FISHER MODEL AND PAYMENT MATRIX

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Abstract

Fisher - economist, statistician, analyst, as we say, has worked closely to establish a model of correlation between the two elements, the source of financing and the needs required by the market, to finance internal and external transactions.

In the context of this analysis, according to the Fisher model, a payment matrix has been established which is nothing more than an arrangement of the statistical variables that take into account the nature of the money (the money supply) and the trading needs of the market. In this sense, the Fisher model of course re-analyzed, evolved and materialized by other adaptations is valid today, and it must be viewed from the perspective of a payment matrix that must exist at the level of the national economy but also at the level of each company. When it comes to the payment matrix at the macroeconomic level, we consider first of all the annual or structured budget of the national economy, which involves expenditure in the form of payments to ensure the harmonious development of the economy. In this sense, we must imagine a payment matrix at the level of a company, the payment matrix being a maturity of the expenses and payments that the company has to make in a given period of time.

In this order of ideas, other comparative payment matrices may appear, in which the economic agent takes into account several variants of the variables he analyzes and these introduced in a matrix system ensure the possibility to correlate the sources of financing with the needs of payment, of course also taking into account the receipts that turn into financial surplus or financial amount recorded by the analyzed companies.

Keywords: matrix, economic agent, variables, money supply, transactions, market, equilibrium.

JEL classification: C51, E20, E40

Introduction

In the article Fisher Model and payment matrix the authors focused on presenting this model designed by Fisher, which becomes in a way through all the successive adaptations that have been made, a general applicable model and a possible model to be used in the desire. to ensure the macro-stability or economic balance of a trading company.

The main characteristics of the Fisher model, the context in which it was realized, the role it has in determining its future evolution and not least the possibility of synthesizing and comparing with a payment matrix are presented.

At the macroeconomic level we understand that the Gross Domestic Product and subsequent, the consolidated budget of a national economy must be based on a series of expenditures (payments) that are properly harmonized, correlated so as to ensure a judicious distribution of them. In other words, the budget can be summed up in a matrix of payments that highlights structured and time-dimensioned expenditure needs (payments) that the macro or microeconomic activity implies. From this point of view between the two variables, respectively, the elements of the Fisher model and the structure of the payment matrix must have a correlation. In this sense, a model can be constructed that will lead to the obtaining of parameters (coefficients) that we must take into account in the current static activity, but even more so in the event of a possible macroeconomic forecast.

The Fisher model and the payment matrix is a component of financial thinking in market conditions, of thinking in macroeconomic conditions of satisfying the requirements in a structured and useful way. Of course, the obtained parameters can be analyzed on a static or dynamic background, and when it comes to time, chronological analysis, we can discuss a prognosis of these variables. This article presents some brief examples accompanied by statistical interpretations that give meaning to the approach taken by the authors.

Literature review

Anghelache, Sacală and Stanciu (2015) analyzed the regression models based on the instrumental variables. Anghelache, Marinescu, Bardasu and Prodan (2013) studied a similar theme. Anghelache and Anghel (2014) highlighted the main models used in the economic analyzes. Anghelache (2008) is a reference work in economic statistics. Aruoba and Diebold (2010) addressed issues related to real-time macroeconomic monitoring. Clark and Ravazzolo discussed elements of macroeconomic forecast performance (2015). Corbore, Durlauf and Hansen (2006) studied the main theoretical and practical aspects of econometrics. Müller (2011) studied the efficiency of statistical tests. Newbold, Karlson and Thorne (2010) presented a series of concepts specific to business statistics. Öllera and Teterukovski (2007) investigated how to quantify the quality of macroeconomic variables.

Methodology, data, discussions, results

In Fisher's identity and models based on it, he considers the payment system as an aggregate. However, in many situations, it is necessary to break down this aggregate and consider the individual payment or a smaller aggregate. These can be conveniently expressed in the form of a payment table or matrix, as in table 1. The different persons of the company are coded A, B, C and D. The table presents a company consisting of only four persons, but the argument can be extended to any number. Individuals are distributed both horizontally and vertically, so that the table has N compartments, where N is the number of persons.

Payment matrix

Table 1

	A	B	C	D	Expenditures	Balance of Payments: Hoarding (+) or Dishoarding (−)
A		20	8	15	43	−12
B	5		15	10	30	+ 7
C	16	9		11	36	+ 2
D	10	8	15		33	+ 3
Receipts	31	37	38	36	142	Total 0

In table 1, 20 represents the payment from A to B, and 8 the payment from A to C and so on. Therefore, each payment represents a revenue for that person and an expense for the person in turn. The total expenses of each person are obtained by bringing in the figures from the rows, and the total receipts of each person are obtained by summing the figures in the columns. Thus, the total expenditure of A is 43, and the total of A's revenue is 31.

• **Total expenses = total receipts - money created**

From this figure it immediately follows that the total of the expenses of a closed company equals the total of the receipts. Regardless of whether we add the column of total expenses or the row of total receipts, the result must be the same, namely 142, because they represent only two different ways of gathering the same list of individual figures. This proposal is true, provided that each income and expenditure is uniform. If the money is either created or consumed by any person, and if we consider the creation of money as income and their destruction as „expense”, then the above proposal must be modified; in the sense that its general form is that the excess of the receipts necessary for the expenses must be equal to the total amount created during that period. If the money is spent there will be an equal excess of the total expenses compared to the total receipts. Suppose (in Table 1), that A spent 10 units of money. His expenses would now be 53, but no receipts would be changed, the total of the receipts was 142, but the total of the expenses being 152. From the matrix in table 1, we can immediately deduct the balance of payments of each of the parties, defined as the excess of receipts over costs. Thus, A's receipts are 31, his expenses are 43, so his balance of payments is -12. B's receipts are 37, his expenses are 30, and his balance of payments is +7. A positive balance of payments is expressed by the increase of the balance of money of the payment, for the receipts representing an increase and a decrease of its balance of money. As much as the revenue and expenses change, if the balance of money in the company is constant, the money is just moved from one account to another, and the increase of the balance of the accounts of some people must be balanced by decreasing the fund of the accounts. This appreciation can be generalized in the form in which the activity of all persons in a closed company must be materialized in the total amount of money created. Therefore, the net change in the sum of the total money balances of all persons must be equal to the net change in the amount of money.

• The protection decisions determine the decrease of the total payments

In table 1 we see that A is quite large and that it registers 12 units during this period. Obviously, he cannot continue and so he decides to reduce his expenses. We will find that as A has ceased to lose, and the other associates of the achievement there will be disputes in the society:

Effect of action

Table 2

	A	B	C	D	Expenditures	Hoarding (+) or Dishoarding (−)
A		16	4	11	31	0
B	5		15	10	30	3
C	16	9		11	36	−2
D	10	8	15		33	−1
Receipts	31	33	34	32	130	Total 0

When analyzing the data in table 2, two aspects must be observed. First, as a result of A's decision to cut his expenses, he „balanced his budget", but his decision to do so led to a decrease in the company's total revenue by an amount exactly equal to its contraction, in expenses. This results from the perspective that total revenue and expenditure are equal. Secondly, it turns out that there will be no winnings because the receipts and expenses are equal, reducing the balance of A from 12 to 0 is offset by a decrease in the winnings of the others due to the reduction of the revenues implied by the decisions of A. Thus, we find that a decision increasing the balance of money by individuals does not result in increasing the balance of money unless there are receipts.

Table 2 shows an important solution for any group of individuals, by the difference between the income of any group from non-members and the expenses of the group against non-members, that is the balance of payments of the group, must be equal (the total gain in the money balances of the people physical of the group). This is illustrated in Table 3, derived from Table 1, by simply referring to A and B as a group. Their total receipts from other groups (C and D) amount to 43, and their total payments to C and D, to 48. The difference (- 5) is the net loss of money from A and B together (A loses 12, but B wins 7). The reason is clear, because the payments that are internal to the group (from A to B and from B to A) are common to the total expenses of the group and the total receipts of the group.

Balance of payments

Table 3

	A + B	C	D	Expenditures	Balance of Payments
A + B		23	25	48	−5
C	25		11	36	+2
D	18	15		33	+3
Receipts	43	38	36	117	Total 0

It can be considered that the total receipts of A, the total receipts of B, the total expenses of A and the total expenses of B determine the increase of A.

By subtracting the receipts A from the revenues of B and B from A from the right side and the identical quantities, the expenses from B to the expenses of A and A from B from the left side of the above equation, we obtain:

$$\hat{I}_{(A+B)} = C_{(A+B)} + Crs_{(A+B)} \quad (1)$$

where: $\hat{I}_{(A+B)}$ represents the receipts (A + B) from outside persons

$C_{(A+B)}$ represents the expenses (A + B) to another group

$Crs_{(A+B)}$ represents the increase of the balance of money (A + B).

The same reasoning can be applied clearly, no matter how many individuals are in the group. The individuals in table 1 can be replaced by groups.

• **Partial speeds**

The question now arises: Can useful models be configured that will express the various sizes of the payment matrix?

The complete finalization of the payment matrix would involve selecting all the variables of the entire economic system and the amounts of goods used, as well as the payments. It is possible to establish a simple model for the payment system, using the concept of particular or partial speed of movement. The partial speed of circulation from A to B, vab, is defined as the ratio of A's and B's expenses (or what is the same, B's receipts from A, CA / B) over a certain period of the money balance At the beginning of the period, SAî. The established relationship is:

$$v_{ab} = \frac{CA/B}{SA_î} \quad (2)$$

where: v_{ab} represents the partial speed of movement from A to B

CA/B represents the ratio of A's and B's expenses

$SA_î$ represents the balance of money A at the beginning of the period

Thus, the v_{ab} will probably grow if A decides that he has too much money and adopts a more liberal spending policy. In this case, it will grow vacant, I see etc. An increase in v_{ab} may also reflect a change in the structure of A's demand for the goods that B sells and far from those that C, D, etc. In this case, a growth of vab can be accompanied by a fall in vac, I see, etc. The whole system of partial speeds presents a crude image of the general structure of demand in a system. Although this is not a complete picture, because it does not explicitly take into account the relationship between purchases and prices, it offers us the possibility of building a model of economic balance.

• **Partial speeds resulting from the payment matrix**

If now the partial speeds corresponding to each system expense are given and the total amount of money in the system is given, the entire payment matrix can be calculated, assuming that all individual payment balances are zero. We will take the simplest case. We assume that a system with two shareholders, A and B. We consider the payment from A to B and the payment from B to A. The payment matrix is presented in table 4.

Determination of the payment matrix

Table 4

A			
	A	B	Expenditures
A		a_b	a_b
B	b_a		b_a
Receipts	b_a	a_b	$a_b + b_a$

B		
	A	B
A		v_{ab}
B	v_{ba}	

Suppose now that the partial velocities v_{ab} and v_{bc} are realized, as shown in table 4 and the total amount of money in the system, M. Suppose it is divided between the two parts, M_a in the possession of A and M_b in B. In this situation, there are equilibrium relations as follows:

$$A_b = b_a \quad (3)$$
$$A_b = M_a \cdot v_{ab} \quad (4a)$$
$$B_a = M_b \cdot v_{ba} \quad (4b)$$
$$M_a \cdot v_{ab} = M_b \cdot v_{ba} \quad (5)$$
$$M_a + M_b = M \quad (6)$$

Equations (5) and (6) can be solved to obtain its values $M_a$and M_b:

$$M_a = \frac{M \cdot v_{ab}}{v_{ab} + v_{ba}} \text{ și } M_b = \frac{M \cdot v_{ba}}{v_{ab} + v_{ba}} \quad (7)$$

By entering these values into equations (4) we obtain values for the forecast payments:

$$a_b = b_a = \frac{M \cdot v_{ab} \cdot v_{ba}}{v_{ab} + v_{ba}} \quad (8)$$

• **Distribution of the balance of money determined by relative partial speeds**

Some features come out of this simple model „The distribution of the money balance of the company between its two parts in equilibrium appears to be discouraged by the relative partial speed. If both partial speeds change in the same proportion, there is no change in the distribution of the money balance. If one increases in relation to the other, the balance of money is directed to the associate whose partial speed has increased, however many associates exist in society, normally there is only one set of payments that will be consistent with any given system. partial speeds, given the amount of money in the system and assuming that all payment balances are zero.The real solutions become more and more complicated as we increase the number of associates. Some general principles are valid. Thus, a partial speed increase one set of individuals versus another set is always likely to push the money balance It is in the hands of those with lower speeds. Associates or groups of associates will be successful in decreasing their money balances only if their activity is relatively stronger than that of others and will only be able to increase their money balances only if their concern is relatively lower than that of others. It can hardly be emphasized that the distribution of the money and payments fund is the result of all the decisions of all the associates and that no one can obtain the results apart from the decisions of all the others.

• **Input-output matrix**

The payment matrix is affected not only by the final demands, but also by the demand for intermediate goods, as determined by the production functions. A matrix that shows how much of the output of each sector of the economy becomes input for each other sector is called the input-output matrix. Thus, assuming we divide the economy into four sectors, we obtain the following input-output matrix:

Input-output matrix

Table 5

	A	B	C	...	N
A		$M_a v_{ab}$	$M_a v_{ac}$		$M_a v_{an}$
B	$M_b v_{ba}$		$M_b v_{bc}$		$M_b v_{bn}$
C	$M_c v_{ca}$	$M_c v_{cb}$			$M_c v_{cn}$
⋮					
N	$M_n v_{na}$	$M_n v_{nb}$	$M_n v_{nc}$		

Regarding each individual, suppose the sum of the receipts is equal to the sum of the expenses and we have n equations of the form

$$M_a \cdot v_{ab} + M_a \cdot v_{ac} + \dots + M_a \cdot v_{an} = M_b \cdot v_{ba} + M_c \cdot v_{ca} + \dots + M_n \cdot v_{na} \quad (10)$$

Any of these can be derived from all the others, so we have only n-1 independent equations. However, we have another equation of form:

$$M_a + M_b + \dots + M_n = M \quad (11)$$

where M is the total stock of money.

Therefore, we have independent equations, sufficient to determine in unknown M_a, M_b,… M_n. Once the distribution of the balance of money is determined, each individual payment can be obtained by multiplying the rotation speed of the balance of money.

We consider several sections, one that produces durable goods, one durable goods, one services and one construction. We include all forms in one or the other of these four sections. Then we will build a matrix based on the data in table 1, which shows the contribution of each sector to another.

The input-output matrix for four sections

Table 6

	Durables	Nondurables	Services	Construction	Total Input
Durables	30	30	40	20	120
Nondurables	40	40	70	30	180
Services	40	80	100	10	230
Construction	10	30	20	10	70
Total output	120	180	230	70	600

Here the figure in each cell represents the entry from the row sector to the column sector (the figures represent values at constant prices). The sum of the rows is the total sum of each sector, and the sum of the columns, the output of each sector. In the table we assumed that the input is equal to the output for each sector. If they were not, then there would be accumulation of goods or unemployment or an overload of services. We can consider that the entry and exit for services must be equal. In this table, the figures in each box depend not only on the production functions, but also on the demand of the company. To eliminate this, we could group companies as a separate sector of the economy. Each input stream produces a reverse flow of payments in the payment matrix. Thus, for any sector, product accumulations tend to produce money accumulations. As the stocks of goods change from one sector to another, money grows in the opposite direction. If the production functions are linear, so that an increase of the input unit always produces the same increase of the production, it is not difficult to calculate the coefficients for each cell of the matrix which shows how much, a unitary change of income increases the change of the cell in question. This can provide information on how an increase in global revenue or output will be distributed among different sectors of the economy.

Conclusions

The authors made this article, the Fisher Model and the payment matrix, based on a study and theoretical conclusions established following the steps taken. A first conclusion is that the Fisher model is still topical, expressing the possibility of undertaking an economic analysis and at the same time a forecast study for a future period.

The payment matrix is actually a deadline if we would like to be less demanding with the terminology used, which will ensure at the micro or macroeconomic level the possibility to know the needs of expenses (payments) and consequently the need for financial sources.

The Fisher model and the payment matrix are instruments of financial management of the economic entities, be it the micro or macroeconomic level. Also, this model can be adapted, thus concretizing the possibilities of extending many analyzes at macro and microeconomic level.

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