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# Accounting Symmetries on Indonesian Entities by Applying the Edgeworth's Box

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## Abstract

Decisions making of entities in an economy are materialized into transactions to transform economic goods into monetary goods, maintaining a continued management of the corporate activity. The transformation of economic goods into monetary ones is a <<mutatis mutandis>> effect in which entities of the economic and financial market interfere with different impact in their respective financial statements. In accordance to the economic situation of the market, we can make a bigger/smaller association between such entities. This association is susceptible of being represented by accounting symmetries. Accounting symmetries are obtained to measure the positions taken by entities in an Edgeworth's Box. The entities that are object of study in this manuscript are banking entities, non-financial entities, and the entity-State, which represents the position of the Indonesian economy in the Edgeworth's Box. Later, the manuscript visually analyses the accounting symmetries between banking and non-financial entities, shorted by economic sectors.

**Keywords:** Symmetry Accounting, Accounting Methodology, Accounting Analysis, National Accounting

## 1. Introduction

### 1.1 Introduce the Problem.

The accounting transaction is defined in this manuscript as the registry of the value identity between economic and financial transactions, which intervene in a decision making of an entity in an accounting information system. The economic transactions can be part or counterpart of the financial transactions that perform as counterpart or part of the ones before mentioned. The conversion of economic or financial transactions into parts or counterparts implies the use of an accounting regulatory paradigm to convert them in accounting transactions. The structuring of the elements of the accounting paradigm establishes an accounting conceptual framework, which is included in the Accounting National System (ANS 2008) of the United Nations (UN 2009). ANS 2008 allows to elaborate macroeconomic variables of different countries and is adopted by different international organizations to make decisions on their economies, such as the World Bank (WB) (Lequiller, F. and D. Blades, 2014).

The Conceptual Framework of the ANS 2008 performs as a conceptual reference to develop the accounting national systems of countries grouped in international organizations. This strategy implies the standardization of the content of the accounting systems of the simplest units of activity, which enables the aggregation of their

accounting transactions to form macroeconomic variables. The annual accounts are the synthesis of the decision making adopted by entities belonging to a same economic-financial environment. The economic-financial environments are identified by the conditions that regulate the transactions, providing an economic culture that has an impact in the patrimonial situation of entities (Krugman, P.R., 1999. Krugman, P.R, & Obstfeld, M., 2006. Williamson, O.E., 2005, 2020).

The continued activity of entities seeks to transform the goods and services of their economic transactions into monetary goods. This <<mutatis mutandis>> effect implies the transformation of economic goods that are managed by non-financial entities into monetary goods that are managed by banking entities. The principle of quadruple entry defined in the ANS 2008 describes this transformation and justifies its analysis by visual representation of accounting symmetries.

The accounting symmetries relate the economic and financial indicators of the entities that measure their positions in an Edgeworth's Box. Non-financial, banking and State entities are added to the Edgeworth's Box. The State entity is the balance of transactions made within the Indonesian economy. The accounting symmetries visualize the level of economic and financial association of entities according to the extension and approximation of the symmetry axes to its centre. The measure of levels of economic-financial association has the explanatory ability of the evolution of the Indonesian macroeconomic variables. The analysis of symmetries can explain the behaviour of the economic sectors that affect the evolution of the Indonesian economy in the last section of this manuscript.

## 2. Method

### 2.1 Accounting Methodology

The accounting symmetries are built from both banking and non-financial entities. It is also considered the financial and economic position of these two entities regarding the State. The existence of the principle of quadruple entry in the ANS 2008 allows considering the relationship between economic and financial transactions made by entities belonging to different economic sectors. To measure the existing association level in this relationship in the Indonesian economy, the accounting symmetries are built with the economic and financial indicators that measure the positions of the mentioned entities in an Edgeworth's Box. Therefore, an economic indicator of one entity is related to the financial indicator of another entity, both belonging to different economic sectors (Pérez, 2019a, 2020).

The positions adopted by non-financial and financial entities in an Edgeworth's Box are presented in equations 1 and 2 respectively.

$$OR - VEA = VM - VFP \quad (1)$$

$$OR - VEA = VFP - VM \quad (2)$$

Equation 1 is the identity of the accounting variables of non-financial entities, representing the compensation between economic and financial transactions made at the end of a fiscal year. Equation 2 is the identity of the accounting variables of banking entities, representing the compensation between economic and financial transactions. The operation of subtraction between variables OR and VEA has the same meaning for both kinds of entities. OR is the economic cash-flow, obtained by correcting the accounting result of the annual accounts by the value of the parts that do not represent the accomplishment of economic transactions. VEA is the variation of the value of the economic accounting assets that have not been placed in the economic market at the end of an accounting exercise (Pérez, 2014).

The variables VM y VFP have the same financial significance, but with a different financial background depending on the kind of entity. VM is the monetary saving obtained from treasury variation of the accounting balance. However, it represents the variation of cash amount for non-financial entities. For banking entities, it represents the variation of the delivered deposits by their clients that may be compensated with the variation of the monetary cash value of the treasury in banking entities, and represents the misplaced cash value in the financial market. VFP is the variation of the financial positions of entities not transformed into cash at the end of a fiscal year. In the case of non-financial entities, it represents the value of financial products that are not paid at the end of the fiscal year.

In the case of financial entities, it represents the value of financial products negotiated in the financial market and not collected at the end of the fiscal year. (Pérez, 2015).

The transposition of elements in equations 1 and 2 provides the following equations regarding accounting equilibrium.

$$VEA + VM = VFP + OR \quad (3)$$

$$VEA + VFP = VM + OR \quad (4)$$

Equations 3 and 4 are accounting equilibrium equations for non-financial and banking entities respectively. Being accounting variations, they can acquire either negative or positive values. This manuscript uses the criteria of representing positive values in the Edgeworth's Box. In order to reach this goal, there is a change of origin in equations 3 and 4 when any of their values is negative. This change of origin consists of aggregating the bigger negative value among all to every accounting equation variable, multiplied by -2 (minus 2). Once the values are corrected, they are added to the Edgeworth's Box by applying a change of unit, dividing them by the sum of the variables of each one of the parts of the identity 3 and 4. This second transformation allows obtaining the percentage values of the relative weight of each one of the variables on the respective annual equations of accounting identity corresponding to equations 3 and 4.

There are four axes in an Edgeworth's Box. Variables RO and VAE are represented in the secondary x-axis and primary y-axis of the Edgeworth's Box, respectively. Variables VPF and VM of non-financial entities (equation 3) are represented in the primary x-axis and secondary y-axis of the Edgeworth's Box, respectively. In the case of banking entities (equation 4), VPF and VM are represented in the secondary y-axis and the primary x-axis of the Edgeworth's Box respectively. This way, the sum of variables represented in both axes is 100%, regardless of the position they acquire in the Edgeworth's Box.

According to the methodology applied, the result of the transformations for the companies of the sample is represented by a black dot and a cross (●, +). Black dot and triangle (●, Δ) have been used for banking entities. We can obtain the measuring of the relative positions of entities by applying equations 5 and 6, respectively.

$$LC = (VM/OR) - (VEA/VFP); GC = (VEA/OR) - (VM/VFP) \quad (5)$$

$$LB = (VFPB/OR) - (VEA/VMB); GB = (VEA/OR) - (VFPB/VMB) \quad (6)$$

L and G indicators measure the financial and economic positions of the accounting identity equations represented in an Edgeworth's Box. The LC indicator is the financial measure of the activity developed by commercial companies, and measures the monetary supply obtained in accordance to the generated operative result (VM/RO) corrected with the obtained financial position materialized in real assets (VEA/VPF) or acquired hedge risk. GC indicator is the measure of investment in real assets in accordance to the generated operative result (VEA/RO), corrected with the monetary value generated regarding the funds obtained from the financial market (VM/VFP). It is necessary that the goal of commercial entities is to capture monetary supply from the financial market in order to keep the continued management of their activity.

In the case of banking entities, their goal is to capture monetary supply from the financial market to give it as loans and facilitate the economic activity of commercial entities. The LB indicator measures the ability to offer credit to the market (VFPB) regarding the generated operative result (VFPB/OR) reduced by the monetary supply (VMB) destined to the acquisition of real assets or hedge of financial operations (VA/VMB). The GB indicator is the economic indicator of banking entities, which measures the investment on real assets generated by the result of the activity (VA/OR) diminished by the amount of loan conceded to the market regarding the generated monetary supply (VFPB/VMB). With that in mind, the GB indicator is also taken as the level of hedge (VA/OR) acquired by a banking entity corrected with the level of risk (VFPB/VMB) acquired in the transfer of credit to the financial market. The inverse value of this indicator is similar to TIER 1 of Basilea III (Pérez, 2019b).

L and G indicators are the value of the x and y in Cartesian axes of the positions acquired by entities in an Edgeworth's Box. These indicators are used to represent the effect of symmetry between economic and financial

positions acquired by entities. This way, entities belonging to different sectors are analysed under the same criteria of measuring in a same analytic space: the Edgeworth's Box.

### 2.2 Participant (Subject) Characteristics.

The accounting symmetries are established between the economic and financial indicators of entities which belong to banking and non-financial sectors obtained from the Edgeworth's Box. The high volume of operations of entities that intervene in the study of accounting symmetries grants, at some extent, the existence of the principle of quadruple entry among them. The width/concentration of accounting symmetries must consider how the economic environment affects their behaviour. This way, accounting symmetries are also established among entities from the sample and State-entity.

This manuscript considers the accounting information of annual accounts from banking and non-financial entities of the Indonesian economy. The accounting information of entities is added to the Edgeworth's Box after homogenizing its measuring and valuation. The accounting variables are valued as US dollars (USD) and measured in thousands of units. Moreover, the accounting model used for the obtaining of the accounting equilibrium variables in the Edgeworth's Box is based on considering the dynamic behaviour of entities. In the previous section, the accounting equilibrium equations contain the economic cash-flow and the variation of assets and liabilities as the result of the accumulation of made transactions. The addition of the behaviour of the Indonesian economy to the Edgeworth's Box has considered the macroeconomic variables obtained by accumulation of the set of made transactions on itself. This action allows considering the dynamic behaviour of the economic sectors. This way, we obtain homogeneous and verifiable values for the set of entities added to the Edgeworth's Box.

The macroeconomic variables included in the accounting equation for the Indonesian economy are described in table 1. These variables have been obtained from the World Bank database (WB) for the Indonesian economy, which codenames of variables are in the first column of Table 1, column <<Variables WB>> contains the codification of macroeconomic variables, column <<Operations>> contains the operations made between macroeconomic variables of SNA 2008 to control the obtained results, and column <<Variables>> contains the acronyms of accounting variables, which form the accounting equilibrium equation for the Indonesian economy.

Table 1. Accounting macroeconomic variables

<i>Financial transactions</i>	<i>Variables WB</i>	<i>Operations</i>	<i>Variables</i>
Net acquisition of financial assets (current LCU)	GC.AST.TOTL.CN	(+)	
Net incurrence of liabilities, total (current LCU)	GC.LBL.TOTL.CN	(-)	
Net lending (+) / net borrowing (-) (current LCU)	GC.NLD.TOTL.CN	(=)	
<i>Economic transactions</i>			
Gross savings (current LCU)	NY.GNS.ICTR.CN	(+)	<i>ORec</i>
Net lending (+) / net borrowing (-) (current LCU)	GC.NLD.TOTL.CN	(-)	
Non-financial assets	(4) = (1)+(2)+(3)	(=)	<i>VEAec</i>
1. Capital transfers	(1)		
2. Acquisitions less sales of non-financial non-produced assets	(2)		
3. Gross capital formation	(3)		
<i>Treasury positions</i>			
Net incurrence of liabilities, total (current LCU)	GC.LBL.TOTL.CN	(+)	
Broad money (current LCU) Liability (M3)	FM.LBL.BMNY.CN	(-)	<i>VMec</i>
Liability financial positions	(5)	(=)	
Net acquisition of financial assets (current LCU)	GC.AST.TOTL.CN (6)	(+)	
Net financial positions	(7) = (6) - (5)		<i>NFPec</i>

The accounting parity equation for the Indonesian economy is presented in equation 7, where *VEAec* is the variation of the non-financial asset, *VFPeC* is the variation of the financial position, *VMec* is the monetary variation and *ORec* is the operative result.

$$VEAec + VFPeC = VMec + ORec \quad (7)$$

Variables of equation 7 are the result of the operations made using variables located in column <<Variables>> from table 1 and are extracted from the macroeconomic variables from ANS 2008 database. The variable for the control of data from ABS 2008 to check the results of the economic and financial activity is <<Net lending (+)/net borrowing (-)>>. This variable is the difference between transactions made between financial assets <<Net acquisition of financial assets>> and financial liabilities <<Net incurrence of liabilities, total>>. The value of the subtraction financially obtained is also obtained by the subtraction of economic figures of <<Gross savings>> and the transactions with non-financial assets <<Non-financial assets>>.

The macroeconomic variables from table 1 are associated to the accounting variables from equation 7. This way, the economic variable <<Gross savings>> is ORec, and <<Non-financial assets>> is the accounting variable VEAec, which is the sum of variables <<Capital transfers>>, <<Acquisitions less sales of non-financial non-produced assets>> and <<Gross capital formation>> (BdE 2019). In relation to financial variables from the Indonesian economy, the monetary variation from equation 7 <<VMec>> is the macroeconomic variable <<M3>> and it is excluded from the value of the macroeconomic variable <<Net incurrence of liabilities, total>>. This operation allows obtaining variable <<VFPes>> in equation 7 by subtraction between macroeconomic variables <<Net acquisition of financial assets>> and the corrected value of <<Net incurrence of liabilities, total>>.

Once the macroeconomic variables are adjusted to the accounting variables from equation 7, positions of the Indonesian economy can be measured in the Edgeworth's Box with indicators from equation 8.

$$Lec = (VFPec/OREc) - (VEAec/VMec); Gec = (VAec/OREc) - (VFPec/VMec) \quad (8)$$

Indicators from equation 8 have the same significance as those obtained for banking entities, but in a macroeconomic sense. The Lec indicator measures the level of financial products made available by the Indonesian economy in relation to the achieved economic savings (VFPec/OREc) corrected with the hedge of acquired risk (EAec/VMec), which is measured regarding the economic investment made on the obtained monetary supply (M3). The Gec indicator measures the level of economic activity reached, which measures the volume of economic investment made regarding the economic savings achieved (VAec/OREc) corrected with the investment in financial products on the obtained monetary supply (VFPec/VMec).

The indicators obtained from the measuring of positions of entities included in an Edgeworth's Box have the same economic and financial significance explainable according to the type of entity they belong. Table 2 explains the levels of risk adopted according to the area in the Edgeworth's Box where the accounting identity equation is located for every entity.

Table 2. Risk zones on Edgeworth's box

Indicator/zones	AA	AB	BB	BC	CC	CD	DD	DA
L	L>0	L>0	L<0	L<0	L<0	L<0	L>0	L>0
G	G>0	G>0	G>0	G>0	G<0	G<0	G<0	G<0
Quadrant	1	1	2	2	3	3	4	4
Tangent	G / L <1	G / L >1	G / L >1	G / L <1	G / L <1	1G /1L >1	G / L >1	G / L <1

The description of the risk areas is made considering the value of both L and G indicators at the same time. The lower risk area is the AA zone, and the higher risk area is the CC zone. In the AA zone, entities obtain or give credit, depending on the kind of entity (non-financial, banking or state), when L is bigger than zero (L>0). Simultaneously, there is a sustainable economic growth (G>0), because it obtains financing for such growth (L>G). The higher risk zone is the CC zone, where the contrary happens. The rest of zones perform as intermediate positions, which risk is measured regarding the value of both indicators at the same time, but indistinctly, maintaining them in a financial and economic sense. Finally, <<Quadrant>> shows the quadrant where the risk area is located by representing the positions of the Edgeworth's Box (figure 1) in coordinate axes (figure 2).

### 2.3 Sampling Procedures

The composition of the sample has been established according to the accounting symmetries to analyse. This manuscript regards the accounting symmetries between non-financial and banking entities and from the Indonesian

economy. Non-financial and banking entities have been obtained from the Orbis database under license of Universidad de Valencia and its annual composition is detailed in tables 3 and 4 respectively.

Table 3. Zones of Edgeworth's box for non-financial entities

Years/zones	AA	AB	BB	BC	CC	CD	DD	DA	SUMA	VARIABLE	P(CHI2)
2018	27	11	71	90	48	54	2	0	303	CHI 2/2018	0,033410377
2017	16	7	53	29	62	116	3	0	286	CHI 2/2017	0,309123871
2016	26	9	87	92	41	51	2	0	308	CHI 2/2016	0,250908197
2015	28	7	81	84	38	63	2	0	303	CHI 2/2015	0,294098535
2014	20	4	104	95	41	49	1	0	314	CHI 2/2014	0,813045964
2013	15	3	51	46	74	118	6	0	313	CHI 2/2013	1,44545E-05
2012	22	6	77	78	58	60	2	0	303	CHI 2/2012	0,239084821
2011	17	10	98	87	54	37	4	0	307	CHI 2/2011	0,861710234
2010	19	13	125	81	32	50	1	0	321	CHI 2/2010	0,93604844
2009	3	36	173	16	7	27	1	0	263	/	/
SUM	193	106	920	698	455	625	24	0	3021	CHI2/TOTAL	1,92798E-38

The annual compositions of the samples of commercial companies are in table 3, which is complemented with probable values of the distribution Chi2 obtained by means of contingency tables between risk areas and economic sectors to which the commercial companies belong, classified according to criteria NACE2. The P(Chi2) values show the level of significance of variable Chi2. When it is high, it shows independency from verified variables; and when it is not high or significant, it shows relation between the elements of the sample. The association of commercial companies is related to unstable years in the markets and companies do not have business alternatives outside their economic environment. When variables P(Chi2) are not important and their value is above 10%, they show that companies have business options alternative to the environment they are located, or this environment does not affect their activity. Years with economic struggle and association between companies are 2013 and 2018. In contrast, the years when companies have management alternatives are 2010, 2011 and 2014. In the first case, companies tend to occupy risk positions classified under letter C, and in the second case, companies tend to locate under in zone BB. In general, companies have taken bigger risk positions throughout the observed years, considering the sum of zones assigned with letter C (1.778) in opposition to those occupying zones of lower risk (1.243), providing as a result a significant value of Chi2 for the sample set of 1,92798E-38, showing the high levels of risk and association the commercial entities have maintained over the years of study.

Table 4. Zones of Edgeworth's box for banks

YEAR	A(AA&AB)	B(BB&BC)	C(CC&CD)	D(DD&DA)	SUM
2018	9	9	16	32	66
2017	7	8	26	22	63
2016	20	5	8	27	60
2015	18	6	8	32	64
2014	15	0	1	30	46
2013	5	1	20	15	41
2012	4	1	5	21	31
2011	18	0	0	12	30
2010	0	0	1	0	1
2009	0	0	0	0	0
SUM	96	30	85	191	402

The elements of the sample for banking entities are distributed by year in table 4 according to the areas of risk grouped in a less explicit way than for non-financial entities from table 3. Banking companies are the ones listed on the Indonesian stock market. It is possible to observe that they are not a high figure in the positions of risk C, in comparison to that observed for commercial companies from table 3 and, in the last years, they tend to acquire intermediate risk positions occupying zone D. The years where they are located in levels of risk are 2013 and 2017, which are similar to the results from table 3 for the commercial companies whose risk years are 2013 and 2018.

### 3. Results. Symmetry Effects

#### 3.1 Accounting laboratory

The methodology used to obtain accounting symmetries has been developed in section 2 of this manuscript. This methodology analyses the dynamic behaviour of entities and it is made over past events. The registry of past events in accounting information system is materialized in accounting statements from which we can explain the dynamic behaviour of entities. The year-on-year variations of grouped accounts, extracted from an accounting model that explains the application the principle of double entry, are put through transformations to be included in a same analytical space: the Edgeworth's Box. The accounting equilibrium variables from entities located in the Edgeworth's Box are responses to changes in the markets.

The indicators that measure the relative positions of the Edgeworth's Box are independent to the action of the researcher, because they are based on being past events, and objective, given that they measure the relative position in the Box without intervention of the researcher. The nature of the indicators shows that the Edgeworth's Box is an accounting laboratory where any entity can be included under specific conditions that enable homogeneity in the valuation of their positions.

The Figure 1 is the Edgeworth's Box where the accounting equilibrium equations from different entities of the research are represented. The positions of banking entities are represented by a triangle ( $\Delta$ ), positions of commercial entities by a cross (+) and positions of Indonesian economy by a circle ( $\circ$ ). Each position sums 100% when assets (x axis) and liabilities (y axis) are put together. Namely, each position has four explanatory variables that are related to the assets and liabilities of the accounting equilibrium equations from equations 5, 6 and 7 from section 2.

The Edgeworth's Box is a space of accounting analysis divided into eight zones by four diagonals. These eight zones have been measured according to the criteria established in table 2. The value of indicators L and G are represented in the Edgeworth's Box. The continuous line joining the highest values of the axes in the Edgeworth's Box represents the value of the L indicator when G is null. The dotted line is the G indicator. The representation of these indicators in coordinate axes is in Figure 2, where the x-axis is L and y-axis is G.

The positions of entities in Figure 2 are a rotation of the Edgeworth's Box. The positions of entities in Figures 1 and 2 have been obtained by accumulation of accounting equilibrium equations for the amount of annual entities in tables 3 and 4. The concentration of banking entities ( $\Delta$ ) in the centre of the coordinate axes shows a prudential behaviour for the banking sector, and the positions of commercial entities (+) in the CC zone show the constant risk position that have kept over the years of study. The positions of banking and non-financial entities confirm the comment made in the analysis of composition of the respective samples of entities in their tables. These positions of risk clash with the Indonesian economy performance ( $\circ$ ) as a whole, which takes the AA zone of the Edgeworth's Box. Namely, the position of the Indonesian economy favours the prudential behaviour of the listed entities.



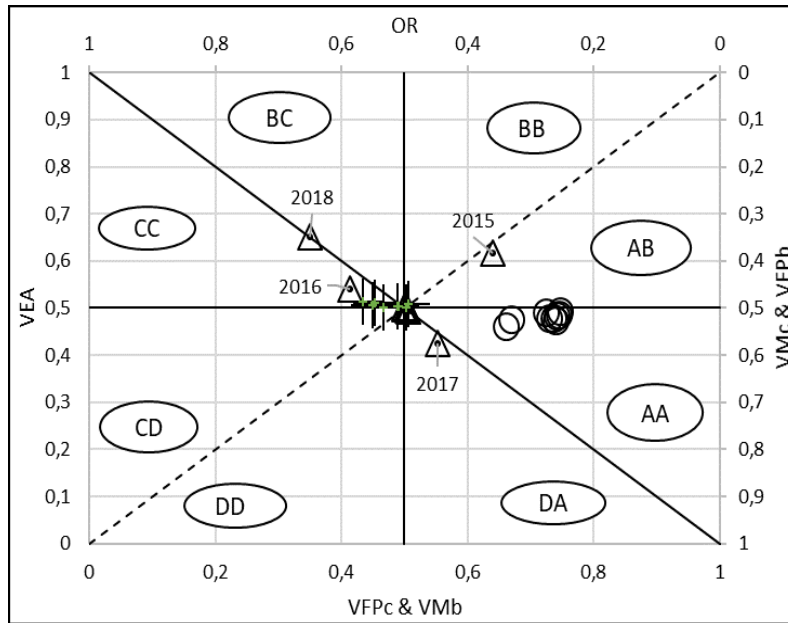


Figure 1. Edgeworth's box of Indonesian entities

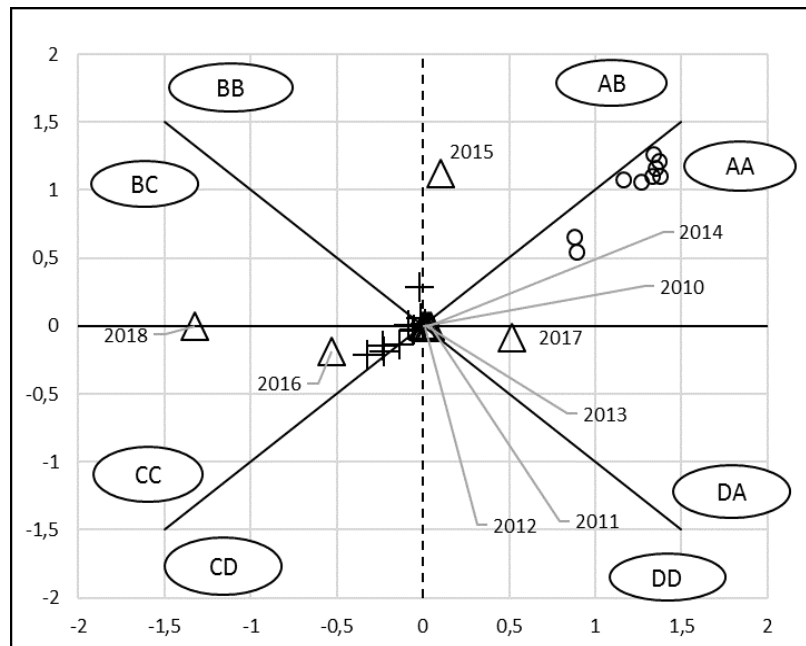


Figure 2. Accounting equilibrium equation

The evolution of indicators L and G in Figure 3 shows the level of prudential behaviour of entities and the high risk involved in 2003 in the continuous management of their activity. The symbols of the indicators for their respective entities in Figures 1 and 2 are used to identify the respective L and G indicators of entities. Besides, L and G indicators are represented by a continuous and dotted line, respectively. L and G for non-financial entities in Figure 3 in 2013 take negative values ( $L < 0$ ,  $G < 0$ ), G adopting a value higher than L ( $G > L$ ), showing the mistrust of the markets on the credit granting to commercial entities. In that year, banking entities acquire a prudential position as it happens in 2010. When commercial entities adopt prudential positions in 2015 and 2016, banking entities adopt a non-prudential behaviour. It is concluded that there are compensations between prudential and risk positions between non-financial and banking entities in the Indonesian economy.

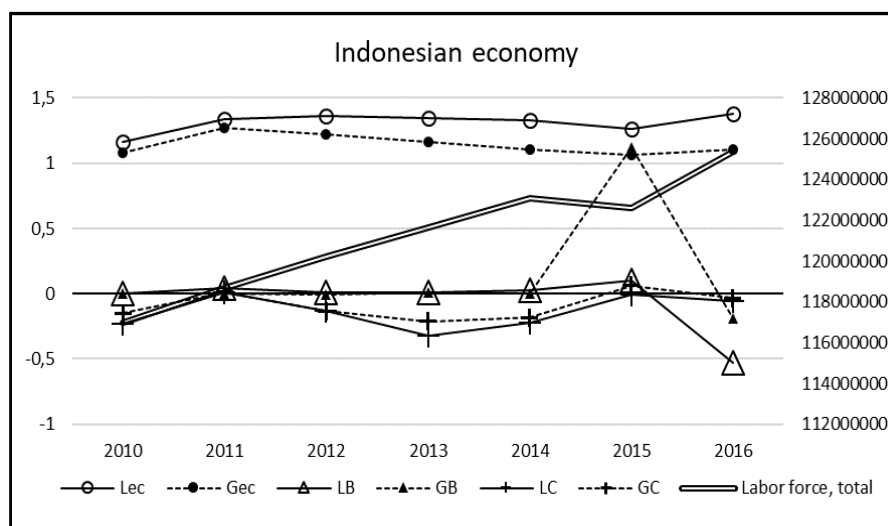


Figure 3. Evolution indicators Edgeworth's box

The evolution of the Indonesian economy remains with positive values for indicators L and G ( $L > 0$ ,  $G > 0$ ) and, moreover, the value of L is higher than the value of G ( $L > G$ ). This behaviour of indicators places the Indonesian economy in the AA zone, and trigger a rise in employment, represented with parallel lines and with reference to the secondary axis of the graph in Figure 3. The evolution of employment has been obtained from the SL.TLF.TOTL.IN series from the World Bank (WB) without tampering with its numbers, given that it is the contrast variable used to validate the analysis of the consequences of being located in the zones of the Edgeworth's Box. Locating the activity of the Indonesian economy in the AA zone from 2010 to 2016 implies that it gives credit to the market that favours investment in economic assets and employment creation, while commercial and banking entities keep their prudential positions. In 2015 there is an alternation of prudential decisions. Banking entities rise their positions in intermediate risk zones in table 4, and non-financial entities improve their positions by raising their positions in the low risk zones in table 3. The rise of employment in the following years is associated to the rise of value of the indicators in the Edgeworth's Box for the Indonesian economy. (Pérez, 2014).

### 3.2 Accounting symmetries of Indonesian entities.

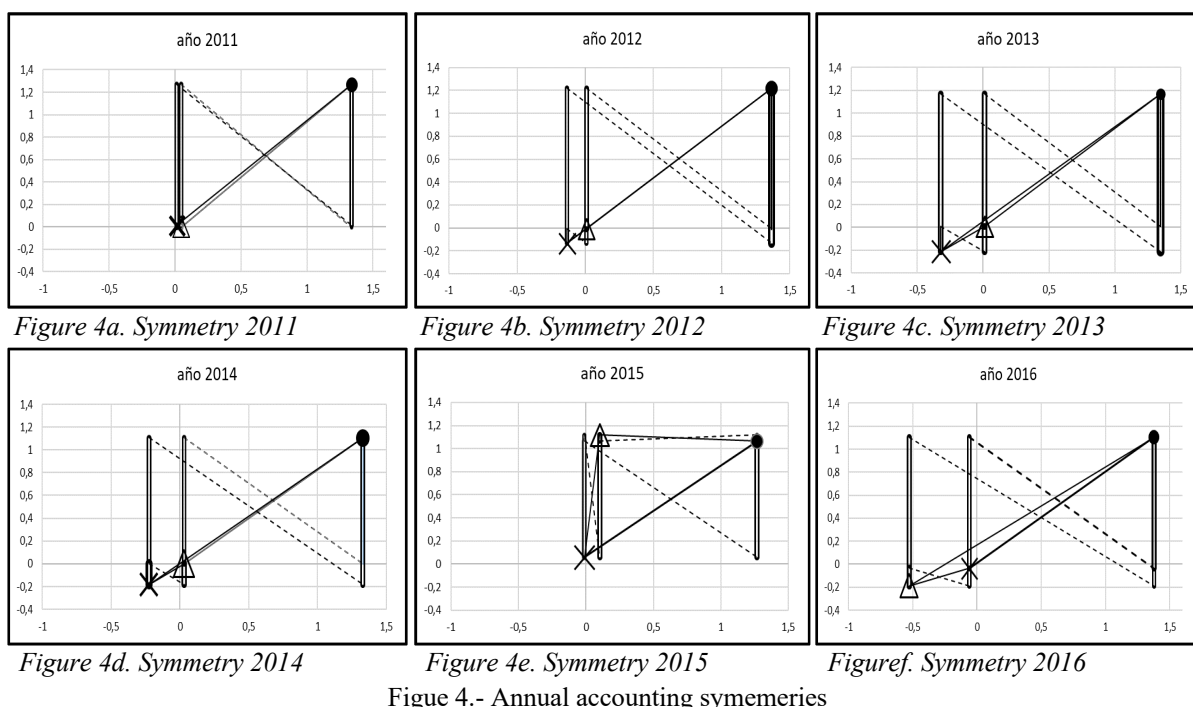
The accounting symmetries are generated relating the measuring of the accounting equilibrium positions of banking entities with the measuring of the accounting equilibrium positions of commercial entities. These relationships between indicators of entities belonging to different sectors are made from their respective representations in the coordinate axes in Figure 2.

The accounting symmetries are represented annually from 2011 to 2016 in Figure 4. Its representation is based on relating the economic indicators of non-financial entities (GC) with financial indicators of banking entities (LB). In the same way, economic indicators of banking entities (GB) are related with financial indicators of commercial entities (LC). The accounting symmetries between the respective entities of the sample and state-entity are represented to observe the effect of the economic environment in their decisions making. What is relevant is to visually analyse the level of association between the entities, considering that the biggest expansion of symmetries represents alternative options to the internal market and the concentration of accounting symmetries towards the centre implies the limitation of their activities in the internal market.

The accounting symmetries from Figure 4 have been built linking the annual positions of entities from Figure 2. To that end, the same symbols to identify the positions of entities in this analysis have been used. Thus, the triangle ( $\Delta$ ) represents the position of banking entities, the cross (X) represents the position of non-financial entities and the circle ( $\bullet$ ) represents the positions of the state-entities from Indonesia.

The annual symmetries of Figure 4 show the association between banking ( $\Delta$ ) and non-financial entities (X) of the sample, as well as the one between each one of them with the positions of the Indonesian economy ( $\bullet$ ). The

bigger/smaller association between the mentioned entities shows bigger/smaller alternatives for the development of their activity. The evolution of the Indonesian economy does not keep relation with the activity of the entities of the sample, while these keep a very associated behaviour. This shows that banking and non-financial entities do not find alternatives outside the environment in which they perform, and that the activity of the Indonesian economy favours their development. The most dangerous situation is present in 2011, where the accounting symmetry between entities of the sample shows a high association. In the following years, the symmetry axes between these entities expand, showing that there are business alternatives to the tight relationship between both entities. From 2011 to 2014, the prudential position of banking entities ( $\Delta$ ) has been favoured, quite close to the coordinate system centre, while non-financial entities have been positioned in risk zones. 2015 means a change of behaviour. The financial association is kept between entities of the sample and their economic relationship in abandoned by the width of their symmetry axes. Namely, there are financial difficulties and banking entities keep a greater economic association with the Indonesian economy, while non-financial entities keep their prudential position, close to the coordinate axes. These accounting symmetries are linked to the loss of employment in 2015, which is recovered in 2016. The activity between entities of the sample improves in 2016, once the symmetry axes were expanded between them and non-financial entities (X), adopt a better risk position than banking entities ( $\Delta$ ).



### 3.3 The centre of accounting symmetries.

The analysis of accounting symmetries can be done by making the set of observations, including coordinate centres, float around symmetries centres. In order to get this alternative representation, the symmetries centres of Figure 4 must be considered as changes of origin for the set of observations represented in them, modifying their position regarding both x and y axes. The result is the graphics of accounting symmetries in Figures 5, 6, 7a and 7b. In the respective graphics, the accounting symmetry centres are the centres of the coordinate axes, the coordinate axes from Figure 4 float around them, represented by a cross (+), the positions of banking entities are represented by a triangle ( $\Delta$ ) and the positions of companies are represented by a diamond ( $\diamond$ ). Interpretations of the positions of risk of entities do not change when taking the positions of the coordinate axes (+) as reference, regarding symmetry centres. This way, when the coordinate axes (+) are in the third quadrant regarding the accounting symmetry centres, it shows that observations located in the first quadrant adopt a low risk position. In contrast, when the centres of the axes (+) meet in the first quadrant, the positions located in the third quadrant regarding symmetry centres adopt a high-risk position.

In the analysis of the accounting symmetries displayed in the following figures, the position of the coordinate axes (+) has relevance. This centre of coordinates allows assessing the positions of risk adopted by entities in an

Edgeworth's Box. The alternative representation of symmetries enables both singular and comparative analysis without losing the risk estimation adopted by an entity.

The symmetries in Figure 5 show the relationship between banking entities ( $\Delta$ ) and state-entities in Indonesia ( $\bullet$ ). Banking entities keep a financial and economic association during the analysed years except 2015 and 2016. The symmetry in 2015 is due to a high economic association, locating itself in the first quadrant of the coordinate axes centre (+). The symmetry in 2016 shows that the economic association is higher than the financial one, showing that there have been financial alternatives between both entities. A compared analysis of symmetries in Figure 5 shows that banking entities have kept prudential performances, locating themselves close to the axes except for the distortion showed in 2015 and 2016. The symmetries in Figure 6 show the relationship between non-financial entities ( $\diamond$ ) and the state-entity of Indonesia ( $\bullet$ ). The companies are located in positions of risk and prudential positions during all the period when they are close to the coordinate axes. The bigger or smaller economic and financial association are altered during this period, in contrast to banking symmetries.

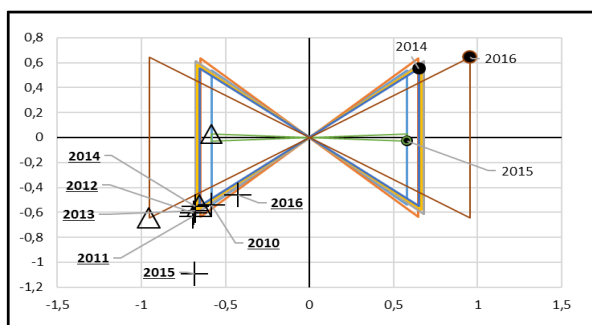


Figure 5. Accounting symmetries of banks

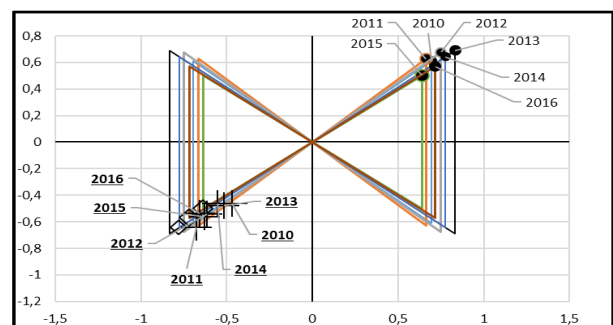


Figure 6. Accounting symmetries of companies

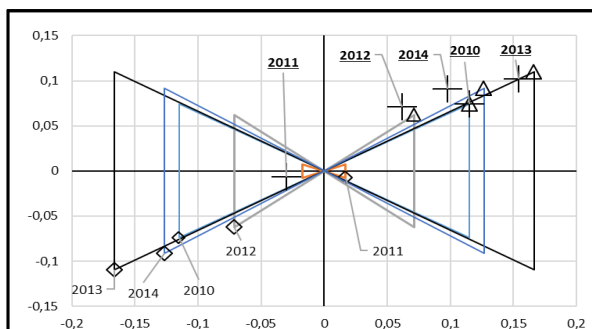


Figure 7a. Accounting symmetries 2010-2014

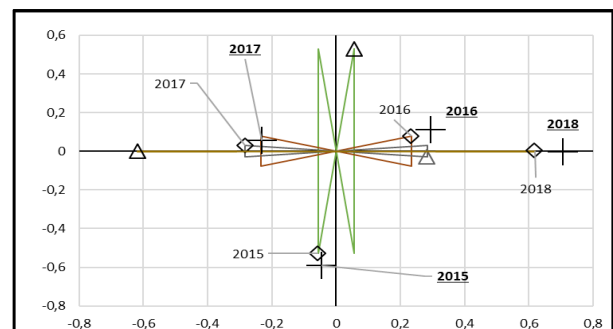


Figure 7b. Accounting symmetries 2015-2018

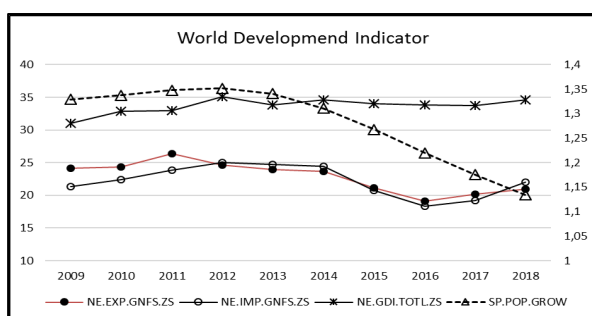


Figure 8a. Evolution of macroeconomic values

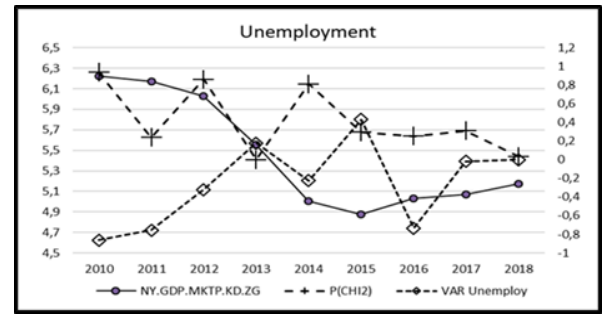


Figure 8b. Evolution P(chi2)

The symmetries of non-financial and banking entities are shown in Figures 7a and 7b. The symmetries of the period between 2010 and 2014 (Figure 7a) are more concentrated than from 2015 to 2018 (Figure 7b). The symmetries in Figure 7a are more concentrated than those in Figure 7b. This means that, from 2010 to 2014, they represent the responses of entities to market alterations when macroeconomic variables present a negative

evolution, shown in Figures 8a and 8b. The economic growth arrives in 2016, and the symmetries of the period between 2015 and 2018 have differentiated behaviour in every year in Figure 7b.

Considering the position of the coordinate axes centres (+) from 2010 to 2018, the axes centre of accounting symmetries from 2011 to 2015 are located in the third quadrant and represent positions of non-high for the entities of the sample. The symmetries in these years show a high financial association, leading to a reduction of GDP (NY.GDP.MKTP.KD. ZG), an increase of unemployment in Figure 8a, and of exports and imports (NE.EXP.GNFS. ZS, NE.IMP.GNFS. ZS) in Figure 8b, where the formers surpassing the latter. The coordinate axes centre (+) of 2017 represents an intermediate risk position, compensating the higher risk of non-financial entities with the lower risk of banking entities, according to their location in an Edgeworth's Box. In this year, exports and imports are increased and the former surpasses the latter (Figure 8 a), leading to an increase of GDP and the level of unemployment. And finally, the coordinate axes centre (+) of the rest of symmetries are located in the first quadrant, leading to locating the non-financial entities in high risk positions, which is compensated with the positions of banking entities. With this scenario, there is a continued decrease of GDP from 2011 to 2015 (Figure 8b) which is recovered starting from 2016. The 2018 represents the economic recovery with a high economic and non-financial association. This scenario repeats itself in 2013, being imports higher than exports. In both years, the distance of the perimeter axes shows that there are alternatives of financing different to those offered by the Indonesian banking.

The value of P(Chi2) measures the association of non-financial entities, and the accounting symmetries explain their nature. Table 5 contains the references of the positions of banking entities (L1) and companies (G1) in the accounting symmetries and explain the relationship between indicator P (Chi2) and the measure of association (MOA). The measure of association is determined by its nature, economic (Eco) or financial (Fin), which is obtained from the relationship between the distances of indicators L and G from the symmetry axes. This relationship compares EAD to FAD when the association is economic and, otherwise, there is an inverted relationship. The distances of the financial (FAD) or economic (EAD) association are obtained by multiplying by two the absolute value of indicators LB1 and GC1, and its lowest value determines the associative behaviour (ASSOC). Finally, the position of entities in the Edgeworth's Box is shown in columns LB and GC. LB measures the financial position of banking entities, and GC measures the economic position of non-financial entities. The changes of origin that are applied over LB and GC are Lo and Go, respectively. The change of origin is the average of financial and economic indicators of banking and non-financial entities, as explained in previous sections.

Table 5. Nature of accounting symmetries

Year	LB	Lo	GC	Go	L1	G1	FAD	EAD	P(Chi2)	ASSOC	MOA
2010	0,00	-0,11	-0,15	-0,07	0,12	-0,07	0,23	0,15	0,94	Eco	0,64
2011	0,05	0,03	0,01	0,01	0,02	0,01	0,03	0,02	0,24	Eco	0,45
2012	0,01	-0,06	-0,13	-0,07	0,07	-0,06	0,14	0,12	0,86	Eco	0,87
2013	0,01	-0,15	-0,21	-0,10	0,17	-0,11	0,33	0,22	0,00	Eco	0,66
2014	0,03	-0,10	-0,18	-0,09	0,13	-0,09	0,25	0,18	0,81	Eco	0,72
2015	0,10	0,05	0,06	0,59	0,06	-0,53	0,11	1,06	0,29	Fin	0,11
2016	-0,53	-0,29	-0,03	-0,11	-0,23	0,08	0,47	0,15	0,25	Eco	0,33
2017	0,52	0,23	-0,03	-0,06	0,28	0,03	0,57	0,06	0,31	Eco	0,10
2018	-1,32	-0,70	0,00	0,00	-0,62	0,00	1,23	0,00	0,03	Eco	0,00

Indicator MOA is related to indicator P (Chi2). The linear correlation between variables P (Chi2) and MOA is of 0.645487591 with a significance level of 0.8673541 for Student's t-test of two tails. The methodologic alternative shows the kind of association between entities of an accounting symmetry, increasing the explanatory capability of an observation in indicator P (Chi2). In the following section, the effect of the sectorial of the set of non-financial associations will be analysed.

### 3.4. Sectorial accounting symmetries of Indonesian entities.

The accounting symmetries of the economic sector to which the companies of the sample belong are analysed in this section and represented in Figures 9. The positions of banking entities ( $\Delta$ ), the position of companies ( $\bullet$ ) and the positions of the coordinate axes (+) are represented in Figure 4. The companies are sorted according to the first

digit of the listing of the economic sectors “*nomenclature statistique des activités économiques dans la Communauté européenne*” (NACE2) that is applied to identify the positions of banking entities ( $\Delta$ ) and the corresponding coordinate axes centre (+) by adding an asterisk (\*).

The analysis of sectors is visually done, in accordance to the distortions they show regarding the set of non-financial entities of the sample in every Figure 9. The y-axis limits change in every Figure 9 and the values of the x-axis stay constant except for 2011 and 2015. Namely, the financial association keeps the same level of visualization in contrast to the random, which presents economic association in every graph.

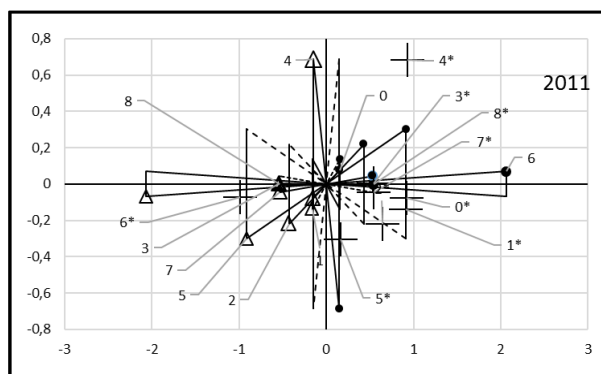


Figure 9a. Sectorial accounting symmetries 2011

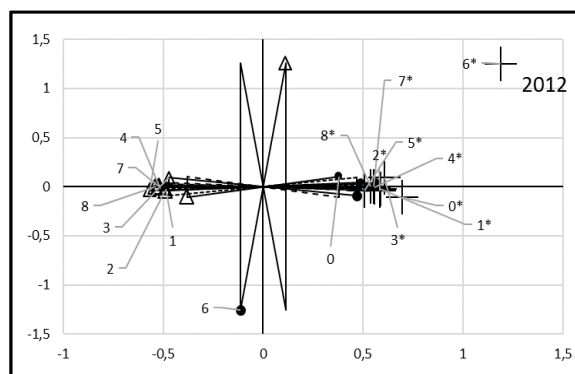


Figure 9b. Sectorial accounting symmetries 2012

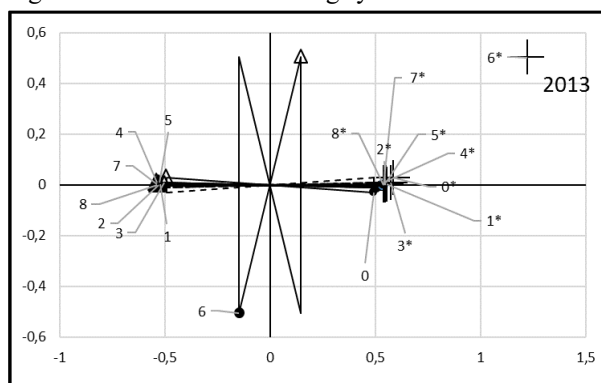


Figure 9c. Sectorial accounting symmetries 2013

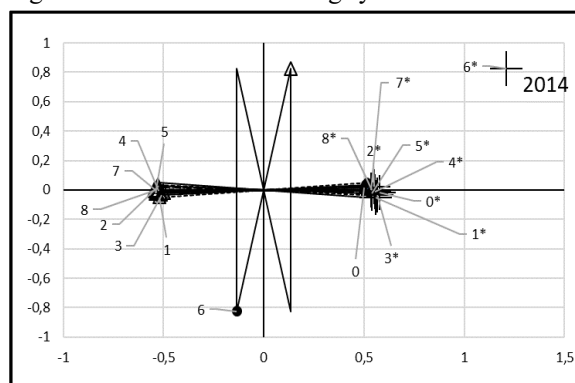


Figure 9d. Sectorial accounting symmetries 2014

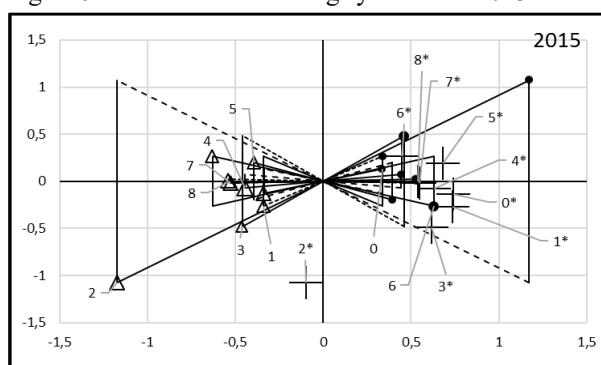


Figure 9e. Sectorial accounting symmetries 2015

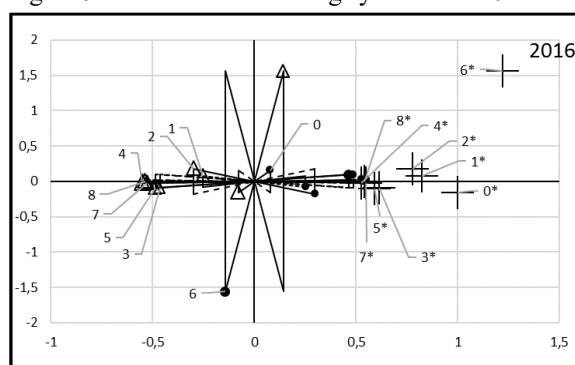


Figure 9f. Sectorial accounting symmetries 2016

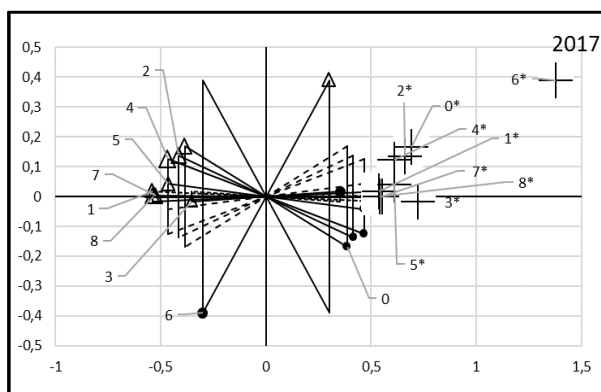


Figure 9g. Sectorial accounting symmetries 2017

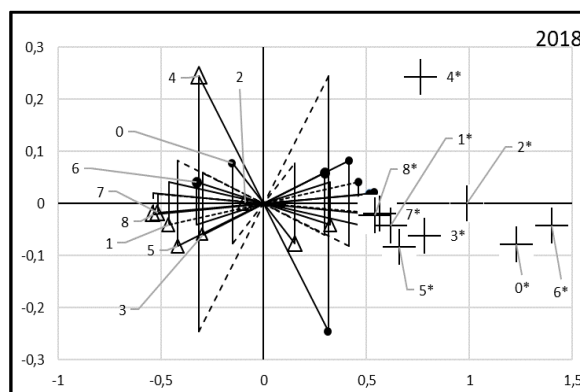


Figure 9h. Sectorial accounting symmetries 2018

The sectors that show distortion on the set of elements of the sample are identified according to the criteria of the European Commission (Eurostat 2008) and of the United Nations (UN, 2008) and are detailed in Table 6.

Table 6. Classification activities

Division	ISIC Rev. 4/ NACE Rev.2
2	Section C - Manufacturing
41 to 43	Section F - Construction
45 to 47	Section G - Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles
49 to 53	Section H - Transportation and Storage
58-60	Section JA - Publishing, audio-visual and broadcasting activities
61	Section JB – Telecommunications
62 + 63	Section JC - IT and other information services
64 to 66 (1)	Section K - Financial and insurance activities
68	Section L - Real Estate Activities
69 to 71	Section M - Professional, Scientific and Technical Activities

(1) *These sectors have not been considered in the research*

Sector 6 is the one showing greater distortion in the analyzed years, with different effect on each of them, being located in the first quadrant of its symmetry centre. Sector 6 is located in the third quadrant of the symmetry centres and adopts positions of risk in an Edgeworth's Box. It is well differentiated from 2012 to 2014 and from 2016 to 2017. The level of financial association is maintained from 2012 to 2014, and the economic associations show oscillations, reaching their highest level of concentration in 2013. Namely, 2013 shows more struggle in the activity of companies as they show greater concentration of accounting symmetries, and there is the highest rise of variation of unemployment of the analysed period (Figure 8b). The coordinate axes centres (+) of 2016 and 2017 are apart from the accounting symmetries, standing in the first quadrant. Companies from sectors rise their risk, and sector 6 shows greater economic association, greater than those from previous years. In this scenario, unemployment rises, GDP and exports overtake imports (Figures 8a and 8b). That is, the monetary policies have allowed maintaining the positions of risk of the sample, enabling facilitating the lower risk position in banking entities.

Sector 6 shows greater economic and financial association with banking entities in 2015, and sector 2 is differentiated from the rest. The coordinate axes centre of sector 2 (+) is located in the fourth quadrant, and sector 2 (●) is located in the lower risk zone in an Edgeworth's Box, damaging the position of banking entities (Δ). In this year, unemployment increases, the GDP variation decreases as well as exterior activity (Figures 8a and 8b). The lower association of the period occurs in 2015.

Sectors 6 and 4 are relevant in 2011 and 2018. Sector 6 shows lower financial association than sector 4 in 2011. The coordinate axes centre of sector 6 (+) is located in the third quadrant, and the one for sector 4 (+) in the first quadrant. Sector 6 increases its economic position and decreases the financial association with banking entities,

and sector 4 behaves in the opposite direction, being in the risk zone. The coordinate axes centres (+) are located in intermediate risk positions in both years. However, there is no compensation between sectors 4 and 6 in 2018. The evolutions of macroeconomic variables are different, showing that the activity in sector 6 determines the economic activity of Indonesia. Companies from sector 4 and banking ones adopt a lower position of risk comparatively with the symmetries of the rest of sectors. The response of the Indonesian economy in 2018 is an increase of imports regarding exports, increase of GDP and a stabilisation of employment. This evolution shows the opening to exterior market.

Table 7. Indonesian sectors

NACE2	N.COM	T% 6*	L 6x*	G 6x*	NACE2	N.COM	T% 4*	L 4x*	G 4x*
60*	60	9,49%	1,2346	0,5683	41*	140	27,29%	-2,7639	0,5470
61*	120	18,99%	-1,0453	4,0638	42*	30	5,85%	-1,1817	0,6550
62*	90	14,24%	0,4880	1,0933	45*	30	5,85%	1,0437	0,8847
66*	72	11,39%	0,2468	0,3039	46*	110	21,44%	-1,1451	2,8130
68*	290	45,89%	-2,9531	1,0312	47*	133	25,93%	-0,1745	-0,1989
					49*	70	13,65%	-2,4954	1,6531
SUM	632	100%	0,29995	0,35692	SUM	513	100%	-2,2659	0,8867

The analysis can be done with more detail, as shown in Table 7, where divisions 68 <<Real estate activities>>, 61 <<Telecommunications>>, 41 <<Construction of buildings>>, 46 <<Wholesale trade, except of motor vehicles and motorcycles>> and 47 <<Retail trade, except of motor vehicles and motorcycles>> have an economic weight of over 50% of the companies analysed in the respective sectors. The obtained values correspond to the period from 2011 to 2018. The economic divisions show mistrust from the markets to obtain financing ( $L < 0$ ) and the most significant position is presented in division 47, where G (-0.989) also adopts negative values. These sectors determine the activity of the Indonesian economy and get balanced, locating banking entities in lower risk situations.

#### 4. Discussion

This manuscript shows the analysis of the Indonesian economy by means of comparing the activities of listed companies belonging to banking and non-financial sectors. Entities are analysed using the Edgeworth's Box as an observation laboratory, where the information about the Indonesian economy is added in order to consider the effect the environment has on the evaluation of the companies of the sample. The manuscript considers that the interior market has determined the evolution of the Indonesian economy with the level of association of the accounting symmetries of the entities of the sample. The level of association and its economic-financial nature has been measured by introducing an alternative indicator in the t-Student used in its analysis. The sectors that have influenced in the evolution of the economy are those that show accounting symmetries differentiated from the prudential behaviour of the rest of them. This behaviour has been compared to the evolution of the macroeconomic variables to provide the results of the investigation with analytic validity.

The analyses of accounting symmetry consider the principle of quadruple entry is made between entities of the sample and it explains its level of economic-financial association, according to changes in markets. The manuscript evolves analysing the accounting symmetries from a general approach to a more singular one to determine the economic sectors that have conditioned the evolution of the Indonesian economy. The accounting methodology used in the manuscript invites to consider the Positive Accounting as an economic science, and the Edgeworth's Box as its investigation laboratory.

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