffusion indexes		33,3	75,0	75,0	70,8	16,7	16,7	41,7
	2004Q1	2004Q2	2004Q3	2004Q4	2005Q1	2005Q2	2005Q3	2005Q4
Coincident indexes	96,2	94,3	97,0	101,0	106,3	111,1	119,0	124,5
Percentage change	-4,9	-1,9	2,7	3,9	5,4	4,8	7,9	5,5
Diffusion indexes	25,0	41,7	70,8	66,7	70,8	70,8	83,3	66,7
	2006Q1	2006Q2	2006Q3	2006Q4	2007Q1	2007Q2	2007Q3	2007Q4
Coincident indexes	121,7	119,7	116,9	123,8	118,1	117,0	117,9	127,2
Percentage change	-2,8	-2,1	-2,8	6,9	-5,6	-1,1	0,9	9,3
Diffusion indexes	20,8	37,5	33,3	79,2	25,0	33,3	33,3	83,3
	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4
Coincident indexes	124,3	124,9	121,7	119,4	112,0	107,6	103,7	110,4
Percentage change	-2,8	0,5	-3,2	-2,3	-7,4	-4,3	-4,0	6,8
Diffusion indexes	33,3	50,0	41,7	41,7	20,8	41,7	12,5	83,3
	2010Q1	2010Q2	2010Q3	2010Q4				
Coincident indexes	109,9	115,6	116,3	121,9				
Percentage change	-0,5	5,7	0,6	5,7				
Diffusion indexes	50,0	83,3	50,0	58,3				

Figure 5.2 – Plot of the first component

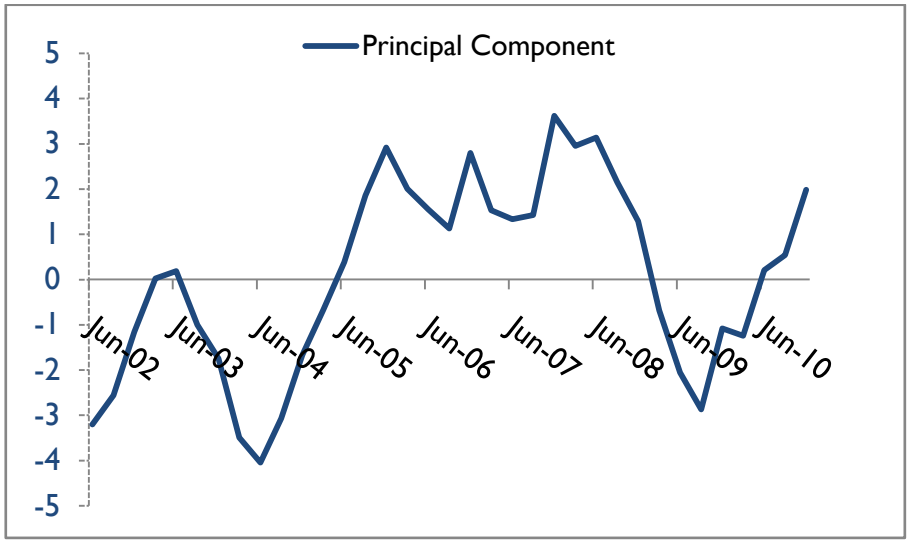


Table 5.2 – The first five estimated principal components

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5
Eigenvalue	4,62	2,34	1,37	1,16	0,87
Variance Prop.	38,50%	19,52%	11,47%	9,67%	7,32%
Cumulative Prop.	38,50%	58,02%	69,49%	79,17%	86,49%

Figure 5.3 – Plot of the first component and Coincident Indicator (normalized data)

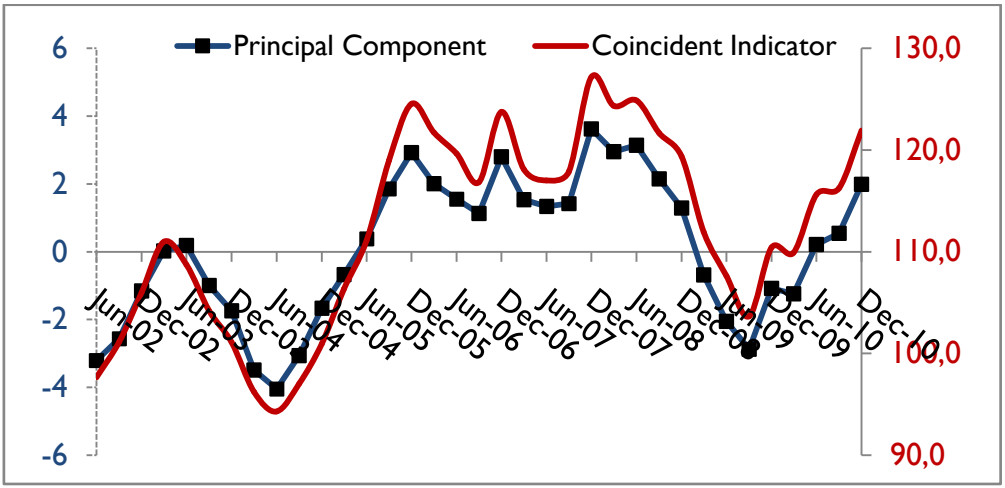
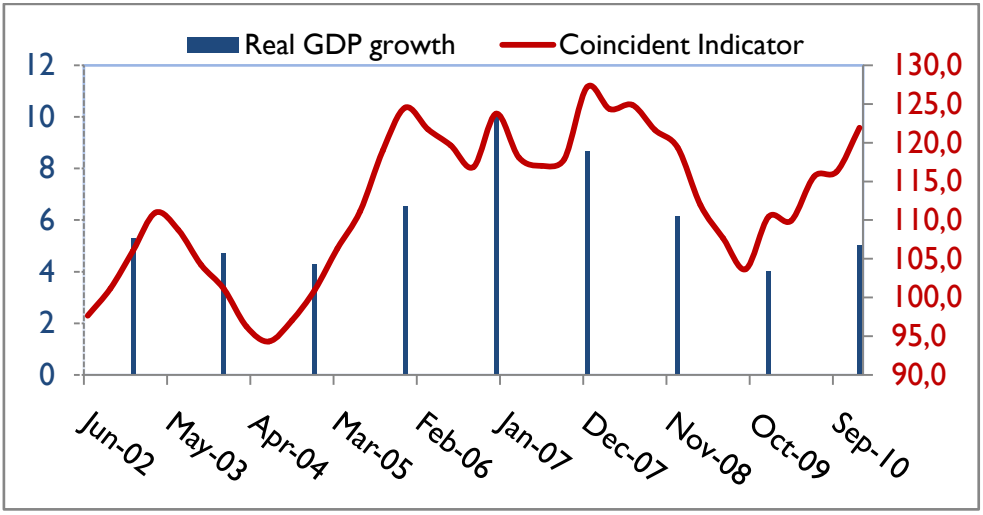


Figure 5.4 – Plot of the Coincident Indicator and the GDP growth rate



6. CONCLUSIONS

An assessment of the direction of economic activity is essential for the formulation of appropriate macroeconomic policies. In this regard, composite indexes of coincident economic indicators provide useful summary statistics to analyze the current and future direction of economic activity. The Coincident Indicator is a summary measure whose levels have no meaning in themselves. The relevant reading is made in regards to the first derivative which results in an acceleration or deceleration of economic activity. Thus, an increase (decrease) of the Coincident Indicator corresponds to acceleration (deceleration) of economic growth.

In this study we proposed a quarterly coincident indicator for the Cape Verdean economic activity, using the Conference Board methodology and the method of principal component analysis. We used the quarterly qualitative business data surveys for several sectors of the economy published by the National Institute of Statistics (INE) from the period of 2002 to 2010. The results of this study show that, even with limited quarterly qualitative observations, the coincident indicator has a behavior that closely monitors the various cycles of activity,

As a suggestion for future work, it may be possible to use combinations of variables at different frequencies, using a different methodology. Thus, it may be possible, for example, to obtain a monthly coincident indicator from a model with monthly and quarterly variables.

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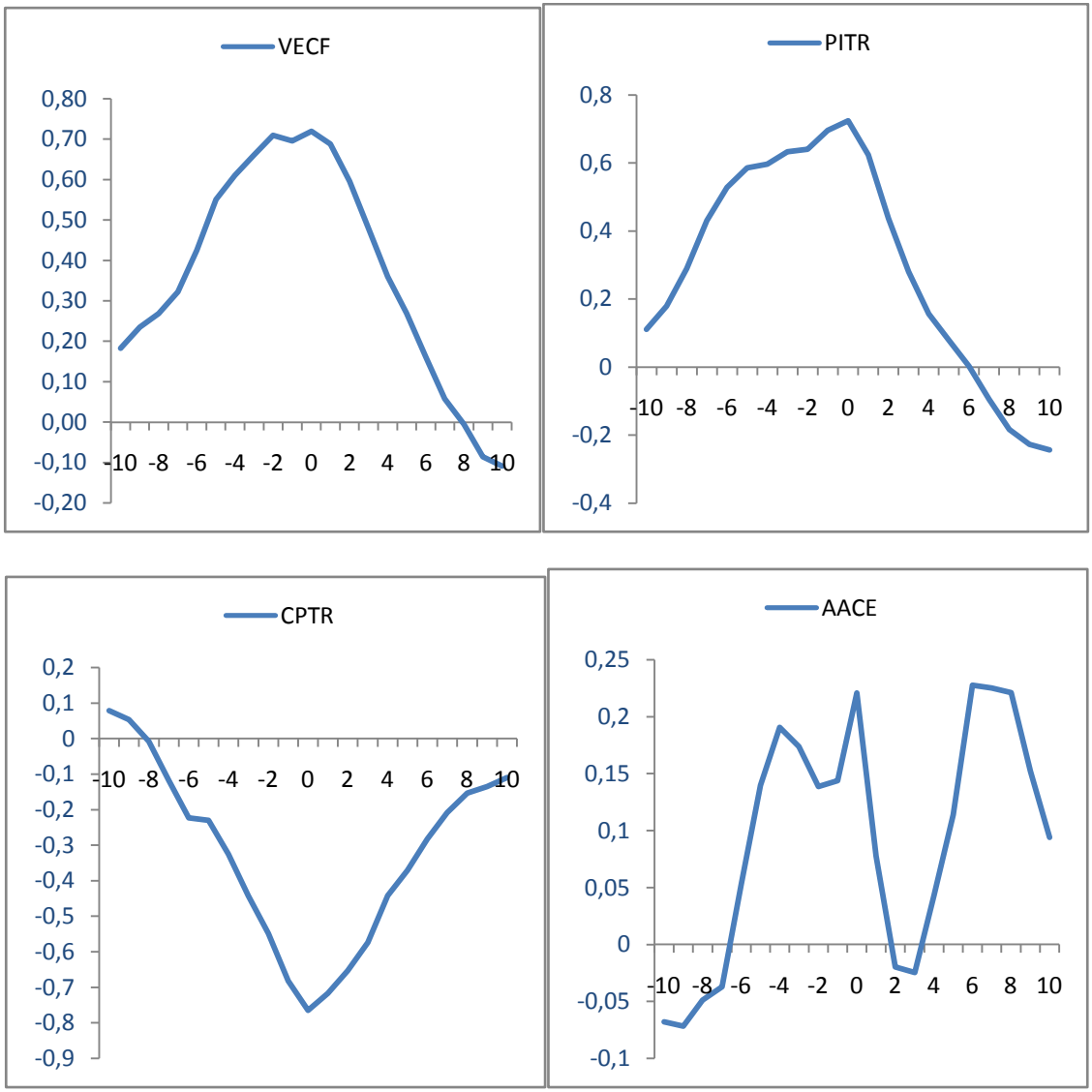
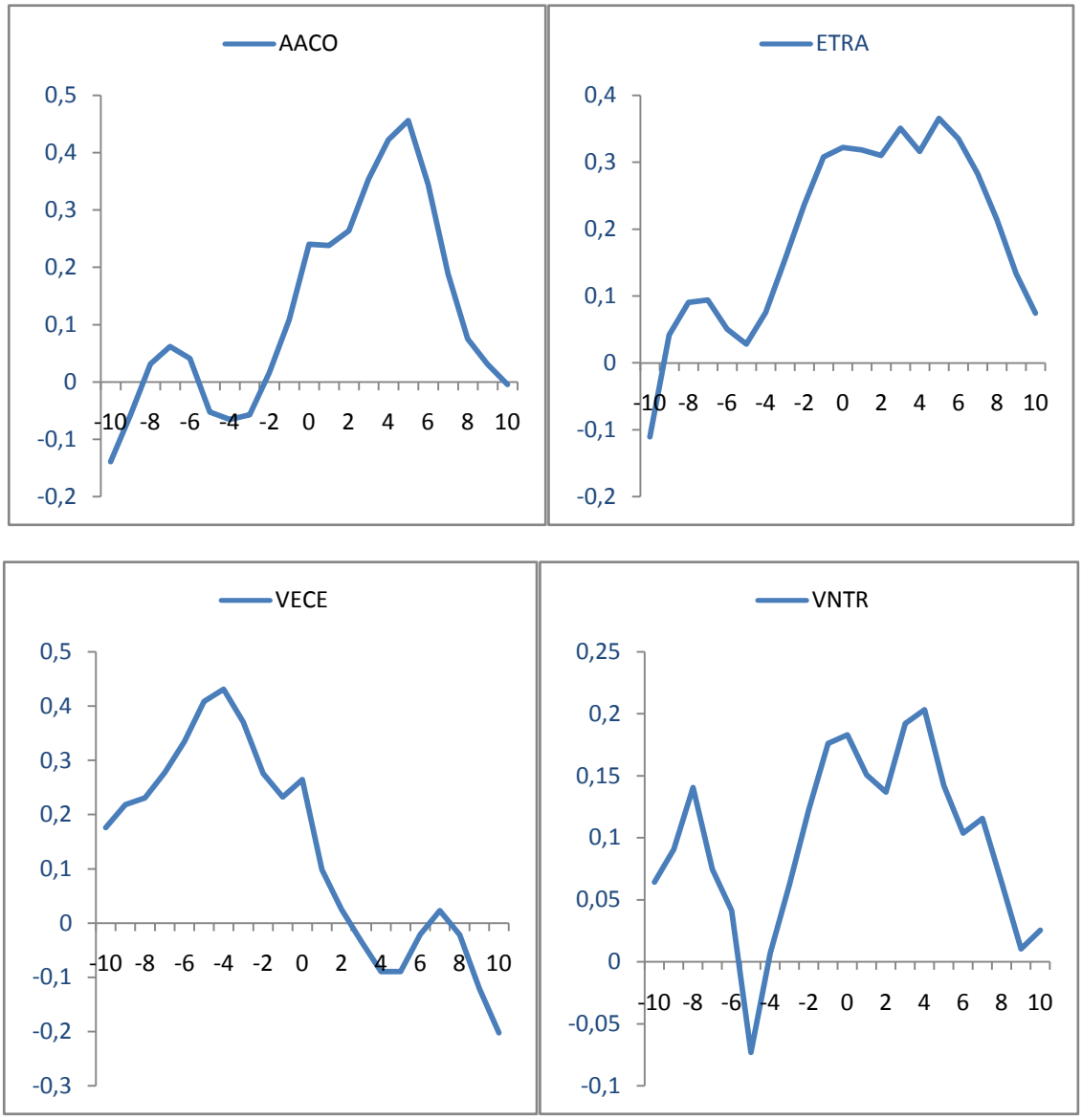
APPENDIX

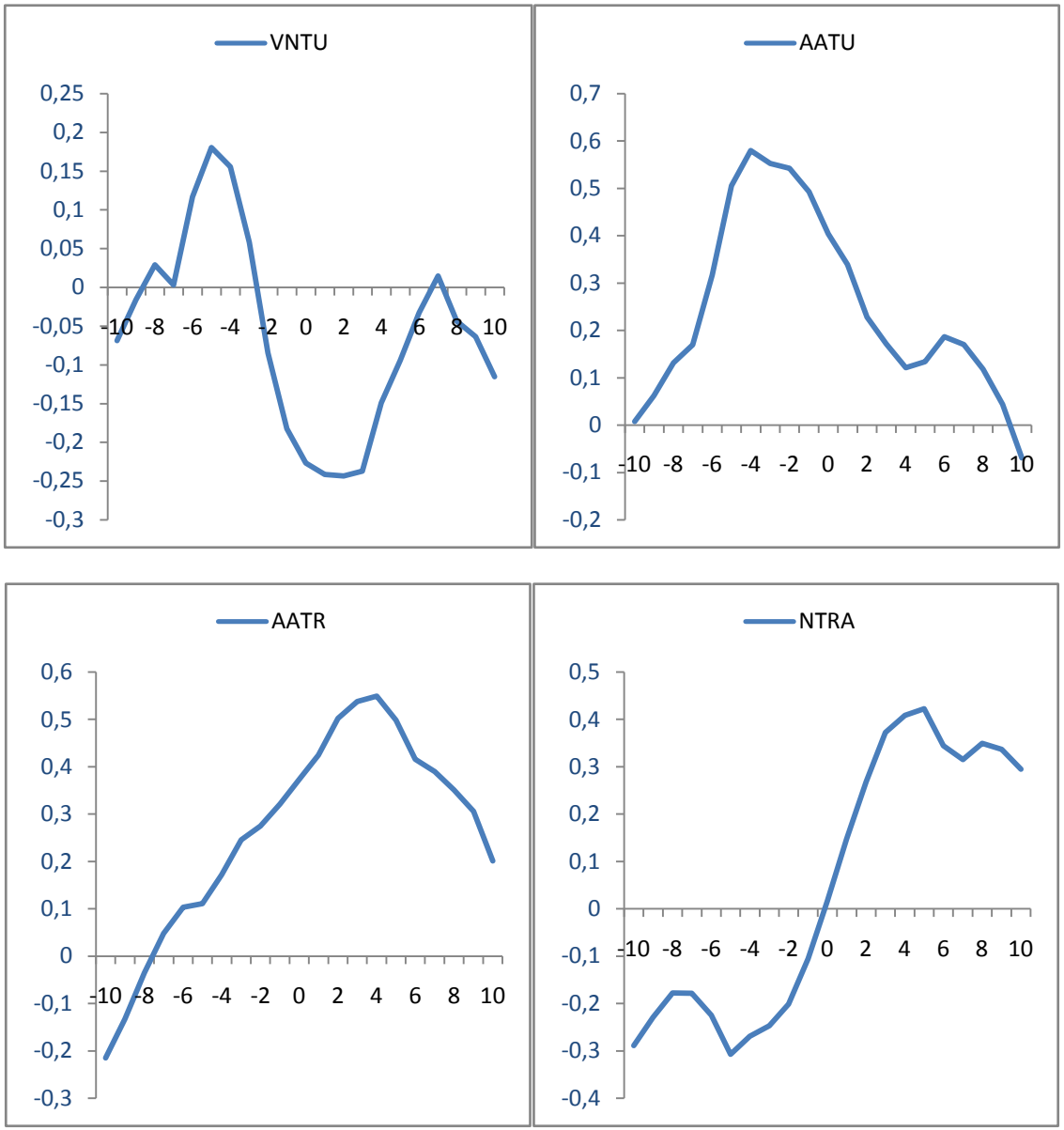
Appendix AI - Correlation matrix between GDP and the components

SERIES	AACE	AACO	AATU	ATRA	CPTR	ETRA	NTRA	PITR	VECE	VECF	VNTR	VNTU	GDP
AACE	100,00%												
AACO	57,38%	100,00%											
AATU	42,29%	57,04%	100,00%										
ATRA	11,21%	21,52%	55,70%	100,00%									
CPTR	34,04%	20,73%	12,06%	29,08%	100,00%								
ETRA	30,01%	-1,03%	2,81%	23,99%	44,82%	100,00%							
NTRA	16,64%	43,59%	56,55%	64,79%	-6,37%	-27,02%	100,00%						
PITR	12,53%	25,30%	22,22%	42,58%	76,68%	17,62%	23,43%	100,00%					
VECE	59,67%	67,02%	45,02%	52,85%	36,67%	7,60%	70,42%	44,71%	100,00%				
VECF	10,78%	28,53%	26,13%	38,72%	59,80%	12,79%	23,09%	74,79%	38,01%	100,00%			
VNTR	28,37%	28,98%	13,75%	27,84%	35,43%	-10,31%	26,45%	28,37%	44,71%	9,27%	100,00%		
VNTU	31,16%	40,77%	65,22%	49,93%	-13,82%	-0,09%	58,37%	-8,90%	43,03%	-9,62%	18,18%	100,00%	
GDP	**22,11%**	**24,07%**	**17,65%**	**17,72%**	**90,71%**	**32,25%**	**-5,50%**	**79,58%**	**26,46%**	**71,97%**	**18,32%**	**-22,69%**	**100,00%**

Appendix AII – Cross-correlation between GDP and the components




AACO
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-10 -8 -6 -4 -2 0 2 4 6 8 10
ETRA
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-10 -8 -6 -4 -2 0 2 4 6 8 10
VECE
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-10 -8 -6 -4 -2 0 2 4 6 8 10
VNTR
0,25
0,2
0,15
0,1
0,05
0
-0,05
-0,1
-10 -8 -6 -4 -2 0 2 4 6 8 10


VNTU
0,25
0,2
0,15
0,1
0,05
0
-0,05
-0,1
-0,15
-0,2
-0,25
-0,3
-10 -8 -6 -4 -2 0 2 4 6 8 10
AATU
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-10 -8 -6 -4 -2 0 2 4 6 8 10
AATR
0,6
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-10 -8 -6 -4 -2 0 2 4 6 8 10
NTRA
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
-10 -8 -6 -4 -2 0 2 4 6 8 10