An Analysis of the ECU as an Invoicing Currency in International Trade in the Period 1983-1990 *

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1. Introduction

The December 1991 meeting of the European Council in Maastricht provided for the introduction of a single European currency. One of the reasons for this decision was the belief that a single currency would diminish the transaction costs within the European Union. Although the ECU has not yet developed into a full-fledged currency, it does provide an alternative, stable invoicing currency. The objective of this article is to assess the contribution to cost reduction of the ECU as an invoicing currency in the period from 1983 to 1990 by simulations of a theoretical model. In Section 2 an overview of the most important theories and determinants with regard to the invoicing currency is given. In Section 3 the theoretical framework for this article is presented. In Section 4 the results of simulations are presented in which the exporter determines the choice of invoicing currency, the importer determines the choice of invoicing currency, or the exporter and the importer determine the choice of the invoicing currency together. In Section 5 some final conclusions are drawn.

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2. Theories and determinants of invoicing currencies

The literature of the invoicing currencies can be divided into empirical and theoretical approaches. Authors using the former approach search for universal laws based on empirical data, and the contributions of Grassman (1973), Carse, Williamson and Wood (1980) are examples. The best known – and probably the most important – result of this research is the finding that the exporter usually determines the choice of invoicing currency,[1] and that this effect is stronger for exporters from relative important economic countries.[2]

The theoretical approach has been followed by authors such as Bilson (1983 and 1987), Donnenfeld and Zilcha (1991), and Rao and Magee (1980). Rao and Magee assume free trade and imperfect markets with no transaction costs and no taxes in their analyses.[3] They construct a model in which the choice of invoicing currency depends on fluctuations in the exchange rate of the currency used in the contract, expressed respectively in the currency of the exporter and the importer and the price of the exported good. In their theory, the future exchange rate is anticipated in the price of the exported good. The actual choice of invoicing currency will depend on the relative risk of incorrectly predicting the future spot rate.[4]

In the analyses of Bilson (1987), price changes are also considered relevant for determining the invoicing currency. Bilson assumes that both the exporter and the importer try to minimize the variations in profits. The invoicing currency that absorbs most of the fluctuations in the cost price of the exporter and fluctuations in the sales price of the importer will be selected. If the sales price of the importer is easier to adjust than the cost price of the exporter, because the nature of the production system makes the amount of capital or labour nearly impossible to change and because wage agreements are only negotiated on a yearly basis, then the exporter will have stronger preference for his own currency than the importer.[5]

[1] Grassman (1973), p. 22.
[2] Page (1977), pp. 77-78.
[3] Rao *et al.* (1980), p. 681.
[4] Rao *et al.* (1980), p. 75.
[5] Jozzo (1989), p. 172; Bilson (1983), pp. 390-399; Bilson (1987), p. 149.

Donnenfeld and Zilcha (1991) analyse the choice of invoicing currency under the assumption that the exporting firm has monopoly power in the domestic and foreign markets and that the choice of invoicing currency and decisions about the price and the quantity are not made simultaneously. Donnenfeld and Zilcha assume that output decisions, pricing decisions and sales are made sequentially. The decision of the exporter relies on a prior distribution of the random exchange rate F(e).[6] In Section 4 the assumption is made that the decision about the invoicing currency will be made after the quantities, the costs of the exporter and the contract price have already been set. None of the other determinants we have discussed, the exchange rate of the invoicing currency expressed in the importer's currency and in the exporter's currency and the sales price of the importer will be fixed *ex ante*.

3. The theoretical framework for the simulations

In Section 2, fluctuations in the exchange rate, the cost price of the exporter and the sales price of the importer are shown to influence the choice of invoicing currency. A variety of market scenarios in which different assumptions are made about the markets for the exporter and the importer include the market for production factors, the market for exported goods and the sales market of the importer.

In Figure 1 the different scenarios for the different markets are outlined, and those underlined are examined in further detail.

It should be noted that the choice of invoicing currency is only open when we assume a fixed cost price for the exporter, a fixed contract price and an importer who is a price taker in his sales market. It is under these conditions that our simulations are undertaken.

The profit W_t1 for the exporter is given by

$$W_t1 = [p_t(c)\ e_t(1) - p_t(1)]\ Q_t \qquad (1)$$

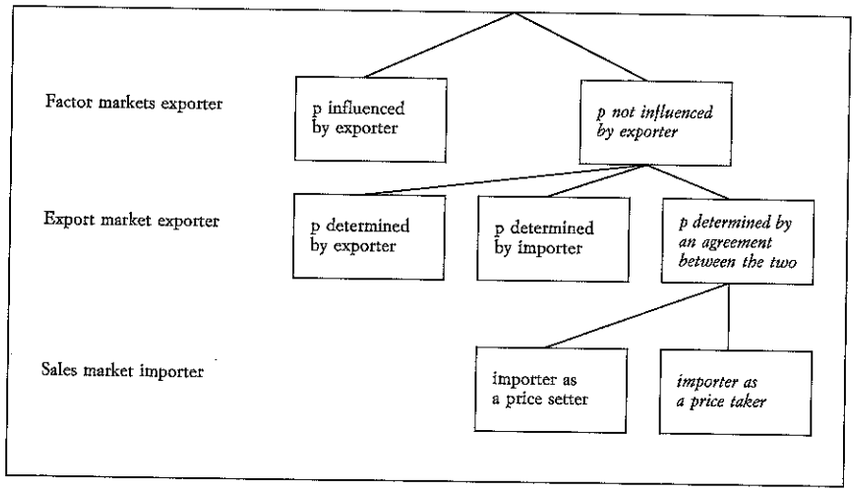
the profit W_t2 of the importer is given by

$$W_t2 = [p_t(2) - p_t(c)\ e_t(2)]\ Q_t \qquad (2)$$

[6] Donnenfeld and Zilcha (1991), pp. 1011 and 1018

FIGURE 1

DIFFERENT SCENARIOS FOR DIFFERENT MARKETS



the total revenue for the exporter $TO_t(1)$ is given by

$$TO_t(1) = [p_t(c)\ e_t(1)]\ Q_t \qquad (3)$$

and the total revenue for the importer $TO_t(2)$ is given by

$$TO_t(2) = p_t(2)\ Q_t \qquad (4)$$

with

W_t1 = profit for the exporter
W_t2 = profit for the importer
$p_t(c)$ = the agreed price expressed in the contract
$p_t(1)$ = the cost price of the exporter
$p_t(2)$ = the sales price of the importer
$e_t(1)$ = the exchange rate of the invoicing currency expressed in the exporter's currency
$e_t(2)$ = the exchange rate of the invoicing currency expressed in the importer's currency
Q_t = the amount of goods expressed in the contract
$TO_t(1)$ = the total revenue for the exporter
$TO_t(2)$ = the total revenue for the importer.

$P_t(c)$ and $p_t(1)$ are assumed fixed, assuming that the products are produced before the contract is signed. This latter assumption will be relaxed. From equation (1), the absolute change in the profit margin for the exporter can be calculated as:

$$d[W_t1/TO_t(1)]\ e_t(1) = \{[p_{t-1}(1)/e_{t-1}(1)] - [p_t(1)/e_t(1)]\}\ e_t(1) \qquad (5)$$

The right and the left side of the equation is multiplied by $e_t(1)$ to make sure that the absolute level of the exchange rate does not influence the results. For the importer, the absolute change in the profit margin can be calculated as:

$$d[W_t2/TO_t(2)]/e_t(2) = \{-\ p_t(c)\ [e_{t-1}(2)/p_{t-1}(2) - e_t(2)/p_t(2)]\}/e_t(2) \qquad (6)$$

Also in this case, both sides of the equation are divided by $e_t(2)$ to make sure that the absolute level of the exchange rate does not influence the results. From equations (5) and (6), one can see that the change in the profit margin for the exporter depends on the exchange rate for the invoicing currency and that the change in the profit margin for the importer depends on the exchange rate for the invoicing currency divided by the sales price of the importer. Apart from the factors shown in these equations to determine the profit margins of the relevant traders, the way in which the invoicing currency is chosen (determined by the exporter, the importer, or on the basis of an agreement between the two parties) is also of critical importance. Finally, the case where the choice of the invoicing currency is determined by an agreement between the two parties (which comes close to a compromise currency) will be analyzed.

Finally, the following distinction between the objectives of the entrepreneur has been made:

1) objective 1: maximizing the growth of the profit margin;

or

2) objective 2: minimizing fluctuations in the growth of the profit margin.

The first objective represents the classical goal of maximizing the profit rate.[7] The second represents a dynamic addition to the objective mentioned by Bilson: to minimize profit fluctuations. We have a situation, here, in which the interests of two individuals are neither

[7] The classical case is profit maximizing. When the quantity is already fixed, however, this comes down to maximizing the profit margin.

completely opposed nor completely coincident. We cannot find a currency that will achieve the objectives of both parties and will therefore follow the suggestion of Nash, who concluded on the basis of an axiomatic approach that the outcome of the negotiating process will be the maximum of the product of the utilities of both partners, if both trader's utilities are equal to zero in the case of a conflict between the traders.[8]

In a process based on negotiations between two parties with different objectives, the optimal compromise currency will have different definitions, if both traders' utilities are equal to zero in the case of a conflict between the traders, namely:

1) the maximum of the product of the profit margin growth; or

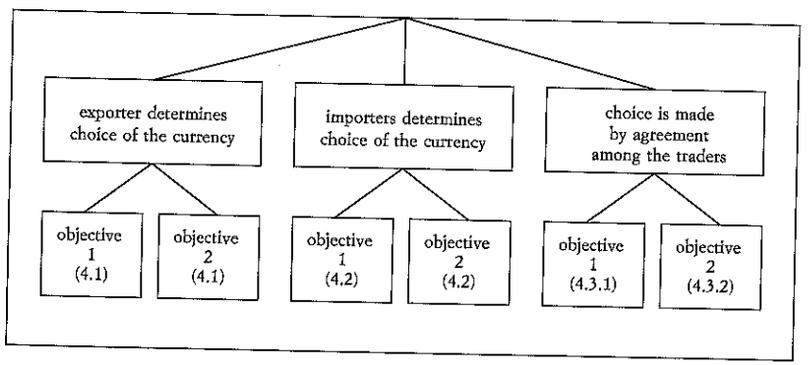
2) the minimum of the product of the standard deviation for the profit margin growth.

In the following, therefore, we calculate the growth of the profit rate and the change in the standard deviation for the profit rate growth with minimization as the goal in the latter case.

In Figure 2 the six cases examined are outlined. The numbers in brackets refer to the sections in which the different cases are analyzed. The six cases are examined under contract periods of three and six months, but to save space only the results for three months are presented here; the outcomes for six months did not differ substantially from the outcomes for three months.

FIGURE 2

THE STRUCTURE OF SECTION 4



[8] Nash (1953), pp. 132 and 133.

The choice of the compromise currency is analyzed under different assumptions about who determines the choice, about the objectives of the trader, and under different contract periods. We assume fixed cost prices for the exporter, fixed contract prices, and an importer who is a price taker on his sales market.

4. The simulations

In this section, the results of simulations are made with different assumptions about who determines the choice of the invoicing currency and with different definitions of the compromise currency as mentioned in the last section. All of the simulations were based on monthly data between January 1983 and November 1990. The data are derived from De Nederlandsche Bank (the Dutch Central Bank), the International Monetary Fund and Eurostat.[9] Since 1983 the performance of the European Rate Mechanism in stabilizing exchange rates has strongly improved. In the simulations six European countries were examined: Belgium, France, Germany, Italy, the Netherlands and the United Kingdom. These countries were chosen because they represent a mix of countries with different currency strengths: a relatively weak currency (Italy, France and Belgium), a strong currency (Germany and the Netherlands) and a weak currency outside the Exchange Rate Mechanism (United Kingdom). By analyzing this combination of countries, it is possible to generalize the conclusions for other weak currencies inside or outside the Exchange Rate Mechanism.

Apart from the local currencies in the countries just mentioned, we also consider developments in the dollar, which is a very important currency in international trade. The costs of the exporter were expressed mostly in his own currency and the revenues of the importer were expressed in his home currency. In addition, it was assumed that the importer sells its goods in his own country and that the development of the sales price follows developments of the consumption price index. Finally, it should be noted that the defi-

[9] De Nederlandsche Bank (1984-1990), International Monetary Fund (1983-1991), Eurostat (1984-1991).

nition of the ECU changed twice, in 1984 and 1989. In Table 1, the different definitions of the ECU are reviewed. In Sections 4.1, 4.2 and 4.3 the outcomes of the simulations are presented, in which the exporter, the importer, or an agreement between the two parties determines the invoicing currency.

TABLE 1

THE DEFINITION OF THE ECU

Currencies	1979	1984	1989
Deutsche Mark	0.828	0.719	0.6242
French Franc	1.15	1.31	1.332
British Pound	0.0885	0.0878	0.08784
Dutch Guilder	0.286	0.256	0.2198
Italian Lira	109.00	140	151.2
Belgian-Luxemburg Franc	3.66	1.45	3.431
Danish Krone	0.217	0.219	0.1976
Irish Pound	0.00759	0.00871	0.008552
Greek Drachma	–	1.15	1.440
Spanish Peseta	–	–	1.393

Sources: Belgische Vereniging der Banken (the Belgian Bank Association; 1985), p. 85; Dewes (1987), p. 87; and N.N. (1989) p. 73.

4.1 *The exporter determines the choice of the invoicing currency*

If the exporter determines the invoicing currency and his objective is to maximize the growth of the profit margin, then the ECU will not be used as the invoicing currency, as can be seen in Table 2. The Italian, German, British and French exporter will choose the Deutshe Mark in such a case. The Belgian exporter will choose the French Franc. And when the contract period is six months, all of the exporters use the Deutsche Mark.[10]

When the objective of the exporter is to minimize fluctuations in the growth of the profit margin, the exporter will opt for his own

[10] Tables for six-month contract periods are available on request.

TABLE 2

THE PROFIT MARGIN FLUCTUATION FOR DIFFERENT EXPORTERS WITH A THREE-MONTH CONTRACT PERIOD
(Calculated from equation 5) (1983-1990)

average 3 months	French exporter	Italian exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	–0.673	–0.428	–1.1912	–0.558	–1.046	–1.1249
BFR	0.385	0.659	–0.1496	0.684	0	–0.0874
DM	0.54	0.815	0	0.842	0.154	0.0633
FRF	0	0.286	–0.521	0.321	0.372	–0.4605
ITL	0.257	0	–0.785	0.018	–0.637	–0.7238
GBP	–0.1	0.171	–0.636	0	–0.489	–0.5755
DFL	0.475	0.751	–0.0616	0.777	0.091	0
ECU	0.213	0.488	–0.319	0.486	–0.169	–0.2574

US$ = dollar, BFR = Belgian Franc, DM = Deutsche Mark, FRF = French Franc, ITL = Italian Lira, GBP = British Pound, DFL = Dutch Guilder, ECU = European Currency Unit.

Sources: Data from De Nederlandsche Bank and Eurostat.

currency, as indicated in Table 3. It should be noted that we are only concerned with fluctuations in the *positive growth* of the profit margin in this case. As can be seen in Table 2, the dollar has a negative growth for all exporters; the British Pound is negative for French exporters, the Italian Lira and the British Pound are negative for Belgian exporters; the French Franc, the Italian Lira and the British Pound are negative for Dutch exporters; and all the currencies are negative for German exporters. These currencies were, therefore, not included in the analyses.

If the cost price of the exporter, $p_t(1)$, is assumed to be flexible instead of fixed, then from the simulations it follows that all exporters prefer the Deutsche Mark, assuming that the objective of the exporter is maximizing profit margin growth. Because the outcomes of the simulations were negative for all the currencies and for every exporter under consideration, the stability of the profit margin growth was not further analysed.

4.2 *The importer determines the choice of the invoicing currency*

As can be seen in Table 4, when the importer decides which invoicing currency will be used and his objective is to maximize the

TABLE 3

THE FLUCTUATIONS OF THE PROFIT MARGIN GROWTH
FOR DIFFERENT EXPORTERS WITH A THREE-MONTH CONTRACT PERIOD
(Standard deviation of the profit margin's change calculated following equation 5) (1983-1990)

Standard deviation 3 months	French exporter	Italian exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	5.823	5.434	5.922	6.0304	5.8456	6.0042
BFR	1.075	1.344	0.639	4.322	0	0.5913
DM	1.297	1.531	0	4.4378	0.642	0.4049
FRF	0	1.575	1.492	4.4452	1.0426	1.0925
ITL	1.556	0	1.251	4.5787	1.3127	1.4661
GBP	4.477	4.6	4.348	0	4.2919	4.3291
DFL	1.121	1.505	0.399	4.4029	0.5923	0
ECU	1.129	1.415	0.847	3.7255	0.7367	0.7852

Sources: Data from De Nederlandsche Bank and Eurostat.

growth of the profit margin, then the choice in all cases is the dollar. For a six-month contract period, the Belgian importer will rely on the Belgian Franc, while all the others will still use the dollar.

When the objective of the importer is to minimize fluctuations in the growth of the profit margin, the Italian importer chooses the Lira; the German importer chooses the Deutsche Mark; the British importer chooses the ECU; the French importer chooses the French Franc; the Belgian importer chooses the Belgian Franc, and the Dutch importer chooses the Guilder, as shown in Table 5. For a six-month contract period, the outcomes change for the British, Belgian and Dutch importers, who use the Belgian Franc, the ECU, and the Deutsche Mark respectively.

4.3 *The choice of the invoicing currency determined by negotiations*

The following describes the outcome of the situation where the compromise currency is determined by an agreement between the

TABLE 4

THE FLUCTUATIONS OF THE PROFIT MARGIN FOR DIFFERENT IMPORTERS
WITH A THREE-MONTH CONTRACT PERIOD (* 0.001)
(Calculation following equation 6) (1983-1990)

average 3 months	French importer	Italian importer	German importer	British importer	Belgian importer	Dutch importer
US$	6.05	4.31	10.70	5.88	9.07	8.67
BFR	2.69	2.41	4.00	2.62	4.30	2.72
DM	2.02	1.97	2.97	1.98	3.41	1.76
FRF	4.22	3.34	6.60	3.97	6.29	5.01
ITL	5.12	4.01	8.30	4.85	7.61	6.58
GBP	4.35	3.37	7.20	4.86	6.63	5.57
DFL	2.31	2.16	3.40	2.24	3.78	2.09
ECU	3.29	1.93	5.20	3.26	5.12	3.73

Sources: Data from De Nederlandsche Bank and Eurostat.

TABLE 5

THE FLUCTUATIONS OF THE PROFIT MARGIN GROWTH FOR DIFFERENT
IMPORTERS WITH A THREE-MONTH CONTRACT PERIOD (* 0.0001)
(Standard deviation of the profit margin change calculated from equation 6) (1983-1990)

Standard deviation 3 months	French importer	Italian importer	German importer	British importer	Belgian importer	Dutch importer
US$	2.08	1.24	3.88	2.11	2.85	3.6
BFR	0.44	0.35	0.51	1.65	0.36	0.55
DM	0.05	0.35	0.36	1.69	0.47	0.47
FRF	0.27	0.42	0.84	1.71	0.62	0.74
ITL	0.64	0.25	1.02	1.74	0.77	1.00
GBP	1.61	1.07	2.85	4.75	2.15	2.58
DFL	0.45	0.36	0.45	1.68	0.48	0.43
ECU	0.04	0.35	0.56	1.45	0.43	0.55

Sources: Data from De Nederlandsche Bank and Eurostat.

parties. As discussed earlier, we assume the outcome of such a negotiation process to be a Nash bargaining solution. Two different cases with two different objective functions will be analysed. The following two functions for the objectives of the exporter were used:

$$U_t e1 = c(1)\ \{d[W_t 1/TO_t(1)]\} \quad (7)$$

and

$$U_t e2 = c(2)\ sd\{d[W_t 1/TO_t(1)]\} \quad (8)$$

where $sd\{d[W1/TO(1)]\}$ is the standard deviation for the growth of the profit margin of the exporter, c(1) and c(2) are constant and $U_t e1$ and $U_t e2$ are the objectives of the exporter.

The different functions for the objectives of the importer were the following:

$$U_t i1 = c(1)\ [d(W_t 2/TO_t(2)] \quad (9)$$

and

$$U_t i2 = c(2)\ sd[d(W_t 2/TO_t(2)] \quad (10)$$

where $sd\{d[W_t 2/TO_t(2)]\}$ is the standard deviation for the growth of the profit margin of the importer and $U_t i1$ and $U_t i2$ are the objectives of the importer.

In Section 4.3.1, the case which attempts to maximize the product of the objective functions in equations (7) and (9), is based on the following equation:

$$\max.\ [(U_t e1 - Ue1d)\ (U_t i1 - Ui1d)] = c(1)^2\ \{d[e_t(1)]\}\ \{-p_t(c)d[e_t(2)/p_t(2)]\} \quad (11)$$

where c(1) and $p_t(c)$ are constant and Ue1d and Ui1d are the utilities of the two traders in case of a conflict. Ue1d and Ui1d are zero in equation (11), because profits are zero if the traders do not agree on the choice of the invoicing currency.

In Section 4.3.2, the case where it is attempted to minimize the product of the standard deviations for the two traders is based on the following equation:

$$\min.\ [(U_t e2 - Ue2d)(U_t i2 - Ui2d)] = c(2)^2\ sd[d(W_t 1/TO_t(1)]\ sd[d(W_t 2/TO_t(2)] \quad (12)$$

$U_t e2d$ and $U_t i2d$ are the utilities of the two traders in case of a conflict. Ue2d and Ui2d are zero in equation (12), because profits are zero if the traders do not agree on the choice of the invoicing currency. Note that cases in which a currency showed a negative growth were not considered in this analysis.

4.3.1 *The optimal compromise currency as the maximum of the product of the growth rates of the profit margins of the exporter and importer*

From Table 6 and Appendix 1, it is possible to derive the currency that maximizes the product of the growth rates for the profit margins of the exporter and the importer. Given an Italian exporter and a French importer, the optimal compromise currency will be the Deutsche Mark. Given a German exporter and a French importer, the optimal currency will also be the Deutsche Mark. The ECU is *not* selected as a compromise currency, even for six-month contract periods.

4.3.2 *The optimal compromise currency as the minimum of the product of the fluctuation of the growth rate of the profit margins for the importer and the exporter*

In Table 7, the product of the standard deviations of the profit margins for both traders are presented. As can be seen, the exporter's currency is always the optimal compromise currency for a contract period of three months. The ECU will *not* be used as a compromise currency.

For a contract period of six months, a consistent pattern of choice is once again visible; however, the ECU will not be selected as compromise currency. This can be seen in Tables 7 and 2.1-2.5 in Appendix 2.

4.4 *Summary*

To whom is the ECU attractive as an invoicing currency according to the simulations, and what is the reason for this attract-

TABLE 6

A COMPROMISE BETWEEN A FRENCH IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT MARGIN
(Calculation following equation 11) (1983-1990)*,[11]

French importer	Italian exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	0.575461	–0.19236	0.444674	–0.04628	–0.12566
BFR	1.663463	0.852688	1.68853	1.00269	0.915055
DM	1.818666	1.00202	1.845721	1.156331	1.065448
FRF	1.291427	0.481021	1.326575	1.37779	0.541777
ITL	1.00512	0.216101	1.023212	0.364859	0.277614
GBP	1.176094	0.365583	1.00435	0.513223	0.426347
DFL	1.755045	0.940568	1.781105	1.09352	1.00231
ECU	1.492896	0.68324	1.490889	0.833734	0.745043

* Average 3 months.
Sources: Data from De Nederlandsche Bank and Eurostat.

TABLE 7

A COMPROMISE BETWEEN A FRENCH IMPORTER AND ITS TRADE PARTNERS OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT MARGIN GROWTH, THREE-MONTH CONTRACT PERIOD[1]
(Calculation following equation 12) (1983-1990)

French importer	Italian exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	6.435338	6.92344	7.031862	6.847024	7.005657
BFR	2.344103	1.639072	5.322234	1.000044	1.59137
DM	2.531127	1.00005	5.438072	1.642082	1.40497
FRF	2.57507	2.492067	5.445347	2.042655	2.092556
ITL	1.000064	2.251144	5.579057	2.312848	2.466258
GBP	5.600902	5.348861	1.000161	5.292752	5.329958
DFL	2.505113	1.399063	5.403143	1.592372	1.000045
ECU	2.415097	1.847074	4.725689	1.736769	1.785271

[1] Standard deviations 3 months.
Sources: Data from De Nederlandsche Bank and Eurostat.

[11] To make it possible to show the influence of the importer when the exporter currency is used, one is added to all the outcomes of Tables 2-5. In Table 6, for instance, the product of (1 + outcome of the French importer in Table 4) times (1 + outcome of all the exporters in Table 2). Otherwise, the outcome of the product will always be zero, because the fluctuation of the exporter currency for the exporter is zero. This addition has no influences on the outcomes.

iveness? If both the exporter's and the importer's objective is to minimize fluctuations in the growth rate of the profit margin, the ECU will be attractive for a British importer with a three-month contract period, provided that he determines the invoicing currency. The Belgian importer should only select the ECU for a six-month contract period. In Table 1.1 in Appendix 1 these conclusions are summarized. The ECU is used in countries with relatively weak currencies, such as the United Kingdom and, to a lesser extent, Belgium. The ECU is used as an invoicing currency because it is a strong and stable currency.

5. Conclusions

The objective of this article was to explain the use of the ECU as invoicing currency in the period 1983-1990 by simulations of a theoretical model. It was found from the literature on the invoicing currency that the choice of the currency depended on the fluctuations in the invoicing currency and the effects of such fluctuations on the profits of the exporter and the importer. The choice of currency also depended on fluctuations in cost and sales prices for the exporters and importers respectively. In addition, the objectives of the exporter and the importer were found to influence the choice of an invoicing currency. These factors determining the invoicing currency were incorporated in a theoretical model.

From simulations of this theoretical model, it followed that the ECU would be used by British and Belgian importers, for three-month and six-month contracts respectively, with the objective of minimizing the fluctuations in profit margin growth. The ECU was used as an invoicing currency because it appeared to be a strong currency compared to the Pound and the Belgian Franc, and because the ECU was a stable currency. The latter characteristic only appeared to be relevant for importers. This analysis suggests that reductions in transaction costs due to the availability of a single currency were not sufficient in the period 1983-1990 to offset preferences for invoicing in national currencies.

APPENDIX 1*

TABLE 1.1

A COMPROMISE BETWEEN AN ITALIAN IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE LEVEL OF THE PROFIT MARGIN[1]
(calculation following equation 11) (1983-1990)

Italian importer	French exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	0.328409	-0.19202	0.443905	-0.0462	-0.12544
BFR	1.388338	0.852449	1.688058	1.00241	0.914799
DM	1.543034	1.00197	1.845629	1.156273	1.065395
FRF	1.00334	0.4806	1.325412	1.376582	0.541302
ITL	1.262041	0.215862	1.022082	0.364456	0.277308
GBP	0.903033	0.365227	1.00337	0.512722	0.425931
DFL	1.478186	-0.940427	1.780838	1.093357	1.00216
ECU	1.215341	0.682314	1.488868	0.832604	0.744033

[1] Average 3 months.

TABLE 1.2

A COMPROMISE BETWEEN A GERMAN IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE LEVEL OF THE PROFIT MARGIN[1]
(calculation following equation 11) (1983-1990)

German importer	French exporter	Italian exporter	British exporter	Belgian exporter	Dutch exporter
US$	0.330499	0.57812	0.446729	-0.04649	-0.12624
BFR	1.39054	1.665636	1.690736	1.004	0.91625
DM	1.544574	1.820391	1.847471	1.157427	1.066458
FRF	1.0066	1.294488	1.329719	1.381055	0.543061
ITL	1.267433	1.0083	1.026449	0.366013	0.278492
GBP	0.90648	1.179431	1.0072	0.514679	0.427556
DFL	1.480015	1.756953	1.783042	1.094709	1.0034
ECU	1.219308	1.495738	1.493727	0.835321	0.746462

[1] Average 3 months.

* Data from De Nederlandsche Bank and Eurostat. For the explanation of the symbols, see Table 2 on p. 61.

TABLE 1.3

A COMPROMISE BETWEEN A BRITISH IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE LEVEL OF THE PROFIT MARGIN[1]
(calculation following equation 11) (1983-1990)

British importer	French exporter	Italian exporter	German exporter	Belgian exporter	Dutch exporter
US$	0.328923	0.575363	-0.19232	-0.04627	-0.12563
BFR	1.388629	1.663347	0.852628	1.00262	0.914991
DM	1.543049	1.818594	1.00198	1.156285	1.065405
FRF	1.00397	1.291105	0.480902	1.377447	0.541642
ITL	1.263096	1.00485	0.216043	0.364761	0.27754
GBP	0.904374	1.176691	0.365769	0.513483	0.426563
DFL	1.478304	1.754922	0.940502	1.093444	1.00224
ECU	1.216954	1.492851	0.68322	0.833709	0.745021

[1] Average 3 months.

TABLE 1.4

A COMPROMISE BETWEEN A BELGIAN IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE LEVEL OF THE PROFIT MARGIN[1]
(calculation following equation 11) (1983-1990)

Belgian importer	French exporter	Italian exporter	German exporter	British exporter	Dutch exporter
US$	0.329966	0.577188	-0.19293	0.446009	-0.12603
BFR	1.390956	1.666134	0.854057	1.691241	0.916524
DM	1.545251	1.821189	1.00341	1.848281	1.066926
FRF	1.00629	1.294089	0.482013	1.329309	0.542893
ITL	1.266566	1.00761	0.216636	1.025747	0.278302
GBP	0.905967	1.178764	0.366413	1.00663	0.427314
DFL	1.480576	1.757619	0.941947	1.783717	1.00378
ECU	1.219211	1.495619	0.684487	1.493608	0.746402

[1] Average 3 months.

TABLE 1.5

A COMPROMISE BETWEEN A DUTCH IMPORTER AND ITS TRADE PARTNERS.
OBJECTIVE: THE FLUCTUATIONS OF THE LEVEL OF THE PROFIT MARGIN[1]
(Calculation following equation 11) (1983-1990)

Dutch importer	French exporter	Italian exporter	German exporter	British exporter	Belgian exporter
US$	0.329835	0.576959	-0.19286	0.445832	-0.0464
BFR	1.388767	1.663512	0.852713	1.68858	1.00272
DM	1.54271	1.818194	1.00176	1.845242	1.156031
FRF	1.00501	1.292443	0.4814	1.327618	1.378874
ITL	1.265271	1.00658	0.216415	1.024698	0.365389
GBP	0.905013	1.177522	0.366027	1.00557	0.513846
DFL	1.478083	1.75466	0.940361	1.780714	1.09328
ECU	1.217524	1.49355	0.68354	1.491543	0.8341

[1] Average 3 months.

APPENDIX 2*

TABLE 2.1

A COMPROMISE BETWEEN AN ITALIAN IMPORTER AND ITS TRADE PARTNERS.
OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT-MARGIN GROWTH,
THREE-MONTH CONTRACT PERIOD[1]
(calculation following equation 12) (1983-1990)

Italian importer	French exporter	German exporter	British exporter	Belgian exporter	Dutch exporter
US$	1.058361	6.922858	7.031272	6.846449	7.005069
BFR	1.010785	1.639057	5.322186	1.000035	1.591356
DM	1.013005	1.000035	5.43799	1.642057	1.404949
FRF	1.000042	2.492105	5.445429	2.042686	2.092588
ITL	1.015585	2.251056	5.578839	2.312758	2.466162
GBP	1.044882	5.348572	1.000107	5.292466	5.32967
DFL	1.011246	1.39905	5.403095	1.592357	1.000036
ECU	1.011325	1.847065	4.725665	1.736761	1.785262

[1] Average 3 months.

TABLE 2.2

A COMPROMISE BETWEEN A GERMAN IMPORTER AND ITS TRADE PARTNERS.
OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT-MARGIN GROWTH,
THREE-MONTH CONTRACT PERIOD[1]
(calculation following equation 12 (1983-1990)

German importer	French exporter	Italian exporter	British exporter	Belgian exporter	Dutch exporter
US$	1.058641	6.436496	7.033128	6.848256	7.006918
BFR	1.010802	2.34412	5.322271	1.000051	1.591381
DM	1.013006	2.531091	5.437996	1.642059	1.404951
FRF	1.000084	2.575216	5.445657	2.042772	2.092676
ITL	1.015664	1.000102	5.579269	2.312936	2.466352
GBP	1.045068	5.601596	1.000285	5.293408	5.330619
DFL	1.011256	2.505113	5.403143	1.592372	1.000045
ECU	1.011347	2.415135	4.725765	1.736797	1.7853

[1] Standard deviation 3 months.

* Data from De Nederlandsche Bank and Eurostat. For the explanation of the symbols see Table 2 on p. 61.

TABLE 2.3

A COMPROMISE BETWEEN A BRITISH IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT-MARGIN GROWTH, THREE-MONTH CONTRACT PERIOD[1]
(calculation following equation 12) (1983-1990)

British importer	French exporter	Italian exporter	German exporter	Belgian exporter	Dutch exporter
US$	1.058453	6.435358	6.923461	6.847044	7.005678
BFR	1.010917	2.344387	1.63927	1.000165	1.591563
DM	1.013141	2.531428	1.000169	1.642277	1.405137
FRF	1.000171	2.57544	2.492426	2.042949	2.092858
ITL	1.015737	1.000174	2.251392	2.313102	2.466529
GBP	1.045266	5.60266	5.35054	5.294414	5.331631
DFL	1.01138	2.505421	1.399235	1.592568	1.000168
ECU	1.011437	2.41535	1.847268	1.736952	1.785459

[1] Standard deviation 3 months.

TABLE 2.4

A COMPROMISE BETWEEN A BELGIAN IMPORTER AND ITS TRADE PARTNERS. THE FLUCTUATIONS OF THE PROFIT-MARGIN GROWTH, THREE-MONTH CONTRACT PERIOD[1]
(calculation following equation 12) (1983-1990)

Belgian importer	French exporter	Italian exporter	German exporter	British exporter	Dutch exporter
US$	1.058532	6.435834	6.923973	7.032404	7.006196
BFR	1.010786	2.344084	1.639059	5.322192	1.591357
DM	1.013018	2.531119	1.000047	5.438056	1.404966
FRF	1.000062	2.57516	2.492155	5.445538	2.09263
ITL	1.015638	1.000077	2.251173	5.57913	2.46629
GBP	1.044995	5.601204	5.34915	1.000215	5.330246
DFL	1.011259	2.50512	1.399067	5.403159	1.000048
ECU	1.011333	2.415104	1.847079	4.725703	1.785277

[1] Standard deviation 3 months.

TABLE 2.5

A COMPROMISE BETWEEN A DUTCH IMPORTER AND ITS TRADE PARTNERS. OBJECTIVE: THE FLUCTUATIONS OF THE PROFIT-MARGIN GROWTH, THREE-MONTH CONTRACT PERIOD[1]
(calculation following equation 12) (1983-1990)

Dutch importer	French exporter	Italian exporter	German exporter	British exporter	Belgian exporter
US$	1.058611	6.436316	6.924492	7.032931	6.848064
BFR	1.010806	2.344129	1.63909	5.322293	1.000055
DM	1.013018	2.531119	1.000047	5.438056	1.642077
FRF	1.000074	2.575191	2.492184	5.445603	2.042751
ITL	1.015662	1.0001	2.251225	5.579258	2.312931
GBP	1.04504	5.601445	5.34938	1.000258	5.293265
DFL	1.011253	2.505108	1.39906	5.403132	1.592368
ECU	1.011346	2.415133	1.847102	4.72576	1.736796

[1] Standard deviation 3 months.

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