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**TOWARDS A THEORY OF THE CREDIT-RISK BALANCE  
SHEET**

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## ABSTRACT

This article designs what it calls a *Credit-Risk Balance Sheet* (the risk being that of default by customers), a tool which, in principle, can contribute to revealing, controlling and managing the bad debt risk arising from a company's commercial credit, whose amount can represent a significant proportion of both its current and total assets.

To construct it, we start from the duality observed in any credit transaction of this nature, whose basic identity can be summed up as  $Credit = Risk$ . "Credit" is granted by a company to its customer, and can be ranked by quality (we suggest the credit scoring system) and "risk" can either be assumed (interiorised) by the company itself or transferred to third parties (exteriorised).

What provides the approach that leads to us being able to talk with confidence of a real Credit-Risk Balance Sheet with its methodological robustness is that the dual vision of the credit transaction is not, as we demonstrate, merely a classificatory duality (a double risk-credit classification of reality) but rather a true causal relationship, that is, a risk-credit *causal duality*.

Once said Credit-Risk Balance Sheet (which bears a certain structural similarity with the classic net asset balance sheet) has been built, and its methodological coherence demonstrated, its properties –static and dynamic– are studied.

Analysis of the temporal evolution of the Credit-Risk Balance Sheet and of its applications will be the object of subsequent works.

## RESUM

En aquest article es dissenya el que hem anomenat *balanç de crèdit-risc* (d'incobrabilitat de clients), una eina que, en principi, pot contribuir a revelar, controlar i gestionar el risc d'incobrabilitat derivat del crèdit comercial de l'empresa, l'import del qual pot representar una part rellevant tant de l'actiu corrent com de l'actiu total.

Per construir aquesta eina s'ha partit de la dualitat que s'observa en tota operació de crèdit d'aquesta naturalesa, la identitat bàsica de la qual se sintetitza en  $crèdit = risc$ . El «crèdit» és el que l'empresa concedeix als seus clients, classificable per la qualitat (suggerim el sistema de *credit scoring*), i el «risc» és tant l'assumit per l'empresa (interioritzat) com el transferit a tercers (exterioritzat).

El que dona consistència metodològica al plantejament que permet parlar amb propietat d'un veritable *balanç de crèdit-risc* és que la visió dual de l'operació creditícia no és, tal com demostrem, una mera *dualitat classificatòria* (doble classificació risc-crèdit de la realitat), sinó una veritable relació causal, és a dir, una *dualitat causal* risc-crèdit.

Un cop construït el *balanç de crèdit-risc*, que presenta un determinat isomorfisme amb el balanç patrimonial convencional, i demostrada la seva consistència metodològica, se n'estudien les propietats, en els seus aspectes estàtic i dinàmic.

L'anàlisi de l'evolució temporal del *balanç de crèdit-risc*, així com de les seves aplicacions, seria objecte de treballs posteriors.

## RESUMEN

En este artículo procedemos a diseñar el que hemos denominado *Balance de Crédito-Riesgo* (de incobrabilidad de clientes), un instrumento que, en principio, puede contribuir a la revelación, control y gestión del riesgo de incobrabilidad derivado del crédito comercial de la empresa, cuyo importe puede representar una parte relevante tanto de su activo corriente como de su activo total.

Para su construcción se parte de la dualidad que se observa en toda operación de crédito de esta naturaleza, cuya identidad básica se sintetiza en  $Crédito = Riesgo$ . El “crédito” es el concedido por la empresa a sus clientes, clasificable por su calidad (sugerimos el sistema de *credit scoring*), y el “riesgo” es tanto el asumido (interiorizado) por la propia empresa como el transferido a terceros (exteriorizado).

Lo que da robustez metodológica al planteamiento que conduce a que podamos hablar con propiedad de un verdadero *Balance de Crédito-Riesgo* es que la visión dual de la operación crediticia no es, tal y como demostramos, una mera *dualidad clasificacional* (doble clasificación riesgo-crédito de la realidad), sino una verdadera relación causal, es decir, una *dualidad causal* riesgo-crédito.

Una vez construido dicho *Balance de Crédito-Riesgo*, que guarda cierto isomorfismo con el balance patrimonial convencional, y demostrada su consistencia metodológica, se estudian sus propiedades, en sus aspectos estático y dinámico.

Sería objeto de trabajos posteriores el análisis de la evolución temporal del *Balance de Crédito-Riesgo*, así como sus aplicaciones.

**Key words:** bad debts, business risk, commercial credit, credit, credit information, credit management, credit risk, credit-risk balance sheet, insolvency, risk.

**JEL classification:** M10, M20, M41.

## 1. INTRODUCTION

Companies always carry on their activities against a background of risk. Hanging over them, individually and interactively, are risks of all manner and size. We can talk of financial risks (market, credit, liquidity, operational, counterparty, country, sovereign, etc.), commercial risks, the risks of their own products and services (due to the damage that, under certain circumstances, they may cause), ecological, technological, competitive, fiscal, political, catastrophic, legal, etc. risks. For these purposes, it is worth distinguishing between insurable risks<sup>1</sup>, when the probability of their outcomes is objectively quantifiable, or non-insurable risks - uncertainty -, whose probability cannot be measured, without prejudice to whether, subsequently, a company may choose to assume insurable risks (interiorisation) or to assign or transfer them to third parties (exteriorisation), either totally or partially, by participating in the relevant risk market. In the specific case of credit risk (the risk of non-collection or of default) this transfer can be made to different entities, such as those shown in the sub-heading “non-assumed or transferred risk” in the Credit-Risk Balance Sheet, shown below.

Additionally, credit granted to customers can be ranked, in accordance with its quality, for example on the basis of credit scoring, as shown in the “Credit” heading of the aforementioned Credit-Risk Balance Sheet.

## 2. THE CREDIT-RISK BALANCE SHEET

Combining the different classes of credit and risk<sup>2</sup>, one can draw up, as part of a risk information system, the *customer default credit risk subsystem*, which would be defined as *an ex-ante representation and measurement of overall credit and the risk of default, as well as the variation therein*, and where the subsystem’s fundamental equation would be:

$$C - RT = RN$$

Where:

$$C = \textit{Credit}.$$

$RT =$  *Transferred risk*. That not assumed by the company, the outside assumption of risk or exteriorised risk.

$RN =$  *Non-transferred risk*. That assumed by the company, own assumption of risk, *net bad debt risk*, net risk or interiorised risk.

*Net risk* is the amount of *Credit*, net of *Transferred Risk* or non-assumed risk.

Let  $R =$  *Risk*,

we have that

$$C = R$$

and thus

$$R = RT + RN$$

and subsequently we get the identity

$$C = RT + RN$$

whose first term represents the credit granted by a company to its customers, classifiable by quality, and whose second term represents risk, classifiable based on the entity that assumes it.

We can now draw up the Credit-Risk (of customer default) Balance Sheet, as set forth below, where  $CS_j$  ( $j = 1, 2, \dots$ ) symbolises credit scoring levels,  $C_j$  ( $j = 1, 2, \dots$ ) amounts awaiting collection in respect of credit sales to customers at each credit scoring level and  $R_i$  ( $i = I, II, \dots$ ) the amount of risk assumed by each of the sources:

### CREDIT-RISK BALANCE SHEET

<u>CREDIT</u>		<u>RISK</u>		
$CS_1$ Credit w/ certain collection .....	$C_1$	<b>NON-ASSUMED RISK (TRANSFERRED)</b>		$RT$
$CS_2$ Credit w/ high prob. collection .....	$C_2$	Credit insurance .....	$R_I$	
$CS_3$ Credit w/ av. prob. collection .....	$C_3$	Non-compliance (guarantee) $R_{I,1}$		
$CS_4$ Credit w/ av./low prob. collection ..	$C_4$	Insolvency (credit) .....	$R_{I,2}$	
$CS_5$ Credit w/ low prob. collection .....	$C_5$	Factoring .....	$R_{II}$	
... ..	...	Forfeiting .....	$R_{III}$	
---		Commission agents .....	$R_{IV}$	
---		... ..	...	
---		<b>ASSUMED RISK (NON-TRANSFERRED)</b>	$R_m$	$RN$
TOTAL CREDIT	$C$	TOTAL RISK		$R$

*Credit* is classified on the basis of its quality, whilst *Risk* is classified on the basis of the source, that is, who assumes the credit or makes it possible. The total for credit also includes guarantees pledged, a figure that is reflected in “non-transferred risk”.

One way of achieving the aforementioned ranking of credit is to employ some form of credit scoring. Each customer will receive a specific discriminant function for the company, thus giving a credit score or  $CS_i$  score for the  $i$ -st customer ( $i = 1, 2, \dots$ ), classifying them in accordance with their status and circumstances and which will take into account their economic-financial situation, their behaviour or problems with them over the length of their commercial relationship (failure to pay, late payment, disagreements over the merchandise sold, sales returns due to disagreements with the order, etc.); state of the economic subsector to which it belongs, group of which it forms part, as the case may be, etc.

The credit ranking would be the result of the following formal stratification

Horizontal axis of  $CS_j$  intervals in decreasing order according to their value



$x_1 \quad x_2 \quad \dots \quad x_{k-1} \quad x_k \quad \dots \quad x_{n-1} \quad x_n \quad \dots$

$$\begin{array}{r}
 CS_1 \geq x_1 \\
 x_1 > CS_2 \geq x_2 \\
 x_2 > CS_3 \geq x_3 \\
 \dots \quad \dots \quad \dots \quad \dots \quad \dots \\
 x_{n-1} > CS_n \geq x_n
 \end{array}$$

where

$$CS_1 > CS_2 > \dots > CS_n$$

In fact, in the Credit-Risk Balance Sheet, we should have written the intervals in the form  $x_{i-1} - x_i$ , instead of the  $CS_j$ , with which we symbolised a specific credit score, and which we have used for simplification purposes.

### 3. THE DUALITY PRINCIPLE IN THE CREDIT TRANSACTION

#### 3.1. COMMERCIAL CREDIT

The word “credit” is “taken from the Latin *creditum* (meaning loan or debt), the neutral participle of *credere*. In the trading sense, at least, it is probable that it reached us via Italian, language in which it was already in use by 1409” (Corominas and Pascual, 1986). *Credere*, in turn, means to trust<sup>3</sup>, believe or lend. As noted by Marcel Torti, quoted by Vlaemminck (1961: 79), “the word “credit” has kept its twin meaning of belief and loan”.

J. B. Say states that credit is “the belief or opinion enjoyed by a person that they will completely comply with their obligations or undertakings or, put another way, the ability to make loans” (Dic. Espasa-Calpe).

For Hervé Bazin it is “the ability to find lenders”. That is: “credit always exists when there is an agreement for future settlement, that is, one which gives rise to duties whose execution is deferred in the case of one of the parties rather than requiring this from it immediately (...) The legal acceptance of credit is thus a promise to make payment” (Dic. Espasa-Calpe).

Credit, for Böhm-Bawerk, is, from an economic viewpoint, the exchange of a present asset for a future one. For Barré, quoted by Jiménez de Parga (1965: 38), “a change in time, by which one person voluntarily assigns to another the economic availability of an asset in exchange for future consideration”.

For Jiménez de Parga (1965: 38), “the basic elements of credit: the existence of the credit, a relationship based on trust or a tool of consumption or production”.

“Credit is based upon consideration provided to another person, under the condition of reciprocal consideration in the *future*” (Lexis, 1928: 7). When someone sells goods to another, to whom they grant a period for payment, “the thing becomes property of the purchaser (...) The matter in question is a sale and a purchase, which could have occurred, under similar conditions, on a cash payment basis. The credit transaction linked to the purchase is not an essential condition thereof, but rather arises by special agreement. The vendor has the option of requiring from the

purchaser an amount of money equivalent to the established price, but leaves this sum in the purchaser's power for a defined or undefined period of time, under the condition that, upon its expiration, the aforementioned sum must be *returned* to them. Is thus, in fact, a *money credit*, the exchange of a certain sum collectible now for another payable in the future..." (Lexis, 1928: 8-9).

For Calvo and Bonilla (1999: 15), commercial credit can be defined as "the postponement of the payment in a transaction for goods or services, normally obtained from suppliers and granted to customers"<sup>4</sup>.

In a credit-based transaction (a sale/purchase involving the postponement of payment of its value), a *credit relationship* is created, which is a debt-based relationship. For Schneider (1958: 27), a *credit relationship* exists when there is a separation of *legal ownership* of an asset and its *economic ownership*. For example, in this type of relationship, A lends money to B to acquire a machine: B is the legal owner of the machine, but not its economic one. The net asset situation of the purchaser, B, who has become indebted to acquire the machine, has not increased, even though it has become the legal owner of said machine. The lender, A, the economic owner, has part of the value of the net assets of the debtor, B, equivalent to the sum lent.

### **3.2. BIDIMENSIONALITY IN COMMERCIAL CREDIT**

The empirical fact of the credit facility granted to a customer, from the vendor's point of view, offers a dual vision, the nature of whose duality we must define. This bidimensionality allows us to identify the *origin* of the credit facility (the existence of someone prepared to assume a credit risk) and the *destination* of the credit facility (the *credit* granted the customer; the creditor's consent to the debtor providing consideration in the future). In other words, delayed payment cannot exist "voluntarily"<sup>5</sup> if there is not, previously or simultaneously, a will on someone's part to accept the risk of default, that is, the possibility of not recovering the relevant sum. This is the "at someone's risk" formula, in other words, "under someone's responsibility", with the responsibility being the "duty to make good and settle any loss or harm". Etymologically, "responsibility" comes from responsible, which in

turn comes from respond “from the Latin *respondere*, consisting of *re* (reiteration) and *spondere*, to give one’s word, derived from *sponsio*, promise” (Barcia, 1879).

Consequently, this vision or concept of a commercial credit transaction is not limited to a simple double “credit and risk” classification (double-entry bookkeeping) of reality, that is, it is not merely a *classificatory duality* (cf. Ijiri, 1975: 81), but rather reflects a true causal relationship, a *causal risk-credit duality* (causal double-entry), structurally similar to the (also causal) financing-investment relationship<sup>6</sup>. The credit transaction make possible (finances) the sale, but this could not happen without the prior existence of someone prepared to assume the risk of default involved in allowing the debtor to settle its debts in this way, which is what makes possible the existence of said credit –in other words, that the customer can enjoy a postponement of its contracted monetary duties. This is what is described in the business world by the saying “there is no trade without credit, nor credit without risk”<sup>7</sup> (“*pas de commerce sans credit, pas de credit sans risque*”) (Ancey, 1932:1). Similarly, “there is no investment without financing”: in other words, there must be someone prepared to raise the necessary funds so that another may apply or set them aside for investment.

As stated by Mattessich (1977:26), in order to speak about the bidimensional property, “the decisive factor is the existence of an economic event dominated by a process of giving and taking, input and output, transferring out and transferring in. It is this property which creates an isomorphism between an empirical phenomenon and our *basically* two dimensional mathematical construct”.

In a credit transaction, however, we could be facing a mere *classificatory duality* if we were only to consider two aspects or two ways of classifying the same reality:

*a)* on the risk side, on the basis of the guarantees covering the credit (recovery of the amount postponed).

*b)* on the credit side, on the basis of its quality based on credit scoring, etc.

However, we are dealing with the *causal duality* if we consider the cause and effect relationship of risk and credit that underlies the credit transaction, explained above, which does not imply a classification from two unconnected points of view, but rather from causation. Thus,  $C_j \leftarrow^n R_i$  symbolises that the assumption of risk ( $R$ ) by someone (as origin or as resorted to) *makes possible* the existence of credit ( $C$ ) (as destination or use)<sup>8</sup>. “Having risk” or not means that there is credit or not and, if there is credit or not means that the principal transaction will or will not take place<sup>9</sup>. This is “that idea of dynamisation implicit in the cause and effect relationship immersed in the duality principle” that Cañibano spoke of (1975: 67).

As noted by Ijiri (1975: 81-82), classificatory duality would not stand up to the test of the three axioms (control, quantities and changes)<sup>10</sup> required to carry out accounting-based measurement, and puts forward an example to show that:

“suppose a group of people in a room is classified by home state on the debit side and by sex on the credit side. Since both sides classify the same group of people, debit must equal credit (...) This recording method has the appearance of the double-entry method. However, something fundamental to a double-entry system is lacking. To clarify this point, let us compare the kinds of judgements needed to carry out the above classification of people with the three axioms stated earlier. The *axiom of control* corresponds to the ability to recognize whether a person is in the room or not. This ability enables one not only to recognize the people in the room at any point in time, but also to identify changes in the population of the room. The *axiom of quantities* makes it possible to classify the people in the room or changes in the population of the room based on home state and sex and quantify the number of people in each class. But what about the *axiom of exchanges*? Clearly, there is no need for the axiom of exchanges in carrying out this classification. The axioms of control and quantities are sufficient, because *the above recording method is not concerned with matching persons going out and persons coming in by means of their causal relationship. Certainly, this is a case of classificational double-entry, where each change is recorded independently from other changes*”.

Note that if the intention were to extend, structurally, the Credit-Risk Balance Sheet to include other risks in the company, we would be dealing with a classificatory and not a causal duality. In the case of the risk of fire or other risks to a specific asset, we would be dealing with simple double entry: the insured element on one side and the insurer on the other (the insurance company or the owner itself, in the case of self-insurance).

A company may be in the financial condition to grant a postponement of payment (credit), but may not be in the condition to assume the risk of default involved

therein. This would be the case of those companies which are prepared to sell on credit (immobilisation of financial resources) but are not prepared (do not wish) or are not in condition (cannot) assume the risk involved in a postponed payment sale. Ancey (1932: 1-2) shows with great clarity this situation when he alludes to “the decisive advantage that is afforded a trading company by the possibility of *keeping its credits whilst suppressing the risks*, or more exactly redeeming them<sup>11</sup> in advance at a fixed price which it can then incorporate into the costs of the merchandise” (the italics are ours).

Furthermore, when a financial institution, for example, does not grant a loan if the applicant does not supply guarantors, that is, if someone does not assume the duty of paying the potential lender if the former should fail to meet it, this clearly shows that we are dealing with two very different aspects of the transaction –financing and risk– and that one (risk or the assumption thereof) determines the other (financing). The bank does not wish to assume the risk and transfers it, although it is prepared to lend the money, since it is one thing to lend money but quite another suffer the possibility of incurring a loss on failing to recover the amount lent. To paraphrase Ancey, it could be said that “there is no loan without guarantees” (in the above case, guarantors). Note, then, that the guarantee, that is, the assumption of risk by a third party<sup>12</sup>, clearly shows the two underlying elements of a credit transaction: the *financing* aspect which is seen in the bank’s role as moneylender and the *riskier* aspect<sup>13</sup>, seen in the role of the guarantor, who provides the financier with the required guarantee of recovering the money lent which is sufficient enough to make the loan possible and whose role, in this case, is not assumed by the financial institute. When a loan applicant looks for a guarantor, because he already has someone to lend him the money, both aspects are not only clearly shown but are also shown perfectly causally ranked.

Thus, two conditions are required for a vendor to grant a commercial loan: the financial condition and the risk condition. From a financial point of view, the credit involves the immobilising of resources, a renouncement of using resources today, not using until the future that which could be available today. However, additionally, the risk perspective implies acceptance (or not) of the potential loss of said resources, due to failure to meet the payment duty contracted by the debtor.

Consequently, the above can be systematised as follows:

Case	Acceptance of FINANCING (granting credit)	Acceptance of RISK (assuming risk)	Example
I	Yes	No	<p>A vendor selling on credit that “turns to” or “makes use of” external sources to guarantee recovery of the amount of the credit. Only accepts or assumes the postponement of payment, but is not prepared to lose the amount postponed.</p> <p>This is a case of <i>risk exteriorisation or transfer</i>.</p>
II	Yes	Yes	<p>A vendor selling on credit that “does not turn to” or “does not make use of” external sources to guarantee recovery of the amount of the credit. Not only accepts or assumes the postponement of payment, but also the loss, as the case may be, of the amount postponed.</p> <p>This is a case of <i>interiorisation or own assumption of risk, in addition to assuming the financing</i>.</p>
III	No	Yes	<p>Guarantor. Accepts, as the case may be, disbursement of the sum guaranteed<sup>14</sup>.</p> <p>This is a case of the <i>interiorisation or own assumption of risk</i>.</p>

In Case I above, the vendor is not prepared not to recover the amount whose payment is postponed, and it therefore transfers assumption of the risk. This would be the case of a non-financial company that sells on credit with some form of guarantee, ranging from a bank guarantee to credit insurance, and including whatever figure may provide such cover, or a financial company that grants a credit with guarantors, a charge over property, etc. In Case II, the vendor is prepared, as the case may be, not to recover the amount whose payment is postponed, which thus implies assuming not only the financing but also the risk of the transaction (assuming both a loss and the

immobilisation of financial resources). This would be the case of a non-financial company which sells on credit with no guarantee other than the trust deserved by the customer, or a financial company that grants a facility with no guarantee other than the solvency of the borrower. In Case III, the company is prepared to disburse a specific sum on behalf of the guaranteed party (assuming the financial loss and the outflow of financial resources). In addition to other guarantors (banks and others), a credit insurance company would be an example of this.

This risk aspect of a credit transaction is not reflected, from a causal perspective, in conventional accounting information and is “confused” (due to superimposition) with the strictly financial dimension. The fact is that, often, the supplier of money or asset and the assumer of the risk are one and the same<sup>15</sup>.

Nonetheless, Ancy’s phrase quoted previously –“there is no credit without risk”– merits, in our view, and following the above analysis, exegetic consideration. It could have at least two meanings: *a)* that any credit involves or implies – *consequently* and negatively– a risk, or, *a contrario sensu*, *b)* that for credit to exist there must *previously* be risk (the granting or acceptance of risk), under the terms we have looked at above. Thus, Spanish business jargon covering customer credit gives us examples of this second sense when it uses terms such as: “*replantearse el riesgo de (concedido a) un cliente*” (reconsider the “risk” of/granted to a customer, “*dar riesgo a*” (give “risk” to), “*estudiar la clasificación crediticia de un cliente*” (“study a customer’s creditworthiness”), etc.

That is, whilst in meaning *a)* risk would be a consequence of credit, in *b)* just the opposite would occur. Which, then, is the cause and which the effect? We are aware of the fact that, often, option *a)* is accepted without much discussion. Thus, an expression frequently repeated in certain business circles and in certain economic circumstances, to the effect that “selling on credit involves excessive risk” bears witness to this, whereas we, irrespective of what Ancy had in mind, believe that a credit transaction would fit meaning *b)*. In other words, that risk is the source of credit and not the other way round.

Consequently, a *sine qua non* requirement to grant payment terms (postponing payment) is the concurrence of two conditions: the possibility of finance and the possibility of risk. The fact that Ancy himself notes (1932: 1-2), as seen above, “the possibility of keeping its credits whilst suppressing the risks”, that is, “redeeming them in advance at a fixed price”, for example by means of credit insurance, means that, thanks to this, the debtor is granted a credit facility, which would not exist otherwise.

### 3.3. THE LOGICAL FORMALISATION OF THE BIDIMENSIONALITY OF COMMERCIAL CREDIT

Thus it that the same reality reveals two aspects, or an aspect and a counter-aspect, perfectly associable with the duality principle:

$$\forall c \exists r / c \mathcal{R} r$$

$$c, r \in C'$$

That is, for every  $c$  (credit granted to a customer, or investment by the vendor company), there is an  $r$  (assumed risk), such that  $c$  and  $r$  are related (the type of relationship  $\mathcal{R}$  that associates  $c$  with  $r$ , in other words, the credit investment with the risk, as indicated above) and belong to the same set  $C'$ .

In its accounting version, and in the context of our credit-risk subsystem, it could be said that for every  $c$  (account representing a credit granted to a customer, or investment by the vendor company), there is an  $r$  (account representing the risk assumed), such that  $c$  and  $r$  are related (the type of relationship  $\mathcal{R}$  that associates  $c$  with  $r$ , in other words, the credit investment with the risk, as indicated above) and belong to the same set  $C'$  (set of accounts), which in our case would consist of the subset of accounts of the credit-risk subsystem, that is,  $C' \subset C$ .

When examined from a legal viewpoint, it could perhaps be argued, against the duality, that both *credit* and (*transferred*) *risk* simply identify the rights to receive payment of the subject of the *Credit-Risk Balance Sheet*, associated with the possible alternatives of receiving payment from the customer-debtor or collecting, as the case may be, from the credit's guarantor. Nonetheless, from an economic viewpoint, as

we have repeatedly mentioned above, we will reveal the causation underlying the credit relationship and contemplate, on the one hand, a destination in the credit facility and an origin in the body prepared to assume a loss due to default on the postponed payment, and that makes possible –is a *sine qua non* condition of– said credit facility.

A transaction ( $T$ ) in credit-risk terms could be represented logical-formal terms, in accordance with the duality principle, by the expression:

$$\forall T \exists c \exists r / (c \mathcal{R} r) \wedge (Pc \supset P'r) \\ c, r \in C'$$

which should, in accordance with the language of logic, be read by saying that for every  $T$  there is at least one  $c$  (credit and the account that represents it) and at least one  $r$  (risk and the account that represents it) such that  $c$  is related to  $r$ , and if  $c$  possesses the property  $P$ , then  $r$  has the property  $P'$ , and  $c$  and  $r$  belong to the set  $C'$ ,<sup>16</sup>

This relationship possesses non-reflexive, asymmetric and non-transitive properties, as do non-credit-risk economic transactions (cf. Cañibano, 1975: 65):

Non-reflexive:  $\exists c [(c \in C') \wedge (\sim c \mathcal{R} c)]$   
 $\exists r [(r \in C') \wedge (\sim r \mathcal{R} r)]$

That is, not all credit and risk accounts relate to themselves.

Asymmetric:  $c, r [(c \mathcal{R} r) \supset (\sim r \mathcal{R} c)]$

That is, “order” plays a role in the relationship between  $c$  and  $r$ .

Non-transitive:  $\exists c \exists r [\exists z (c \mathcal{R} z; z \mathcal{R} r \wedge \sim c \mathcal{R} r)]$

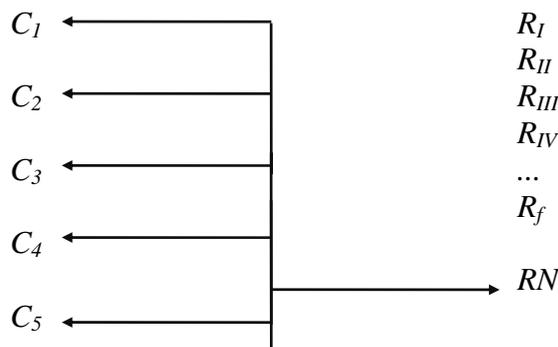
That is, the fact that there is an account  $c$  related with another  $z$  and that the latter is, in turn, related with a third  $r$ , does not always imply that  $c$  and  $r$  are related.

**4. CREDIT-RISK BALANCE SHEET STATICS. THE CORRELATION BETWEEN THE TOTALS FOR CREDIT AND RISK**

Credit-Risk Balance Sheet statics involve studying the company’s situation in this area, that is, the total risk at a given point in time, with the goal of examining its qualitative and quantitative composition, that is, as expressed in types of credit and risk.

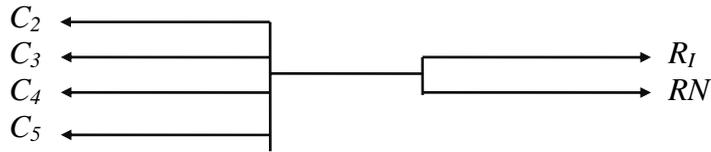
To understand the correlations between the totals for *credit* and *risk* in the *Credit-Risk Balance Sheet*, it should be noted that we have carried out the classification of credit taking into account intrinsic, and not functional, factors<sup>17</sup>, that is,  $C_1$  is a credit whose recouping is certain *per se* and not because the risk has been transferred. Thus, for example, the recouping of a credit granted to a public authority is intrinsically certain. Furthermore, we can predict that the recouping of a credit granted to a specific customer is certain because it has been factorised (by means of maturity factoring), although it could, intrinsically, be classified in any of the categories  $C_2$  to  $C_5$ .

With the *Credit-Risk Balance Sheet* we cannot talk of a bijective application from the credits  $C$  to the risks  $R$ . For example, the following situations arise:



when a company does not transfer (either because it does not wish to or it cannot) credits whose recouping is uncertain ( $C_2$  to  $C_5$ ).

There may also be credits in the subset  $C_2$  to  $C_5$  whose risk has been transferred only partially, when the vendor assumes a part thereof (the “excess” or “deductible”) as would be the case with credit insurance, which does not provide 100% cover (a basic insuring technique), so that:



We could continue with multiple possible combinations, but consider it unnecessary given that our objective is to show that a bijective application from  $C$  to  $R$  does not necessarily occur.

## 5. THE CREDIT-RISK BALANCE SHEET DYNAMICS

Credit-Risk Balance Sheet dynamics involves the study of the total for risk, which is in constant movement and transformation, be this a consequence of its management or causes beyond its control.

One can be easily check that, starting from the fundamental postulate of the credit risk subsystem

$C - RT = RN$  Equation which allows us to determine the risk of default assumed based upon the credit granted to customers and the transferred risk of default.

$C = RT + RN$  *CREDIT = RISK* identity,

in our risk system<sup>18</sup>, the nine laws of the equity system are complied with, with it being possible to find a specific semantic or empirical meaning in all of them, with some slight variations. Its generic meaning is *the representation of credit and of the risk of default and its variations*.

Starting with the identity  $C = RT + RN$

Introducing all the possible variations in its terms gives:

- [1]  $C + \Delta C = RT + \Delta RT + RN$
- [2]  $C + \Delta C = RT + RN + \Delta RN$
- [3]  $C - \nabla C = RT - \nabla RT + RN$
- [4]  $C - \nabla C = RT + RN - \nabla RN$
- [5]  $C + \Delta C - \nabla C = RT + RN$

$$\begin{aligned}
[6] \quad C &= RT + \Delta RT - \nabla RT + RN \\
[7] \quad C &= RT + RN + \Delta RN - \nabla RN \\
[8] \quad C &= RT + \Delta RT + RN - \nabla RN \\
[9] \quad C &= RT - \nabla RT + RN + \Delta RN
\end{aligned}$$

Their specific economic-financial meaning is as follows<sup>19</sup>:

- [1] Increase in credit with transferred risk.
- [2] Increase in credit with non-transferred risk.
- [3] Decrease in credit with transferred risk.
- [4] Decrease in credit with non-transferred risk.
- [5] Variation in credit with no impact on the transference of risk. This would be the case of a reclassification of credit based on its quality, without this affecting the assumption of the risk.
- [6] Qualitative variation in transferred risk. This would be the case of a change in the type of risk transfer. For example, a risk initially assumed by credit insurance or factoring that, for a particular reason (perhaps due to some defect in the transaction, as considered below), is subsequently assumed by the sales agent.
- [7] Qualitative variation in non-transferred risk. In principle, risk is assumed by the company or not. However, on a merely speculative basis and keeping the company as the assumer of the risk, it is possible to conceive of two types of situation: firstly, independent assumption (in the sense of “voluntary”) and, secondly, conditional assumption (in the sense of “compulsory”), which would be the case when a company either does not wish or cannot exteriorise risk, and a change in such situation would be formally reflected in this way.
- [8] Qualitative variation in risk: risk changes from non-transferred to transferred.
- [9] Qualitative variation in risk: risk changes from transferred to non-transferred.

Although the following situations may arise in the asset system:

$$\begin{aligned}
[a] \quad A &= E & (L = 0; E > 0) \\
[b] \quad A &= L + E & (A > L; E > 0) \\
[c] \quad A &= L & (E = 0) \\
[d] \quad A + E &= L & (A < L; E < 0) \\
[e] \quad E &= L & (A = 0; E < 0)
\end{aligned}$$

in the credit-risk subsystem, only the following situations would arise:

$$\begin{aligned}
[a'] \quad C &= RN & (RT = 0; RN > 0) \\
[b'] \quad C &= RT + RN & (C > RT; RN > 0) \\
[c'] \quad C &= RT & (RN = 0)
\end{aligned}$$

given the existence of the restriction  $RN \geq 0$ , that is, indication that the risk assumed is negative is cannot be interpreted empirically.

As is the case with the equity system, we can, in our credit-risk subsystem, classify “credit-risk accounting events” into those which are modificatory (involving increases and decreases) and permutative. And, in turn, depending whether we consider their impact on: *a*) Non-transferred risk or *b*) credit and risk structures, we have:

<b>Type of credit-risk accounting event</b>	<b>According to hypothesis <i>a</i>)</b>	<b>According to hypothesis <i>b</i>)</b>
Modificatory (increase)	2, 9.	1, 2.
Modificatory (decrease)	4, 8.	3, 4.
Permutative	1, 3, 5, 6, 7.	5, 6, 7, 8, 9.

## **6. THE MEANING OF THE CUSTOMER DEFAULT CREDIT-RISK SUBSYSTEM**

The subsystem has meaning from both a formal and material viewpoint. We can also, in turn and from a formal point of view, consider a purely algebraic interpretation, arising from the subsystem’s fundamental equation and its possible transformations. Additionally, we can consider an accounting interpretation, in that it includes and coordinates a set of accounts: those of the subsystem under review.

From a material point of view, it has temporal meaning in that it represents and measures the credit-risk transactions that have taken place. It has legal meaning in that it represents and measures a set of rights of the organisation whose Credit-Risk Balance Sheet it is. Furthermore, it has economic and financial meaning in that, as mentioned above, it represents and measures an investment in customer credit as well as the assumption of risk which has made the granting of said credit possible.

## 7. THE RECORDING FOR ACCOUNTING PURPOSES OF CREDIT-RISK TRANSACTIONS

Where:

- $c$  = account representing *credit*.
- $r$  = account representing *risk*.
- $rt$  = account representing *transferred risk*.
- $rn$  = account representing *non-transferred risk*.
- $\alpha, \beta, \gamma$  = values expressed in monetary units representing the *magnitude of the credit transaction*.

the complete accounting entry would be:

$$\begin{array}{rclcl}
 c & \longleftarrow & [\alpha] & \longrightarrow & r & \text{[I]} \\
 r & \longleftarrow & [\beta] & \longrightarrow & rt & \text{[II]} \\
 r & \longleftarrow & [\gamma] & \longrightarrow & rn & \text{[III]}
 \end{array}$$

where  $\alpha = \beta + \gamma$

It is clear that we can do without [I], such that the entry is reduced to [II] and [III], that is:

$$\begin{array}{rclcl}
 c & \longleftarrow & [\beta] & \longrightarrow & rt \\
 c & \longleftarrow & [\gamma] & \longrightarrow & rn
 \end{array}$$

## 8. CONCLUSIONS

1. A credit transaction, from a vendor's viewpoint, allows for the identification of the origin of the credit facility (the existence of someone prepared to assume a credit risk) and the destination thereof (the credit granted to the customer). Consequently, we can say that a causal risk-credit relationship is established: we are thus dealing with a causal and not merely classificatory duality.
2. The Credit-Risk Balance Sheet drawn up –following an approach which is compatible with the causal duality– classifies credit on the basis of its quality (credit score), and risk on the basis of its source –that is, establishment of

who assumes said risk or makes the credit possible. Of total risk, the following two categories may be established: non-assumed risk (that transferred to third parties) and assumed (non-transferred) risk. Its generic meaning is the representation of credit and risk of default and the variations thereof.

3. The Credit-Risk Balance Sheet has certain structural similarities with the conventional balance sheet of the equity system. In our credit-risk subsystem, the nine laws of the equity system are complied with, and semantic or empirical meaning can be found in all of them, with some small variations. Continuing with the analogy of the said system, it is also possible to typify the “credit-risk accounting events” as modificatory (involving increases and decreases) or permutative and, in turn, from the dual viewpoint of their impact on either “non-transferred risk” or on “credit and risk structures”.

## NOTES

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<sup>1</sup> We use the word “insurable” in its most generic sense, without limiting it to the strict actuarial meaning.

<sup>2</sup> Referring here solely to bad debt risk.

<sup>3</sup> Trust in someone with a duty to provide future consideration. One thus trusts in its compliance with the duty assumed, although such trust may be betrayed.

<sup>4</sup> “Commercial credit, together with financial credit (which includes all financing granted to companies when not forming part of their business object, that is, the latter is normally negotiated between companies belonging to the same economic-financial group) constitute business-to-business, that is, direct financing granted by non-financial companies to one another”.

<sup>5</sup> Given the trust earned by the debtor or, sometimes, due to strategic commercial reasons, it may be difficult or inconvenient to operate otherwise.

<sup>6</sup> We shall analyse in more detail the matter of classificatory vs. causal duality below.

<sup>7</sup> “In his magnificent study of the formation of accountancy in the Middle Ages, Raymond de Roover gives three fundamental reasons for the development of accounts the period: the development of credit, the creation of trading companies and the use of the mandate contract. (...) The growth of trade caused by the crusades was joined by a considerable increase in credit. Under such circumstances, an increasing number of transactions were recorded that were not on a strict cash basis (...) The first accountancy of this type, then, did nothing more than cover credit transactions (...) It can safely be stated, in light of the documents in our possession, that the true origin of mediaeval accountancy coincides with the appearance of credit in economic relations. Consequently, only the accounts of individuals are found in primitive documents of this kind, since the accountants of the time did not more than protect them against lapses in their memory and set down their legal obligations” (Vlaemminck, 1961: 49).

<sup>8</sup> Like Ijiri, Professor García (1972: 41) believes that “the principle of duality in accountancy expresses, basically, a causal relationship implied by the concept of transaction. Therefore, of all the formulas employed to express this, (...) we prefer the sagittal formulation”.

<sup>9</sup> “In, the difference between single- and double-entry accountancy does not depend upon whether the resources are object of simple or dual classification. Instead, the distinction is made based upon

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whether the resources are recorded irrespective of other changes or *linked to other changes by a causal relationship*” (the italics are ours) (Ijiri: 1975: 83). “The current double entry system based on the dual classification of assets and resources can also be carried out from a strictly double classificatory entry point of view. For example, a change involving the receipt of goods and a cash payment can be considered as two events. Firstly, the receipt of goods is recorded by debiting stocks and crediting the owner from a strictly classificatory point of view. Then, a cash payment is recorded by debiting cash and crediting the owner for a negative amount, or with a counter entry using the negative entry convention. Each change in overall resources is thus recorded independently of other changes. Each change is recorded in two accounts only because we are dealing with dual classification” (page. 82). “N. D’Anastasio published in 1803 a book entitled *La Scrittura doppia ...*” (Vlaemminck, 1961, p. 270).

<sup>10</sup> Summarising, those are “the three fundamental judgments required in carrying out accounting measurement: (i) *Control*. An ability to identify  $R_\tau$  for all  $\tau \leq t$  where  $t$  is the present time. (ii) *Quantities*. An ability to classify resources in  $R_\tau$  and measure resources in each class based on the quantity measure (satisfying the indifference, additivity and nonnegativity conditions) that is defined for the class for all  $\tau \leq t$ . (iii) *Exchanges*. An ability to partition all changes in  $R_\tau$ , for  $\tau \leq t$  into a set of exchanges which consists of an increment and a decrement (...) Briefly speaking, in carrying out the process of accounting measurement, we must be able to recognize which resources are controlled by the entity. We then must be able to classify resources and to define a quantity measure for each class so that there is indifference to the choice of resources in the same class and of the same quantity. Finally, we must be able to recognize which resources are exchanged for which other resources” (Ijiri, 1975: 68).

<sup>11</sup> Etymologically, redeem, from the Latin *redimere*, composed of *re*, reiteration, a euphonic *d* and *emere*, to purchase: purchase reiteratively, fully, completely (Barcia, 1879).

<sup>12</sup> Although the risk could be assumed by the financier itself.

<sup>13</sup> We hereby create the word “riskier” and employ it to describe someone who assumes risks or, technically, a “speculator” who is a specialist in investing money in the assumption of risk due to their capacity to manage it due to an intrinsic knowledge of said risk and with a sufficiently high probability of ruin. E.g. an insurance company.

<sup>14</sup> Included here are guarantees and other securities pledged. “(In Spanish) these are called “signed credits” (*créditos de firma*), since although, on formalising the credit, no sum is paid over, and nor is it if the transaction is completed as contemplated, the fact is that *a commitment is assumed* (by means of a signature) to make payment should the customer not do so” (the italics are ours) (Silvestre, 1982: 470).

<sup>15</sup> Etymologically, “confuse” comes from the Latin *confundere*, a combination of *cum*, with, and *fundere*, melt.

<sup>16</sup> As stated by Devine (1985: 24), “notice that a good part of accounting theory, as commonly understood, turns on the interpretation of recognizable transaction  $z$  ( $T$ , in our case), for  $z$  might be given such interpretations as changes in the degree of blueness, or degree of hardness, or degree of favoritism toward church activities instead of the usual subjective concept of favorable expectations. It should be clear that many difficult problems that face accountants and constitute accounting theory are related to: (a) specifying the rules for recognizing recordable events (This covers such practical activities as determining the entity and deciding which events are important.); (b) specifying what dimensions (aspects) of the events should be recorded; (c) adapting measurement rules for each dimension; and (d) giving instructions for collecting, classifying and reporting these measurements. The usual bookkeeping rules for debit and credit are a relatively minor part of (d)”.

<sup>17</sup> This could have been treated differently.

<sup>18</sup> Referring here specifically to the risk of default, because the approach as formulated here would not be applicable in other cases.

<sup>19</sup> For Hempel (1952: 39), a theoretical system that lacks empirical interpretation cannot be tested and cannot therefore constitute a theory of empirical phenomena; we say that its terms and contents lack “empirical relevance”.

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