

THE CHOICE OF CURRENCY
IN THE FOREIGN TRADE OF ITALY

G. Basevi - D. Cocchi - P.L. Lischi

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Giorgio Basevi
Dipartimento di Scienze Economiche
Università di Bologna

Daniela Cocchi
Dipartimento di Scienze Statistiche "P. Fortunati"
Università di Bologna

Pier Luigi Lischi
Associazione Prometeia

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1. Introduction*

The main object of this study is an empirical analysis of the determinants of the choice of currency in settling payments and receipts for Italian foreign trade. While this topic has already been analyzed, both theoretically and empirically, by a number of authors and for various countries¹, the size of the sample available to us and the relative richness of information that it contains allow deeper statistical screening of the data and further testing of both old and new hypotheses.

Our data stem from the records of Italian banks as they are reported to the Italian Foreign Exchange Office for purpose of statistical information and legal control. A group of major Italian banks, covering about 60% of Italian foreign trade, is currently making available to us the tapes on which records for their customers are contained.

The availability of such an unusually large data bank is both an asset and a liability. The wealth of information contained in it and its continuous updating provide a sound basis for testing theoretical hypotheses about some economic characteristics of Italian foreign trade. On the other hand, the set of variables on which these data are collected cannot be enlarged, as it is predetermined by the statistical recording of the Italian Foreign Exchange Office; the way in which the data themselves are organized and synthetized can hardly be changed;

and, last but not least, the cost of processing the data is very large. These reasons, besides inducing us to extract a smaller sample of traders from the total population, account for the fact that we allow more than the usual space to the analysis of statistical associations between variables relative to the space reserved to testing economic hypotheses. However, the preliminary statistical analysis is itself conducive to suggestions for new hypotheses or modifications of old ones.

This study revisits a number of empirical generalizations that have emerged from research conducted by various authors, and for different countries, about the choice of currencies in foreign trade.

The best known regularity goes back to the seminal work by Grassman (1973a,b), according to which foreign trade among developed countries is mainly invoiced in the currency of the exporter's country. This "law" has already been revisited by other authors and found to be less generally applicable than originally thought. In those contributions, it was made clear that in any case a regularity of this sort must be analyzed in connection with other characteristics of foreign trade, such as the types of products exchanged, the risk attached to the currencies involved, the nature and economic dimension of the trading firms, and the characteristics of the countries in terms of their degree of participation in the system of convertible international transactions, and of their inflation experience.

In fact, a second important regularity that has emerged, particularly as a test of a theoretical hypothesis suggested by McKinnon (1979), is that the use of a third currency --i.e. a currency different from both partners' currencies and usually a major international vehicle currency-- is more widespread for primary products and in general for commodities traded in efficient international markets; whereas the scope of application of "Grassman's law" would be limited to trade in manufactured products.

An additional limitation to this law is that it seems not to apply to trade between less developed countries, nor to trade between them and developed countries; a similar "caveat" applies also to trade involving countries with inconvertible currency. Another limitation depends upon the level and variability of inflation that characterizes a country and hence the purchasing power of its currency.

It is worth emphasizing that a proper testing of Grassman's law requires the analysis of the joint distribution of variables that are apt to determine the phenomena just mentioned. Perhaps the main novelty of our study is to depart from the practice of considering such variables pairwise; in fact, we shall study jointly the whole set of variables at our disposal. In so doing, we first follow the line of previous studies, which concentrated on the distribution of the total number and value of records of individual transactions. In addition, however, our data permit the aggregation of values of individual transactions over the firms to which they belong, thus making possible an economic analysis of some determinants of the behaviour of individual firms in their choice of currency.

In section 2 we present the data and perform a preliminary statistical screening of the most relevant associations among the variables at our disposal. Section 3 contains the results obtained by means of a loglinear model for the multivariate distributions of the set of individual transactions. Section 4 presents the results of regression analysis aimed at identifying the main determinants of the firms' choice of currency. We indicate in section 5 the directions for future research that are suggested by this study and its predecessors.

2. Presentation of the data bank and its descriptive analysis

2.1. Our data bank

In our data bank are recorded the banking documents accompanying the foreign trade of the customers of 11 major Italian banks, aggregated through time since 1977 on an yearly basis.

Relative to the total Italian import and export trade, they cover about 55% of the value of Italian imports during that period, and from 61 % (in 1982) to 64% (in 1977) of Italian exports.

The basic unit of information for our data is the individual banking document which accompanies each foreign trade transaction made by an individual firm through a given bank². Each banking document --and therefore its value-- records an entry for each of the following categorical variables (besides a few others that are not used in this

study):

- the bank which operates the settlement
- the country from or towards which the settlement is directed
- the currency in which payment is made ³
- the term of payment, i.e. the lead or lag with which payment is made relative to the time at which the original banking document that accompanies the merchandise through customs is filled
- the product sector, based on the tariff nomenclature.

It is worth pointing out that each banking document contains a code identifying the firm which imports or exports the product involved (for reasons of secrecy, this code has been randomly changed in our version of the data). Thus the documents of each firm can be grouped together and across the different banks with which a firm operates. This feature constitutes a new and potentially fruitful aspect of our data ⁴.

Another aspect of our data worth emphasizing concerns two points: a) as each banking document and its value are both classified according to the entries of categorical variables, it follows that multivariate contingency tables may be obtained. In the cells of such tables will appear, in one case, the "counts" (frequencies) of the number of banking documents that belong to the combination of entries which cross in that particular cell, in the other case, the "counts" of the money units of value of the document involved; b) the two multivariate classifications just mentioned refer also to each individual firm. Thus, when the object of the analysis is the behaviour of firms, it will be necessary to build new variables which synthetize, as indicators, the various characteristic over which all the individual transactions of a firm are distributed.

The mass of available data in our hands is huge. Adding up over six years (1977-1982), we have about 2.6 million documents per year, attributed to about 75,000 firms per year. Thus, we decided to select a sample of 1,729 individual firms, randomly selected, with all their banking documents. The choice of a random sample of firms has been preferred to that of a sample of documents because it allows analysis of data both as aggregates over individual firms (the set of the firms' banking documents and that of their values) and as individual transactions ⁵.

Actually, the population from which firms have been selected

randomly is already a subset of the original population of our data, characterized by the fact that its elements are firms operating with at least one of the group of 11 reporting banks in every year through 1977-82; i.e. we do not allow new firms to appear, or old firms to disappear, during the time period. This limitation, while useful for consistency of analysis through time, is not a stringent one: in fact the value of trade of firms who "live" through the period is always more than 70% of the total value of all firms.

2.2. The three data sets and their classification

2.2.1. The first two data sets, i.e. that of the number of banking documents and that of their values, can both be classified according to different categorical variables, including time on a yearly periodicity.

It is not obvious, at first sight, whether a preliminary analysis of the sample has to be performed over the set of banking documents (each element of the set being a document), or over the set of their values (each element of the set being a unit of the chosen money measure for their values).

In any case, when the object of the analysis is the set of banking documents, it is necessary, in order to make sense of their distribution over any type of classificatory variables, to associate each of them with its dimension. In other words, we add a further variable (which groups documents in different sizes according to their individual money value) to the set of variables in which documents are classified by their numbers. It may be noticed that, if the object of the analysis is the value of the documents rather than their number, this problem does not arise, as the frequency in itself denotes value.

In the analysis of the set of banking documents, we shall infer about the probability that a banking document (of a given money dimension) falls in a particular cell of the contingency table. As for the set of values, we should infer such probability for one unit of the chosen money numeraire. This, however, has no relation to an individual banking document and the economic decision process that originated it; thus we have chosen to perform our analysis only over the set of banking documents and not over the set of their values.

In other words, in the first case we identify the individual document as the object of the firms' decision process, and therefore of a meaningful econometric analysis; although this is made at the cost of forcing a classification by dimension which is arbitrary to some extent. In the second case, in return for a direct classification of the money values, we would be investigating the probability distribution of a phenomenon which does not reflect any clear economic behaviour.

In the next section, however, we shall rescue the values of documents, by aggregating them over each individual firm. This reflects the alternative assumption that economic behaviour of firms depend upon a decision process, in which the operations of the firm are considered as a whole, rather than individually.

It must be noticed that, while in the analysis of the set of firms each firm clearly counts as an observation, and thus its share in the total value of the sample does not bias the result, such a bias may arise when very large traders enter into the analysis of the set of banking documents through large values of their individual transactions. Thus, in the analysis of banking documents (but not in that of firms), we have netted out of the sample all the documents pertaining to four large firms (mainly trading in oil products).

The variables listed in section 2.1 range in our original data over a rather detailed spectrum of categories. These are not all equally meaningful from an economic point of view. Thus, we intend to use a blend of theoretical and "a priori" knowledge about empirical regularities observed by previous researchers, in order to regroup the categories of our variables into less detailed but more pregnant classifications.

In all cases we will treat separately data concerning imports and exports respectively, i.e. we construct separate classifications for the banking documents pertaining to imports and export. In a few cases, the definition of the classificatory variables will be different from imports to exports.

Among the various theoretical and empirical aspects that could be examined with our data, one is dominant and links our work to those of previous researchers in this field. It consists in the analysis of firms' behaviour with respect to the choice of currency in the denomination of their transactions. This dominant point of view will

condition the classifications of all the other variables, in addition clearly to that of the variable "currency" itself.

(i) Following the strand of research initiated by Grassman (1973a,b), we reclassify the different currencies into a variable (C) which is constructed so as to pay attention to the question of the possible choice of a third currency in foreign trade. This, according to some authors (McKinnon, 1979; Carse, Williamson and Wood, 1980, labelled CWW in the following) is generally identified as one of the major international currencies (typically the US dollar) or as the currency in whose country major commodities markets are located. Other authors (Magee and Rao, 1980a,b; Cornell, 1980) tried to present more theoretical justifications for the factors that determine the choice of a currency as a "vehicle" currency.

In our classification, we focus on the dollar as the major vehicle currency; however, in the statistical analysis of sections 3 and 4, we also test whether the use of this or of other third currencies is more or less associated with economic characteristics of the firm, the product under trade, or the country with which trade takes place.

The "currency choice" variable is therefore classified into the following four groups:

- C1 - documents settled in domestic currency (the Italian lira)
- C2 - documents settled in the partner's currency
- C3 - documents settled in the US dollar with countries other than the USA
- C4 - documents settled in other vehicle currencies.

(ii) As already pointed out, the analysis of the set of documents must be supported by a dimensional variable based on the value of each document in order to be meaningful.

Clearly there is complete arbitrariness on the number of dimensional classes and their extremes. Yet, we need a classification which allows comparison through time without being affected by a nominal phenomenon such as inflation. Our solution has been to consider four classes, having as bounds the values of the 25th, 50th, 75th percentiles of the cumulated distribution of the values. This procedure allows, as desired, to find appropriate and different bounds for the case of

imports and for that of exports, and to change them through time. As a result, the four categories obtained for the "dimension of the banking documents" (B), are:

- B1 - documents with value accounting for the first 25% of the total value of ranked documents (first quartile)
- B2 - documents whose values contribute to the 25%-50% cumulated fraction of the total value (second quartile)
- B3 - documents whose value contribute to the 50%-75% cumulated fraction of the total value (third quartile)
- B4 - documents whose values make up the upper 25% of the total value of the ranked documents (fourth quartile).

(iii) As pointed out in classifying the variable C, the choice of currency is likely to depend, among other things, upon the type of products involved in trade. We follow McKinnon and CWW, in assuming that the relevant difference is between products traded in markets where all firms are price takers (efficient or competitive markets) and products traded in markets where selling firms are price makers to a certain extent. Rather than a dichotomy, this suggests a continuum of more or less competitive markets. While in section 4 we shall attempt to give a measure of such continuity, in section 3 --where the analysis is based on the set of documents classified according to categorical variables-- we use a binary classification of products and their markets, established in the light of our prior knowledge of the characteristics of the Italian economy.

Moreover, contrary to what CWW appear to have done, we allow for the dichotomic classification to include under its headings different sectorial items according to whether we consider Italian import or export trade. In fact, because of inevitable aggregation, a same sectorial heading covers different products (and thus different markets, more or less competitive) depending on whether they are imports or exports (e.g. Italian imports of agricultural products generally involve products traded in markets more competitive than those of exports, where some degree of price making is available to Italian sellers).

The two categories of the "sector" variable (S) contain the following:

Imports

Exports

Sector S1 (competitive markets)

fishing and agriculture	fishing and agriculture
mining	mining
oil, coal and gas	oil, coal and gas
refined oil products	refined oil products
hides, skins and leather	ferrous metals
wood and furniture	non ferrous metals
paper	machinery
ferrous metals	transport vehicles
non ferrous metals	other mechanical products
machinery	engineering products
transport vehicles	refined chemical products
other mechanical products	rubber
engineering products	other products
non ferrous minerals	paper
refined chemical products	
rubber	
other products	

Sector S2 (seller's markets)

food industries	food industries
textiles	textiles
clothing	clothing
shoes	shoes
	hides, skins and leather
	wood and furniture
	non ferrous minerals

(iv) Because of the different economic and monetary importance of a country and its currency, there should be a relationship between currency choice and countries with whom trade takes place ⁶. We adopted a classification for the country variable (G), which identifies the most important partners in Italian foreign trade and relatively homogeneous geopolitical groups:

G1 - West Germany

- G2 - France
- G3 - USA
- G4 - UK
- G5 - Switzerland
- G6 - Denmark, the Netherlands, Belgium-Luxembourg
- G7 - Rest of Western Europe
- G8 - OPEC Countries
- G9 - "Off shore" countries ⁷
- G10 - Socialist countries
- G11 - Rest of the world

This classification also allows a regrouping of G1-7 and G8-11: a partition which approximates the dichotomic classification by CWW into countries with convertible and non convertible currencies.

(v) Our data contain information on the number of months with which payment or receipt is either anticipated (leads) or postponed (lags), relative to customs clearance. While this information can be the basis for a measurable variable (see section 4), for the purpose of section 3, where we will use categorized variables, banking documents are classified in two leads and lags (L) classes:

- L1: anticipated and simultaneous settlements
- L2: posticipated settlements

The dimension of the firm is clearly an important economic element for the analysis. However, it has various possible aspects, and our data allow to build at least two different representations of such variable.

(vi) The overall dimension of the trader (D). This is measured by a firm's total import or export trade (i.e. a separate classification of the same trader with respect to import or export), and it has been split into categories corresponding to percentiles in a way analogous to the variable B. Thus we have:

- D1 - firms accounting for the first quartile of the total value of ranked documents
- D2 - firms accounting for the second quartile of the total value of ranked documents
- D3 - firms accounting for the third quartile of the total value of

ranked documents
 D4 - firms accounting for the fourth quartile of the total value of
 ranked documents

(vii) The overall dimension of a firm may very well be unimportant in a given product and/or in a given market, when a trader deals in many products and/or in many markets. Thus, the economic weight of a firm must be proportioned to these two aspects (market-product) in which it either imports or exports. In order to do so we have computed for each banking document belonging to firm k, a dimension

$$d_k = \sum_i \sum_j \left(\frac{k^{X_{ij}}}{\cdot X_{ij}} \right) k^{w_{ij}}$$

where

$$k^{w_{ij}} = k^{X_{ij}} / \left(\sum_i \sum_j k^{X_{ij}} \right)$$

$k^{X_{ij}}$ = import (export) value by firm k in sector i from (towards) country j

$\cdot X_{ij} = \sum_k k^{X_{ij}} / n$ import (export) value by the average firm in the sample in sector i from (towards) country j.

This dimensional variable d has been classified into two categories separated by the mean value:

- d_1 = documents pertaining to a firm contributing, on average over sectors and countries, to the lower half of the total intensity
- d_2 = documents pertaining to a firm contributing, on average over sectors and countries, to the upper half of the total intensity.

2.2.2. We shall now describe the distributions by categorical variables of the set of documents and the set of their values.

On the basis of the variables presented in section 2.2.1, a joint classification according to seven variables is obtained for the two data sets made up of the banking documents and of their values respectively. This classification prepares the ground for the investigation of section 4.

In Table 1 we report the total values and the number of banking documents in our sample. All the descriptive tables that follow this first one are given in percentage values (with 100 equal to the overall total or subtotal) without any loss of information, as the actual values and numbers can be recomposed with reference to Table 1. In the rest of this paper we shall limit our analysis to the extreme years of the period (i.e. 1977 and 1982).

Table 1
Total foreign trade of 1721 foreign traders
(million liras at current prices)

	Number of banking documents		Value of the banking documents	
	Import	Export	Import	Export
1977	38,657	101,431	861,235	1,006,745
1982	32,625	77,298	1,446,808	1,798,502

Table 2 shows that, as a result of our classification according to the percentiles of the total value distribution of the banking documents, the dimensional classes are independent of inflation, at the small cost of obtaining decreasing percent values from class to class. It is interesting to note that on import side the value of a document is on average higher than on export side. This phenomenon could be explained by the fact that Italy tends to import relatively more raw materials and semi-manufactured products, and export relatively more

Table 2
Upper extremes of the classes for the distributions of banking
documents according to:
B: dimension of the banking document
D: overall dimension of the trader
(million liras at current prices)

	Import		Export	
	1977	1982	1977	1982
B1 first quartile	25	43	9	20
B2 second quartile	83	125	28	64
B3 third quartile	442	436	119	260
B4 fourth quartile	10,570	5,780	3,598	9,679
D1 first quartile	1,781	3,214	1,183	2,144
D2 second quartile	6,019	9,000	4,245	7,810
D3 third quartile	37,606	36,800	10,955	22,191
D4 fourth quartile	56,207	93,000	28,106	64,079

finished products, and that the former are shipped by larger quantity and value instalments. This feature interplays with the fact, observable in the lower part of the table, that in Italy the size of importers is on average consistently larger than the size of exporters. As there may be a positive correlation between the size of a firm and the size of its individual shipments, the two aspects could reinforce each other.

Focusing now attention on a more detailed level, we present in the following tables a set of bivariate distributions, together with their marginal univariates. These tables clearly do not exhaust all possible and available bivariate distributions; yet, as our principal interest lies in the analysis of the currencies chosen by foreign traders, the tables presented all deal with the association between variable C and each other relevant one.

In Table 3 we can read on the right hand side the univariate marginal distribution by currencies for imports and exports, and with respect to number of banking documents and to their values. The pattern of settlement currencies chosen by traders shows a very strong differ-

Table 3
Choice of the currency (C) by geopolitical area (G)
(each of the eight subtables adds up to 100)

		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	Total
1977													
Number of documents	C1	3.28	3.22	0.03	1.90	0.86	4.61	2.59	0.0	0.01	1.43	1.15	19.08
	C2	22.25	11.56	6.52	6.16	5.25	6.18	5.30	0.0	0.0	0.0	0.98	64.20
	C3	0.52	0.72	0.0	1.07	1.64	0.79	0.82	0.06	0.79	1.50	4.55	12.48
	C4	0.35	0.15	0.04	0.14	1.07	0.58	0.24	0.03	0.02	0.48	1.16	4.25
	Total	26.40	15.65	6.60	9.26	8.82	12.16	8.94	0.09	0.82	3.41	7.84	100.00
Value of documents	C1	3.60	6.20	0.43	1.15	1.66	5.53	1.09	0.0	0.04	0.46	0.90	21.05
	C2	16.24	6.85	12.87	3.23	2.13	4.36	2.52	0.0	0.0	0.0	0.60	48.82
	C3	0.97	2.44	0.0	1.60	6.59	1.40	1.50	1.42	1.48	1.67	6.92	26.00
	C4	0.34	0.09	0.08	0.13	1.25	0.57	0.21	0.04	0.01	0.32	1.09	4.13
	Total	21.15	15.58	13.38	6.12	11.63	11.87	5.32	1.46	1.53	2.44	9.51	100.00
1982													
Number of documents	C1	6.27	9.37	0.93	2.52	3.40	4.13	6.91	1.99	0.67	1.30	4.96	42.46
	C2	15.95	8.44	4.37	1.41	2.37	3.95	2.17	0.0	0.0	0.0	0.31	38.95
	C3	0.24	0.22	0.0	0.60	0.48	0.43	2.47	3.02	1.34	0.33	6.78	15.91
	C4	0.10	0.13	0.01	0.13	0.27	0.36	0.68	0.12	0.03	0.08	0.77	2.68
	Total	22.55	18.17	5.32	4.66	6.52	8.87	12.22	5.14	2.03	1.70	12.83	100.00
Value of documents	C1	5.53	7.58	0.65	2.30	2.86	2.34	4.51	3.32	0.33	2.75	3.76	35.92
	C2	11.80	6.22	6.79	1.55	3.35	2.99	1.34	0.0	0.0	0.0	0.27	34.31
	C3	1.15	0.48	0.0	0.73	1.33	0.86	2.08	10.06	1.48	1.28	7.92	27.37
	C4	0.15	0.18	0.00	0.20	0.23	0.24	0.38	0.25	0.01	0.17	0.60	2.41
	Total	18.63	14.45	7.44	4.78	7.77	6.43	8.31	13.63	1.82	4.20	12.55	100.00
1982													
Number of documents	C1	3.93	4.25	0.02	1.58	2.02	3.88	4.52	0.00	0.04	1.68	1.72	23.64
	C2	24.36	12.32	3.57	3.55	3.36	6.18	4.64	0.0	0.0	0.0	1.48	59.45
	C3	0.50	1.39	0.0	1.76	2.15	0.75	0.85	0.04	0.42	0.50	3.37	11.74
	C4	0.19	0.12	0.01	0.39	1.16	0.57	0.44	0.02	0.11	0.75	1.42	5.17
	Total	28.98	18.07	3.60	7.27	8.70	11.39	10.44	0.07	0.56	2.93	7.99	100.00
Value of documents	C1	2.97	8.69	0.01	2.06	3.33	6.31	2.55	0.01	0.05	1.00	2.56	29.54
	C2	15.25	8.77	7.09	2.25	2.82	4.33	2.66	0.0	0.0	0.0	2.17	45.35
	C3	1.19	1.95	0.0	2.72	5.24	1.79	1.13	0.21	0.85	1.01	4.46	20.54
	C4	0.09	0.18	0.01	0.43	0.92	0.47	0.53	0.03	0.12	0.52	1.28	4.57
	Total	19.51	19.59	7.10	7.47	12.30	12.90	6.86	0.24	1.02	2.53	10.46	100.00
1982													
Number of documents	C1	5.69	7.86	1.40	2.74	3.35	3.53	7.28	1.79	1.23	0.70	5.91	41.48
	C2	15.20	11.19	4.36	2.43	2.21	2.90	1.55	0.0	0.0	0.0	0.43	40.29
	C3	0.18	0.12	0.0	0.34	0.42	0.16	0.94	3.13	1.23	0.41	6.78	13.70
	C4	0.16	0.12	0.01	0.17	0.44	0.52	1.25	0.29	0.05	0.17	1.33	4.52
	Total	21.23	19.29	5.76	5.69	6.42	7.11	11.03	5.21	2.52	1.28	14.46	100.00
Value of documents	C1	4.35	5.08	1.16	1.97	2.16	1.89	4.01	2.42	0.92	1.30	4.11	29.37
	C2	9.56	6.79	5.49	2.54	1.94	1.71	0.95	0.0	0.0	0.0	0.48	29.44
	C3	0.56	0.45	0.0	1.59	1.73	0.34	1.81	11.64	3.02	1.67	12.25	35.06
	C4	0.09	0.06	0.01	0.22	0.47	0.47	1.47	1.56	0.11	0.36	1.32	6.12
	Total	14.56	12.37	6.66	6.32	6.31	4.39	8.24	15.61	4.06	3.33	18.16	100.00

ence between import and export trade. The distribution for imports reproduces the pattern already found by other researchers particularly for the UK: in both years the largest share goes to the partner's currency (i.e.: the exporter's currency), while the second largest goes

to the dollar in 1977 and to the domestic currency in 1982. This tendency to verify "Grassman's law" is however not confirmed on the export side: although the lira does come first in 1977 (but only slightly over the partner's currency), it falls to third position in 1982. More interesting is to notice that, while the domestic and partner's currencies added up symmetrically to about 70% of the total in 1977, they symmetrically lost positions in 1982 in favour of both the dollar and other third currencies. This suggests that, as discussed by Magee and Rao (1980a, 1980b) and Cornell (1980), the use of third currencies does not just depend on their static status, but more on a dynamic view of their attractiveness as vehicle currencies: a feature which may depend on their stability (variation of their purchasing power) relative to the domestic and partner's currencies.

Rather than commenting upon the marginal univariate distribution by countries as given in the column totals of Table 3, we find interesting to underline a number of facts in the bivariate distributions: the use of the lira in both import and export values is more evenly spread geographically than the use of the partner's currency, and this seems to be more so as we move from 1977 to 1982. As a counterpart, the use of the partner's currencies with our three main partners (Germany, France, the U.S.)⁸, while higher in import than in export trade -- a consequence of the regularity already discussed above -- becomes higher (more uneven distribution) as we move from 1977 to 1982 for both directions of trade. This may be due to increasing attractiveness of the currencies of these three partners relative to the lira and to other currencies, in a period of turbulence in foreign exchange markets and of high and variable inflation in Italy relative to these main countries.

Table 4 aims at giving a first view of the hypothetical association between type of sector ("price takers" versus "price makers" as seen by the seller) and choice of the currency; an association discussed by McKinnon, and tested by CWW. The dominance of sector 1 - the "price taker" or "efficient markets" sector - is likely to be the consequence of two facts: on the import side, Italy mainly imports primary products and raw materials, while on the export side, although exporting manufactured products, it hardly has a monopoly power in their markets.

Notice that our "a priori" classification of sectors into the two groups is such that more than 3/4 of import and export trade falls in a

Table 4
Choice of the currency (C) by sector (S)
(each of the eight subtotals adds up to 100)

		C1	C2	C3	C4	Total
1977						
IMPORTS						
Number of documents	S1	16.49	40.86	10.02	3.23	70.60
	S2	2.59	23.33	2.46	1.01	29.40
Total value of documents	S1	18.20	31.92	21.07	3.53	74.73
	S2	2.85	16.90	4.92	0.60	25.27
EXPORTS						
Number of documents	S1	28.66	28.01	13.18	1.83	71.68
	S2	13.80	10.94	2.73	0.85	28.32
Total value of documents	S1	25.52	26.94	22.64	1.70	76.80
	S2	10.40	7.36	4.73	0.71	23.20
1982						
IMPORTS						
Number of documents	S1	20.56	42.78	8.82	4.11	76.27
	S2	3.07	16.68	2.91	1.06	23.73
Total value of documents	S1	27.22	32.59	15.76	3.65	79.21
	S2	2.32	12.76	4.79	0.92	20.79
EXPORTS						
Number of documents	S1	25.51	27.95	10.91	3.61	67.98
	S2	15.97	12.34	2.79	0.91	32.02
Total value of documents	S1	18.93	22.26	29.17	5.35	75.71
	S2	10.44	7.19	5.89	0.77	24.29

stable way under sector 1 (the "price taker" sector). It is also interesting to look inside the table (the bivariate distributions), and notice that on the import side sector 1 is more evenly distributed over the first three types of currencies than sector 2, where the partner's currency has the larger share (16.90% in 1977 and 12.76% in 1982, i.e. more than 60% of the total of sector 1). On the export side the lira,

although weak during the period, remains stably the currency more used in sector 2, while in sector 1 it loses ground in favour of the dollar when we pass from 1977 to 1982. Thus, although McKinnon's hypothesis seems to be confirmed, this is only partially so, because we also have indication that both the domestic and the partner's currency lose ground in favour of third currencies in a period of inflation and exchange turbulence.

In Table 5 we present the bivariate distributions between the vari-

Table 5
Choice of the currency (C) by leads and lags (L)
(each of the eight subtables adds up to 100)

		C1	C2	C3	C4	Total
1977						
IMPORTS						
Number of documents	L1	1.78	10.07	6.41	1.21	19.47
	L2	17.30	54.12	6.07	3.04	80.53
Total value of documents	L1	2.40	14.06	14.17	1.74	32.38
	L2	18.65	34.75	11.83	2.39	67.62
EXPORTS						
Number of documents	L1	3.11	2.16	2.94	0.30	8.50
	L2	39.35	36.80	12.98	2.38	91.50
Total value of documents	L1	5.35	4.80	9.58	0.37	20.11
	L2	30.57	29.50	17.78	2.04	79.89
1982						
IMPORTS						
Number of documents	L1	2.35	7.73	4.67	1.63	16.37
	L2	21.29	51.73	7.07	3.55	83.63
Total value of documents	L1	5.80	10.77	8.90	1.77	27.25
	L2	23.74	34.57	11.65	2.80	72.75
EXPORTS						
Number of documents	L1	4.62	3.45	3.56	.57	12.20
	L2	36.86	36.84	10.14	3.96	87.80
Total value of documents	L1	5.27	3.34	14.03	1.45	24.09
	L2	24.10	26.10	21.03	4.67	75.91

able "leads and lags" (L) and "choice of currency" (C). It is tempting to read from this table a test for the hypothesis - suggested by CWW - that the larger is the use of the exporter's currency (which should prevail in sector 1), the larger is the length of credit (lag) allowed to importers. However, as our wording of it indicates, a proper test of this hypothesis requires the analysis of the trivariate distribution sectors-currencies-leads and lags. Yet, even on the basis of Table 5, it is possible to see that deferred payments always prevail in the totals (of number of documents and their values) for both years and in both directions of trade. On the side of exports, the prevalence of lags is a phenomenon common to all types of settlement currencies. The lowest discrepancy between leads and lags appears when the dollar is used as third currency; this holds also for imports, where in 1977 we have the only case when leads and contemporaneous payments weigh more than delayed payments (14.2% as against 12%): this, in addition to the much lower importance of the lira in L1 on the import side of 1977, suggests that for that year, which followed a dramatic crisis of the domestic currency, Italian importers tried with success to accelerate their settlements when denominated in foreign currencies and to delay them when denominated in domestic currency.

Perhaps the most interesting information conveyed by Table 6 is

Table 6
Choice of the currency (C) by dimension of the banking document (B)
(each of the eight subtables adds up to 100)

		1977				1987			
		B1	B2	B3	B4	B1	B2	B3	B4
I ! Number of documents	C1	15.76	2.39	0.78	0.15	17.99	3.76	1.40	0.48
	C2	55.11	7.65	1.29	0.14	48.62	8.59	1.89	0.36
	C3	8.32	2.84	1.15	0.17	6.97	3.12	1.35	0.29
	C4	3.39	0.63	0.22	0.00	3.95	0.93	0.27	0.03
P ! Total		<u>82.58</u>	<u>13.51</u>	<u>3.44</u>	<u>.67</u>	<u>77.53</u>	<u>16.40</u>	<u>4.92</u>	<u>1.16</u>
R ! Total	C1	5.68	4.31	6.30	4.76	6.08	5.70	8.54	9.22
T ! value of	C2	15.26	14.34	8.73	10.49	14.37	13.44	8.88	8.65
S ! documents	C3	3.05	5.78	8.53	8.64	3.19	4.85	6.45	6.05
!	C4	1.25	1.30	1.49	0.09	1.44	1.44	1.26	0.43
!	Total	<u>25.24</u>	<u>25.73</u>	<u>25.06</u>	<u>23.98</u>	<u>25.08</u>	<u>25.43</u>	<u>26.12</u>	<u>24.36</u>
I ! Number of documents	C1	33.16	7.42	1.69	0.19	33.28	6.54	1.57	0.10
	C2	30.74	6.22	1.82	0.17	32.23	6.42	1.54	0.11
	C3	10.66	3.42	1.54	0.29	7.66	3.48	1.95	0.61
	C4	1.98	0.53	0.15	0.01	3.18	1.01	0.28	0.05
P ! Total		<u>76.54</u>	<u>17.59</u>	<u>5.20</u>	<u>.67</u>	<u>76.35</u>	<u>17.45</u>	<u>5.34</u>	<u>.87</u>
R ! Total	C1	10.87	11.21	8.23	5.61	10.87	9.32	6.87	2.32
T ! value of	C2	10.36	9.45	8.78	5.71	10.95	9.63	6.89	1.98
S ! documents	C3	3.67	5.41	8.14	10.15	2.83	5.24	9.99	16.99
!	C4	0.66	0.81	0.67	0.27	1.10	1.47	1.43	2.12
!	Total	<u>25.03</u>	<u>25.86</u>	<u>25.62</u>	<u>23.49</u>	<u>25.75</u>	<u>25.65</u>	<u>25.18</u>	<u>23.41</u>

that the prevalence of the exporter's currency ("Grassman's law") needs to be reinterpreted not just on the basis of the sector in which trade occurs ("McKinnon's law"), but also on the basis of the dimension of the individual transaction. It clearly appears from Table 6 that the larger the transaction, the greater is the use of the dollar as a third currency. This phenomenon is particularly important on the export side in both years (where the dollar grows from 3.7 to 10.2% in 1977, and from 2.8 to 17.0% in 1982), but relevant also on the import side; so much that we may identify this as a new regularity, which seems not to have attracted the attention of previous researchers. This is the more remarkable, if we consider that we have eliminated from our sample four large importers transacting mainly in dollars (oil-importers). It is interesting to note that the growing importance of the dollar with the size of the document is obtained always at the expense of the partner's currency (e.g.: in exports for 1982, the partner's currency falls from 11 to 2%); whereas the share of the lira, while also falling on the export side as the dimension of the banking document increases, rises on the import side.

Finally, Tables 7 and 8 refer the variable "choice of currency" (C)

Table 7
Choice of the currency (C) by dimension of the trader (D)
(each of the eight subtables adds up to 100)

		1977				1982			
		D1	D2	D3	D4	D1	D2	D3	D4
I ! Number of documents	C1	6.63	6.02	5.88	0.55	9.94	8.21	2.40	3.08
	C2	35.50	17.83	10.71	0.15	32.68	14.42	9.45	2.91
	C3	5.88	4.28	1.99	0.32	4.85	2.27	4.20	.43
	C4	2.43	1.34	0.47	0.0	2.86	1.62	.53	.16
	<u>Total</u>	<u>50.45</u>	<u>29.47</u>	<u>19.06</u>	<u>1.02</u>	<u>50.33</u>	<u>26.51</u>	<u>16.58</u>	<u>6.58</u>
R ! value of documents	C1	4.03	5.11	7.44	4.47	5.61	8.07	4.31	11.55
	C2	14.56	12.00	14.67	7.58	14.45	11.27	13.99	5.63
	C3	5.29	6.90	8.47	5.34	3.63	4.61	9.43	2.88
	C4	1.37	1.41	1.35	0.0	1.69	1.74	.90	.25
	<u>Total</u>	<u>25.25</u>	<u>25.42</u>	<u>31.93</u>	<u>17.39</u>	<u>25.38</u>	<u>25.69</u>	<u>28.62</u>	<u>20.30</u>
E ! documents	C1	22.89	10.42	5.10	4.06	22.38	11.70	5.39	2.02
	C2	12.02	12.41	8.93	5.59	15.10	12.01	10.74	2.44
	C3	4.71	4.75	3.75	2.69	4.08	3.33	3.24	3.05
	C4	0.79	0.52	1.00	0.36	1.26	1.51	1.14	.62
	<u>Total</u>	<u>40.41</u>	<u>28.11</u>	<u>18.78</u>	<u>12.71</u>	<u>42.82</u>	<u>28.55</u>	<u>20.51</u>	<u>8.12</u>
S ! documents	C1	13.10	9.48	6.71	6.63	12.19	9.16	5.12	2.90
	C2	6.29	8.93	9.72	9.36	7.83	8.42	8.47	4.73
	C3	5.00	6.95	8.25	7.16	4.40	6.14	10.31	14.21
	C4	0.63	0.50	0.94	0.34	.75	1.47	2.56	1.33
	<u>Total</u>	<u>25.03</u>	<u>25.86</u>	<u>25.62</u>	<u>23.49</u>	<u>25.17</u>	<u>25.19</u>	<u>26.46</u>	<u>23.18</u>

to the two alternative measures of dimension of the firm that were discussed above ⁹. As there is a positive correlation between size of the firm and size of the individual transactions (e.g., in 1977 while small firms dealt about 80% of their imports in small size transactions, large firms did so for about 60%), the information contained in these tables is only partly additional to that contained in Table 6.

Table 8
Choice of the currency (C) by
market product dimension (d')
(each of the eight subtables adds up to 100)

		C1	C2	C3	C4	Total
1977						
IMPORTS						
Number of documents	d ₁	4.04	28.17	4.53	1.93	38.68
	d ₂	15.04	36.02	7.94	2.31	61.32
Total value of documents	d ₁	1.86	9.13	3.09	1.01	15.08
	d ₂	19.19	39.69	22.91	3.13	84.92
EXPORTS						
Number of documents	d ₁	17.36	8.10	3.63	0.63	29.72
	d ₂	25.10	30.85	12.28	2.04	70.28
Total value of documents	d ₁	8.32	3.77	2.68	0.37	15.15
	d ₂	27.60	30.53	24.68	2.03	84.85
1982						
IMPORTS						
Number of documents	d ₁	6.71	23.48	3.59	2.46	36.24
	d ₂	16.93	35.98	8.15	2.71	63.76
Total value of documents	d ₁	3.28	8.13	2.38	1.31	15.10
	d ₂	26.25	37.22	18.16	3.26	84.90
EXPORTS						
Number of documents	d ₁	17.29	9.63	3.19	1.19	31.30
	d ₂	24.20	30.66	10.51	3.33	68.70
Total value of documents	d ₁	8.11	4.31	2.98	0.67	16.07
	d ₂	21.26	25.13	32.09	5.45	83.93

The "law" just identified with reference to the dimension of the banking document does not seem to hold as well with reference to the dimension of the firm (D) as shown in Table 7. In fact, the use of the dollar grows with size in a very clear way only for exports and in 1982, particularly at the expense of the lira. On the import side, we remark the increase with size in the lira share at the expense of the partner's currency for 1982, but not for 1977.

2.2.3. The third data set allows an analysis of the distribution of firms according to metric variables or to indices that synthetize the set of variables just examined.

(i) As our main interest is in the choice of currency, the first index to be considered is one that measures the shares (C') that each firm allocates in its transactions to the four groups of currencies:

- C1'- share in Italian lira
- C2'- share in partner's currency
- C3'- share in dollar (as a third currency)
- C4'- share in other third currencies.

(ii) the second variable is the overall dimension of each firm, which is considered as a metric variable (D') equal to the total value of import (export) trade managed by the firm.

(iii) the third variable is the dimension "sector-country", which reproduces the variable d of section 2.2.1, but now considered as a metric variable (d').

(iv) the fourth variable is built with the purpose of overcoming the dichotomic classification of sectors 1 and 2, which was criticized above as being too stringent. In order to capture the different degree of capacity to make the price, we have classified the firms by an index which is based on the coefficient of variation of unit values (import or export respectively) over the countries of origin or of destination for each sector. The assumption is that a sector --on import or on export-- is composed of more or less homogeneous products and is more or less

competitive, the smaller or the larger is the coefficient of variation of "prices" across different countries of origin or destination. These coefficients of variation -- two (import and export) for each of the 23 sectors listed with reference to the variable S -- are then made specific to each firm by weighting them with the shares that a firm has in each sector:

$$S_k' = \sum_i k_i^{w_i} s_i$$

where s_i is the normalized coefficient of variation of unit values¹⁰ on import or export by countries of origin and destination.

(v) although the variable S' is specifically meant to bypass the limitations of the two-sector classification used in section 2.2.1, we decided to introduce, as a check, also a variable (S''), which measures, for each firm, the share of its trade in the "price-taker" sector as was identified in the previous dichotomic classification;

(vi) with the same purpose of variable L , but again with the possibility of considering now a metric index, we built a variable L' , which represents, for every firm, its weighted average number of months leading or lagging the time of settlement with respect to the time of customs clearance, i.e.:

$$L'_k = \sum_i L_i k_i^{w_i}$$

where i ranges from -60 to +60 (months) and $k_i^{w_i}$ is the share of a firm k 's transactions (in import or export) in each lead or lag interval;

(vii) a variable aimed at testing one of the hypotheses suggested by CWW is the share of the value of trade (import or export) that each firm transacts with countries having convertible currency (QC);

(viii) because of the institutional links between Italy and the other EEC countries, we thought useful to construct an index for the share of transactions that each firm has with EC countries, (QE);

(ix) an index of the number of different countries (NG) over which the total transactions of a firm are distributed during a year, either as imports or exports. This index is computed by the formula

$$NG = \frac{2n}{n+1} \sum_{i_k=1}^n w_i^{(k)} i_k$$

where n is the total number of countries with which the trader is active, $w_i^{(k)}$ is the i -share of trade in the decreasingly ordered list of shares, and k is the index of the country. Note that the ordering of countries is specific to each trader. Since

$$\sum_{i=1}^n i = \frac{n(n+1)}{2},$$

the range of this index is the closed interval $[1, n]$.

(x) an index of the number of commodity sectors (NS) over which the total transactions of a firm are distributed during a year, computed as in (ix).

2.2.4. As a preliminary description of the distribution of firms by the variables presented in the preceding section, we discuss here the most interesting tables, which are those of currency choice (C'), total dimension (D'), sector-country dimension (d'), market structure (S').

In Tables 9-12, the firms are classified according to the shares that they transact in the four possible groups of currencies. Thus, in Table 9, we have 388 firms that have had at least one transaction in lira, classified by the share that each of them actually trades in lira (the shares are grouped in four classes for ease of tabulation).

It then appears that "Grassman's law" (in its original univariate formulation), although it has been tested by previous researchers on the

basis of data on individual transactions, also tends to hold for data aggregated over individual firms. In fact, Tables 9 and 10 jointly show that:

TABLE 9
CURRENCY SHARES : LIRA
YEAR 1977

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	181	46.65	282	21.48
25% - 50%	62	15.98	173	13.18
50% - 75%	48	12.37	165	12.57
75% -100%	97	25.00	693	52.78
TOTAL	388	100.00	1313	100.00

TABLE 10
CURRENCY SHARES : PARTNER' S CURRENCY
YEAR 1977

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	118	12.34	371	44.06
25% - 50%	111	11.61	145	17.22
50% - 75%	128	13.39	124	14.73
75% -100%	599	62.66	202	23.99
TOTAL	956	100.00	842	100.00

YEAR 1982

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	192	43.74	268	21.74
25% - 50%	52	11.85	160	12.98
50% - 75%	47	10.71	147	11.92
75% -100%	148	33.71	658	53.37
TOTAL	439	100.00	1233	100.00

YEAR 1982

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	138	14.84	321	38.17
25% - 50%	102	10.97	148	17.60
50% - 75%	104	11.18	145	17.24
75% -100%	586	63.01	227	26.99
TOTAL	930	100.00	841	100.00

(i) the number of firms exporting in lira is much larger in both years than the number of firms importing in lira;

(ii) out of the 1313 firms that dealt in lira in 1977 on the export side, 53% did most of their trade in lira (1233 and 53% also in 1982);

(iii) symmetrically, on the import side, about 45% of traders deal in the lower class of incidence for the lira;

(iv) similarly, but with opposite tendency, we see that the use of the partner's currency is slightly more popular among firms on the import than on the export side (965 firms as against 842 in 1977; 930 as against 841 in 1982);

(v) on the import side about 63% of the firms do most of their trade in the partner's currency, while on the export side the smallest use of this choice is the most frequent (from 38 to 44% of the firms).

TABLE 11
CURRENCY SHARES : DOLLARS AS THIRD CURRENCY
YEAR 1977

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	165	41.56	336	51.14
25% - 50%	80	20.15	127	19.33
50% - 75%	60	15.11	79	12.02
75% -100%	92	23.17	115	17.50
TOTAL	397	100.00	657	100.00

TABLE 12
CURRENCY SHARES : OTHER THIRD CURRENCY
YEAR 1977

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	185	75.82	239	87.55
25% - 50%	30	12.30	17	6.23
50% - 75%	13	5.33	8	2.93
75% -100%	16	6.56	9	3.30
TOTAL	244	100.00	273	100.00

YEAR 1982

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	129	42.72	299	52.46
25% - 50%	59	19.54	104	18.25
50% - 75%	43	14.24	60	10.53
75% -100%	71	23.51	107	18.77
TOTAL	302	100.00	570	100.00

YEAR 1982

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0 - 25%	177	69.69	248	83.50
25% - 50%	35	13.78	27	9.09
50% - 75%	21	8.27	14	4.71
75% -100%	21	8.27	8	2.69
TOTAL	254	100.00	297	100.00

Tables 11-12 represent the use of the dollar and of other currencies as vehicle currencies. It can be seen that, while the dollar is used by a larger number of firms on the export than on import side, among the firms who do deal in dollars, a small use of this currency is more frequent on export than on import side (and viceversa, a large use of the dollar is more frequent on import than on export side). The same pattern appears to hold, but in a stronger way, for the use of other third currencies, even though in this case the number of firms using them is more balanced between imports and exports.

Table 13 contains the univariate distribution of firms according to their overall trade dimension (D'), while Table 14 that according to the sector-market dimension.

For both measures of dimension, the distribution of firms appears to be skewed towards small size in terms of numbers of firms, and towards large size in terms of their values.

Table 15 is perhaps one of the most interesting descriptive tables, as it presents a new way of measuring the joint presence of product

TABLE 13
 SIZE OF FIRMS (D')
 (VALUES IN BILLION LIRA)

YEAR 1977					
IMPORTS			EXPORTS		
CLASSES	FIRMS	%	CLASSES	FIRMS	%
0.0 - 1.8	987	90.72	0.0 - 1.2	1295	87.92
1.8 - 6.1	73	6.71	1.2 - 4.2	119	8.08
6.1 - 37.6	21	1.93	4.2 - 10.6	36	2.44
> 37.6	7	0.64	> 10.6	23	1.56
TOTAL	1088	100.00	TOTAL	1473	100.00

YEAR 1982

YEAR 1982					
IMPORTS			EXPORTS		
CLASSES	FIRMS	%	CLASSES	FIRMS	%
0.0 - 3.2	974	90.27	0.0 - 2.1	1263	87.89
3.2 - 9.0	70	6.49	2.1 - 7.8	118	8.21
9.0 - 36.8	24	2.22	7.8 - 22.2	38	2.64
> 36.8	11	1.02	> 22.2	18	1.25
TOTAL	1079	100.00	TOTAL	1437	100.00

TABLE 14
 SIZE OF FIRMS IN SECTOR-MARKETS (d')
 (VALUES IN BILLION LIRA)

YEAR 1977					
IMPORTS			EXPORTS		
FIRMS	%		FIRMS	%	
0 - 0.5	156	14.34	158	10.73	
0.5 - 1.0	562	51.65	797	54.11	
1.0 - 3.0	219	20.13	300	20.37	
3.0- 10.0	132	12.13	180	12.22	
> 10.0	19	1.75	38	2.58	
TOTAL	1088	100.00	1473	100.00	

YEAR 1982

YEAR 1982					
IMPORTS			EXPORTS		
FIRMS	%		FIRMS	%	
0 - 0.5	160	14.83	157	10.93	
0.5 - 1.0	576	53.38	767	53.38	
1.0 - 3.0	208	19.28	306	21.29	
3.0- 10.0	109	10.10	179	12.46	
> 10.0	26	2.41	28	1.95	
TOTAL	1079	100.00	1437	100.00	

heterogeneity and price-making capacity. As expected for a country like Italy --relatively small but exporting more differentiated products than those it imports-- the frequency distributions for imports and exports are opposite: most firms are either importing standardized products or unable to influence their price, while on the export side a substantial number of firms sell products which are either more heterogeneous or such that a higher degree of price discrimination is possible.

TABLE 15
INDEX OF " MARKET POWER " (S')

YEAR 1977

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0.0 - 0.2	653	60.02	49	3.33
0.2 - 0.4	236	21.69	357	24.24
0.4 - 0.6	57	5.24	318	21.59
0.6- 0.8	33	3.03	513	34.83
0.8 - 1.0	109	10.02	236	16.02
TOTAL.	1088	100.00	1473	100.00

YEAR 1982

	IMPORTS		EXPORTS	
	FIRMS	%	FIRMS	%
0.0 - 0.2	501	46.43	51	3.55
0.2 - 0.4	506	46.90	419	29.16
0.4 - 0.6	43	3.99	411	28.60
0.6- 0.8	5	0.46	511	35.56
0.8 - 1.0	24	2.22	45	3.13
TOTAL	1079	100.00	1437	100.00

3. Analysis of the multivariate classification of the set of banking documents.

3.1. Methodology

A multivariate analysis of contingency tables can be performed through loglinear models. Even if conceived for association analysis (Goodman, 1970), these models can be used also for analyzing structural asymmetric relationships between "explained" and "explanatory" variables in terms of statements of conditional independence. In fact, a relationship between log-linear models and multivariate logit models has been established (Goodman, 1971; Nerlove and Press, 1976; König, Nerlove, Oudiz, 1979, 1981).

On the basis of the so-called log-linear "saturated model" it is possible to rebuild exactly the logarithm of the cells of a multivariate contingency table by means of additive contributions of the single variables and of all the interactions among them up to the k -th order, k being the dimension of the table. A representation by means of a saturated model does not allow a parsimonious interpretation of the phenomenon under exam, but it reveals the pattern of association among variables. The analysis of the parameters of the saturated models is also a guide in looking for more parsimonious models.

The search for a model simpler than the saturated one is interesting because it allows to detect particular structures in the data sets, focusing on fewer but sufficient elements of the phenomenon. However, a necessary condition for such "parsimonious" models to be acceptable is that they fit data in an adequate way. A model which fits well means that there is no significant difference, tested by a χ^2 -type statistic, between the actual cell values and those estimated by the log-linear unsaturated model. In our case, however, it is difficult to have good fits (in the χ^2 sense) with models which are more parsimonious than the saturated one, because, as is well known, χ^2 -type statistics are function of the total number of cases considered: our sample is so large that the computed χ^2 for most unsaturated models always produce significant values.

Hence, in our study we shall not use the χ^2 criterion to choose an adequate model; we shall instead refer to economic theory, which suggests a class of models suitable for our investigation. In fact, our main interest is in trying to explain the choice of a currency in the light of the other available variables. Thus, we want to analyse --separately for import and export and for the two years considered-- the model which allocates the probabilities $p(C|G,S,L,D,B)$, where D stands alternatively for one of the two variables D and d , and where we consider only the first order interactions between the explanatory and explained variables. This model, which excludes second and higher order interactions among C and the other variables, is therefore the simplest among those investigating the association between the choice of currency and the other variables, conditionally on the association among the set of the variables (G,S,L,B,D) . In other words, the restricted model shall yield the conditional probability that a banking document is settled in

one of the four categories for the choice of currency. This probability could be computed with the contribution of all the additive terms, related to the association among (G,S,L,D,B), and with the contribution of coefficients linked to variable C and to the interactions between C and G, C and S, C and L, C and D, C and B. We shall analyse the statistical significance and algebraic sign of such coefficients, rather than the probabilities (multivariate logits) of having a particular choice of currency.

3.2. The results.

The model of the preceding paragraph has been fitted to the two six dimensional tables, where D and d are alternatively considered. Moreover, with respect to the descriptive analysis of section 2.2.2, we grouped together the categories from G8 to G11 of variable G (thus obtaining a more compact definition of the category "Rest of the world"), the categories B3 and B4 of variable B, and D3 and D4 of variable D. The results for the two measures of dimension did not show remarkable differences; therefore we report only those concerning D as a variable characterizing the dimension of the firm.

In Tables 16 and 17 are reported the estimates of the log-linear parameters for the variable C and the interactions between C and the other variables. Under each coefficient is reported within brackets its standardized value, which can be used for testing the difference from zero of the estimated values on a standardized normal distribution.

(1) Let us first examine the results related to exports, for the two years considered (Table 16). The contribution of the variable C by itself is very important, as can be seen from the standardized values. The signs of the coefficients, which add up to zero by hypothesis, show opposite tendencies for the subset of the vehicle currencies (strong and negative) and the subset of the domestic and partner's currencies (strong and positive).

The analysis of the interaction between C and S may be compared with two of the hypotheses which were tested in a different way by CWW. The first one is that the goods of sector 2 (tradables settled in the

Table 16
Log-linear parameter estimates for Exports

		1977				1982			
		C1	C2	C3	C4	C1	C2	C3	C4
Effect of the variable	C	1.234 (42.008)	.666 (20.391)	-.491 (-11.866)	-1.409 (-28.668)	1.273 (41.479)	.732 (21.522)	-.784 (-16.924)	-1.221 (-25.327)
Effect of the interaction CS	S1	-.089 (-3.021)	.132 (4.057)	.158 (3.832)	-.203 (-4.120)	-.259 (-8.426)	.026 (.758)	.115 (2.483)	.118 (2.437)
	S2	.089 (3.021)	-.132 (-4.057)	-.158 (-3.832)	.203 (4.120)	.258 (8.421)	-.026 (-.762)	-.115 (-2.486)	-.118 (-2.441)
	G1	.195 (2.899)	1.531 (21.534)	-.832 (-7.357)	-.895 (-6.352)	.066 (.911)	1.390 (19.90)	-.733 (-5.942)	-.723 (-5.047)
	G2	.616 (8.353)	.858 (11.357)	-.927 (-8.082)	-.547 (-4.228)	.578 (7.194)	1.196 (13.543)	-.903 (-6.516)	-.871 (-6.220)
	G3	.121 (1.062)	2.117 (22.473)	-.453 (-2.764)	-.453 (-2.764)	.266 (2.381)	1.904 (21.865)		-.805 (-4.881)
Effect of the interaction CG	G4	-.144 (-1.744)	-.37 (-4.334)	.558 (5.58)	-.045 (-.314)	-.159 (-1.829)	.069 (.738)	.325 (2.741)	-.236 (-1.776)
	G5	-.191 (-2.969)	-.152 (-1.979)	.045 (.502)	.298 (2.377)	-.245 (-3.26)	-.313 (-3.691)	.176 (1.511)	.382 (3.167)
	G6	-.282 (-3.310)	.108 (1.248)	-.234 (-2.004)	.408 (3.25)	-.208 (-2.325)	-.003 (-.031)	-.46 (-3.577)	.67 (5.648)
	G7	-.262 (-3.953)	-1.095 (-12.672)	.885 (11.185)	.471 (4.211)	-.067 (-1.003)	-1.298 (-15.142)	.523 (5.545)	.842 (8.487)
	G8	-.054 (-.997)	-2.998 (-27.381)	2.29 (38.814)	.761 (8.749)	-.232 (-4.244)	-2.947 (-25.100)	2.439 (38.554)	.740 (8.966)
Effect of the interaction CL	L1	-.143 (-4.854)	-.210 (-6.444)	.217 (5.246)	.136 (2.762)	-.062 (-2.021)	-.159 (-4.686)	.248 (5.351)	-.027 (-.555)
	L2	.142 (4.849)	.210 (6.439)	-.217 (-5.25)	-.136 (-2.766)	.062 (2.016)	.159 (4.681)	-.248 (-5.355)	.027 (.552)
Effect of the interaction CB	B1	.053 (1.479)	.248 (6.261)	-.242 (-4.437)	-.059 (-.932)	.170 (4.458)	.343 (8.468)	-.423 (-6.819)	-.091 (-1.478)
	B2	.023 (.561)	-.149 (-3.237)	.044 (.755)	.082 (1.156)	-.01 (-.237)	-.007 (-.154)	-.058 (-.881)	.075 (1.121)
	B3	-.076 (-1.601)	-.099 (-1.893)	.197 (3.186)	-.023 (-.312)	-.161 (-3.251)	-.336 (-6.048)	.481 (7.012)	.016 (.215)
Effect of the interaction CD	D1	.496 (12.026)	-.146 (-3.196)	-.199 (-3.446)	-.151 (-2.138)	.467 (11.165)	.035 (.734)	-.171 (-2.269)	-.331 (-4.900)
	D2	-.037 (-.918)	.172 (3.694)	.112 (1.89)	-.247 (-3.505)	-.007 (-.174)	-.043 (-.898)	-.093 (-1.362)	.143 (2.066)
	D3	-.459 (-10.730)	-.026 (-.562)	.087 (1.485)	.398 (5.900)	-.46 (-10.033)	.008 (.166)	.263 (4.151)	.188 (2.767)

seller's currency) will be invoiced in the exporter's currency. This agrees with the positive and significant values obtained for C1/S2 and the negative and significant values of C3/S2 in both years. For 1977 we have a positive association between S2 and C4. For 1982 all signs agree with such hypothesis, even if the coefficient is not significantly different from zero for C2/S2. Specular comments can be referred to the association between S1 and the choice of the currency: in fact, in this

class of models, coefficients must sum up to zero. Thus, the second hypothesis, that tradables of sector 1 (i.e. of efficient markets) are invoiced in a vehicle currency, is supported by the negative coefficient of $C1/S1$ and the positive coefficient of $C3/S1$.

Another very interesting interaction occurs between the choice of the currency and the geopolitical area. Almost all these coefficients are statistically significant. In particular $C1$ (the domestic currency) is positively associated only in trade with our three main partners (Germany, France and the USA). Thus, Grassman's law turns out to be confirmed but with two limitations: first it applies to trade with a subset of countries, even though to the main partners, second it does not reflect in an opposite use of the partner's currency, as also the association $C2$ is positive with $G1/G3$.

The contrary pattern (a negative association with both domestic and partner's currency) is observed in exports to Switzerland, the "Rest of Europe", and the "Rest of the World". This result --which is at odds with Grassman's law-- is probably due to a relatively stronger influence of the dollar (except for Switzerland) and of other third currencies (probably the D.M., particularly for Switzerland) as "vehicle" currencies in these areas. In the case of Belgium, Luxembourg, the Netherlands and Denmark, it is interesting to notice that the standard pattern, already modified for Switzerland, becomes even more bent towards the use of other third currencies (e.g. the DM), and less so towards the US dollar: a result in line with the inclusion of these countries into an informal but economically important "DM area". This is true, but only in part, also for exports to the UK, in so far as the dollar has a positive association with $G4$; the negative association of the pound ($C2$) and other third currencies ($C4$) suggests that the decline in the international role of sterling has already been accomplished but also that other third currencies have not succeeded to pick up this role in our export trade to this country.

The association between choice of currency and leads and lags appears to be strong. The sign is negative for $C1/L1$ and $C2/L1$, positive for $C3/L1$ and $C4/L1$.

Let us now consider the interactions between the choice of the currency and the dimension of the banking document and of the firm. As for the first, we note that the dimension of the banking document is

never associated with C4, switches from strong negative to strong positive coefficient for the dollar, while the opposite result holds for the partner's currency. For the Italian lira, there is a positive association with small, and a negative one with large dimensions in 1982, showing the progressive loss of relevance of the domestic currency during the period (in 1977 we notice irrelevance for the interaction C1/B3).

With respect to the relationship between choice of currency and dimension of the firm, we remark signs going from negative to positive for C3 and C4, suggesting that traders who are important on the market choose the use of a vehicle currency for their exports, as this appears more reliable. There is substantial irrelevance of the association between exporting in the partner's currency and dimension of the firm, and this agrees with common sense. On the other hand, settling in domestic currency is advantageous to exporters and corresponds to the initial hypothesis by Grassman, but this is so only for small traders. It is interesting to remark the indifference in the choice of currency for medium dimension traders and the negative association of lira with their large dimension.

(ii) In Table 17 are reported the corresponding results from the import side. In this case, the contribution of the currencies by themselves is not equally relevant as for exports. In particular we find that the dollar by itself is never relevant and that C1 shows a negative value in 1977, which becomes irrelevant in 1982.

The parameters of the interaction between sector and choice of the currency show a pattern which agrees with the findings by CWW. In fact, since in this case the exporter's currency is the partner's one, we find a strong and positive association between C2 and S2 as expected, and a strong but negative association between C1 and S2. A substantial independence seems to exist between the sector and C4. The association with the dollar is irrelevant in 1977. In 1982, dollar and partner's currency show the same kind of association, while, according to the findings of other researchers, sector 1 ought to be dealt with in a vehicle currency.

As for the relationship between geopolitical area and choice of the currency, we notice the same pattern of association for Germany and

Table 17
Log-linear parameter estimates for imports

		1977				1982			
		C1	C2	C3	C4	C1	C2	C3	C4
Effect of the variable	C	-.25 (-5.205)	1.229 (32.964)	.042 (.942)	-1.021 (-19.428)	.035 (.748)	1.078 (29.599)	-.009 (-.193)	-1.104 (-21.210)
Effect of the interaction	S1	.294 (6.118)	-.236 (-6.331)	.013 (.279)	-.071 (-1.356)	.268 (5.706)	-.142 (-3.898)	-.131 (-2.887)	.004 (.086)
CS	S2	-.295 (-6.122)	.236 (6.327)	-.013 (-.283)	.071 (1.352)	-.268 (-5.710)	.142 (3.894)	.131 (2.883)	-.005 (-.090)
	G1	.259 (2.410)	.872 (11.583)	-.767 (-6.769)	-.364 (-2.80)	.347 (2.978)	1.269 (16.145)	-.800 (-7.292)	-.816 (-5.708)
	G2	.352 (2.752)	.546 (5.585)	-.12 (-.953)	-.779 (-5.106)	.373 (2.946)	.672 (6.508)	.132 (1.031)	-1.133 (-7.595)
	G3	-1.091 (-6.596)	1.993 (19.304)		.392 (2.358)	-1.027 (-5.985)	1.775 (5.062)		.236 (1.362)
Effect of the interaction	G4	.283 (2.240)	-.019 (-.198)	.43 (4.36)	-.695 (-4.85)	-.226 (-1.750)	-.48 (-5.062)	.678 (6.018)	.028 (.214)
CG	G5	-.864 (-7.208)	-.421 (-4.357)	.483 (4.74)	.801 (6.71)	-.365 (-3.385)	-.813 (-8.561)	.529 (5.710)	.649 (5.145)
	G6	.516 (4.522)	-.32 (-3.518)	.334 (3.072)	.137 (1.005)	.384 (3.595)	-.084 (-.859)	-.443 (-3.83)	.142 (1.091)
	G7	.455 (3.338)	-.244 (-2.473)	.164 (1.357)	-.375 (-2.674)	.505 (4.256)	-.412 (-3.891)	-.002 (-.016)	-.092 (-.680)
	G8	.090 (.800)	-2.409 (-19.478)	1.437 (16.157)	.881 (7.535)	.008 (.079)	-1.883 (-19.566)	.889 (10.467)	.985 (9.578)
Effect of the interaction	L1	-.418 (-8.692)	-.044 (-1.192)	.413 (9.182)	.05 (.945)	-.407 (-8.66)	-.133 (-3.669)	.442 (9.731)	.098 (1.886)
CL	L2	.418 (8.688)	.044 (1.187)	-.413 (-9.186)	-.05 (-.949)	.407 (8.656)	.133 (3.654)	-.442 (-9.735)	-.098 (-1.889)
Effect of the interaction	B1	.236 (3.86)	.470 (10.805)	-.49 (-8.64)	-.217 (-3.275)	-.026 (-.437)	.293 (6.703)	-.276 (-4.686)	.01 (.146)
CB	B2	-.116 (-1.715)	.146 (2.902)	.068 (1.051)	-.098 (-1.318)	-.174 (-2.572)	.05 (.992)	.146 (2.266)	-.024 (-.321)
	B3	-.12 (-1.612)	-.617 (-9.85)	.421 (6.13)	.315 (3.879)	.200 (2.819)	-.343 (-5.82)	.130 (1.883)	.014 (.169)
Effect of the interaction	D1	-.430 (-6.392)	.248 (4.762)	-.066 (-1.056)	.247 (3.376)	-.119 (-1.853)	.277 (5.617)	-.223 (-3.482)	.064 (.891)
CD	D2	-.03 (-.441)	-.027 (-.534)	.018 (.286)	.038 (.519)	.319 (4.986)	-.036 (-.724)	-.428 (-6.594)	.145 (2.001)
	D3	.459 (6.617)	-.221 (-4.002)	.047 (.724)	-.286 (-3.771)	-.200 (-2.816)	-.241 (-4.414)	.650 (10.222)	-.21 (-2.757)

France: a strong and positive association with C1 and C2, a strong and negative one with C3 and C4, apart from the irrelevance of the interaction of the dollar with France. For the USA there is a negative association with the lira and a positive one with the partner's currency, i.e. the dollar. An uncertain pattern, except for the constant positive association with the dollar, is shown with the UK. For Switzerland there is a negative and strong association with the lira and

the partner's currency, and a positive one with vehicle currencies. For Belgium, Luxemburg, the Netherlands and Denmark, we have a positive association with the lira and the dollar (only in 1977), a negative one with the partner's currency (not significant in 1982) and irrelevance for the other vehicle currencies. For the rest of Western Europe we have a positive association with the lira, and a negative one with the partner's currency. For the rest of the world we remark the irrelevance of the lira, a negative association with the partner's currency, and a positive one with the other third currencies. It is interesting to remark that these results, together with those already discussed on the export side, show how, rather than looking for a simplistic application of Grassman's law, it is necessary to interpret the associations between currency and countries according to the type of country involved. In fact, in dealing with our main partners (Germany, France and the USA), the currency pattern is practically the same on import as on export side: a result, by the way, which shows the advantage of using methods for the analysis of multivariate tables, as these enable to look for regularities --such as the one suggested by Grassman-- at a more complex level of aggregation.

The relationship between leads and lags and choice of currency has the same structure as for exports.

With regard to the dimension of the banking document, we have an uncertain behaviour for the lira, and a clear switch from positive to negative association for C2 when dimension increases: since it is generally unattractive for the importer to settle in C2, this occurs only for small transactions. The same interpretation can be given to the switch from negative to positive association between dimension of the banking document, the dollar (in its use as a vehicle currency), and the other vehicle currency (notice however the insignificance of the latter in 1982).

Comparing the choice of the currency with the dimension of the trader, we can remark a substantial indifference in 1977 as the dimension of the trader increases, but a certain strength of association from negative to positive for the dollar in 1982, together with the opposite tendency for the other third currency. For the partner's currency we move from positive to negative association as the dimension of the trader increases, while for Italian lira the opposite switch from

negative to positive association, significant in 1977, seems not to continue in 1982.

4. Analysis of the multivariate classification of the set of trading firms

4.1. Methodology.

We have already remarked that, in dealing with firms rather than individual transactions (number or values of documents), it is possible to relate each firm's annual shares in the four choices of currency to a set of variables which are metric and not categorical. These variables are the indeces, for the various characteristics of each firm, that were described and tabulated in sections 2.2.3 and 2.2.4. Thus, the traditional method of regression analysis, which fits the best linear relationship between a dependent variable and a set of "explanatory" variables, can now be employed.

The method of estimation must be such to respect the constraints imposed by the fact that the sum of four shares adds up to unity, and that each share is related to the same set of variables. In our case, the problem is directly solved by OLS method, as this yields estimates for each one of the four equations such that the coefficients of the variables add up to zero, the sum of the constants adds up to 100, so that for each individual firm the estimated shares exhaust the total.

Our aim being to explore the possible determinants of the behaviour of firms with respect to the choice of currency, we estimate the relations cross-section over the set of firms; and we do so for two different years, in order to check for the stability of the estimates.

Ideally, we should first specify a functional form between the control variable (choice of currency) and a set of variables suggested by a theory of the economic behaviour of importers and exporters with respect to this choice. However, a full specification would require a model in which the decision about the currency is part of a joint decision on quantities produced and prices quoted or quantities sold in the different markets. A model of this type, although theoretically available in bits and pieces¹¹, can be hardly fitted to the data at our

disposal. We have therefore limited our analysis, at this stage, to an exploratory search based on linear functions that relate only the choice of currency to a set of variables which are apt to capture and test the various hypotheses that previous authors have suggested on the basis of observed regularities.

4.2. The results

In Tables 18 and 19 we present the results of the regressions based on individual firms' data (import and export) for the years 1977 and 1982.

Table 18
Shares of currencies and their determinants: regression estimates cross section
Exports

	Constant	D'	d'	S'	S''	L'	QC	QE	MC	NS
1977										
C1'	71.20	.18	-.02	-4.94	-.03	-.001	.02	-.05	-1.40	1.26
R ² = .05		(1.25)	(-6.83)	(-1.22)	(-1.29)	(.65)	(.59)	(-1.31)	(-2.73)	(.67)
C2'	-7.65	-.10	.01	-.94	.04	.007	.29	.10	.03	.58
R ² = .17		(-.87)	(4.37)	(-.30)	(2.06)	(1.37)	(9.66)	(3.52)	(.08)	(.39)
C3'	34.58	-.06	.01	4.68	-.01	-.002	-.31	-.04	1.34	-1.93
R ² = .23		(-.65)	(5.09)	(1.84)	(-.43)	(-1.22)	(-12.77)	(-1.75)	(4.11)	(-1.62)
C4'	1.85	-.02	.001	1.20	-.002	.001	-.004	-.01	.03	.08
R ² = .01		(-.60)	(.68)	(1.8)	(-.24)	(1.37)	(-.44)	(-1.37)	(.27)	(.18)
1982										
C1'	73.69	.12	-.02	-2.87	-.01	-.005	.02	-.10	-1.65	-1.59
R ² = .05		(.86)	(-6.01)	(-.44)	(-.33)	(-2.73)	(.43)	(-2.68)	(-2.89)	(-.80)
C2'	-3.69	-.17	.01	-.22	-.01	.003	.29	.18	.45	-.27
R ² = .21		(-1.58)	(3.23)	(-.04)	(-.51)	(2.26)	(9.44)	(6.15)	(.99)	(-.17)
C3'	28.85	.12	.01	1.82	.01	.001	-.29	-.08	.69	2.37
R ² = .26		(1.51)	(4.15)	(.48)	(.37)	(1.46)	(-12.61)	(-3.54)	(2.06)	(2.02)
C4'	1.13	-.07	.004	1.27	.01	.000	-.02	-.003	.51	-.51
R ² = .03		(-1.91)	(3.95)	(.75)	(1.97)	(.36)	(-.69)	(-.32)	(3.41)	(-.97)

An overall survey of these tables brings to light a first remarkable characteristic: the relative stability of the estimates through time. While this may usefully be tested by performing the same regressions over the whole set of years, it already justifies the limitation of the analysis to these two representative periods for the purpose of this paper.

Table 19
Shares of currencies and their determinants: regression estimates cross section
Imports

	Constant	D'	d'	S'	S''	L'	QC	QE	NG	NS
1977										
C1'	22.66	-.24	.01	-4.15	.13	.01	-.21	.03	-2.04	.02
R ² = .10		(-1.57)	(5.02)	(-2.74)	(5.62)	(4.28)	(-5.67)	(1.26)	(-2.38)	(.02)
C2'	9.87	.13	-.13	4.23	-.13	-.003	.73	.07	-4.09	4.27
R ² = .39		(.80)	(-4.51)	(2.56)	(-5.33)	(-1.06)	(18.37)	(2.54)	(-4.37)	(3.16)
C3'	59.35	.19	-.001	-.67	-.002	-.01	-.46	-.09	4.52	-3.24
R ² = .33		(1.48)	(-.32)	(-.52)	(-.10)	(-3.69)	(-14.68)	(-4.27)	(6.14)	(-3.05)
C4'	8.12	-.08	.000	.59	.006	.000	-.06	-.01	1.62	-1.05
R ² = .04		(-1.12)	(.31)	(.78)	(.52)	(.08)	(-3.49)	(-.73)	(3.77)	(-1.69)
1982										
C1'	24.33	-.16	.01	5.78	.14	.01	-.25	.04	-.09	-.76
R ² = .08		(-1.18)	(3.77)	(.94)	(5.28)	(4.06)	(-5.89)	(1.50)	(-.09)	(-.48)
C2'	16.36	.04	-.01	-7.32	-.15	-.004	.72	.04	-4.54	3.79
R ² = .32		(.28)	(-3.98)	(-1.17)	(-5.40)	(-1.89)	(16.36)	(1.24)	(-4.21)	(2.36)
C3'	39.41	.15	.002	9.14	.02	-.004	-.33	-.08	3.13	-1.64
R ² = .22		(1.53)	(.96)	(2.10)	(.86)	(-2.47)	(-10.78)	(-3.83)	(4.19)	(-1.47)
C4'	19.61	-.03	-.001	-7.60	-.01	-.001	-.14	-.001	1.50	-1.40
R ² = .07		(-.39)	(-.078)	(-2.51)	(-.76)	(-.76)	(-6.41)	(-.09)	(2.87)	(-1.80)

A second overall characteristic of the estimates is the relatively high (for cross section estimates) values of the R² statistic in the case of the shares of trade settled in the partner's currency or in dollars as third currency; but also the very unsatisfactory fit in the case of the shares settled in lira and in third currencies other than the dollar. The persistence of such an asymmetric result calls for a deeper statistical analysis. In fact, the number of zero values in the dependent variable is particularly important in the case of lira and other third currencies shares (see tables 9-12); this problem should be treated with a model for "censored" variables. The standard regression model in this case should more correctly be substituted by other models, such as the tobit model. Yet, an attempt to estimate regression coefficients only on the sample of non-zero observations gave results not very different from those obtained from the whole sample. We are left, however, with data that, on the basis of the model here used, do not throw the same amount of light on the determinants of the choice of lira and other third currencies, as on those for the choice of the partner's currency and the dollar.

Considering now the importance of the explanatory variables, it is of interest to see that the trade dimension of the firm (D') never contributes significantly to explaining the variability of the currency shares. However, the other measure of dimension (d'), which tries to capture the specific economic importance of a firm in a product sector and in a market (relative to the average firm in the sample), is very significant on the import side for the shares in lira and in the partner's currency, and for almost all currency shares on the export side. The symmetrically opposite signs of the coefficients of the lira and of the partner's currency as between imports and exports, suggest that firms with a relatively higher market weight (as measured by d') succeed in settling their imports more in the weak currency and less in the generally stronger partner's currency, while for exports they do the opposite, as the speculative advantage of being creditor in relatively stronger currencies is the reverse. The statistical strength of these coefficients is slightly higher in 1977 than in 1982, possibly because the domestic currency was relatively weaker in the former than in the latter year. Notice also that, on the export side, the dollar (in 1977), together with other third currencies (in 1982), and the partner's currency, are chosen more by economically weighty firms.

With respect to McKinnon's hypothesis, the variables S' and S'' only partially confirm it. Our attempt to avoid the dichotomic partition in price-taking and price-making markets through the construction of the variable S' (which specifically attempts to capture the joint aspects of product heterogeneity and price discrimination) appears to be successful only on the import side, but even so not with stable coefficients: in 1977 the higher is the capacity to make the price on the part of the foreign exporter (Italian imports) the lower is the use of the lira and the higher that of the partner's currency; a result fully in line with McKinnon's law. This, however, does not carry over to 1982, when the signs of these two coefficients change (but they are insignificantly different from zero), while there appears to be a positive association with the share settled in dollars and a negative one with that settled in other third currencies.

On the export side the variable S' is almost insignificant: yet, the positive but weak coefficients for the shares in dollars and in other third currencies may suggest that for Italian firms a relatively

higher capacity to make the price pushes them to do so in dollars or in other currencies rather than in domestic currency: a result which, together with the one already commented with respect to the variable d' , is probably a reasonable modification of Grassman's and McKinnon's laws for a country with a structurally weak currency.

The dichotomic partition in "price taker-price maker" sectors is here measured by S'' as the firm's share in markets labelled as competitive. Also this variable is much more significant on the import than on the export side. We notice that the larger is the share of a firm's imports that come through competitive markets, the lower is the quota of the partner's currency, and very significantly so for both years: a result fully in line with McKinnon's law. Less easy to understand economically is why this goes to the advantage of the quota settled in lira, rather than of that settled in dollars or in other third currencies; however, the effect of S'' should be read jointly with that of S' in order to evaluate how the two measures of the phenomenon reinforce (in 1977) or complement (in 1982) each other ¹².

On the export side, the only significant coefficient of S'' is the one for $C2'$ in 1977, which, together with the hardly significant negative coefficient of $C1'$, confirms McKinnon's law only in part: firms exporting more in competitive markets settle their receipts less in lira but more in the partner's currency, rather than in major or minor vehicle currencies. This behaviour is not confirmed in 1982. It is worth underlying that, on the export side, the two variables S' and S'' are generally weak. Thus, we may summarize their overall effect by saying that McKinnon's law, in the case of Italian trade, appears to be verified, but with important conditional limitations, only on the import side.

Moving now to the other variables and possible interpretations, the influence of L' is particularly interesting. On the import side it clearly appears that longer lags in payment are associated with higher lira shares and lower dollar shares or, in a weaker way, lower partner's currency shares. The suggestion is that Italian importers, considering the domestic currency weak relative to the main alternative choices, try and succeed in lagging their payments so as to take advantage from such weakness, and in leading them so as to reduce risky positions in relatively strong currencies. The fact that the Italian side in the deal

appears to impose the choice to its own advantage could be explained with the fewer possibilities for covering that are available to Italian traders relative to their more diversified and financially control-freer partners. This result is confirmed by the opposite signs of variable L', on the export side: the coefficients, however, are significant only for 1982 (and not fully for the dollar share).

The variable QC, which measures a firm's share of trade with countries whose currency is convertible, is a powerful one for explaining the variability of the choice of currency, particularly so on the import side. The interpretation is straightforward: the more a firm imports from non-convertible currency countries (i.e. the lower is the value of QC), the more it tends to use the dollar, the lira, or minor vehicle currencies; and the less the partner's currency. On the export side, the same straightforward results and interpretation hold for the partner's currency and the dollar, while the coefficients for the lira and minor third currencies are insignificant.

The variable measuring the share traded with EC countries (QE) clearly indicates that the higher is its value the more there is a tendency to use the partner's currency, and this holds both for imports and for exports. The reverse is true for the use of the dollar as a third currency, with strong significance always on the import side but only for 1982 on the export side.

The last two variables are indices that measure the degree of dispersion of a firm's import or export activity over countries (NG) or sectors (NS). Particularly significant appears to be the first of the two. Its coefficients indicate that firms which deal with larger number of countries tend to use more the dollar or other third currencies and less the lira or the partner's currency. This result, which is again stronger on the import than on the export side, may reflect the need to reduce transaction and treasury management costs for firms geographically more diversified. Again, also for the variable NS the results, when significant, are more so on import than on export; they indicate that the more sectors a firm deals in, the more it tends to use the partner's currency and the less the dollar or other third currencies. This is probably a reflection of a positive correlation between this variable and product heterogeneity and price making capacity: a firm which imports many products is probably importing

diversified products rather than raw materials; thus it tends to settle them more in the partner's currency, according to McKinnon's law.

5. Conclusions and indications for additional research.

A summary of the many regularities observed in sections 3 and 4 with respect to currency choice and its possible determinants may seem in order. However, the wealth of results obtained, as well as the complexity and sometimes shaky nature of their interpretation make such a summarizing effort difficult and dangerous: for the sake of brevity, results which are partial and tentative must be stated in an apodyptic way, while important but vague insights must be disregarded. Generally, it seems to us that researchers in the social sciences should refrain from looking for simple "laws"; more particularly, the summarizing message that can perhaps be extracted from our analysis without danger of misrepresentation, is that neither Grassman's nor McKinnon's laws are verified in their simple version. Indeed, following the footsteps of Carse, Williamson and Wood, we have shown how the hypotheses suggested by previous authors on the choice of currency are necessarily joint hypotheses involving a whole set of decision variables and their relations to structural variables. The main motivation for using multivariate analysis over the set of individual transactions --besides its being characterized by a technique appropriate to the categorical nature of variables-- was in fact the need to face up to the joint nature of the hypotheses under analysis. Similarly, in our attempt to estimate functional relations between a firm's choice of currency and a set of possible determining variables, the use of multiple regression analysis is the reflection of the different aspects that limit the general validity of simple "laws" in explaining such a choice.

To say that phenomena are complex and hardly amenable to simple descriptions is, however, no excuse for avoiding the need for more satisfactory theorizing of them and deeper empirical testing of theoretical hypotheses. Thus, we think it useful to indicate the lines for further research that appear to us empirically promising or theoretically desirable.

Empirically, it is clear that even a large data bank like ours cannot compensate with its mere size the lack of information on some crucial variables. It should be particularly useful to have data on product prices and on other variables connected with the real aspects of the transactions: shares of imported inputs and of other costs in the fabrication process of the exporting firms, connection between imports, domestic sales and exports for the firms which deal both on import and export trade, etc. As for the financial aspects of the transactions, information on various ways of covering exchange risks, on the means to finance leads and lags, and their relative costs, should be equally important.

Theoretically, a model limited --as is the one we have been using in the tradition of previous researchers-- to the choice of currency in foreign trade, is not very satisfactory. It is time to bring together the different aspects and variables over which the economic strategy of a firm involved in foreign trade is played; and to perform econometric studies, possibly based on both macro- and micro- economic data, on the joint determination of prices, quantities and the financial variables through which the decisions of foreign trading firms are actually expressed.

Footnotes

* We are grateful to W.Gaab for comments made on the version of this work that was presented at the Kiel conference in September, 1984. As a consequence, the paper has been substantially revised and hopefully improved; we are responsible for any remaining shortcomings and errors. We acknowledge the cooperation of Prometeia and the group of banks associated with it in allowing us to use their data for this work. This study is part of a larger research project on the structure of the Italian economy, promoted by the Italian National Research Council (CNR).

¹ Following the pioneering contributions by Grassman (1973a,b), the analysis has been developed theoretically by McKinnon (1979), Magee and Rao (1980a,b), Cornell (1980), and Bilson (1983). Empirical research, originally presented for Sweden, has been extended to the UK by Page (1977-1981), and by Carse, Williamson and Wood (1980), to France by Bourguinat and Cazals (1977, 1978), to Italy by Pecci (1978), and by Basevi, Pecci and Steinherr (1979), to Germany by Scharrer (1980), and to Italy again by Cecchini, Conti, Hamauti and Silvani (1984).

² Although it may happen, particularly with respect to delayed payments, that an individual commercial transaction is subdivided for its payment into more than one document, we shall always treat each individual document as if it represented an individual commercial transaction.

³ Our data refer to currencies of payment rather than currencies of contract. However, according to the Bank of Italy (Biagioli and Pompili, 1978), the difference between contract currency and settlement currency is for Italy relatively unimportant.

⁴ In general, previous researchers either utilize data on individual transactions without information on the firm that operates them or use data from questionnaires submitted to firms, where the questions refer to an individual representative, typical or random, transaction.

- 5 Strictly speaking, each set of banking documents associated to an individual firm constitutes a "cluster"; this would in general require a specific statistical treatment, but in our case the sample is so large to guarantee equivalence with simple random sampling.
- 6 Actually, our data do not refer to countries to which imports originate or from which exports are directed; they refer instead to countries towards which payment is made (for imports) or from which it is received (for exports). While in general there is a close correspondence between the two phenomena, significant differences arise in some cases; most notably when imports are payed to multinationals with their headquarters located in a country different from the country of merchandise origin, or when the foreign seller wishes for other reasons to be credited in a country differen from its own.
- 7 Notice that, because our data refer to debtor or creditor country rather than to country of origin or destination of merchandise, the "off-shore countries" are more important than otherwise.
- 8 Notice that the cross-cell between the US (G3) and the dollar as a third currency (C3) is zero by definition.
- 9 In tables 6 and 7 the subtotals for the values of documents ought to to be 25% by definition. The discrepancies occur because some large documents (in table 6) or some large traders (in table 7) fall on the hedge of the boundaries but must be perforce classified within one of the classes.
- 10 Import and export unit values are taken outside our data bank, from the national statistics on Italian foreign trade.
- 11 See Baron (1976), Aspe and Giavazzi (1978, 1982), Katz, Paroush, and Kahana (1982).
- 12 Remember that the two variables measure the phenomenon in opposite ways: a higher value of S' indicates higher "price-making" capacity, a higher value of S" a higher presence in competitive markets.

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