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Alternative Measure of Dispersion in the Polar-Radar Chart Methodology for Activity Management

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ABSTRAT

Dynamic Activity measured through Averaging periods allows obtaining geometric figures to explain the effects of decision-making on management Activities. The sides of the triangle are perimeter distances whose lengths are tensions of types of management adopted by the companies. The type of management are variations of a kind of management identify by hierarchical ordering of perimeter distances. Measurement of Activities is developed through sufficiency indicators based on angular relationships of each area. Furthermore, intersections of linear equations generated from polar coordinates of triangle vertices, whose tangents are the mean angles of the vertices, form an alternative center of the triangle, which represents an equitable distribution of effects the decision making on financial statements. The manuscript considers its distance to the Cartesian center as a measure of dispersion, improving the estimation models.

Keywords: Accounting methodology, Visual analysis, Dispersion measure, Function of Utility, Fourier Accounting series.

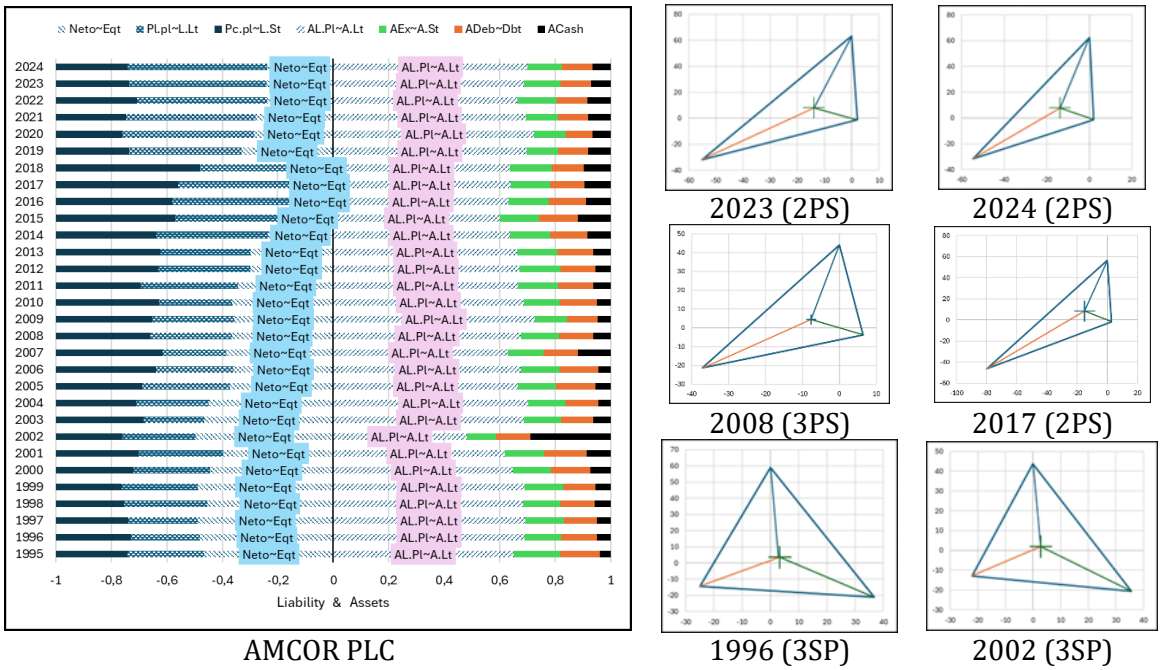
INTRODUCTION

The manuscript proposes measuring the continued activity of entities by applying accounting methodology of polar-radar chart. The financial statements are synthesis of making decisions records in an accounting system. The dynamic activity is measured by maturity average periods, which are vectors of geometrical figures from Cartesian center of a polar-radar chart. This action suggests that an equitable distribution of them could allow for contrast with another equitable one. Thus, this accounting dispersion could measure the adequacy of the distribution of the company's resources. The external variable for contrast this distribution is employment and stock market indicators associate to activity of companies, variables not included in accounting information.

The results obtained confirm the previous hypothesis and are explained below until obtaining the accounting dispersion Fourier series. The criteria that have been considered to develop the research are based on the visual perception of the results [1][2][3], criteria of experimental economics [4][5], accounting analysis [6] and analytical geometry [7][8]. The sample is made up of 6 companies in the paper and cardboard manufacturing sector, listed on the stock exchange in the United Kingdom. The annex has graphs showing the evolution of the development indicators in 5 of them, applying all the analytical indicators to the analysis of one a more extensive way on fallow sections.

KINDS AND TYPES OF ACCOUNTING MANAGEMENT

The Accounting methodology of polar-radar chart analyzes the management Activities visually by measuring geometrical figures generated from financial statements. Annual Accounts are a synthesis for making decisions. The Average periods of maturity are measures of dynamic Activity and they are vectors which dispersions from cartesian centers defining kinds of management. The sides of geometrical figures are perimetral distances and represent tensions of management areas. So, their extensions represent the greater or lesser dynamism transformations of variables included in radar-polar graphics vectors.



AMCOR PLC

Figure 1: Structure of Balance sheet and annual polar-radar charts.

The kinds of management are on table 1 According to order measures of Perimetral Distances (DPi). They are obtained applying Euclidean distances or Theoren of Cosine. Figure 1 represents the types of annual management, included in Kinds of Table 1, where the left, right and vertical vectors are respectively Average of the payment, collection and sale periods.

Table 1: Kinds of Management

PDT > PDS > PDP (1SP)
PDS > PDT > PDP (2SP)
PDS > PDP > PDT (3SP)
PDT > PDP > PDS (1PS)
PDP > PDT > PDS (2PS)
PDP > PDS > PDT (3PS)

Comparing two by two Perimetral Distances (PD i) using Sine Theory (Table 1), conditions of financial and economic sufficiency are deducted for sales, treasury and purchasing management Activities, locating them to the right, bottom and left of the triangles in Figure 1, respectively. The Kinds of management have assigned numbers according to positions of treasure activity.

Table 2: Conditions of Financial Sufficiency

	Treasury	Purchasing	Sales
(1SP)	(Ap) / (Bs) > 1	(As) / (Bt) > 1	(Bp) / (At) > 1
(2SP)	(Ap) / (Bs) > 1	(Bt) / (As) > 1	(Bp) /(At) > 1
(3SP)	(Ap) / (Bs) > 1	(Bt) / (As) > 1	(At) / (Bp) > 1
(1PS)	(Bs) / (Ap) > 1	(As) / (Bt) > 1	(As) / (Bt) > 1
(2PS)	(Bs) / (Ap) > 1	(Bt) / (As) > 1	(At) / (Bp) > 1
(3PS)	(Bs) / (Ap) > 1	(Bt) / (As) > 1	(At) / (Bp) > 1

Applying Sine Theorem on (1SP) kind of management is possible obtain condition for treasury Activity of table 2 as follows, where variables (APi) are average period of sales (s), collect (c) and payment (p).

PDS>PDP; APS / Sine (Bs) > APS / Sine (Ap)
Sine (Ap) / Sine (Bs) > APS / APS
(Ap) / (Bs) > 1

The Ap/Bs measure replaces the vector that measures the Average period of sales (APS) and has financial effects on management because it is obtained from accounts of the financial statements.

Table 3: Conditions of Economic Sufficiency

	Treasury	Purchasing	Sales
(1SP)	(Bp) / (As) > APP/PMC	(Bs) / (At) > APS/APP	(Ap) / (Bt) > APS / PMC
(2SP)	(Bp) / (As) > APP/PMC	(At) / (Bs) > APP / APS	(Ap) / (Bt) > APS / PMC
(3SP)	(Bp) / (As) > APP / PMC	(At) / (Bs) > APP / APS	(Bt) / (Ap) > PMC / APS
(1PS)	(As) / (Bp) > PMC / APP	(Bs) / (At) > APS / APP	(Bs) / (At) > APS / APP
(2PS)	(As) / (Bp) > PMC / APP	(Bs) / (At) > APS / APP	(Bt) / (Ap) > PMC / APS
(3PS)	(As) / (Bp) > PMC / APP	(At) / (Bs) > APP / APS	(Bt) / (Ap) > PMC / APS

Application of Sine Theorem on contrasting PDS>PDP is possible obtain the next expression:

(Bp) / (As) > APP/APC

Bp/As > [365*Trade Creditors / Purchases*(1+TAV)] / [365*Trade Debtors/Sales*(1+VAT)] (1)

Purchases*(1+VAT) = Trade Creditors + Liquid purchases (CL) (1.1)

Sales*(1+VAT) = Trade Debtors + Liquid Sales (VL) (1.2)

Compensations

Bp/As > [Trade creditors / Purchases*(1+VAT)] / [Trade debtors/Sales*(1+VAT)] (2)

[Trade creditors / Purchases*(1+VAT)] = [Purchases (1+VAT) – CL] / Purchases*(1+VAT) (2.1)

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$$[\text{Trade creditors} / \text{Purchases}*(1+\text{VAT})] = 1 - \text{CL} / (\text{Purchases}*(1+\text{VAT}) = 1 - \text{Pchs}\% \quad (2.1a)$$

$$[\text{Trade debtors} / \text{Sales}*(1+\text{VAT})] = \text{Sales}*(1+\text{VAT}) - \text{VL} / \text{Sales}*(1+\text{VAT}) \quad (2.2)$$

$$[\text{Trade debtors} / \text{Sales}*(1+\text{VAT})] = 1 - \text{VL} / \text{Sales}\ (1+\text{VAT}) = 1 - \text{Sles}\% \quad (2.2a)$$

$$\text{Bp/As} > (1 - \text{Pchs}\%) / (1 - \text{Sles}\%) \quad (3)$$

The measure of Economic Sufficiency is comparation between angular relation (Bp/As) contrasted with a relation on accounts of General Result of companies but measured them according to financial criteria.

MEASURES OF FINANCIAL AND ECONOMICS SUFFICIENCY

Assessment of Sales and Purchases Activities

The applications of sufficiency indicators are in figure 2. Their evolution shows changes in strategies to maintain activity of company according to evolutions of polar-radar graphics in figure 1. The management change in 2008, and it continues to end of periods. Firstly, since 1996 the company has adopted the 3SP strategy, achieving longer distances in PDS than other activities. These effects have effects since 2002 in fugue 2 when financial sufficiency of sales increases more than purchases. General criterion to obtain continued activity on management areas is that Financial sufficiency be higher than Economic sufficiency. This condition is met in all areas during the periods analyzed, as demonstrated by their respective evolution in the graphs in Figure 2. It should be noted that optimal management is obtained when all areas reach the indicated condition.

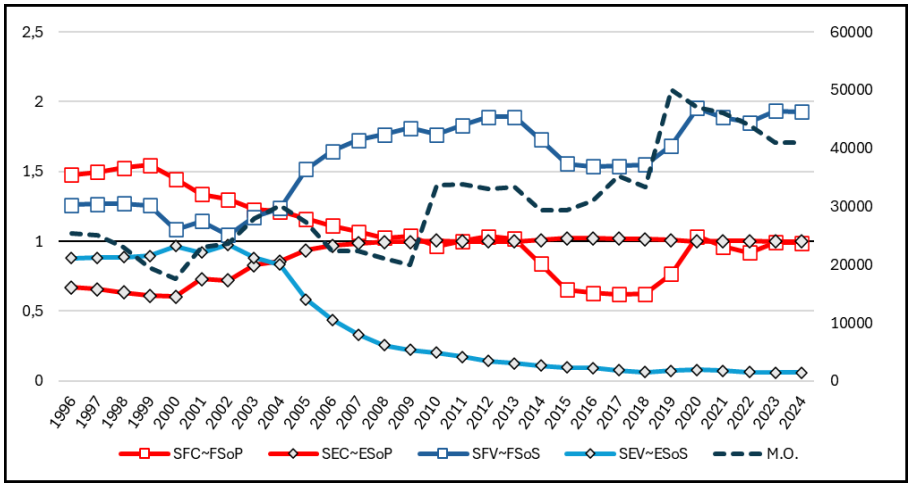

Figure 2: Economics and Financial Sufficiency of AMCOR

The evolution of the discontinued line has referenced the secondary axes and represents levels of employment, and it has more related to Purchases activities than Sales. Management risks are in the Purchasing activities because the sufficiency indicators are closer throughout the periods. So that, periods when FSoP is higher than ESoP (2010, and 2013 up 2024) the Purchasing activity does not meet or achieve management optimums.

Measures of Sufficiency on Treasure Activity

The nature of values in economy are economics, financial and monetary. This section is an analysis of compensation purchases and sales areas with effects on treasure activity. The variable cause-effect and no include in accounts of financial statements is evolution of employment, which nominal annual value is referred on secondary y-axes of figure 3.

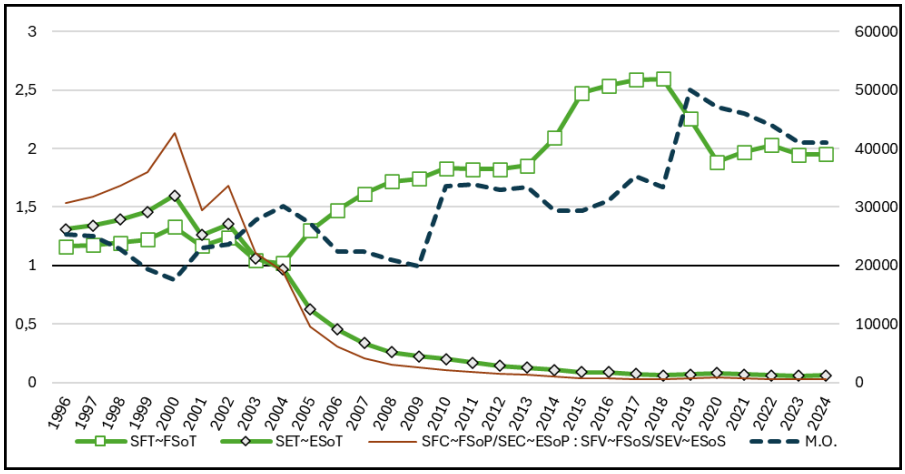

Figure 3: Evaluating treasury activity AMCOR

The evolution of Financial Sufficiency (FSoT) and Economics Sufficiency (ESoT) are indicating difficulty from 1996 up to 2004 when ESoT is higher than FFoT (FSoT<ESoT). This situation justifies changes in management as well as changes to accounting structures in Figure 1. It involves loans from external financial sources rather than Equity. According to this decision, changes in perimeter distances and increased tension in sales activity are directly related to purchasing activities.

Contrasting Financial and Economic indicators of Purchases and Sales activities, a new indicator is obtained by quotient between them with same evolution of ESoT. The change of management allows us to associate the evolution of Employment with the financial conditions of Treasure. The period between 2014 and 2018 are critical years and justify the favorable evolution of financial sufficiency with the reduction in the volume of contracted employment, by example (figure 1).

ACCOUNTING UTILITY, MEASURE DISPERSION AND FOURIER

Criteria of Accounting Utility

Previous sections analyzed activities by indicators of sufficiency. This section describes the general effects of how decision-making works. This section compares the proportional and equitable distribution of the results obtained in the activities carried out in accordance with the accounting structures of the balance sheet achieved over time.

The above-mentioned sufficiency indicators regarding the activities carried out in an accounting period are proportional measures obtained from the financial statements. The equitable distribution of the effect of decision-making with respect to the proportional effect obtained through the sufficiency indicators is a measure of dispersion over the application of resources in a period. The criteria of efficiency (financial sufficiency) and effectiveness

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(economic sufficiency) are synthesized in this measure of dispersion that implicitly measures the usefulness of decision-making, the accounting utility.

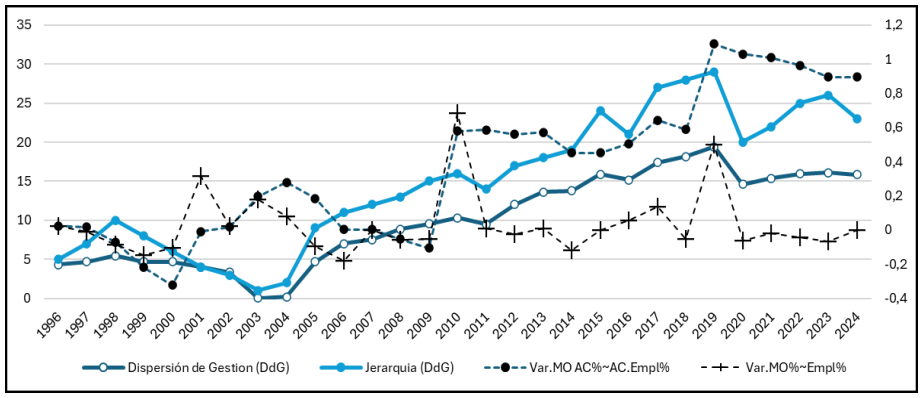

Figure 4: Employment and Accounting utility.

The equitable distribution of resources is visually obtained by the intersection of the linear equations in the management types represented in Figure 1 whose tangents are the mean angles of the vertices of the geometric figures. (The management types are included in the management classes). The graphic with blue color is annual dispersion (functions of accounting utilities) and have as reference the primary y-axis. The discontinued lines are annual variations of employment (Empl%) and accumulated employment (AC. Empl%) which have secondary y-axis as reference. With the Utility indicator located in the purchasing activity zone, the accumulation of employment varies according to the variations in utilities, and this implies a continuous increase in employment as indicated by the evolution of the cross in the respective graph.

Statistics Application of Accounting Dispersion Measure

According to database Orbis, the application of the accounting dispersion of centers obtained by equitable distribution of resources criteria has been due on MONDI PLC company. The adjustment of stock market variables is developed divide them by measure of dispersion (DoM) on polar-radar chart or types of management. The correlation coefficients justify what structural variables there are when they do not get a level higher than 0.9, correcting its value using the dispersion measure obtained. The results obtained of estimation models replace obtaining correlations coefficients and they are new alternative ways for estimation behavior entities. The models of estimation have the Number of Employments as dependent variable (NoE) and market prices (MP). Operating profit (Op.Profit), Book value and Working Capital (WC) as independent variables of Stock Market.

Table 4: Variables considered for regression models

	Nominal valúes.						Corrected values.			
Years	**DoM**	**NoE**	**MP**	**Op.Profit**	**Book value**	**W.Cap**	**MP**	**Op.Profit**	**Book value**	**W.Cap**
2023	3,3949	21400	16,913	1,771	11,982	2,724	4,982	0,522	3,529	0,802
2022	4,7288	26700	15,505	3,7	12,522	3,586	3,279	0,782	2,648	0,758
2021	3,4796	26400	20,086	2,057	9,338	2,712	5,772	0,591	2,684	0,779
2020	2,7878	25700	18,914	1,798	9,077	2,378	6,785	0,645	3,256	0,853
2019	2,8656	25900	19,498	2,368	8,505	2,589	6,804	0,826	2,968	0,903
2018	2,1655	26100	17,969	3,22	10,333	3,739	8,298	1,487	4,772	1,727

2017	1,9393	26300	21,241	2,574	10,653	3,446	10,953	1,327	5,493	1,777
2016	0,2510	25400	18,326	2,42	9,486	2,977	73,001	9,640	37,787	11,859
2015	0,2442	25300	14,674	1,98	7,013	2,55	60,078	8,106	28,712	10,440
2014	0,2224	25100	11,55	1,682	6,743	2,635	51,941	7,564	30,324	11,850
2013	0,1631	25200	11,506	1,518	7,139	2,596	70,543	9,307	43,769	15,916
2012	0,0207	23700	7,365	1,215	7,195	2,682	355,103	58,581	346,906	129,312
2011	1,5005	24500	5,005	1,431	6,482	2,176	3,336	0,954	4,320	1,450
2010	1,0572	28800	5,649	1,236	7,07	2,531	5,343	1,169	6,688	2,394
2009	0,4225	30100	3,685	0,458	6,392	2,446	8,722	1,084	15,129	5,789
2008	0,8572	33400	2,241	0,217	6,643	3,183	2,614	0,253	7,750	3,713
2007	1,5653	35000	4,675	0,944	6,521	2,861	2,987	0,603	4,166	1,828

Table 5: Regression statistic

Regression statistics	Uncorrected variables	Corrected variables
Coeficiente de correlación múltiple	0,75812542	0,99987114
Multiple correlation coefficient R^2	0,574754153	0,999742298
R^2 ajusted	0,433005538	0,999656397
Typical error	2541,822222	5012,106264
Observations	17	17

Table 6: Analysis of Variance to Uncorrected variables and corrected variables

Analysis of Variance (Uncorrected variables)					
	Grados de libertad	*Suma de Cuadrados*	*Promedio de los cuadrados*	*F*	*Valor crítico de F*
Regresión	4	104788501	26197125,3	4,0547426	0,0263061
Residuos	12	77530323	6460860,2		
Total	16	182318824			
ANALYSIS OF VARIANCE (Corrected variables)					
Regresión	4	1,2E+12	2,9E+11	11638,33	2,04981E-21
Residuos	12	3,0E+08	2,5E+07		
Total	16	1,2E+12			

The column of probability of estimation models (Table 7) indicates the fulfillment of the null hypothesis. Consequently, the second model improves the employment estimates. However, according to the results in tables 5 and 6, the validity of the research results does not have to be associated with the validation of the variables of the estimation models to obtain a non-refutable result, when the incorporation of more events in the research refutes the estimation model initially obtained. That is, the manuscript takes a position with respect to socioeconomic research in the sense of considering the dispersion of time rather than dispersion measures of long periods.

Table 7: Estimation model with uncorrected variables

Estimation model with uncorrected variables						
Variables	Coefficients	Standard error	t-statistic	Probability	Lower 95%	Upper 95%
Intercepción	20849,95	4667,005	4,468	0,00076898	10681,42	31018,48
MP	-57,54	179,545	-0,320	0,75412687	-448,73	333,66
Op.Profit	-1784,06	1415,905	-1,260	0,23161761	-4869,05	1300,93
Book value	-671,91	591,460	-1,136	0,27813073	-1960,59	616,77
W.Cap	5513,97	2027,453	2,720	0,01861979	1096,53	9931,41

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Estimation model with corrected variables						
Variables	Coefficients	Standard error	t-statistic	Probability	Lower 95%	Upper 95%
Intercepción	3140,279	1510,892	2,078	0,05978920	-151,671	6432,230
MP	1233,063	395,707	3,116	0,00891921	370,891	2095,235
Op.Profit	-9795,570	3632,959	-2,696	0,01944175	-17711,107	-1880,033
Book value	-2308,137	986,046	-2,341	0,03733129	-4456,547	-159,728
W.Cap	16060,572	2430,041	6,609	0,00002504	10765,968	21355,176

The results obtained draw attention to the need to isolate events, occurrences and decision-making processes from the environment in which they occur at a given time or period and not to use wide ranges of values to smooth the variables to obtain valid linear estimation models. In other words, the option presented by the research, regardless of the linear estimation of the models, is to adjust the variables to the time in which they report an event to obtain a better explanation of the socioeconomic event being analyzed.

Analyzing the Accounting Utility as Fourier's Series

The evolution of the Fourier series allows us to observe that the effects of the increase in areas have consequences on the increase in employment. The Fourier triangle has a base the dispersion of Xi from Cartesian axes and accounting dispersion is pendent line, which is positive at beginning and latter is negatives up to end of periods.

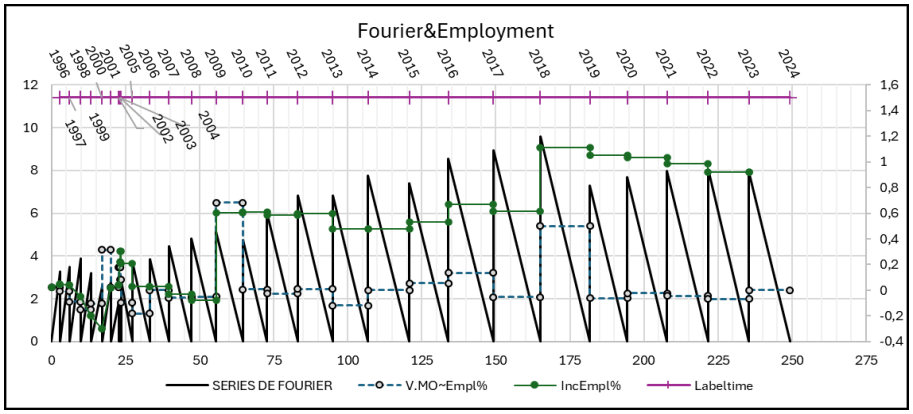


Figure 5: Employment and Fourier series

The listed companies located in United Kingdom of sample are in annex whit respective analysis which results are visually presented. The companies belong to the sector Manufacture of paper and cardboard articles (NACE 172), and number of Kinds management is position of Treasure Perimeter Distance. DS Smith and MacFarlane Group have the same type of management (1CV) as well as the same evolution of the Fourier series for accounting dispersions. According to these identities their respective accounting liable have same evolution but not assets structures. So that, the general criterion is maintaining Loans higher than Equity. Regarding the general behavior of companies, Market Prices have the same evolution as the variation in Employment and both indicators are adjusted to the evolution of the Fourier series.

CONCLUSION

The continued management of companies depends on financial sufficiency being greater than economic sufficiency. The effects of this criterion on treasury activity justify that economic

sufficiency have same evolution of contrasting by ratio the relations of both economic and financial sufficiency the other activities. The manuscript presents the dispersion of equitable distribution of resources versus proportional distribution measured by management indicators. This measure is an alternative way of adjusting the observable value of variables on the behavior of firms when adjusted for division. That is, we have managed to improve the estimation models when the adjustments are made on the value of the variable at the time of observation rather than following the orthodox criterion of obtaining dispersions of the variables over the set or totality of their values of a continuous set of events or occurrences where it intervenes. The research aims to distinguish between the presentation of results for anyone who has an interest -direct or indirect- in the evolution of the business and the researcher's interest in the results obtained. The accounting structure of the balance sheet and the radial charts are images aimed at any interested person without prior discrimination, and the researcher's interest is oriented towards contrasting the results obtained with variables that are not deduced from the financial statements. The presentation of the Fourier series pursues this last objective, evolving according to market and labour variables. The results obtained suggest that socioeconomic analyses can be improved and an alternative methodology is presented that allows alternative lines of research aimed more at the analysis of the event than at the set of events.

References

[1]. Awh. E., Evidence for Split Attentional Foci. Journal of Experimental Psychology 2000, Vbi. 26, №?!834-846. DOI: 10.1037/0096-1523.26.2.834.

[2]. Eriksen, Ch. W and Spencer, T., Rate of information processing in visual perception: Some results and methodological considerations. Journal of Experimental Psychology. Monograph. February 1969. Vol. 79, No. 2, Part 2. https://doi.org/10.1037/h0026873

[3]. Hatfield, G.; Epstein, W., The status of the minimum principle in the theoretical analysis of visual perception. Sychological bulletin, 1985, Vol.97(2), p.155-186. DOI: 10.1037/0033-2909.97.2.155.

[4]. Gülgöz, S. Need for cognition and cognitive performance from a cross-cultural perspective: Examples of academic success and solving anagrams. The Journal of Psychology, 2001. 135(1), 100-112.

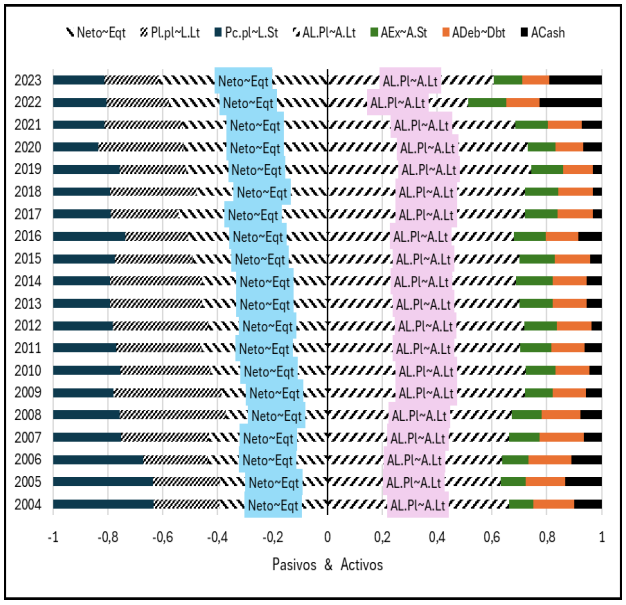
[5]. Hevey, D., Thomas, K., Pertl, M., Maher, L., Craig, A., & Ni Chuinneagain, S. Method effects and the need for cognition scale. International Journal of Educational and Psychological Assessment, 2012. 12(1), 20-33.

[6]. Fernando, T., et al. Determinants of Corporate Indebtedness in Portugal: Analysis of Financial Behaviour Clusters. Risks 2024. 12: 91. https://doi.org/10.3390/risks12060091

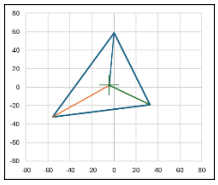
[7]. Basu, K. The Globe and the Circle. Geometry and Economic Geography as Tribute to Thales and Nash. World Bank Group. Policy Research Working Paper 7819. September 2016. WPS7819

[8]. Meyer, C., Jetz, W., Guralnick, R.P., Fritz, S.A. and Kreft, H. Range geometry and socio-economics dominate species-level biases in occurrence information. Global Ecology and Biogeography, 2026. Vol. 25, No. 9/10.

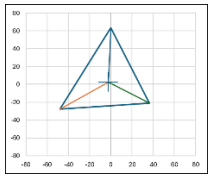
Annex 1
COMPANY MONDI PLC



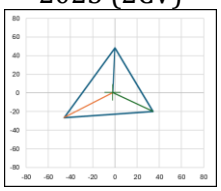
MONDI PLC



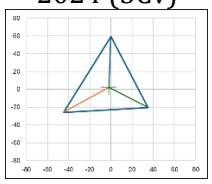
2023 (2CV)



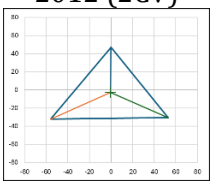
2024 (3Cv)



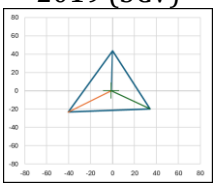
2012 (2CV)



2019 (3CV)



2005 (1CV)



2010 (2CV)

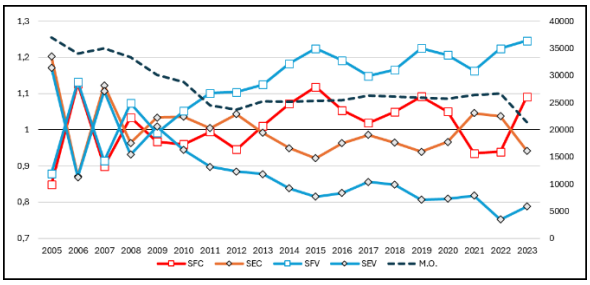


Figure 2: Economics and Financial Sufficiency

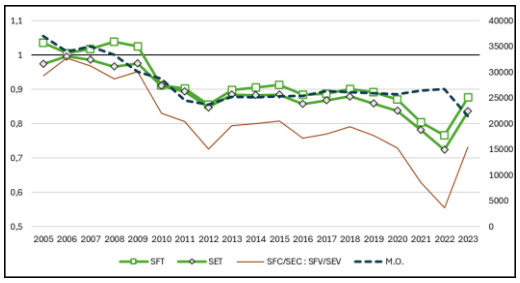


Figure 3: Evaluating treasury activity

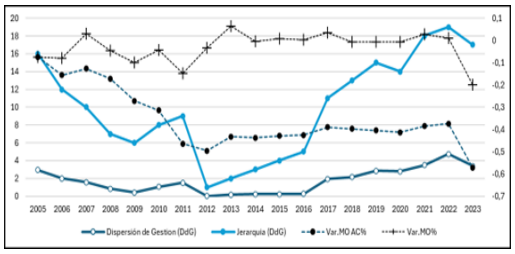
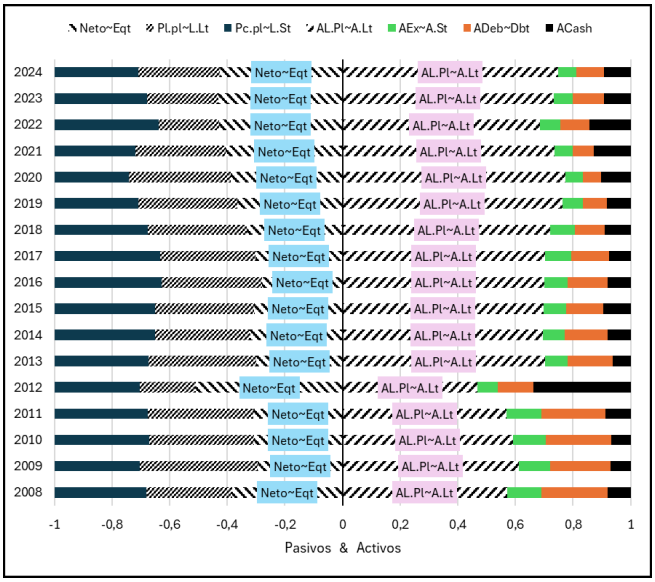


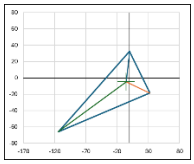
Figure 4: Employment and Accounting utility.

Figure 5: Employment and Fourier series

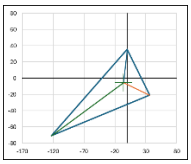
COMPANY DS SMITH PLC



DS SMITH PLC



2023 (1CV)



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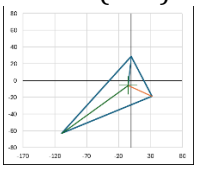
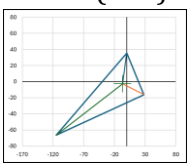


2016 (1CV)



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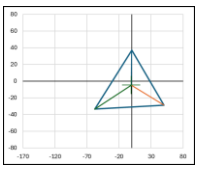
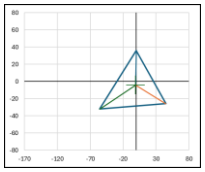


2009(1CV)



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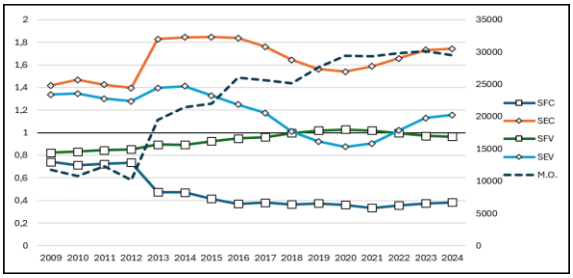


Figure 2: Economics and Financial Sufficiency

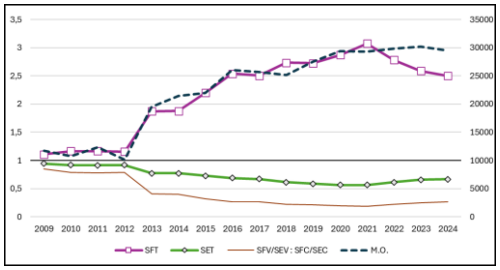


Figure 3: Evaluating treasury activity

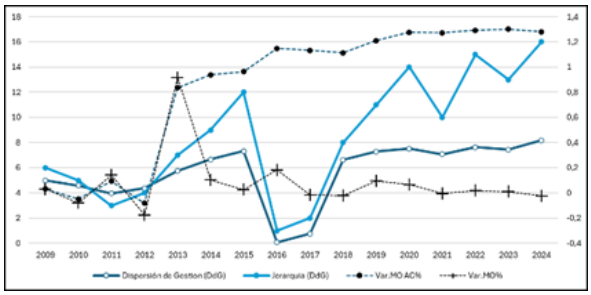


Figure 4: Employment and Accounting utility

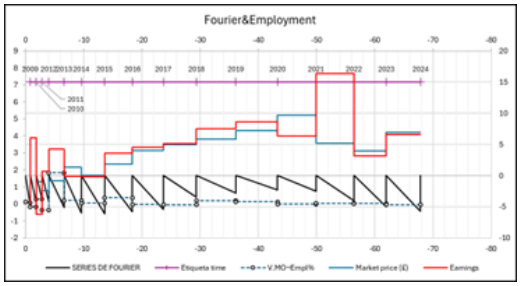
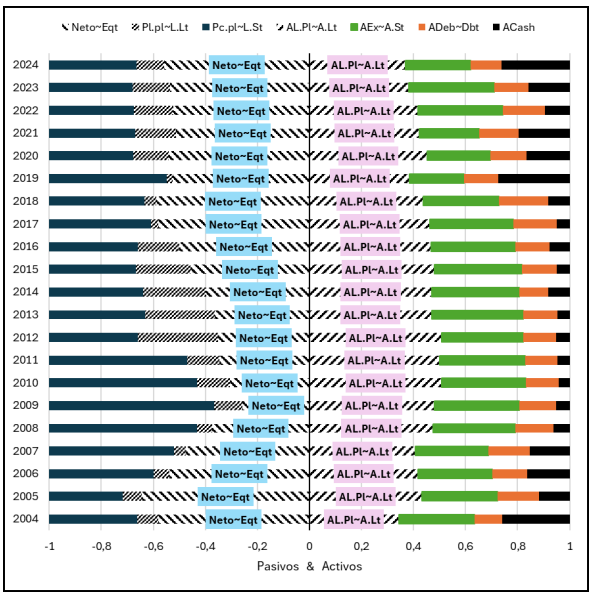
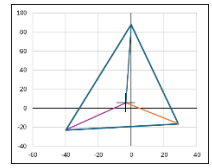


Figure 5: Employment and Fourier series

COMPANY: IG DESIGN GROUP PLC



IG DESIGN GROUP PLC



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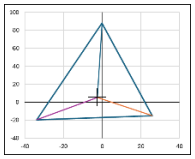
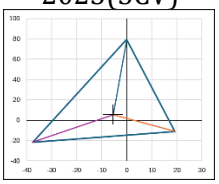
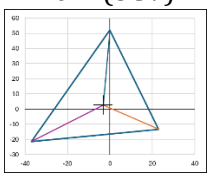


2024(3CV)



2014(3CV)



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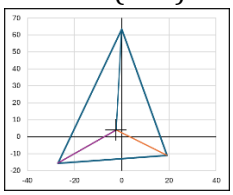
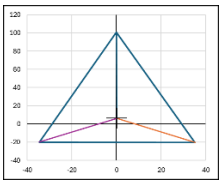


2005(3CV)



2009(3VC)

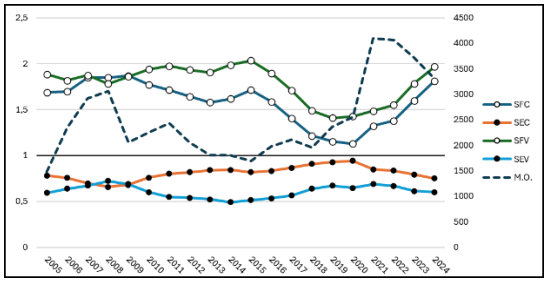


Figure 2: Economics and Financial Sufficiency

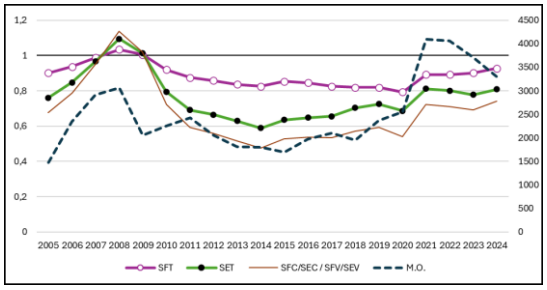


Figure 3: Evaluating treasury activity

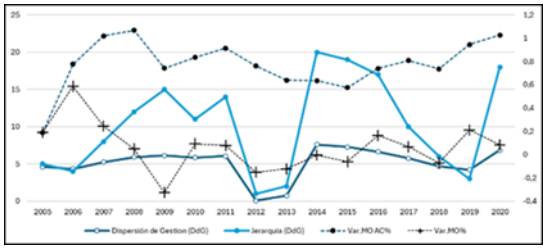


Figure 4: Employment and Accounting utility

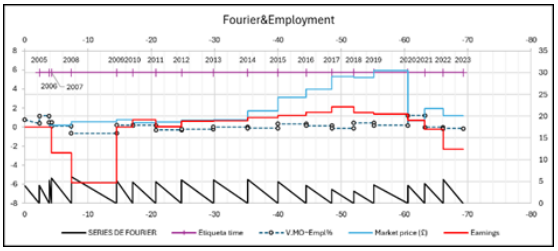
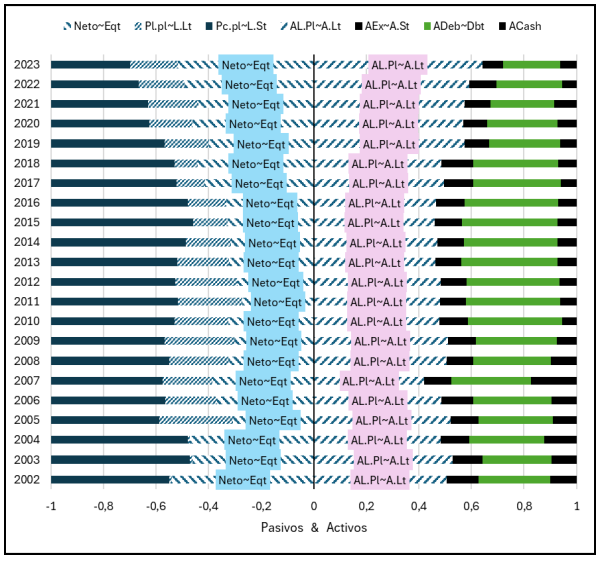
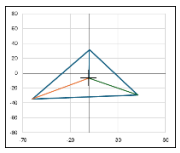


Figure 5: Employment and Fourier series

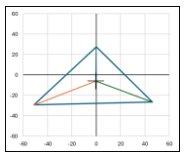
COMPANY: MACFARLANE GROUP PLC



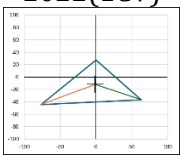
MAPFARLANE GROUP PLC



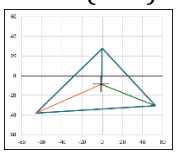
2022(1CV)



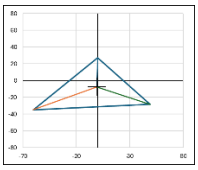
2023(1CV)



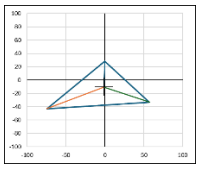
2016(1CV)



2019(1CV)



2003(1CV)



2008(1CV)

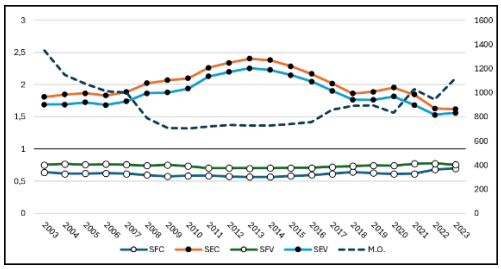


Figure 2: Economics and Financial Sufficiency

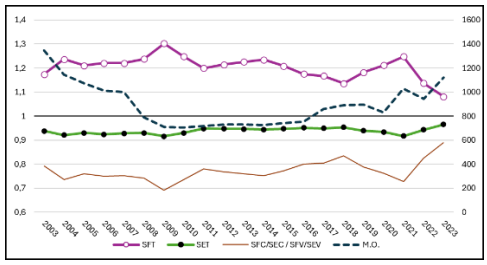


Figure 3: Evaluating treasury activity

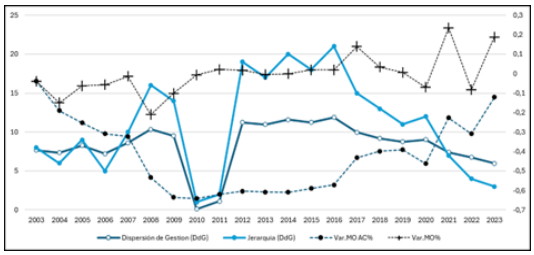


Figure 4: Employment and Accounting utility

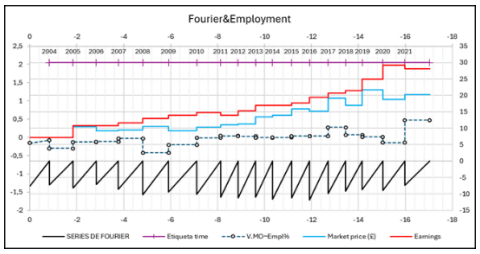
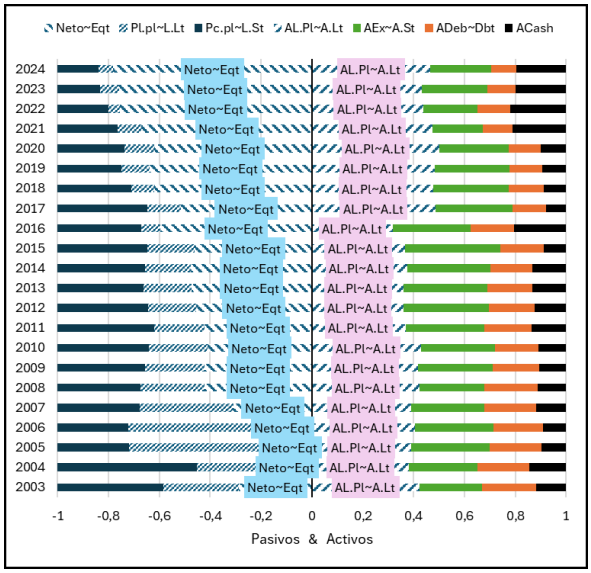
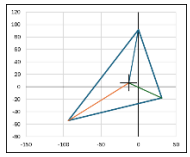


Figure 5: Employment and Fourier series

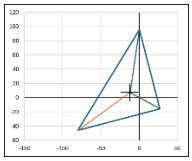
COMPANY: SANDERSON DESIGN GROUP PLC



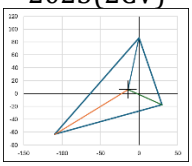
SANDERSON DESING PLC



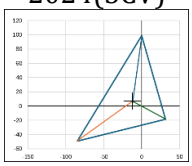
2023(2CV)



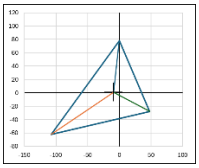
2024(3CV)



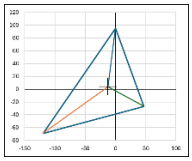
2014(2CV)



2019(3CV)



2004(2CV)



2008(2CV)

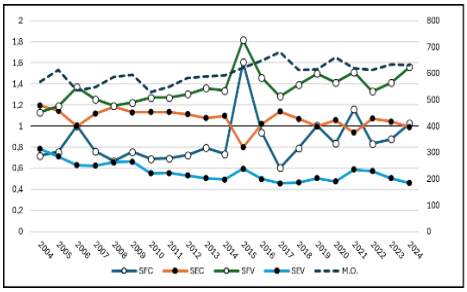


Figure 2: Economics and Financial Sufficiency

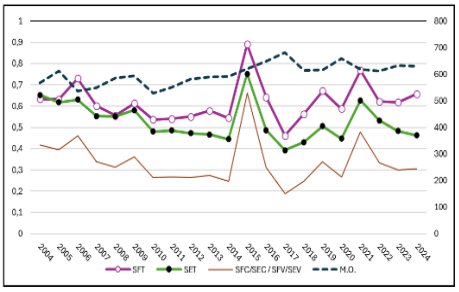


Figure 3: Evaluating treasury activity

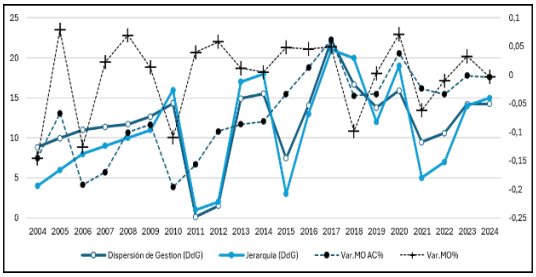


Figure 4: Employment and Fourier series

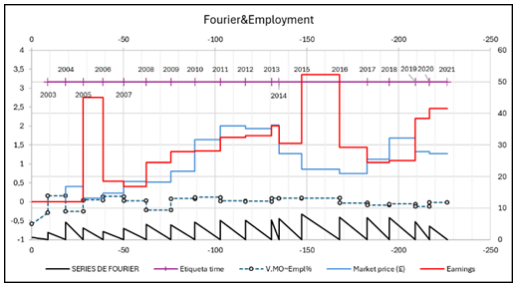


Figure 5: Employment and Fourier series