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THE SWEDISH PAYMENTS SYSTEM AND THE UNDERGROUND ECONOMY

by

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10.1 Introduction.

When physicists make conjectures concerning the existence of a heretofore unobserved particle or energy source whose presence would challenge some current interpretations of natural laws, such claims are met with a mixture of excitement and skepticism. The excitement is engendered by the possibility that a new discovery will help to resolve observed anomalies within a broader conceptual framework. The skepticism is motivated by the lack of precision that characterizes the statement of newly formulated hypotheses, and by the absence of reliable empirical observations for verification.

Economists have recently drawn attention to the possibility that there exists a large and growing "underground economy" that has eluded the observational domain of professional economists. This conjecture, referred to as the "unobserved income hypothesis", has has generated great interest and controversy. The interest is sparked by the possibility that the hypothesis will help to explain and correct some of the predictive failures of current macroeconomic analysis. Moreover, the hypothesis has direct relevance to some of the major policy issues of the day: growing government deficits, declining productivity and real economic growth, high rates of interest and socially unacceptable levels of unemployment. The controversy, surrounding the issue of the "underground " economy is motivated by the lack precision in defining the domain of underground economic activity, and by the now apparent shortcomings of the initial empirical efforts to establish estimates of its size and growth.

The major purpose of this study is develop and implement a general framework of analysis that is broad enough to incorporate meaningful notions of "underground" economic activity into the conventional apparatus used to classify and analyse regular economic activity. The conceptual development is made operational by efforts to estimate the magnitude of underground activities in Sweden over the period 1956 - 1982. Sweden is thought to be an excellent experimental laboratory for this type of work. The Swedish economy confronts among the highest marginal tax rates of any country in the world. There are surely adequate economic incentives to encourage participation in "underground" economic activities. Moreover, Sweden is endowed with a data base that is of high quality and is reasonably extensive.

Alternative measures of the size of the "underground economy" have revealed a wide range of estimates of its magnitude. These apparent inconsistencies suggest not only the difficulty of attempting to estimate a phenomenon whose raison d'etre is to defy detection, but more importantly, the fact that the different measures are incommensurable since they are estimates of different conceptual entities. Recent efforts have been devoted to the elaboration of different notions of "underground income" and to the reconciliation of diverse empirical measures.[1] One of the key ambiguities which plagues the literature on the underground economy is the repeated confusion between economic and fiscal concepts of income. All too often, the under-recording of income in the National

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1. See Feige, E. "The Meaning of the Underground Economy and the Full Compliance Deficit" in Gaertner, A and Wenig, A The Economics of the Shadow Economy Springer-Verlag 1985.

Income and Product Accounts (NIPA) has been erroneously identified with the issue of tax evasion. The approach followed in the present study, lays the groundwork for the final estimation of both unrecorded income and unreported income. Estimates of these particular measures of "underground income" must, however, await the determination of "total unrecorded transactions" which is the immediate focus of the investigation.

The major portion of the study departs from the conventional post Keynesian concentration on income, and alternatively, elaborates the more general Fisherian framework for analysing economic activity by means of the equation of exchange. The equation of exchange is a high order identity that highlights the dual nature of exchange in a monetary economy. For every monetary payment, there is an equivalent real transaction. From this perspective, "money is, what money does", namely, it serves as the economy's medium of exchange. According to the equation of exchange, the aggregate of monetary payments must be identical to the aggregate of real transactions.

The classification, measurement and analysis of the transactions side of economic activity has been the dominant activity of macroeconomists for the last half century. By contrast, there has been no comparable effort to classify, disaggregate and measure economic activity from the perspective of monetary payment flows. Since the veracity of the conventional transactions side measures of economic activity are now being challenged by the "unobserved income hypothesis", it is particularly important to develop an independent measure of economic activity that can serve as a check on the completeness and accuracy of the transactions measures that provide the empirical foundations for all current macroeconomic analysis. As will be developed below, a money payments measure of gross economic activity includes all transactions in the economy that are mediated by the medium of exchange. A natural operational definition of the "underground" economy is therefore, the residual difference between the sum of all monetary payments and the sum of all measured transactions. This residual reflects "unrecorded transactions". If an acceptable measure of unrecorded transactions reveals that they represent a significant portion of total economic activity, and, that they vary independently of recorded economic activity, then they surely merit greater attention. Once we have an aggregate measure of unrecorded transactions, methods must be found to decompose those transactions into their natural counterparts in the recorded economy. For macroeconomic analysis, these will include estimates of unrecorded economic income, consumption, savings and investment. For fiscal analysis, measures of unreported fiscal income are required as well as estimates of concomitant losses of tax revenue.

The major portion of this study is devoted to the task of providing a preliminary estimate of the monetary payments side of economic activity, and attempting to reconcile this measure with available estimates of the transactions side of the economy. While the focus of the analysis is the ultimate measurement of unrecorded transactions, (the "underground economy") it is hoped that a detailed development of the payments side of the economy, will be of general interest in its own terms. National Income accountants can view this exercise as a means of imposing a higher order identity on conventional accounting systems. Monetary economists, will hopefully discover that the full application of monetary theory to economic activity can only be brought to fruition once the monetary payments side of the economy has been developed as extensively as the transactions side. The elaboration and estimation of both sides of the equation of exchange will hopefully bring us closer to the long sought goal of a general conceptual framework that fully integrates the perspectives of monetary and value theory. The conjecture that guides this study, is, that economic activity can most fruitfully analysed from the dual perspectives of monetary payments and real transactions. The payments and transactions that are directly related to production of final goods and services make up a subset of the aggregate of payments and transactions suggested by the equation of exchange.

We begin the study with an overview of the Swedish system of payments. This lays the groundwork for estimates of the total sum of monetary payments in the Swedish economy (MV). We then turn our attention to task of constructing comparable estimates of total transactions in Sweden (PT). The difference between MV and PT, then represents the sum of unrecorded transactions.

10.2 An Overview of the Payments System of Sweden

The Swedish payments system utilizes three assets that serve the medium of exchange function. These are currency, bank deposits that require no notice for withdrawal of funds and post giro demand deposits. Throughout this study, the money supply is defined as the sum of the stock of assets that serve as media of exchange. The Swedish money supply is therefore composed of currency and demand deposits in banks and in the postal giro system.

The payment system in Sweden, is representative of payments systems in many northern European countries, but is very different from the payments system in the United States. Whereas, the U.S payments system relies primarily on check payments effected through a network of more than 1500 banks, the Swedish system, like that of the Netherlands, relies on a highly centralized giro system that operates primarily through the Post Giro Service. Banking services are concentrated in the hands of three or four major banking institutions, which have established their own independent and competitive bank giro services through the Bank Giro Center. The bank giro system was established in the late 1950's and has grown significantly over the last twenty five years. Nevertheless, it still accounts for less that 15% of the total giro transactions in Sweden.

The primary payment mechanism in Sweden is the automated paperless transfer of funds between giro account holders. Unlike the payments system in the United States, which relies primarily on the physical clearing of checks drawn against bank deposit balances, check payments in Sweden play only a minor role in effecting payments. Instead, payments are effected through a complex and highly computerized system of inpayments, outpayments and transfers between giro account holders. [2]

The oldest and by far the largest payment system is the Post Giro. It was established in 1925 and served its customers throughout Sweden by offering services at post offices in different localities. [3] The term "giro" meaning circulation, was chosen as the name for the postal payments system to denote the continual flow of remittances between giro accounts. These paperless inter-account transfers are entirely computerized, making Sweden's payments settlement system one of the fastest and most efficient in the world. It may therefore seem paradoxical, that despite the system's emphasis on paperless transfer payments, currency functions as a vital medium of exchange throughout the Swedish payments system.

10.2.1 The Swedish Payments Matrix

In order to apply the Payment—Transaction (PT) method of estimating the size and growth of the unrecorded economy, it is first necessary to calculate the total volume of payments (MV) which

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2. Detailed descriptions of the Swedish payments mechanisms are found in :Payments Systems in Eleven Developed Countries, Bank for International Settlements February, 1980 and in Banking Systems Abroad, Inter—Bank Research Organization London April, 1978

3. For a historical review of the development of the Post Giro see, Postal Giro 50 Years Postgirot, Stockholm 1976. A full description of the regulations and services offered by the Post Giro can be found in Regulations governing Post Girot: The Swedish Postal Giro Service Post Girot Stockholm 1980

are effected by each of the medium of exchange assets. The total volume of payments, (MV), is given as:

$$M \cdot V = C \cdot V^{c} + P \cdot V^{p} + B \cdot V^{b} \qquad (10.2.1)$$

where:

C = Currency in the hands of the public

V_{c} = Velocity or annual turnover of the currency stock

P = Post Giro deposits

V^{p} = Velocity or annual turnover of Post Giro deposits

B = Demand deposits in the banking system

V^{b} = Velocity or annual turnover of bank demand deposits

M = Total stock of money

V = Velocity of circulation of the money stock

The payments system in Sweden is comprised of three main components:

1) payments effected by means of cash,

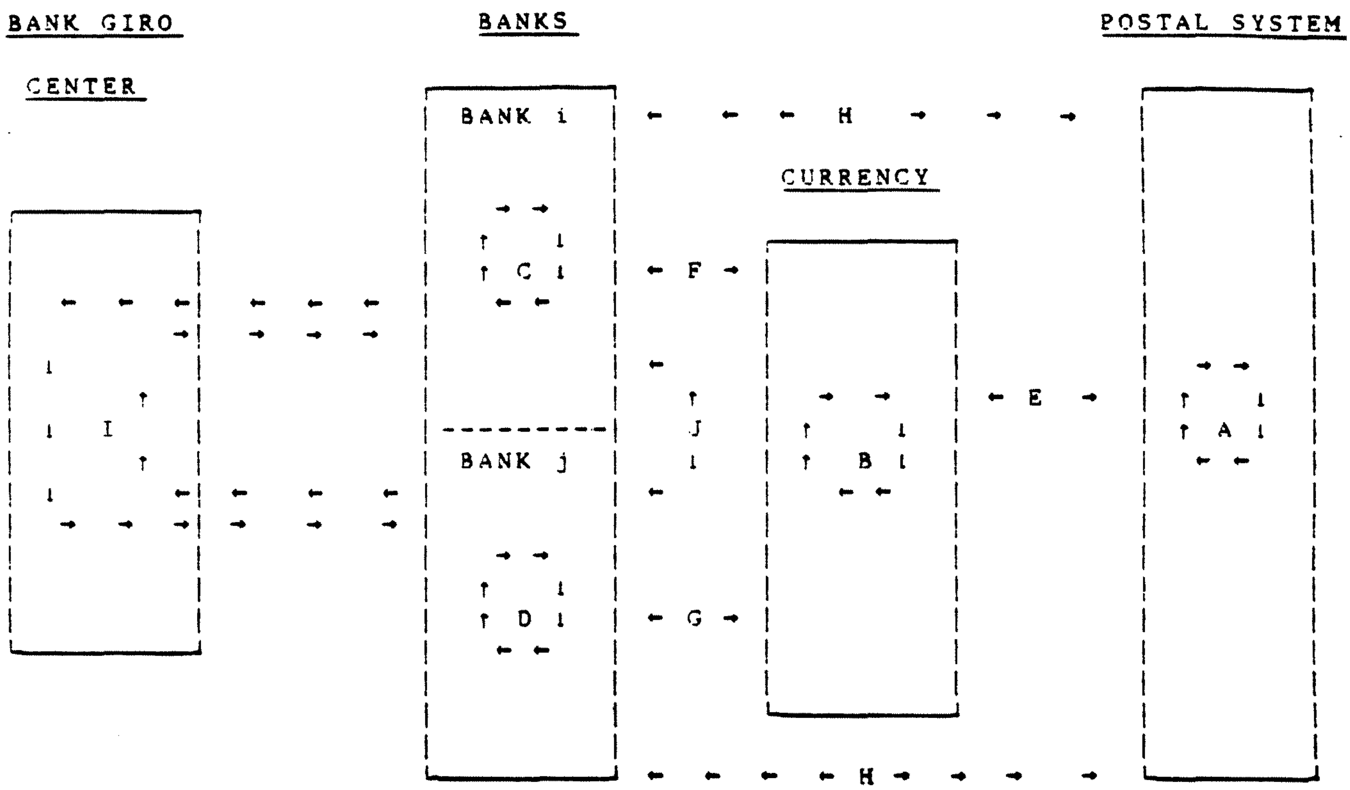
2) payments effected via the post giro system,

3) payments effected via the bank giro system.

Any effort to measure the total flow of payments in the Swedish economy requires that account be taken of the various flows which take place both within and between the major components of the payments system. Figure (10.2.1) presents an overview of the Swedish payments system which identifies the the flows of payments which link the financial institutions.

Figure 10.2.1

SCHEMA OF SWEDISH PAYMENT FLOWS



Final payments in the system can only be effected by the use of currency, postal giro deposits or bank deposits. The system is therefore decomposed into a currency subsystem, a bank subsystem and a postal subsystem. Figure (10.2.1) depicts all of the payment flows within and between the various subsystems. Payments within a subsystem are described as transfers, whereas payments between the subsystems are described as either inpayments to, or outpayments from a subsystem. The particular flows in Figure (10.2.1) which must be accounted for in order to construct a total payments aggregate are described as follows:

A: These payments represent giro transfers between account holders of the Post giro system. The payor's account is debited and the payee account is credited, and the total volume of debits are recorded as post giro transfers (P_r)

B: These payments represent direct payment of currency for goods, services and the acquisition of real and financial assets. The total volume of such payments are represented by C^g.

C and D: These payments represent intra-bank transfers between accounts held by individuals and firms within a particular bank. These intra bank payments are denoted B_w^i and B_w^j respectively, and the sum of all such intra bank transactions is B_w.

E: Cash can enter the post giro system via a variety of services offered by the post giro system.[4] Similarly, cash

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4. For example, many companies preprint bills which are sent to customers on a "C" inpayment card. The amount due can be paid in cash by the customer at any post office. The payment is automatically recorded by optical recognition equipment (OCR) and the company account is credited when the payment record is received

outpayments or withdrawals can be made at post offices with the use of outpayment cards which provide the records required to debit the appropriate post giro account by the amount paid out in cash. Such payments or withdrawals are recorded in the inpayment and outpayment statistics of the post giro system and are here denoted $P_n^c = C_o^p$. The symbols P and C denote the medium of exchange involved (post giro and currency, respectively) whereas the superscripts denote either the destination or the origin of a payment. The subscripts denote the direction of the payment flow, where n represents an inpayment and o represents an outpayment to or from the specified medium of exchange. Thus, C_o^p represents an outpayment from currency destined to a post giro account. This same payment, when viewed from the perspective of the post giro system is recorded as P_n^c, an inpayment to the post giro from currency which is outside the post giro system.

F and G: In similar fashion, the payment flows, F and G are either currency inpayments to the banks (B_{ni}^c and B_{nj}^c) or outpayments of currency from the banks (B_{oi}^c and B_{oj}^c). Seen from the perspective of the currency holder, these flows represent deposits (C_o^{bi} and C_o^{bj}) and withdrawals (C_n^{bi} and C_n^{bj}).

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by the post giro. Similarly, there are "A" and "B" inpayment cards which permit customers to pay cash at the post office in order to make payment on the delivery or order of merchandise.

H: Although the bank giro and the post giro function as separate payments systems, without any formal mechanisms for direct transfers of funds between bank and post accounts, various transfers are effected and recorded as inpayments or outpayments by each of the separate systems. Inpayments from the banks to the postal giro are denoted by $P_n^b = B_o^p$ and similarly, outpayments from the post giro system to the banks are denoted as $P_o^b = B_n^p$.

I: The Bank Giro Center functions as the clearing agent for inter-bank transfers and all payments effected by means of bank deposit accounts in bank i to accounts in bank j are settled via the Bank Giro Center. These inter-bank transfers are denoted by B_r.

J: Prior to the establishment of the Bank Giro Center, inter-bank transfers were made between banks and such settlements are denoted by B_d. As the Bank Giro Center grew in importance, attracting more and more banks to its transfer service, B_r grew at the expense of B_d.

Since payments within and between each of the media of exchange subsystems generate both credit and debit entries, care must be taken to avoid double counting of payments. Table (10.2.2) contains a matrix of payments which separately identifies all credit and debit entries for each medium of exchange.

The payments matrix makes it possible to define the total volume of payments from two different perspectives, namely, the sum

Figure 10.2.2

PAYMENTS MATRIX FOR SWEDEN

CREDITS

DEBITS	CURRENCY	POST GIRO	BANK i	BANK j
CURRENCY	C^g	$P^c_n = C^p_o$	$B^c_{ni} = C^{bi}_o$	$B^c_{nj} = C^{bj}_{op}$
POST GIRO	$P^c_o = C^p_n$	P_r	$P^{bi}_o = B^p_{ni}$	$P^{bj}_o = B^p_{nj}$
BANK i	$B^c_{oi} = C^{bi}_n$	$B^p_{oi} = P^{bi}_n$	B^i_w	$B^i_r + B^i_d$
BANK j	$B^c_{oj} = C^{bj}_n$	$B^p_{oj} = P^{bj}_n$	$B^j_r + B^j_d$	B^j_w

of all payment credits and the sum of all payment debits.

The first method of constructing a total payment aggregate, relies on the summation of all debit entries for each medium of exchange. Double counting of payments is avoided by only considering debit entries for inclusion in the total payment aggregate. The horizontal summation for each row in Figure (10.2.2) represents the total debits accruing to each category of exchange media. The summation of debits over each medium of exchange then represents one means of obtaining the total sum of payments (MV) in the system.

Summing the debits to each of the media of exchange in the payments matrix, produces the formulas which are necessary to calculate the payments effected by each medium of exchange. Thus:

$$C \cdot V_T^{c} = C^{g} + C_o^{p} + C_o^{b} \qquad (10.2.2)$$

$$P \cdot V^{p} = P_o^{c} + P_r + P_o^{b} \qquad (10.2.3)$$

$$B \cdot V^{b} = B_o^{c} + B_p^{o} + B_w + B_r + B_d \qquad (10.2.4)$$

Defining:

$$P_o = P_o^{c} + P_o^{b} \qquad (10.2.5)$$

$$B_o = B_o^{c} + B_p^{o} \qquad (10.2.6)$$

$$\pi = C_o^{p} + C_o^{b} \qquad (10.2.7)$$

the total volume of system payments can be expressed as:

$$M \cdot V = C^{g} + \pi + P_o + P_r + B_o + B_r + B_d + B_w \qquad (10.2.8)$$

where,

C^{g} = Total cash payments for goods

π = Total Cash deposits

P_o = Total Post Giro outpayments

P_r = Total Post Giro transfers

B_o = Total Bank Giro outpayments

B_r = Total Bank Giro transfers

B_d = Direct bank transfers

B_w = Within bank transfers

Alternatively, the total payments in the system can be defined in terms of the sum of credit entries in the payments matrix. In this case, credits to each of the media of exchange are expressed as:

$$C \cdot V^c = C^g + P_o^c + B_o^c \qquad (10.2.9)$$

$$P \cdot V^p = P_n^c + P_r + P_n^b \qquad (10.2.10)$$

$$B \cdot V^b = B_n^c + B_n^p + B_w + B_r + B_d \qquad (10.2.11)$$

and total payments are defined as:

$$M \cdot V = C^g + T + P_n + P_r + B_n + B_w + B_r + B_d \qquad (10.2.12)$$

where:

T = Total cash withdrawals

P_n = Total Post Giro inpayments

B_n = Total Bank Giro inpayment

Figure 10.2.3

TOTAL DEBITS and CREDITS

	TOTAL CREDITS	TOTAL DEBITS
CURRENCY	$C^g + \tau$	$C^g + \pi$
POST GIRO	$P_n + P_r$	$P_o + P_r$
BANKS	$B_n + B_w + B_r + B_d$	$B_o + B_w + B_r + B_d$
TOTAL PAYMENT CREDITS	$C^g + \tau + P_n + P_r + B_n + B_r + B_w + B_d$	
TOTAL PAYMENT DEBITS	$C^g + \pi + P_o + P_r + B_o + B_r + B_w + B_d$	

The final equations for estimating the credit and debit payments for each medium of exchange are displayed in Figure (10.2.3). Both methods of defining total payments, must in princple yield similar results, however, the double entry accounting of payments is useful since a number of the component flows must be estimated rather than be obtained from readily available data sources. As such, the actual tabulations of credit and debit payments are unlikely to be equal in practice, as a result of statistical discrepancies in the estimates of some of the separate components. The preferred method of estimating total payments, therefore depends upon the method of data capture in the payments system. Since estimation of the components of the payment aggregate is complex, we devote each of the following sections to an explanation of how each separate component is measured.

10.3 The Estimation of Currency Payments

One of the most intractable problems in the area of monetary economics continues to be the question of how to estimate the volume of cash payments. Since the stock of currency (C), is well defined and easily measured, the estimation of total cash payments $(C \cdot V^c)$ reduces to the problem of estimating the number of times the average unit of currency turns over in any given period. he question can be traced back to Jevons who in 1875 wrote:

> "I have never met with any attempt to determine in any country the average rapidity of circulation, nor have I been able to think of any means whatever of approaching the investigation of the problem, except in the inverse way. If we knew the amount of exchanges effected, and the quantity of currency used, we might get by division the average number of times the currency is turned over; but... the data are quite wanting"[1]

The implications of the intellectual barrier established by the absence of a viable method for estimating V^c can not be underestimated. For example, the modern version of the quantity

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1. Jevons, W. S. Money and the Mechanism of Exchange (1875) quoted in Selden, R. "Monetary Velocity in the United States" in Friedman, M. ed. Studies in the Quantity Theory of Money The University of Chicago Press, 1956.

theory of money,[2] although intellectually rooted in Fisher's pioneering elaboration of the Equation of Exchange,[3] departs from Fisher's emphasis on monetary flows, and reformulates the theory in terms of the stock of money. This emphasis on monetary stocks rather than payment flows, has left modern monetary theory lacking in its ability to adequately predict prices and income. The emphasis on money stocks rather than on transactions flows relegates, the critical effects of changes in payment velocity to a conceptual limbo.

The central role of V^c was clearly recognized by Fisher, who in 1909 proposed an ingenious method for measuring this illusive magnitude.[4] Fisher argued that:

> "The importance of such accurate determinations (of the velocity of currency) can scarcely be overestimated.. When we know statistically the velocity of circulation of money we shall be in a position to study inductively the "quantity theory" of money, to discover the significance of that velocity in reference to crises, accumulations of wealth, density of population, rapid transit and communication, as well as many other conditions. In fact a new realm in monetary statistics will have been opened" p.618

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2. Friedman, M. "The Quantity Theory of Money-A Restatement" in Studies in the Quantity Theory of Money The University of Chicago Press 1956

3. Fisher, I. The Purchasing Power of Money Macmillan, 1911

4. Fisher, I. "A New Method of Estimating the Velocity of Circulation Money" Journal of the Royal Statistical Society, Vol 72, 1909 pp. 604-618. This approach is extended in the Appendix to Chapter XII in The Purchasing Power of Money.

Yet, despite Fisher's claims for the theoretical importance of the payment velocity of currency, and his early efforts to devise a method for calculating V^c, little further attention was given to the problem for almost sixty years. The intervening years did produce a number of studies[5] that focused on the behavior of income velocity rather than on payment velocity. Income velocity, being easily measured as the ratio of income to the money stock, remains the focus of contemporary monetary theorists, despite Keynes' warning that income velocity was "a hybrid conception having no particular significance"[6] whose use, " has led to nothing but confusion."[7]

It was not until 1970, that Laurent,[8] apparently unaware of Fisher's earlier work, carefully examined the magnitude of currency transfers, and suggested an approach which can be utilized to derive a method for estimating currency velocity. Different approaches to the problem are presented below.

10.3.1 The Fisher Cash Loop Method:

In 1909, Fisher devised an ingenious approximation for estimating the velocity of cash payments. Fisher constructed a model of cash flows that described the various types of currency exchanges that can take place between the time cash was initially withdrawn from the banking system and finally redeposited in banks. Sectoring

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5. See Selden (1956) ibid. for an excellent review
6. A Treatise on Money Vol. II Macmillan, 1930 p.24
7. The General Theory p.299
8. Currency Transfers by Denomination Ph. D. Thesis at the University of Chicago, 1970

his hypothetical economy into firms, individual depositors and non depositors, Fisher examined all possible cash exchanges between the three sectors, and then derived an expression for C^g, namely, the volume of cash payments which represent direct exchanges for goods.[9]

Fisher's model specification was conditioned by the institutional structure of the payments mechanism as it functioned during the early years of the 20th century. The approximate formula he derived for the "total circulation of cash in exchange for goods" equaled the total amount of cash deposited in banks plus total wages paid. On the basis of existing data on currency deposits, Fisher estimated a velocity of circulation for currency of 18 times per year, or an average holding period of about 20 days.

Assuming that individuals exclusively acquire cash by withdrawing it from banks,[10] Fisher argued that it was possible to estimate total cash payments by multiplying cash withdrawals at banking institutions by a multiple which reflected the number of "loops" or payments that occurred between cash withdrawals and subsequent cash deposits.

Thus;

$$C^g = T \cdot \lambda \qquad (10.3.1)$$

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9. In a more general model, C^g can be seen to also include direct cash purchases of real and financial assets.

10. A model of currency transfers that includes real and finacial assets other than "money" would permit the acquisition of cash from sales of real and finacial assets. Such "sales" would of course include cash withdrawals from time and savings deposits.

where:

C^g = cash payments for goods

T = Withdrawals of cash from monetary institutions

λ = the "cash loop"- the number of payments occurring between cash withdrawals and subsequent deposits.

Fisher's calculations for 1909 suggested that a cash loop of approximately two (λ = 2) was appropriate. Fisher's loop lenght of two was adopted by Cramer (1982)[11] and was subsequently used by the Netherlands Central Bank (1984) as the basis for their efforts to estimate total cash payments in Holland.[12] Both Cramer (1982) and Boeschoten and Fase (1984) made use of estimates of cash withdrawals from demand deposits, to which they applied Fisher's original cash loop estimate. By selecting the arbitrary value of λ = 2 for the cash loop in the Netherlands, Boeschoten and Fase estimated a currency velocity which averaged 13.27 turnovers per year during the period 1965 - 1981. This estimated velocity implies an average holding period for currency of 27.5 days before it is spent for the purchase of goods. In light of the major role played by currency transactions in the Netherlands, it is difficult to give much credence to this estimate of V^c.

Given the strong similarities between the payment systems and the organization of financial institutions in the Netherlands and Sweden, it is possible to approximate Swedish cash withdrawals by

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11. "Transactions Demand and the Circulation of Money in the United States, 1950-1979, University of Amsterdam 1982

12. Boeschoten, W.C. and Fase, M.M.G. Betalingsverkeer en officieuze economie in Nederland 1965-1982 Monetaire Monografieen Nr.1 De Nederlandsche Bank n.v. 1984

applying the ratio of withdrawals to currency in the Netherlands, to the Swedish currency supply.[13] The resulting estimates of Swedish cash withdrawals are presented in column (1) of Table 10.3.1. The second column of the table displays the estimate of V^c obtained by the Fisher cash loop method, on the assumption that the appropriate cash loop is two.

Without any independent information concerning the actual length of the cash loop, it is not reasonable to utilize Fisher's 1909 estimate of the U.S. cash loop as a means for determining the total volume of cash payments in Sweden. However, as will be developed below, other proceedures are availabe for the estimation of total cash payments in Sweden. The estimates of Swedish cash withdrawals developed above, can be then be used to derive a more appropriate estimate of the cash loop implicit in the estimate of total cash payments.

10.3.2 The Laurent Cash Transfer Method

Applying a model of cash transfers, Laurent (1970) made a renewed effort to estimate the total volume of currency payments in the United States for the period 1867-1967. The cash transfer model assumes that any given currency note is capable of performing a total of G payments during its lifetime, namely, between the time a note is initially issued and finally withdrawn from circulation. Given the average lifetime of a unit of currency (L_t), the average

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13. This indirect proceedure is necessary, since Swedish withdrawal figures are unpublished.

Table 10.3.1

ESTIMATED CASH WITHDRAWALS AND CURRENCY VELOCITY (CASH LOOP METHOD)
SWEDEN 1965-1981

Year	Estimated Cash Withdrawals (Bil. Kr.)	Estimated Currency Velocity ($\lambda = 2$)
56	11.43	4.38
57	13.12	4.78
58	14.55	5.18
59	16.09	5.58
60	18.00	5.98
61	20.32	6.38
62	22.71	6.78
63	25.95	7.18
64	29.14	7.58
65	32.39	7.98
66	34.47	8.05
67	39.13	8.64
68	47.65	9.79
69	58.15	11.29
70	67.01	12.47
71	80.21	13.83
72	95.01	14.75
73	107.70	15.41
74	124.57	15.74
75	140.92	15.82
76	158.05	15.60
77	172.83	15.59
78	187.73	15.13
79	213.79	15.37
80	230.42	15.26
81	246.05	14.93

velocity of a unit of currency, (V_t^c), is simply:

$$V_t^c = G/L_t \qquad (10.3.2)$$

Thus, the number of times a unit of currency turns over in any period t, depends upon the total number of payments that the unit can sustain throughout its entire lifetime, divided by the number of years the note remains in circulation before being withdrawn as being unfit. The average lifetime of currency is determined as:

$$L_t = C_t / .5(I_t + W_t) \qquad (10.3.3)$$

where C_t is the average number of notes in circulation, I_t is the number of newly issued notes and W_t is the number of notes withdrawn from circulation in period t. Laurent assumed that G remained constant over the entire period of study and that it was the same for all denominations of currency. Given these restrictive assumptions, Laurent proceeded to estimate the value of G from the Equation of Exchange.

$$C_t \cdot V_t^c + D_t \cdot V_t^d = P \cdot T \qquad (10.3.4)$$

where D_t is the stock of demand deposits, V_t^d is the velocity of demand deposits and $P \cdot T$ is the total volume of transactions undertaken with the medium of exchange. In the absence of any estimates of $P \cdot T$, Laurent employed the traditional assumption of a proportional relationship between $P \cdot T$ and GNP. Representing

$$C \cdot V_t^c = G \cdot C_t / L_t, \qquad (10.3.5)$$

Laurent proceeded to estimate the value of G by examining the correlation of total payments with GNP. He then selected that value of G that produced the maximum correlation. For the period 1875-1967, a value of G=129 produced the maximum correlation, although values of G ranging between 75 and 175 also produced high correlations.

Applying Laurent's estimate of 129 income producing cash payments to the actual average lifetime of Swedish currency yields estimates of currency velocity by denomination as displayed in Table (10.3.2).[14]

The final column in Table (10.3.2) displays the average velocity of currency circulation which is derived by weighting each denomination's velocity by the percentage of total notes made up by that denomination. The overall average velocity of currency for the period 1956-1980 is 66.25 which implies an average holding period for currency of 5.51 days. This latter figure appears to correspond more closely to common experience than the significantly longer holding periods that were estimated by imposing Fisher's original cash loop estimate.

The currency velocity time series estimated by the Laurent cash transfer method reveals significant short term erratic movements, that may in part, be the result of changes in the

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14. The actual average lifetime for each denomination of Swedish currency is found in Table A1.6 of Appendix A. These average lifetimes were calculated by applying Equation (10.3.3) to data on issues and withdrawal of currency provided by the Banknote Printers

Table 10.3.2

ESTIMATES OF CURRENCY VELOCITY BY DENOMINATION - LAURENT METHOD

SWEDEN 1956 - 1980

Year	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.	$\bar{V}_c$
56	14.95	26.26	50.93	61.88	94.37	41.26
57	13.88	25.87	52.70	64.48	83.96	42.39
58	14.47	26.40	51.50	55.30	79.13	40.09
59	19.47	26.76	50.80	59.13	78.97	41.71
60	18.55	26.70	50.56	58.54	78.54	41.12
61	21.50	25.45	49.36	55.49	72.02	40.43
62	21.23	28.20	58.85	61.32	77.16	45.81
63	18.94	26.40	56.22	53.32	72.60	41.82
64	18.83	25.86	56.64	54.75	73.40	42.01
65	17.49	23.75	73.60	51.63	64.57	48.01
66	15.28	38.49	107.25	78.96	101.97	67.02
67	16.20	46.79	164.15	124.08	70.30	98.54
68	18.13	44.97	113.24	80.51	77.53	70.14
69	18.00	41.44	114.98	82.44	78.93	71.08
70	19.05	49.72	133.90	108.49	97.14	83.58
71	21.70	46.45	114.48	86.15	77.35	70.76
72	22.69	54.29	145.34	112.42	100.91	86.55
73	22.09	50.57	144.97	109.42	92.84	84.22
74	23.69	51.91	149.96	105.20	103.31	84.35
75	25.60	48.61	147.43	109.33	108.71	83.30
76	18.35	46.77	147.95	113.54	108.94	80.33
77	30.78	50.34	153.93	107.31	101.76	85.68
78	37.49	55.49	155.44	122.09	107.52	90.13
79	29.21	52.99	157.51	131.02	120.22	86.98
80	27.23	52.79	157.29	150.12	114.57	88.85

physical characteristics of currency. The effects of technological changes in the physical characterisitics of notes are ignored by his methodology. In order to relax some of the restrictive assumptions employed by the Laurent method, we modify the procedure and estimate the velocity of currency based entirely on relevant Swedish data.

Association.

10.3.3 Optimal Cash Management-Physical Characteristics Model

An alternative method for estimating the velocity of currency combines the conventional insights of the Tobin-Baumol (Miller-Orr) cash management model with specific information concerning the physical characteristics of currency. The OCMPC model utilizes the Laurent proceedure as a point of departure by specifing that the velocity (V^c_{it}) of a particular denomination of currency (i) during a time interval (t), depends upon the ratio of the total number of transactions (G_{it}) that a unit of currency can undertake during its total lifetime and the average lifetime of the unit of currency (L_{it}).

$$V^c_{it} = G_{it} / L_{it} \qquad (10.3.6)$$

The Laurent cash transfer model, assumed that G_{it} was constant over time and for all denominations of currency. However, the actual number of transactions that a unit of currency can undertake in its lifetime depends upon the physical characteristics of the currency itself. Paper currency, like other goods, undergoes quality changes over time as a result of technological innovation. Such innovations include changing composition of the paper itself [15] as well as changes in methods of manufacture and sizing.[16] Since

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15. For example, varying percentages of cotton or linen fibers.

16. In Sweden, the primary method of manufacture is Mould made currency, except for the 5 Kr. note which is manufactured by a Fourdrinier process. The sizing of currency in Sweden varies both over time and over denomination. Sizings include: animal glue; animal gelatin and melamine. The technical descriptions of Swedish notes were made available by the Riksbank on the basis of data

different denominations of currency exhibit different physical characteristics over time, it is desirable to summarize these different characteristics by some measure of the physical strength. Engineering tests of currency characteristics are performed by means of folding tests by machines which repeatedly fold currency under controlled conditions until the physical unit displays significant deterioration. The number of folds that each denomination of currency can sustain is recorded by the Banknote Printers Association along with the specification of the equiptment employed to perform these physical characteristics tests. Assuming that these folding tests represent a good proxy for the particular combination of physical characteristics of currency determined by its method of manufacture, its paper weight and composition and its sizing, then as a first approximation, we specify that

$$G_{it} = F_{it}^{\alpha^1 i} \cdot M_{it}^{\alpha^2 i} \qquad (10.3.7)$$

where, F_{it} represents the number of folds sustained by the ith denomination of currency at time t on the M_{it} machine used to test the particular denomination of currency. α^{1i} and α^{2i} are technical coefficients that transform engineering performance into the actual number of transactions (G_{it}), that a particular denomination of currency can sustain in its lifetime.

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collected by the Banknote Printers Association.

If the fitness standards established by the Central Bank are uniform over time, the velocity of a note of a particular denomination depends only upon its use as a means of payment, and this in turn, depends upon the denomination size (D_i) and on the economic variables suggested by optimal cash management models, namely, income (Y_t); the opportunity cost of using cash (R_t); and a time trend (T_t) representing secular changes in transactions costs. Given these assumptions,

$$V^c_{it} = Y_t^{\beta^1} \cdot R_t^{\beta^2} \cdot T_t^{\beta^3} \cdot D_i^{\delta} \qquad (10.3.8)$$

Since neither G_{it} nor V^c_{it} are directly observable, it is necessary to combine equations (10.3.6),(10.3.7) and (10.3.8), in order to express the observable variable L_{it}, as:

$$L_{it} = F_{it}^{\alpha^1 i} \cdot M_{it}^{\alpha^2 i} \cdot D_i^{-\delta} \cdot Y_t^{-\beta^1} \cdot R_t^{-\beta^2} \cdot T_t^{-\beta^3} \qquad (10.3.9)$$

where the expected signs of the coefficients are as follows:

$\alpha^1 i > 0$

$\alpha^2 i = ?$

$\delta < 0$

$\beta^1 > 0$

$\beta^2 > 0$

$\beta^3 > 0$

If the technical transformation coefficients depend only upon the physical characteristics that describe any unit of currency, then,

$\alpha^{1i} = \alpha^{1j}$ and $\alpha^{2i} = \alpha^{2j}$, for all i and j.

Equation (10.3.9) can be estimated as the log linear function:

$$\ln L_{it} = \alpha^1 \cdot \ln F_{it} + \alpha^2 \cdot \ln M_{it} - \delta \cdot \ln D_t - \beta^1 \cdot \ln Y_t - \beta^2 \cdot \ln R_t - \beta^3 \cdot \ln T_t + \mu_t \quad (10.3.10)$$

where, $\mu_t = \varepsilon_t + \phi\varepsilon_{t-1}$,

and ϕ is the moving average coefficient.

Equation (10.3.10) was estimated for the period 1956 - 1980 over all denominations i, and the resulting coefficient estimates and descriptive statistics are reported in Table 10.3.3.

Each of the estimated regression coefficients has the expected sign, suggesting that the fold test procedures provide a reasonable proxy for the physical characteristics of currency, and that the intensity of currency usage is inversely related to denomination size. The behavioral parameters implied by the optimal cash management model all have the expected sign, but do not appear to be statistically significant for denomination specific data.

Given the estimated coefficients from Equation (10.3.10) and the relationship defined by Equation (10.3.11), it is possible to derive estimates of the number of cash transfers that a unit of currency can undertake during its lifetime ($\hat{G}_{it}$),

Table 10.3.3

REGRESSION ESTIMATES OF EQUATION (10.3.10)
1956 - 1980
Dependent Variable $\ln L_{it}$

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-2.1122118	7.4290079	-0.2843195
lnF	0.5764733	0.3187020	1.8088163
lnM	0.8493321	0.3781024	2.2463020
lnD	0.3017744	0.0151701	19.8927240
lnY	-0.3739506	0.5081710	-0.7358756
lnR	-0.2306132	0.2033508	-1.1340658
lnT	-0.2487866	2.4067961	-0.1033684
ϕ	0.8215650	0.0942971	8.7125145

R-squared	0.858189	Mean of dependent var	0.837647
Adjusted R-squared	0.849704	S.D. of dependent var	0.688124
S.E. of regression	0.266772	Sum of squared resid	8.326574
Durbin-Watson stat	1.994698	F-statistic	101.1486

$$\hat{G}_{it} = F_{it}^{\hat{\alpha}^1} \cdot M_{it}^{\hat{\alpha}^2} \qquad (10.3.11)$$

and an estimate of the velocity of currency ($\hat{V}^c_{it}$),

$$\hat{V}^{c}_{it} = \hat{G}_{it} / \hat{L}_{it} = \hat{\delta}_{i} \cdot Y_t^{\hat{\beta}^1} \cdot R_t^{\hat{\beta}^2} \cdot T_t^{\hat{\beta}^3} \tag{10.3.12}$$

The estimated lifetime of each note denomination is displayed in Figure (10.3.1).

As expected, the average note lifetime increases with denomination. The smallest denominations (10 Kr. and 5 Kr.) have an average lifetime of less than a year during the latter period, owing to the Sveriges Riksbank's policy of automatically destroying such notes when they are returned to the bank in order to economize on the costs of sorting. The average lifetime of the 1000 Kr. note has decreased from over eight years at the beginning of the period to just over three years during the early 1980's. All denominations show an increase in average lifetimes in 1975, when a technologically superior notes where introduced.

Figure (10.3.2) displays the estimated velocity of currency for each denomination. Every denomination reveals an increase estimated velocity, with the most pronounced increases occurring in the smaller denomination notes.[17]

On the basis of these denomination specific estimates, weighted averages of $\hat{V}^{c}_{it}$, $\hat{L}_{it}$ and $\hat{G}_{it}$ have been constructed for the Swedish currency supply, and these final estimates are presented in Table (10.3.4).

Table (10.3.4) reveals that the average velocity of currency inreased more than fourfold over the past twenty five years. In the

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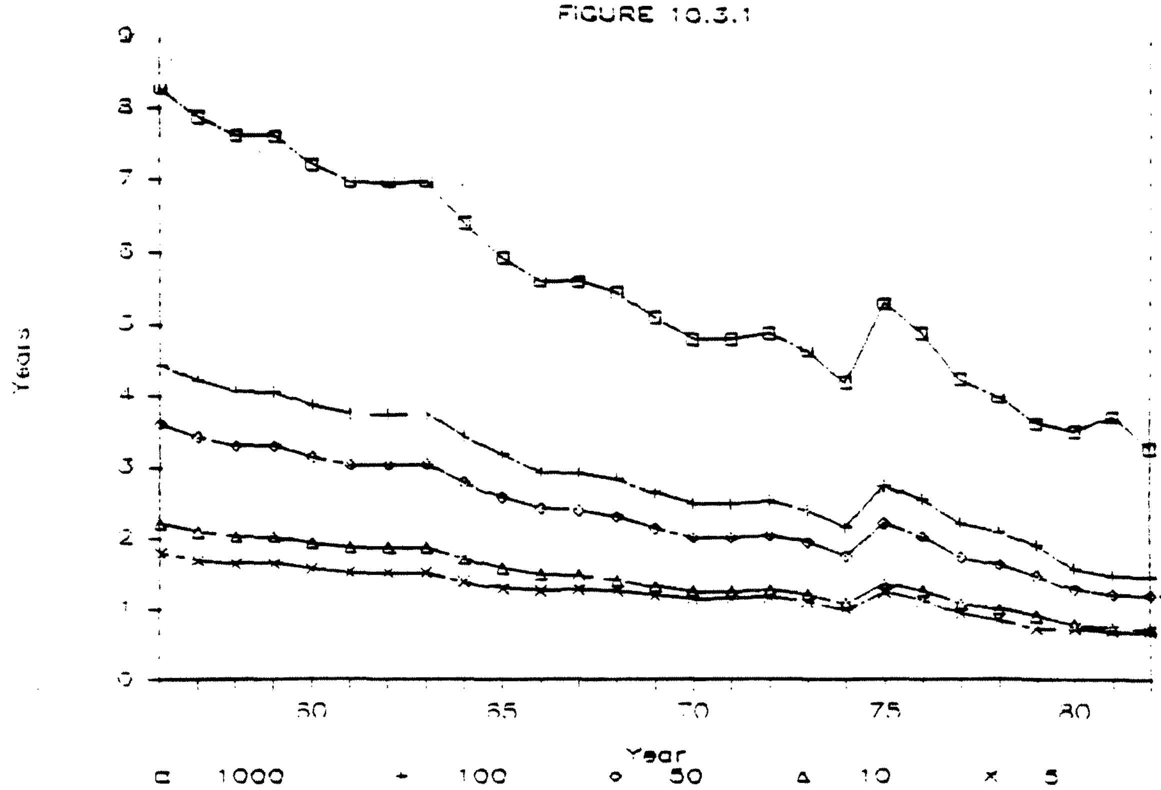
17. The numerical values of the estimates of $\hat{V}ci_t$, $\hat{L}_{it}$, $\hat{G}_{it}$ are displayed in Tables A1.7 -A1.9 of Appendix A.

Estimated Note Lifetime

FIGURE 10.3.1



Currency Velocity by Denomination

FIGURE 10.3.2

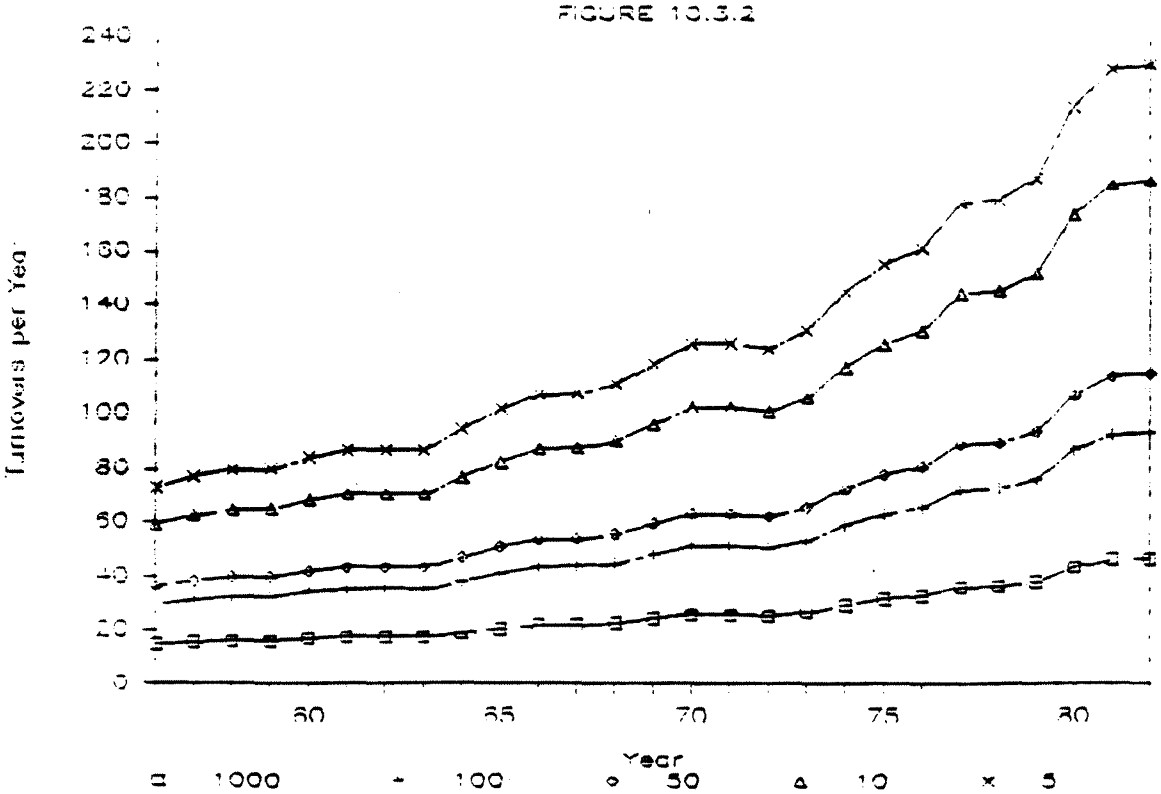


Table 10.3.4

ESTIMATED VALUES OF CURRENCY VELOCITY, AVERAGE LIFETIME AND LIFE PAYMEN
OCMPC MODEL

Year	$\hat{V}^c_t$	$\hat{L}_t$	$\hat{G}_t$
56	26.26	4.39	115.29
57	27.84	4.17	116.21
58	29.40	4.12	121.14
59	29.73	4.18	124.40
60	31.85	4.02	128.11
61	32.90	3.93	129.35
62	33.66	4.00	134.76
63	33.84	4.06	137.44
64	37.65	3.79	142.73
65	39.91	3.52	140.40
66	43.31	3.32	143.88
67	44.28	3.38	149.63
68	46.01	3.31	152.21
69	48.00	3.07	147.56
70	51.64	2.91	150.28
71	53.72	3.02	162.34
72	52.77	3.09	162.80
73	56.68	2.99	169.34
74	64.15	2.74	175.65
75	70.89	3.60	255.05
76	73.26	3.33	243.67
77	83.01	2.93	242.93
78	84.78	2.83	239.98
79	90.22	2.63	237.00
80	105.11	2.44	256.31
81	112.86	2.50	282.60
82	112.80	2.36	266.33

mid 1950's, the average holding period between transactions was two weeks, whereas by 1982, the holding period had fallen to three days. The average currency velocity over the entire period is 56.2 turnovers per year, implying an overall average holding period of 6.4 days. Table (10.3.5) displays the estimated average holding periods by denomination for selected years.

The OCMPC estimates suggest that over the period under study,

Table 10.3.5

ESTIMATED AVERAGE CURRENCY HOLDING PERIOD BY DENOMINATION

Year	Average Holding Period (Days)				
	1000 Kr.	100 Kr.	50 Kr.	10 Kr.	5 Kr.
1956	24.7	12.3	10.0	6.2	5.0
1982	7.8	3.9	3.2	2.0	1.6
1956-1982	14.9	7.5	6.0	3.7	3.0

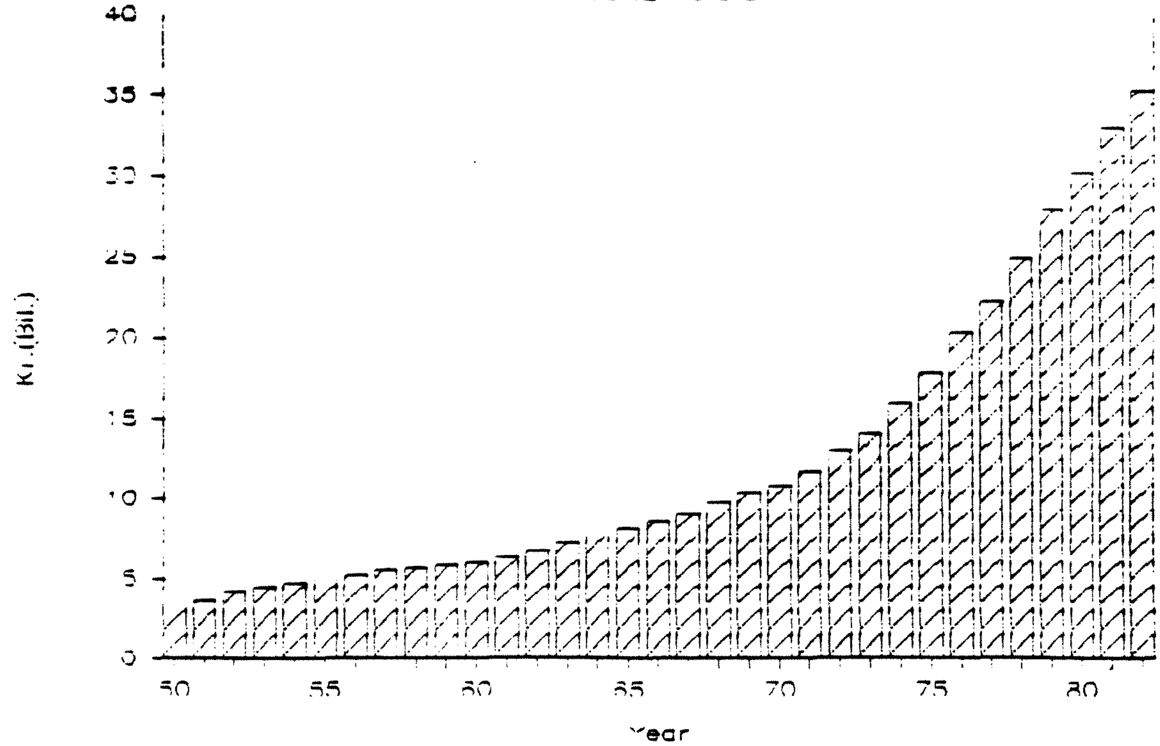
1000 Kr. notes turned over approximately once every two weeks whereas the small denomination bills turned over once about every three days.

The foregoing estimates of currency velocity, and the published statistics on the stock of currency in the hands of the public, enable us to calculate the final estimate of total cash payments in Sweden. Figure (10.3.3) displays the growth of currency outside of banks, and Figure (10.3.4) shows the corresponding increase in cash payments for the period 1956 - 1982.

Despite the considerable development of an automated payments system in Sweden, it appears that earlier predictions of a "cashless" society are wide of the mark. Both the stock of currency in the hands of the public, and the volume of payments undertaken with currency have increased significantly over the period under study. Moreover, the increase in currency holdings and payments is not simply the result of rising prices. As displayed in Figures

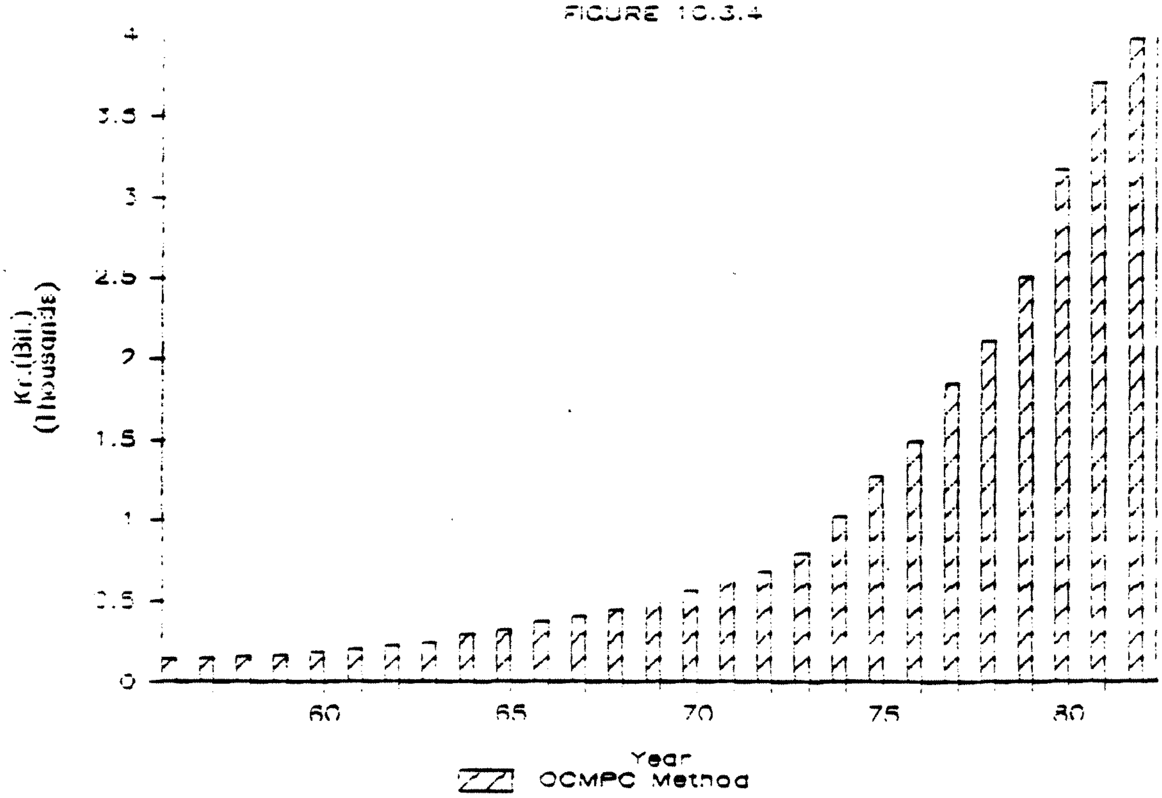
Currency Outside Banks

FIGURE 10.3.3



Estimated Currency Payments

FIGURE 10.3.4



(10.3.5) and (10.3.6), cash balances as well as cash payments have also increased in real terms, although to a less estent.

Given these estimates of total cash payments, and recalling that:

$$C \cdot V^{c} = C^{g} + T = T \cdot \ell + T = (1 + \ell) \cdot T \qquad (10.3.13)$$

it is possible to derive an estimate of ℓ as,

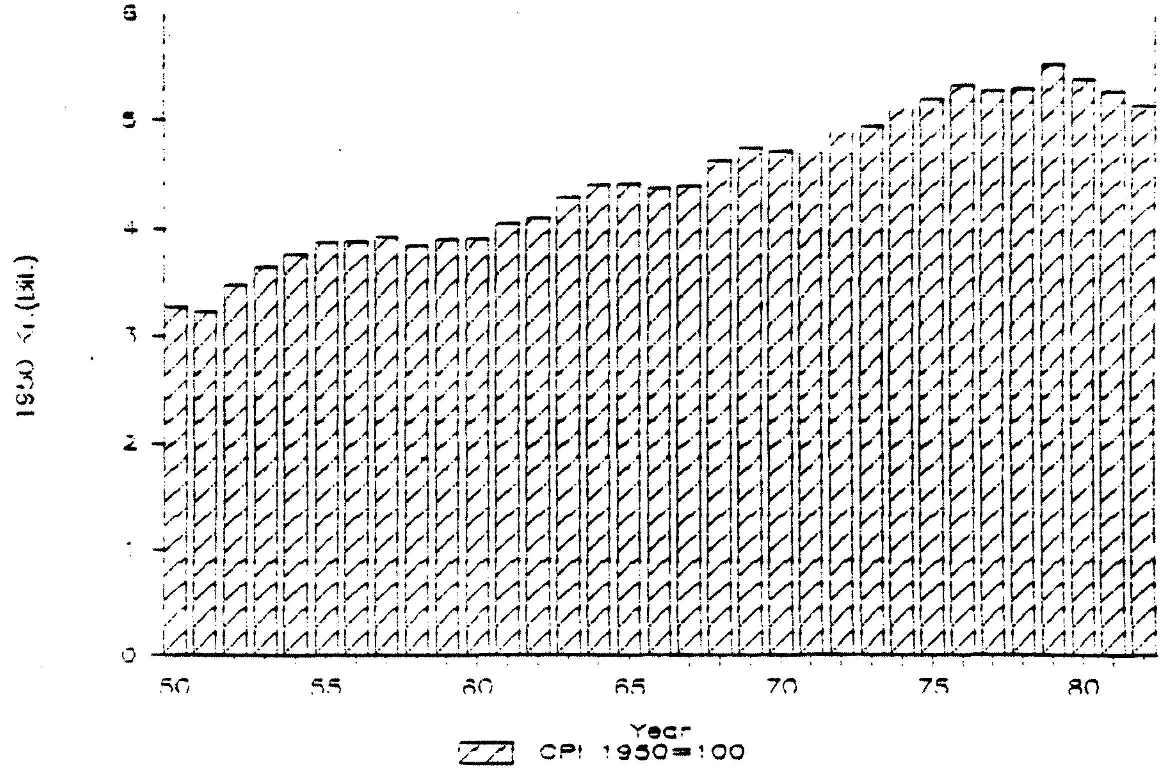
$$\hat{\ell} = \left(\frac{C \cdot \hat{V}^{c}}{\hat{T}} \right) - 1 \qquad (10.3.14)$$

The estimated value of cash withdrawals (T) is displayed in Figure (10.3.7) and the corresponding estimate of the cash loop derived from the OCMPC model is displayed in Figure (10.3.8). Whereas, the volume of cash withdrawals appear to increase secularly, the estimated cash loop declines from 1956 - 1972 and subsequently displays an upward trend.

Two features of the cash loop estimate merit special attention. First, the size of the estimated cash loop is considerably larger than what might have been expected from Fisher's observations in the early 1900's. The current estimate suggests that currency circulates between six and fourteen times before being redeposited. Second, it appears that the cash loop is by no means constant, as had been assumed by Cramer(1982) and Boeschoten and Fase(1984). Indeed, there are both institutional and economic reasons to believe that the cash loop is likely to be variable. A possible institutional explanation for the secular decline in the

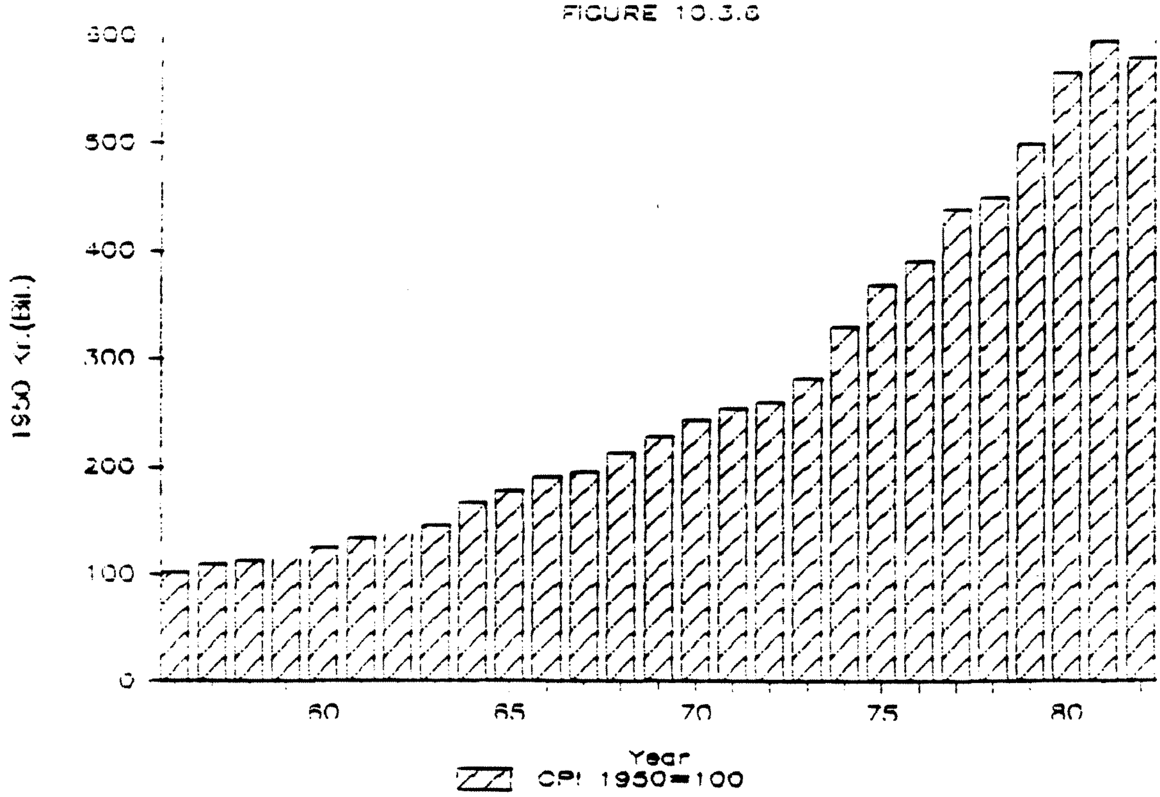
Real Currency Outside Banks

FIGURE 10.3.5



Real Currency Payments

FIGURE 10.3.6



cash loop during the early period of analysis is the growth of giro accounts.

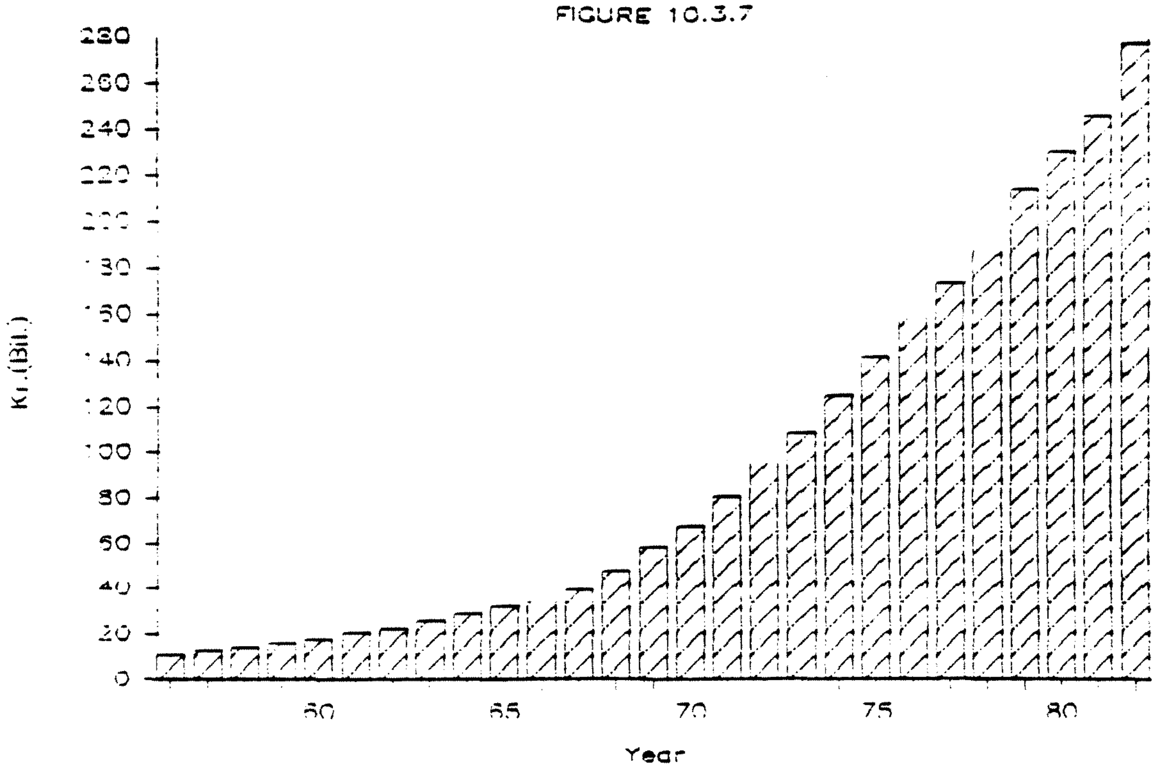
Figures (10.3.9) and (10.3.10) display the number of giro accounts and the number of giro payments. Both increased considerably during this period. A growing "banking habit" might well lead to efforts to economize on currency holdings by depositing cash more rapidly in deposits, particularly, when such deposits can earn an interest yield. What is surprising about the cash loop estimate is the reversal in this expected downward trend, despite the fact that both the number of giro accounts and the number of giro payments continued to increase.

Moreover, it is during the 1970's, that Sweden witnessed the growth of wage and salary accounts, as firms, in increasing numbers paid wages and salaries directly into giro linked accounts rather than pay by cash or check. The transition to wage and salary account payments, no doubt, changed the payment habits of the public, as more and more individuals became accustomed to the giro system of transfers. Prior to this transition, giro accounts where held primarily by business and public sector agencies.

The reversal of the downward trend in the cash loop, might therefore signal the increased use of currency in the underground economy, as the number of direct cash transactions between withdrawal of cash from monetary institutions and their subsequent redeposit, increased dramatically. By 1982, the average unit of currency was used for purchasing goods and assets almost fourteen times between withdrawal and deposit, whereas the cash loop had fallen to six such purchases a decade earlier. A fuller investigation of this hypothesis must await our efforts to apply the

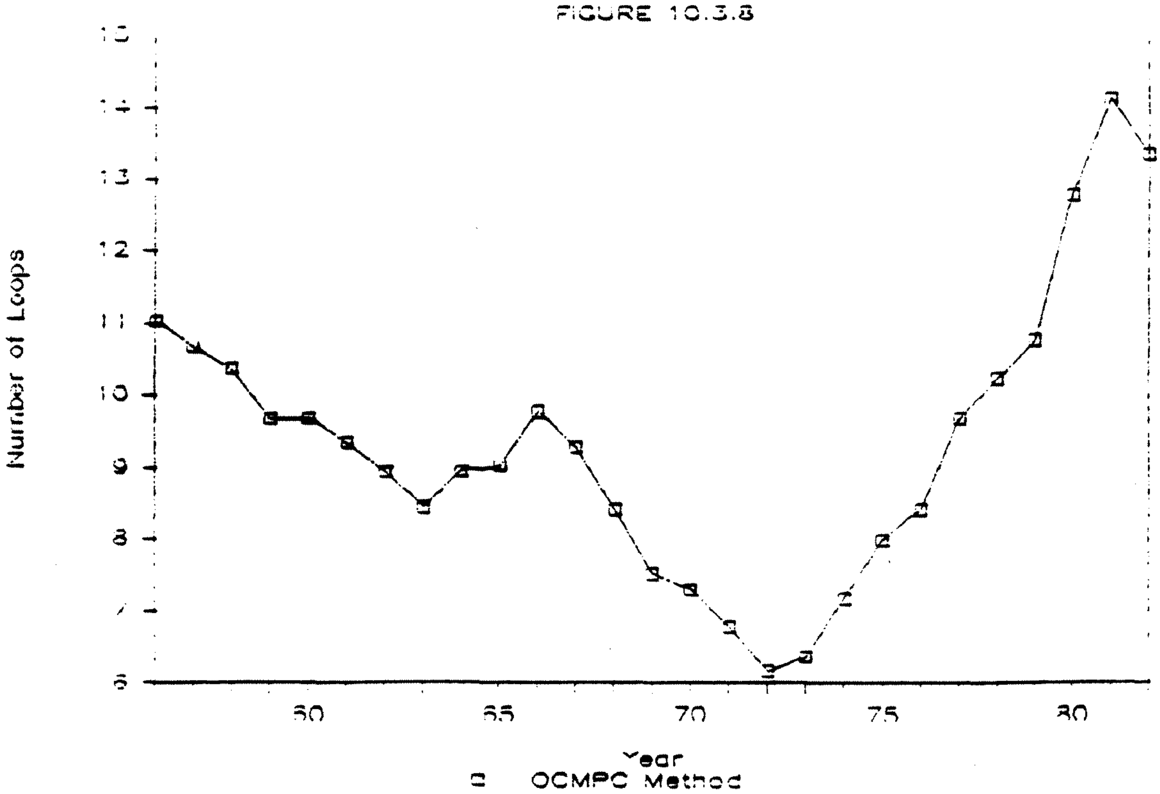
Estimated Cash Withdrawals

FIGURE 10.3.7



Estimated Fisher Cash Loop

FIGURE 10.3.8



TP method to the full payments system.

10.3.4 Summary of the Cash Payments Estimates

The foregoing sections have reviewed several of the methods which have been employed to estimate currency payments and V^c. In Table (10.3.6), we summarize the estimated volume of cash payments in Sweden, based on each of the three procedures described.

Figures (10.3.11) and (10.3.12 display the estimates of currency velocity and implied average holding periods that result from each of the procedures described above.

The results from the three methods, display important disparities with respect to both the size and growth path of V^c. It is therefore necessary to select, for further analysis, that set of estimates in which we have the greatest confidence. The simple Fisher cash loop method as utilized by Cramer (1982) and Boeschoten and Fase (1984) is rejected, since it relies entirely on a cash loop that is arbitrarily assumed to be constant at a value of two since the early twentieth century. The second procedure for estimating cash payments in Sweden requires the assumption of a fixed number of total lifetime turnovers, invariant over denomination, time and country.

The final OMCPC estimates are preferred, in so far as they:

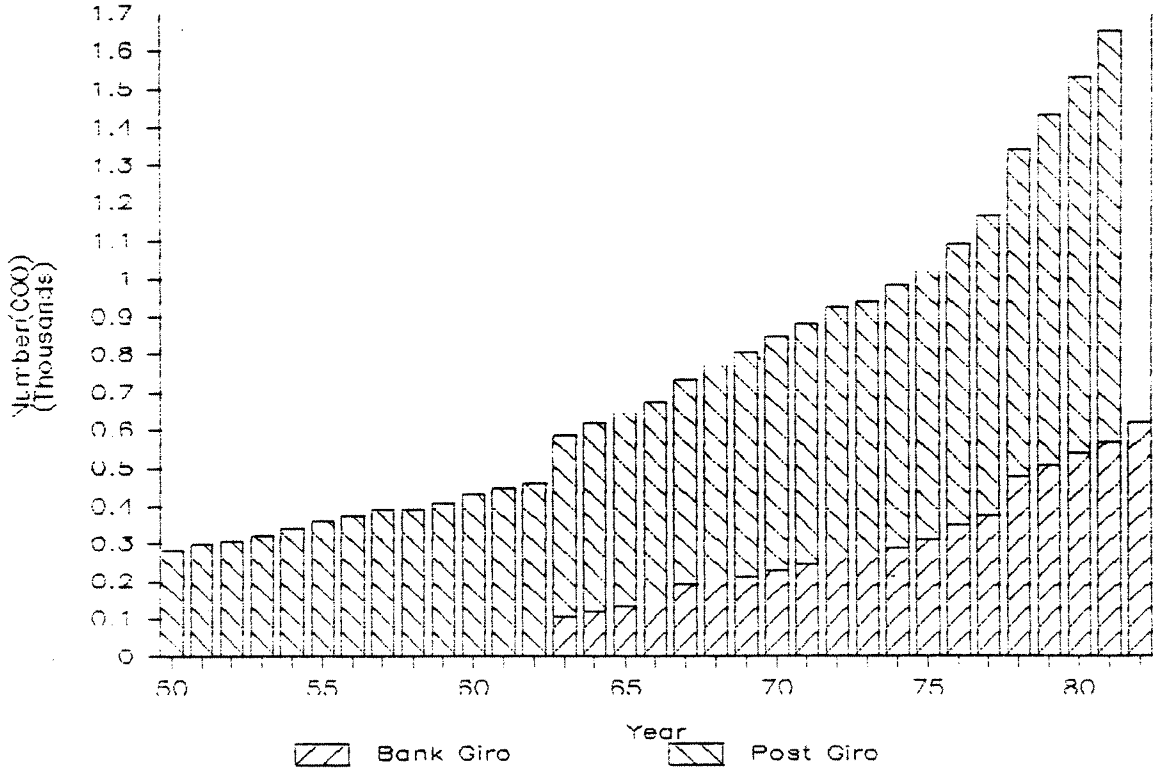
1) require the least restrictive assumptions;

2) are based on a well accepted theoretical framework describing the demand for monetary transactions;

3) take direct account of innovations in the technology of currency production, and

Number of Giro Accounts

FIGURE 10.3.9



Number of Giro Payments

FIGURE 10.3.10

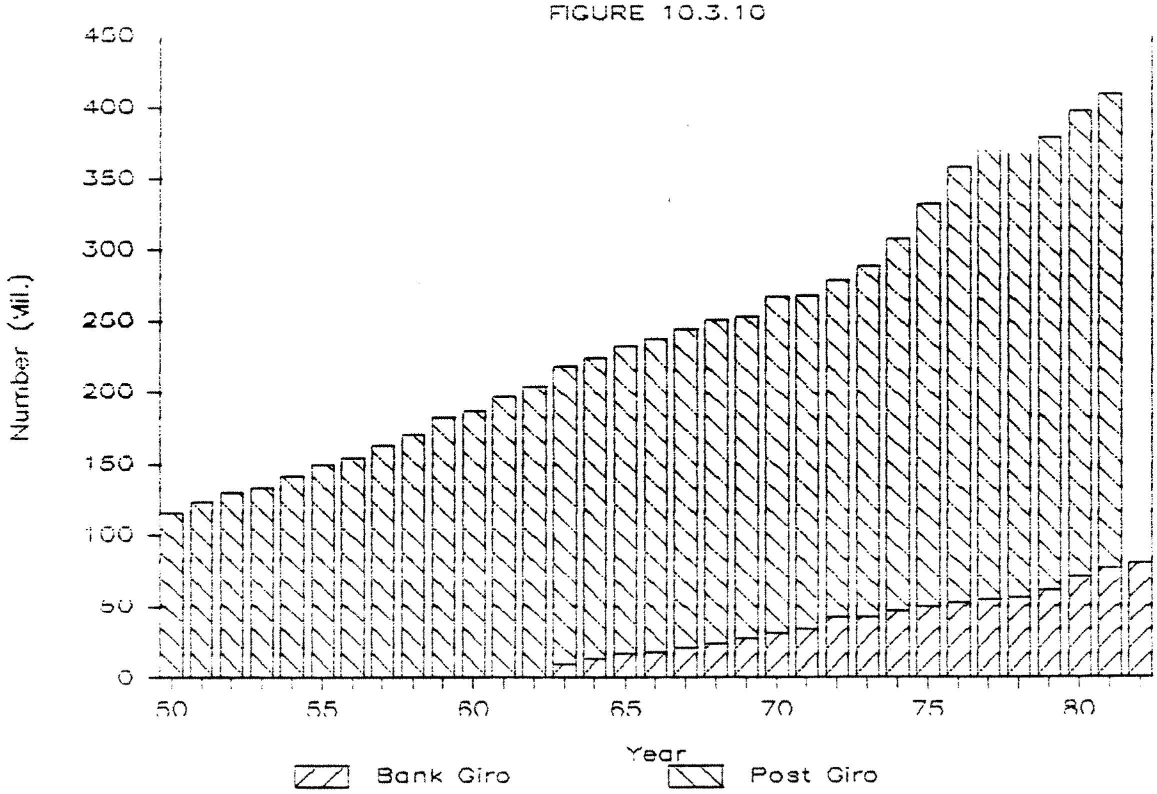


Table 10.3.6

ALTERNATIVE ESTIMATES OF SWEDISH CASH PAYMENTS

Year	Currency Held By Public	Estimated Cash Payments: Cash Loop (ℓ = 2)	Laurent (G = 129)	OCMPC
56	5.22	22.86	215.38	137.36
57	5.49	26.24	232.72	153.12
58	5.62	29.10	225.31	165.34
59	5.77	32.19	240.67	171.70
60	6.02	35.99	247.54	191.99
61	6.37	40.63	257.54	209.92
62	6.70	45.42	306.93	225.83
63	7.23	51.90	302.36	245.16
64	7.69	58.28	323.06	290.01
65	8.12	64.80	389.84	324.53
66	8.56	68.94	573.69	371.19
67	9.06	78.26	892.77	401.72
68	9.73	95.31	682.46	448.37
69	10.30	116.30	732.12	494.94
70	10.75	134.01	898.49	555.54
71	11.60	160.43	820.82	623.95
72	12.88	190.02	1114.76	680.96
73	13.98	215.39	1177.40	793.48
74	15.83	249.14	1335.26	1017.37
75	17.82	281.83	1484.41	1265.19
76	20.26	316.10	1627.49	1486.73
77	22.17	345.67	1899.53	1842.27
78	24.82	375.46	2237.03	2106.93
79	27.82	427.59	2419.78	2513.03
80	30.19	460.83	2682.38	3175.78
81	32.96	492.10	N.A.	3722.51
82	35.36	N.A.	N.A.	3986.18

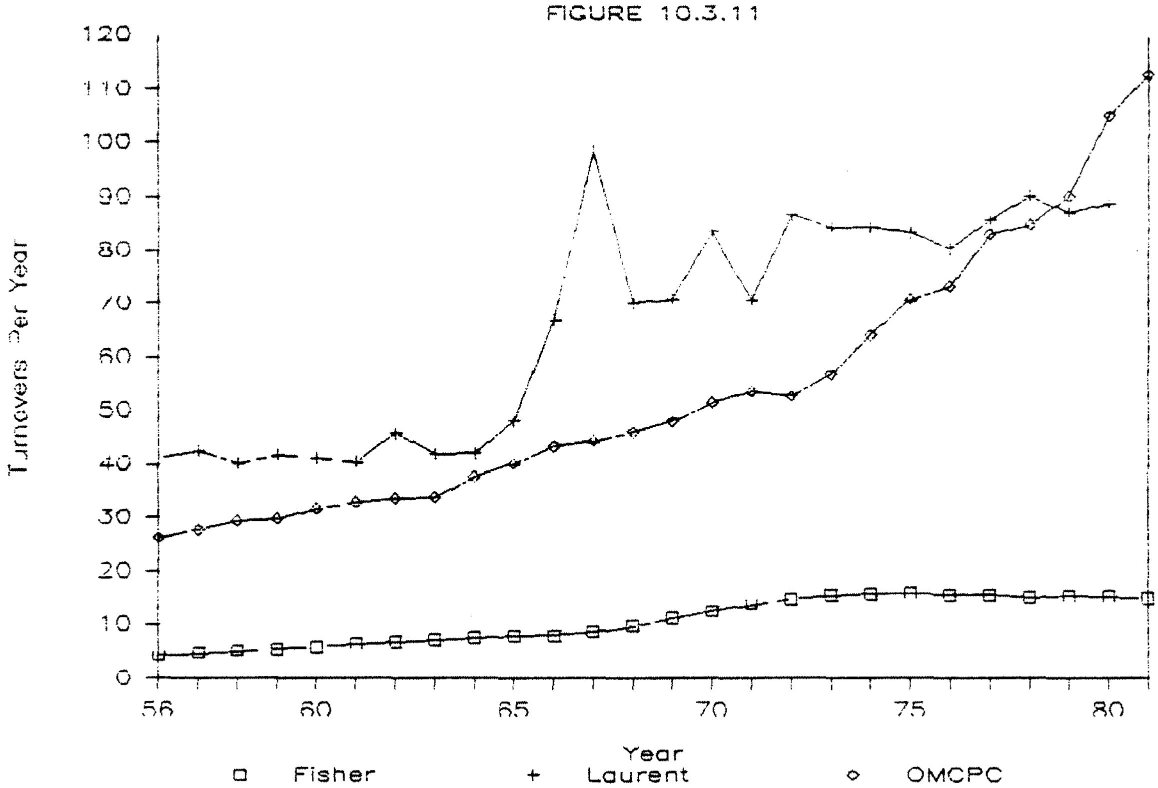
4) are based entirely on Swedish data.

Figure (10.3.13) displays the final estimate of V^c, based on the OCMCP method. The velocity of currency increases secularly, with the latter period showing faster growth than the earlier period.

The velocity of currency can be decomposed into two sepatate

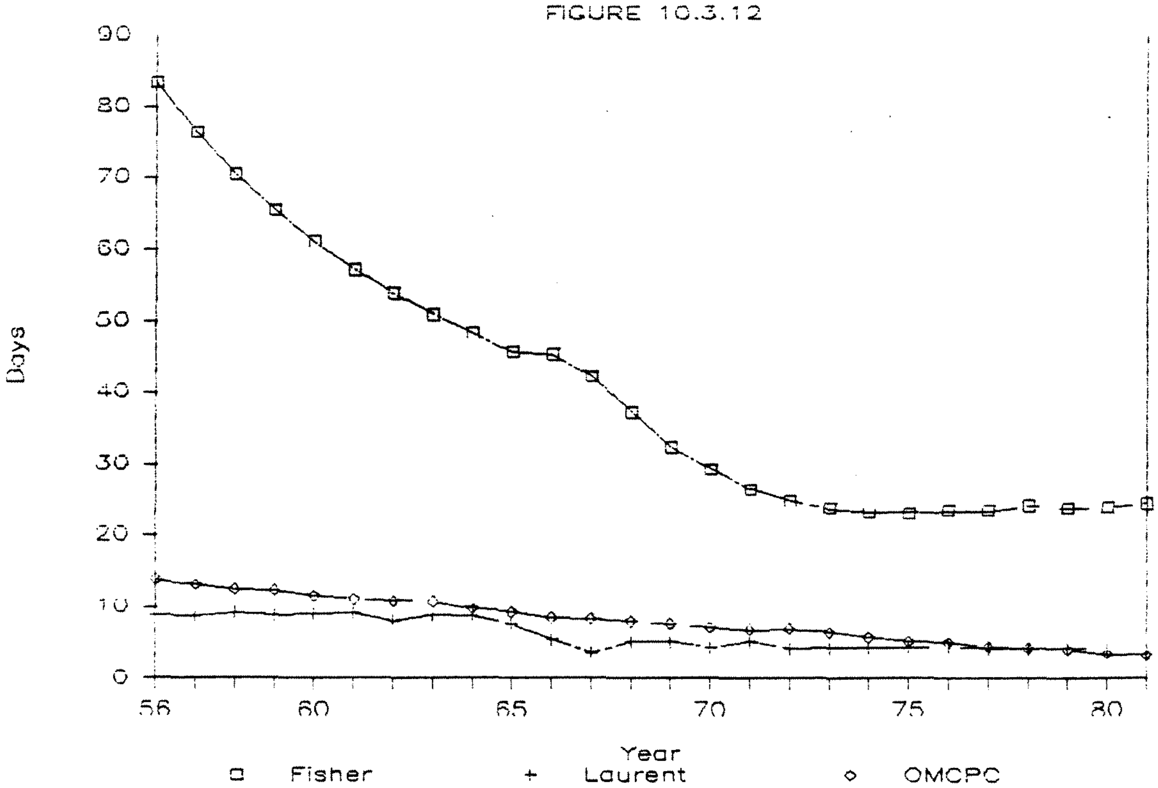
Currency Velocity-Alternate Estimates

FIGURE 10.3.11



Average Currency Holding Period - Days

FIGURE 10.3.12



multiplicative components, namely the loop turnovers per year, and the withdrawals per year. Figure (10.3.14) displays these components which are derived by dividing both sides of equation (10.3.13) by the stock of currency (C). The decline in the cash loop during the early part of the period is more than offset by the increase in the frequency of withdrawals, whereas, during the latter part of the period, withdrawals become stationary, as loop frequency increases substantially.

Given the foregoing estimates of withdrawals, and loop transactions, it is now possible to estimate the total volume of currency payments from both the credit and debit perspectives defined in the payments matrix of Table 10.2.2. The sum of credits to the currency account equals cash loop payments plus withdrawals ($C^g + \tau$), whereas the sum of debits to the currency account is equal to cash loop payments plus deposits ($C^g + \pi$). Deposits (π) can be estimated as follows:

$$\pi = \tau + \Delta C \qquad (10.3.15)$$

since the change in currency in the hands of the public,

$$\Delta C \equiv \pi - \tau \qquad (10.3.16)$$

The final time series estimates of C^g, τ, π and $C \cdot V^c$ for Sweden are presented in Table (10.3.7).

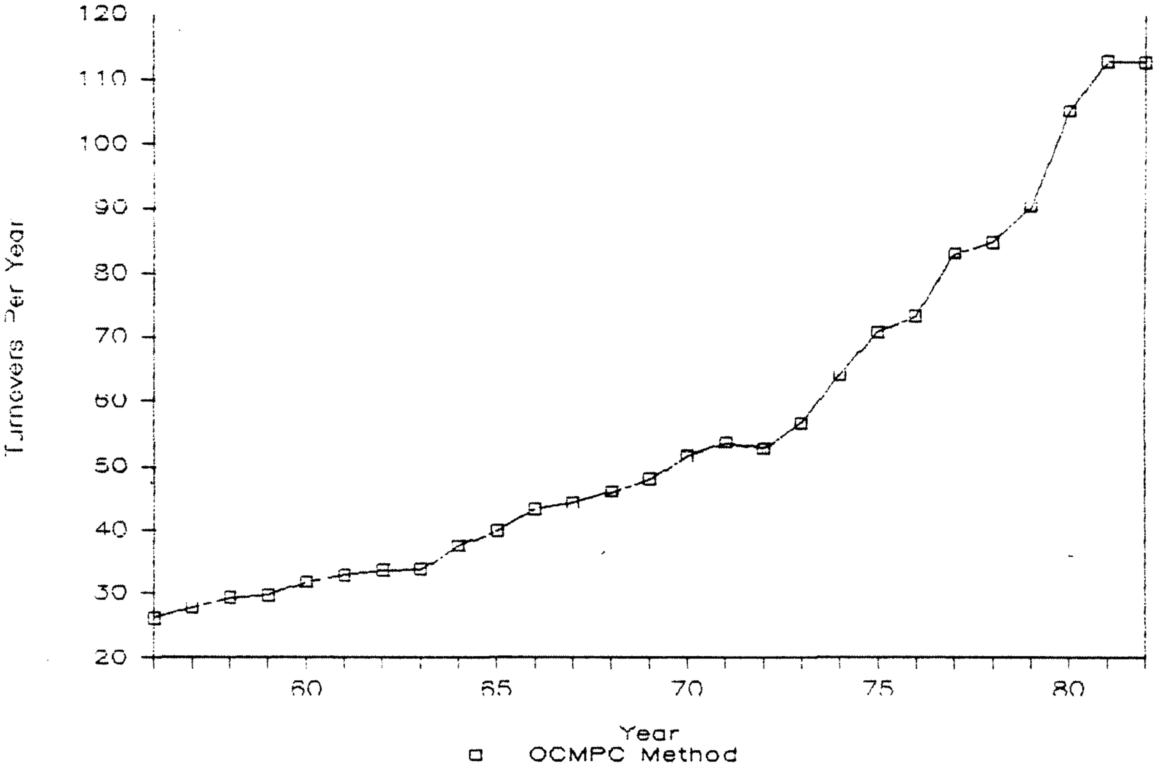
Table 10.3.7

FINAL WITHDRAWALS, DEPOSITS, AND CASH PAYMENTS (Bil. Kr.)
Sweden 1956 - 1982

YEAR	CASH WITHDRAWALS	CASH DEPOSITS	Cg	CASH PAYMENTS
56	11.43	11.69	125.93	137.36
57	13.12	13.39	140.01	153.12
58	14.55	14.68	150.78	165.34
59	16.09	16.24	155.61	171.70
60	18.00	18.25	174.00	191.99
61	20.32	20.67	189.61	209.92
62	22.71	23.04	203.12	225.83
63	25.95	26.48	219.21	245.16
64	29.14	29.60	260.87	290.01
65	32.39	32.82	292.13	324.53
66	34.47	34.91	336.72	371.19
67	39.13	39.63	362.59	401.72
68	47.65	48.32	400.72	448.37
69	58.15	58.72	436.79	494.94
70	67.01	67.46	488.53	555.54
71	80.21	81.06	543.74	623.95
72	95.01	96.29	585.95	680.96
73	107.70	108.80	685.79	793.48
74	124.57	126.42	892.80	1017.37
75	140.92	142.91	1124.27	1265.19
76	158.05	160.49	1328.68	1486.73
77	172.83	174.74	1669.44	1842.27
78	187.73	190.38	1919.20	2106.93
79	213.79	216.79	2299.24	2513.03
80	230.42	232.79	2945.37	3175.78
81	246.05	248.82	3476.46	3722.51
82	277.93	280.33	3708.25	3986.18

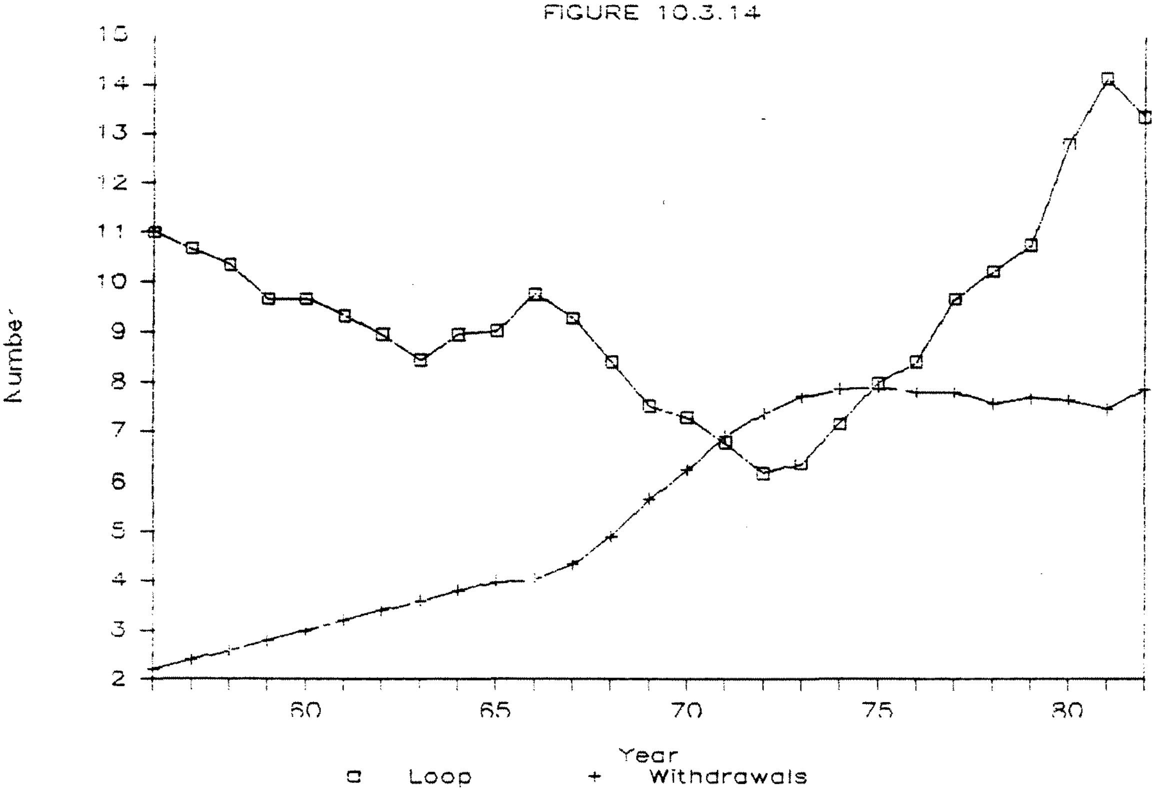
Estimated Velocity of Currency

FIGURE 10.3.13



Components of Currency Velocity

FIGURE 10.3.14



10.4 The Estimation of Bank Payments

10.4.1 The Bank Payments System

The banking sector in Sweden is composed of fourteen commercial banks, twelve cooperative banks and approximately 200 savings banks. These banks in turn, have a network of some 3800 branches scattered throughout Sweden. The four largest commercial banks account for about 85% of bank deposits.

During the 1950's, the banks established the Bank Giro (BG) in order to compete more effectively with the Postal payments system. Today, all banks participate in the payment transfer services provided by the BG, and it is the payments effected through the BG which are reported in the published statistics. A payment transaction effected through a bank is normally undertaken either by writing a check or by transferring funds through giro accounts. Checks are most often used by individuals, whereas firms tend to rely more heavily on giro transfers.[1] Prior to the establishment of the BG, bank payments were made exclusively by checks or cashier's checks which were cleared through a paper based system of inter-bank and intra-bank settlements. Since 1975, a computerized system of clearings has been established through the BG. The BG now reports each banks' net position to the Riksbank, and the Riksbank, in turn, effects the final interbank settlements.

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1. For a detailed description of the institutional arrangements of bank clearing, see, Payment Systems in Eleven Developed Countries, Bank for International Settlements, February 1980.

The Bank Giro is essentially a system for the transfer of funds between bank accounts. The system accommodates the same type of services as the Post Giro, namely, inpayments, outpayments and transfers.

The only published data that exists in Sweden on bank payments are those reported by the BG. The BG now regularly reports its total volume of turnovers, representing the sum of inpayments, outpayments and transfers effected via the BG. These payment data begin in 1960, but represent only a portion of the total payments effected through the banking system. As the BG grew over time, an increasing proportion of total bank payments were effected through the giro system. The estimation of total bank payments effected through the entire banking system therefore presents some unique difficulties. Particularly, if one wishes to construct a series of bank payments that includes years prior to, during, and after the establishment of the Bank Giro (BG). No published data are available on the volume of bank payments prior to the establishment of the BG, nor are there any data series on payments effected by demand deposits that are cleared within or directly between banks. The problem then, is to construct a series of bank payments that reflects transactions undertaken with demand deposits prior to the establishment of the BG, as well as estimates of transactions not included in the published BG data.

As discussed in section (10.2), bank payments can be measured as the sum of credits to bank accounts or as the sum of debit payments. Representing credit payments by (CP_b) and debit payments as (DP_b):

$$CP_b = B_n + B_r + B_w + B_d \qquad (10.4.1)$$

$$DP_b = B_o + B_r + B_w + B_d \qquad (10.4.2)$$

where:

B_n = inpayments to bank demand deposit accounts.

B_o = outpayments from bank demand deposit accounts.

B_r = transfer payments between bank accounts effected by the BG.

B_w = transfer payments between accounts within a bank effected by the bank.

B_d = transfer payments effected between banks or branches by the bank.

Prior to the establishment of the BG, all fund transfers between bank accounts were undertaken by the banks themselves, and such transfers consisted of within bank transfers (B_w) and between bank transfers (B_d). Upon establishment of the BG, more and more clearings were effected via the BG, and correspondingly fewer transfers were effected by the banks themselves. Since no data are publicly collected on the size of B_w and B_d, these data must either be obtained from the historical internal records of individual banks, or alternatively, estimated by more indirect means.

10.4.2 The Estimation of Within and Between Bank Transactions

The estimation of B_w and B_d for Sweden, is based on an extensive survey conducted by the author, of confidential information on the amounts of within and between bank transfers undertaken by the four major commercial banks in the Netherlands.[2] The estimation of Swedish within and between bank payments, based on data for the Netherlands, is justified by the remarkable similarities between the financial institutions of the two countries. Both Holland and Sweden have a dominant Post Giro system, and a recently established Bank Giro system. In the Netherlands, the Bankgirocentral (BGC) was established in 1967, and fulfills essentially the same functions as the Swedish BG. The share of total demand deposits of the four largest banking institutions in the Netherlands was approximately 85% during the mid 1970's compared with 87% for Sweden.[3] In short, the experience of the Netherlands' banking system in adapting to the introduction of the BGC is taken as a useful model for retroactively estimating the responses of the Swedish banking system to the growth of the BG. Given the

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2. The author gratefully acknowledges the cooperation of the AMRO, ABN, NMB and RABO banks of the Netherlands in providing this information.

3. See the chapter entitled " The Role and Functioning of Large Deposit Banks" in Banking Systems Abroad Inter-Bank Research Organization 1978.

similarities of both financial systems, and the common experience of a structural shift in institutional arrangements, it is possible to generate a Swedish payment series for B_w and B_d based on available data from the Netherlands.

On the basis of the Netherlands survey, a time series, covering 1970 - 1981, was constructed of the ratio of payments between banks to total deposits in Holland (B_d^h/D). This ratio reflects non-BGC transfer payments effected directly by the four largest banks. In order to model the temporal path of this ratio, it was assumed, that between bank payments (outside of the bank giro) would decline with the size of the Bank Giro (BGC) and with its growth (ΔBGC). Thus;

$$B_d^h / D = \alpha_0 + \alpha_1 \cdot BGC + \alpha_2 \cdot \Delta BGC + \epsilon \qquad (10.4.3)$$

where the expected signs of the coefficients are:

$\alpha_0 > 0$

$\alpha_1 < 0$

$\alpha_2 \quad 0$

Equation (10.4.3) was estimated for the period 1971 -1981 and the estimated coefficients and descriptive statistics are reported in Table (10.4.1)

The estimated coefficients have the expected signs, suggesting

Table 10.4.1

REGRESSION ESTIMATES FOR BETWEEN BANK TRANSFERS

1971 - 1981

Dependent Variable B_d^h/D

Based on Confidential Data for the Four Largest Dutch Banks

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	6.1527340	0.4233305	14.534116
BGC	-0.0064988	0.0017055	-3.8104566
ΔBGC	-0.0158471	0.0076565	-2.0697542

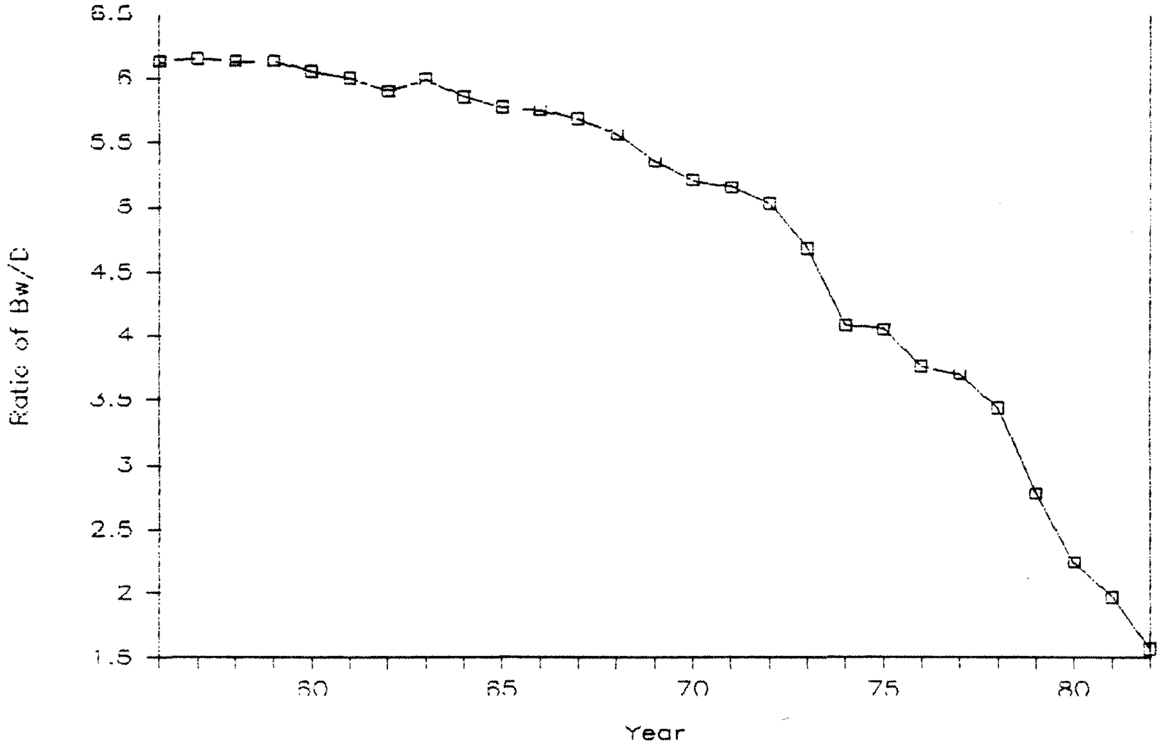
R-squared	0.814457	Mean of dependent var	4.189039
Adjusted R-squared	0.768071	S.D. of dependent var	1.781129
S.E. of regression	0.857774	Sum of squared resid	5.886211
Durbin-Watson stat	1.465345	F-statistic	17.55832

that the ratio of between bank payments to deposits declines with the size and growth of the Bank Giro system. Given the estimated coefficients, it is possible to calculate the forecast values of B_d for Sweden, by applying the estimated coefficients to the Swedish data on bank giro turnover. The estimated series is displayed in Figure (10.4.1). As the Bank Giro grew to incorporate the entire banking system, the ratio of between bank payments directly effected through the banks to demand deposits, declined throughout the period.

A similar methodology was used to obtain an estimate of the transfers effected within banks. The within bank transfers in the Netherland's four largest banks (B_w^h) were regressed on the total

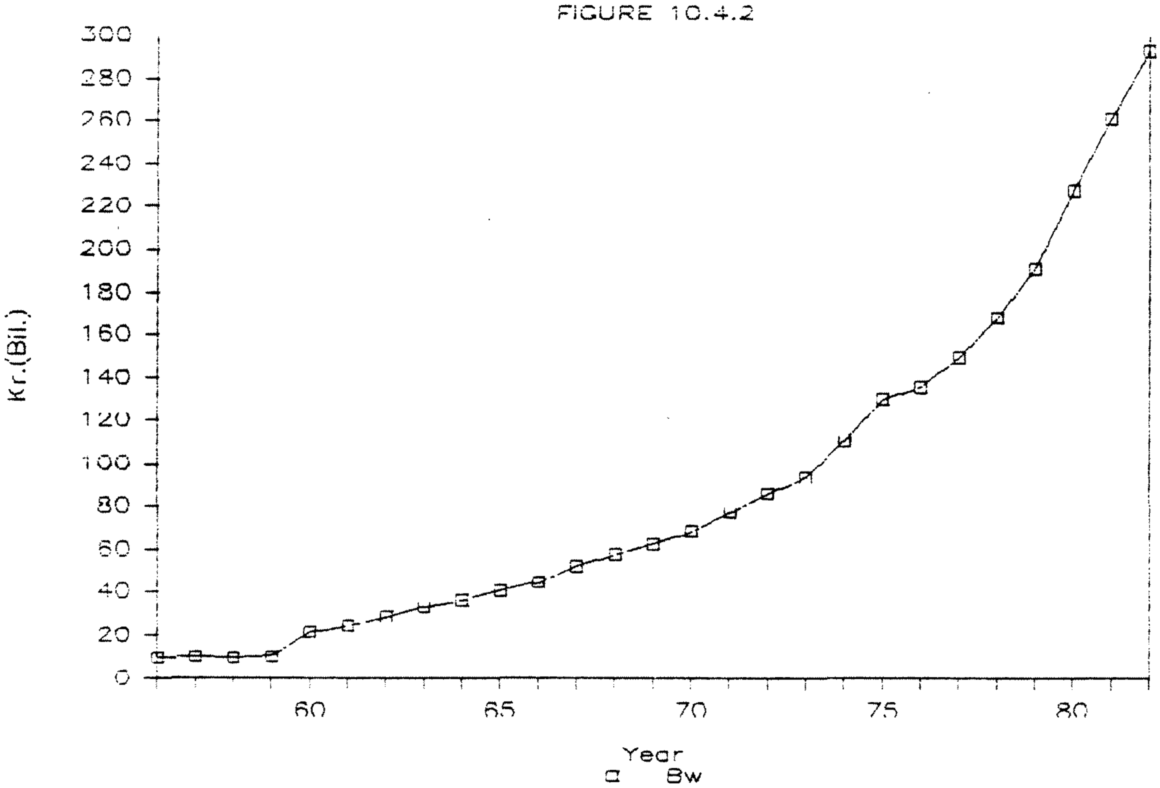
Between Bank Transfers

FIGURE 10.4.1



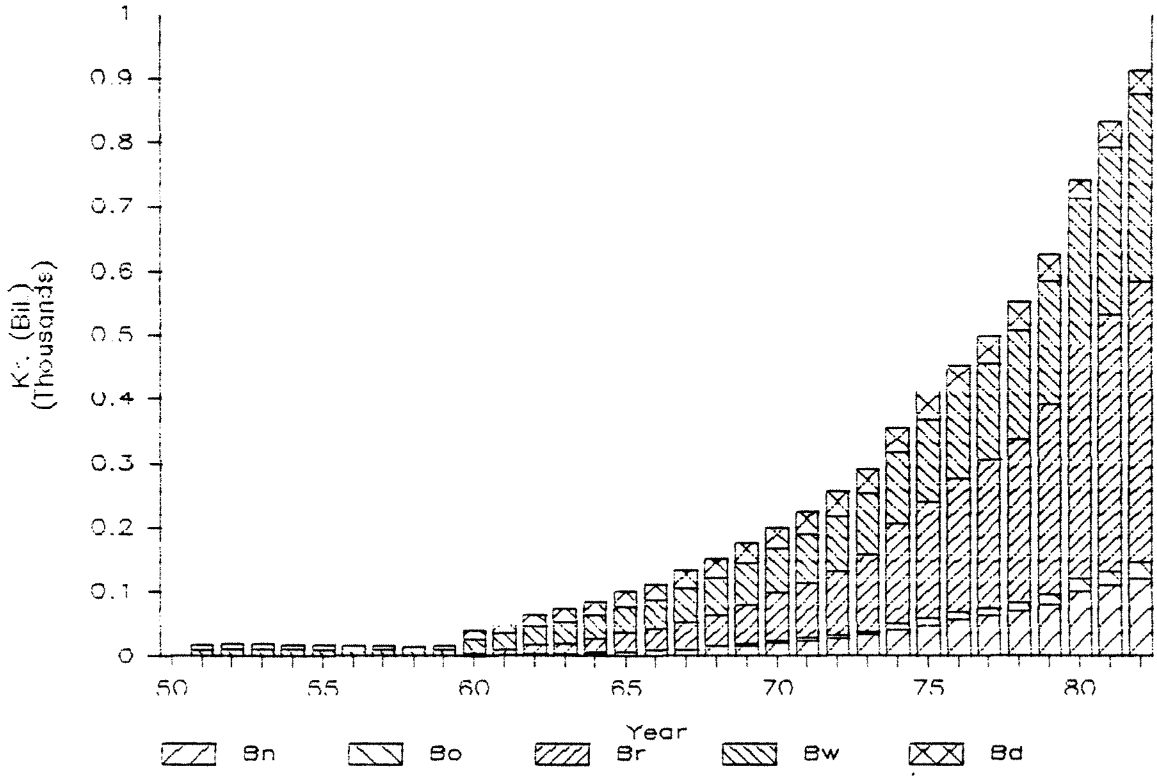
Estimated Within Bank Transfers

FIGURE 10.4.2



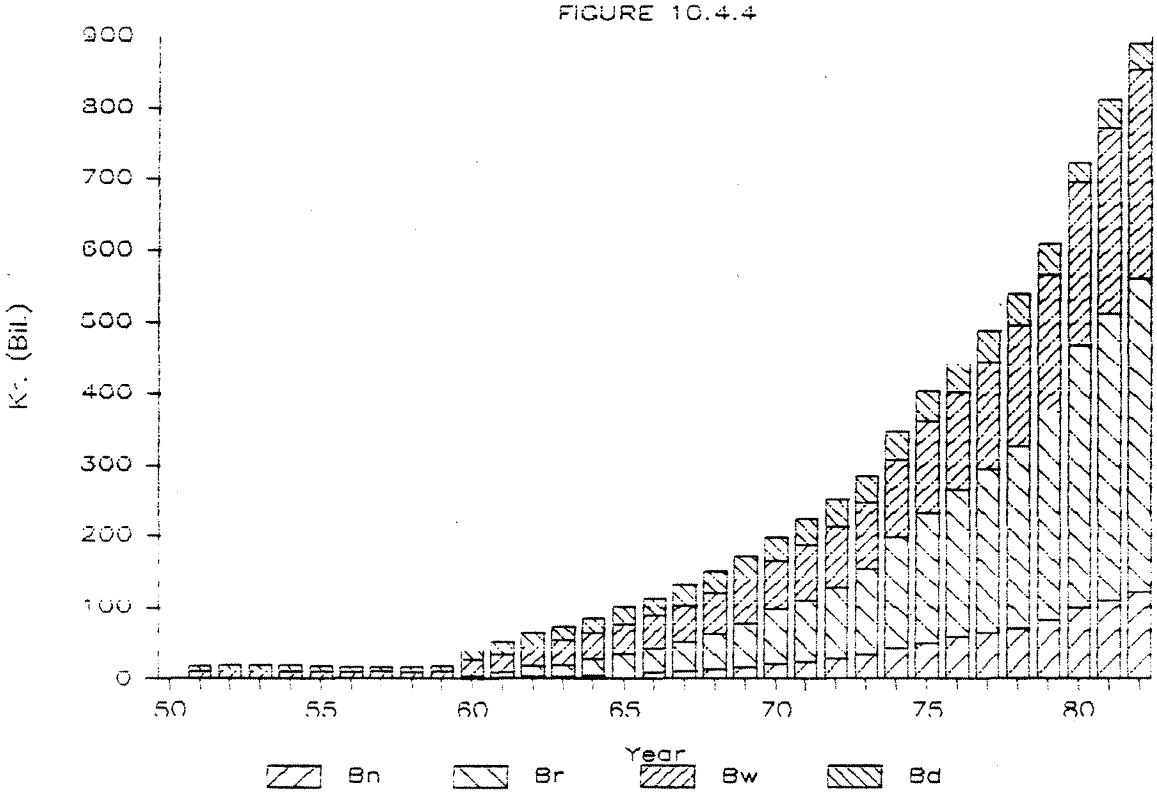
Components of Adjusted Bank Turnover

FIGURE 10.4.3



Bank Payment Credits

FIGURE 10.4.4



stock of demand deposits (D), the size of the bank giro (BGC) and the growth in the bank giro (ΔBGC). The regression estimates are displayed in Table (10.4.2).

Table 10.4.2

REGRESSION ESTIMATES FOR WITHIN BANK TRANSFERS

1971 -1981

Based on Confidential Data from the Four Largest Dutch Banks

Dependent Variable is B_w^h

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
D	9.2451138	0.5823752	15.874840
BGC	0.1521178	0.0465584	3.2672442
ΔBGC	-0.2009504	0.1771485	-1.1343614

R-squared	0.950730	Mean of dependent var	233.0000
Adjusted R-squared	0.938412	S.D. of dependent var	76.33865
S.E. of regression	18.94490	Sum of squared resid	2871.272
Durbin-Watson stat	1.690232	F-statistic	77.18477

In order to obtain estimates of B_w for Sweden, the estimated regression coefficients were applied to the Swedish data on the dependent variables, and the resulting series is displayed in Figure

(10.4.2).[4] These estimates indicate that within bank transfers grew pari passu with the growth of overall deposits.

10.4.3 Estimation of Bank Inpayments, Outpayments and Transfers

Published data on the Bank Giro refer to the total volume of turnovers in the Bank Giro system.[5] The total volume of turnovers consists of the inpayments, outpayments and transfers effected by the Bank Giro. This total turnover series was decomposed into its separate components,[6] and the resulting time series for each type of payment are displayed in Figure (10.4.3) along with the previously estimated series for within and between bank transfers.

Figures (10.4.4) and (10.4.5) respectively display the total of bank payments, measured from the credit and the debit perspectives. The credit payments measure exceeds that of the debit measure because the estimated volume of bank inpayments exceeds that of bank outpayments.

Figure (10.4.6) displays the fraction of estimated credit payments made up by each of the components. In the period prior to

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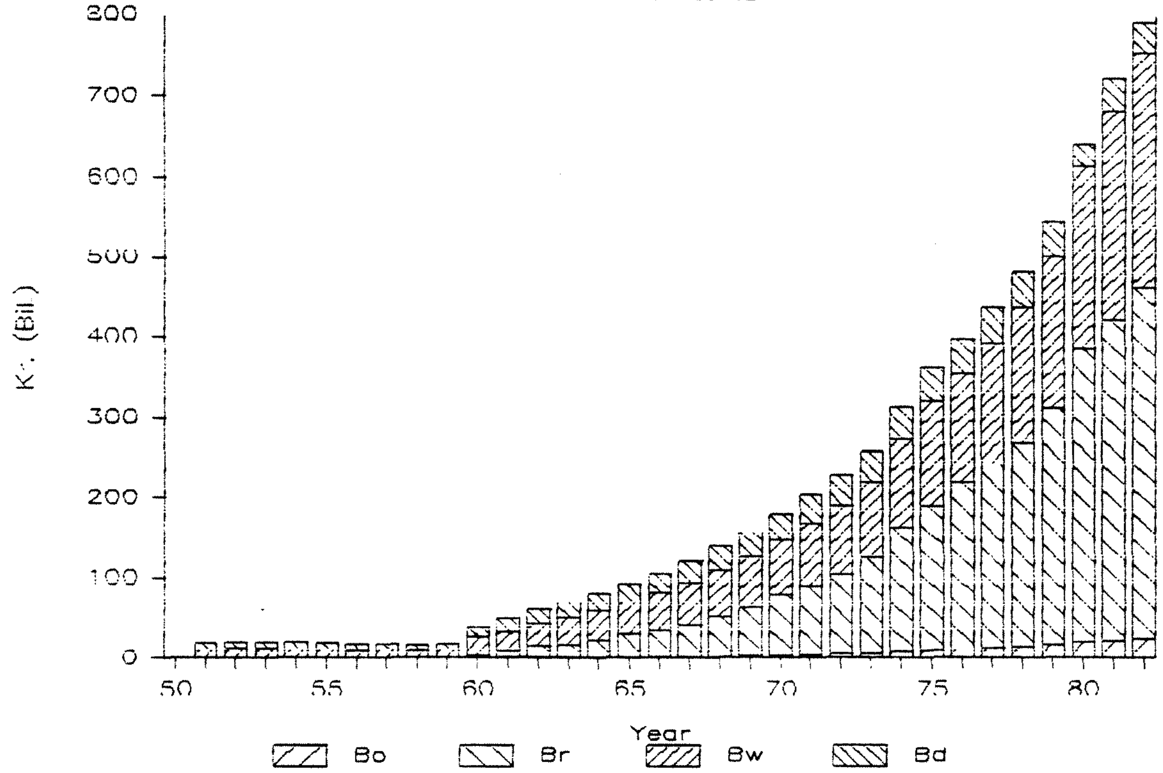
4. Appendix B.1 discusses the conceptual discontinuities in the Swedish published data on demand deposits and describes the adjustments to the published series which were required in order to derive a conceptually consistent set of inter-temporal observations on demand deposits.

5. The statistics relating to the Bank Giro are to be found in various issues of the Statistisk arsbok in the Credit Market section. Data are reported on the number of Bank Giro accounts and the number and value of total turnover payments.

6. The Bank for International Settlements cites a breakdown of total bank giro turnover into its components for the year 1977 in Payment Systems in Eleven Developed Countries ibid. p 211. The estimated value of inpayments, outpayments and transfers are derived by applying the 1977 percentages of each of the components to the published turnover totals for other years.

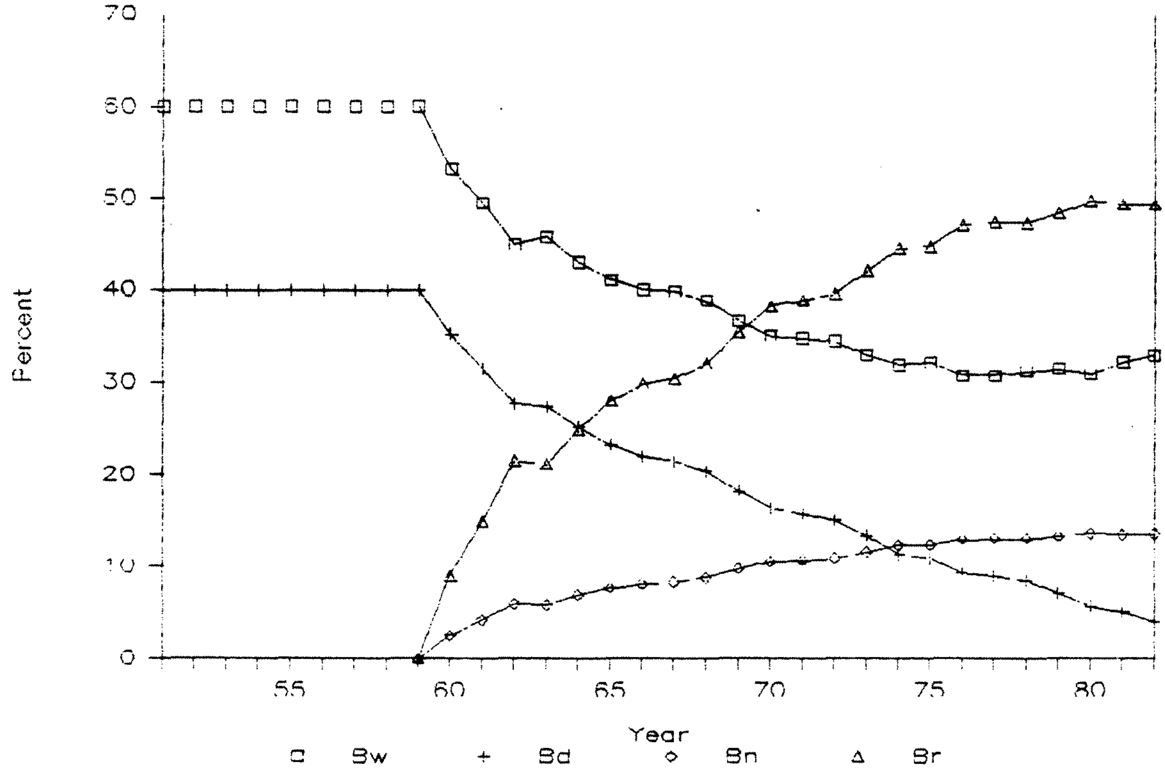
Bank Payment Debits

FIGURE 10.4.5



Composition of Bank Payment Credits

FIGURE 10.4.6



the establishment of the Bank Giro, approximately 40% of payments were effected by between bank transfers and 60% of payments were within bank transfers. With the establishment of the Bank Giro, the fraction of total credit payments made up by these direct bank transfers continued to decline, as giro transfers and giro outpayments grew rapidly.

10.5 Estimation of Post Giro Payments

The published data on Postal Giro accounts is more complete than that for the Bank Giro. Time series data are available on the size of Post Giro deposits, but these require adjustment in order to construct a conceptually consistent series.[7]

Published data on Post Giro turnover and its components are also readily available, but these series also require adjustments in order to avoid the double counting that occurs in some of the published series. It is also necessary to eliminate the sizable volume of governmental inter-agency transfers which are effected through the Post Giro system.[8] Once these various adjustments to the raw data have been undertaken, it is possible to derive the total credit and debit measures of postal giro payments. The components of adjusted giro turnover are displayed in Figure (10.5.1) and the estimated value of Post Giro credit payments are displayed in Figure (10.5.2).

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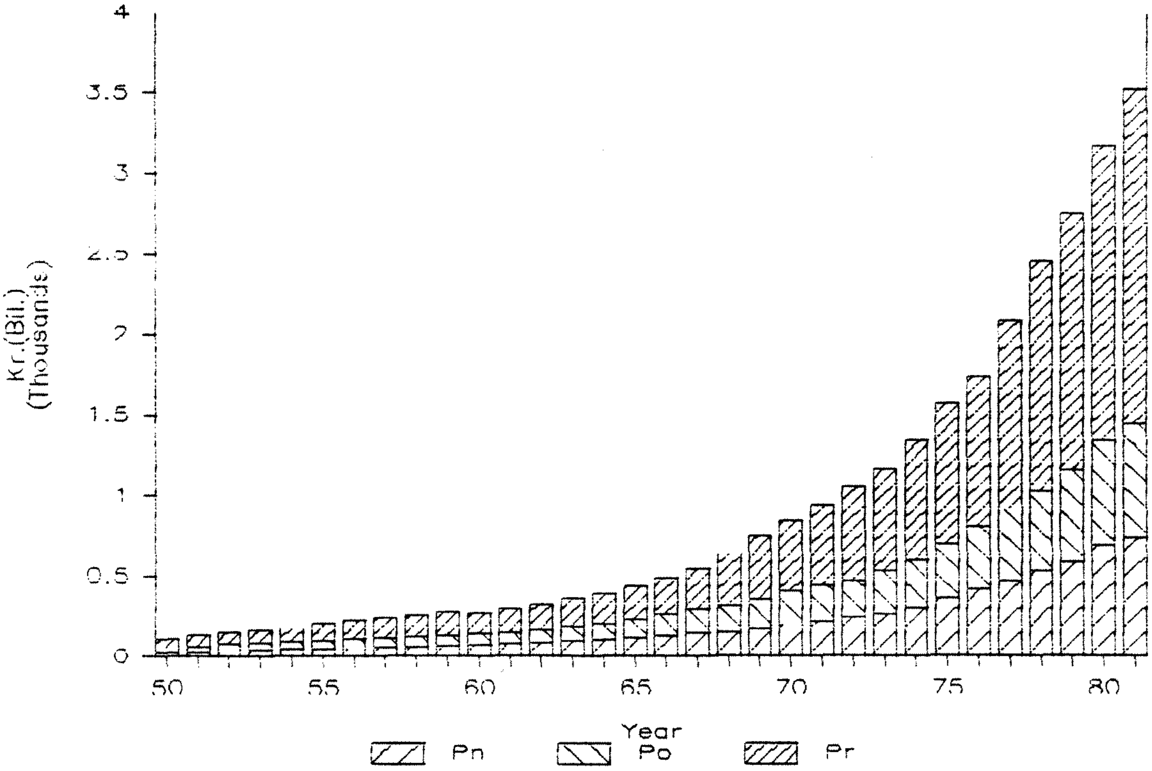
7. Appendix B.2 describes the adjustments required for the Post Giro data on deposits in order to account for the shifting of interest bearing postal accounts to the PK Bank during 1974.

8. Appendix B.2 displays the published series and explains the adjustments undertaken in order to obtain a conceptually consistent time series.

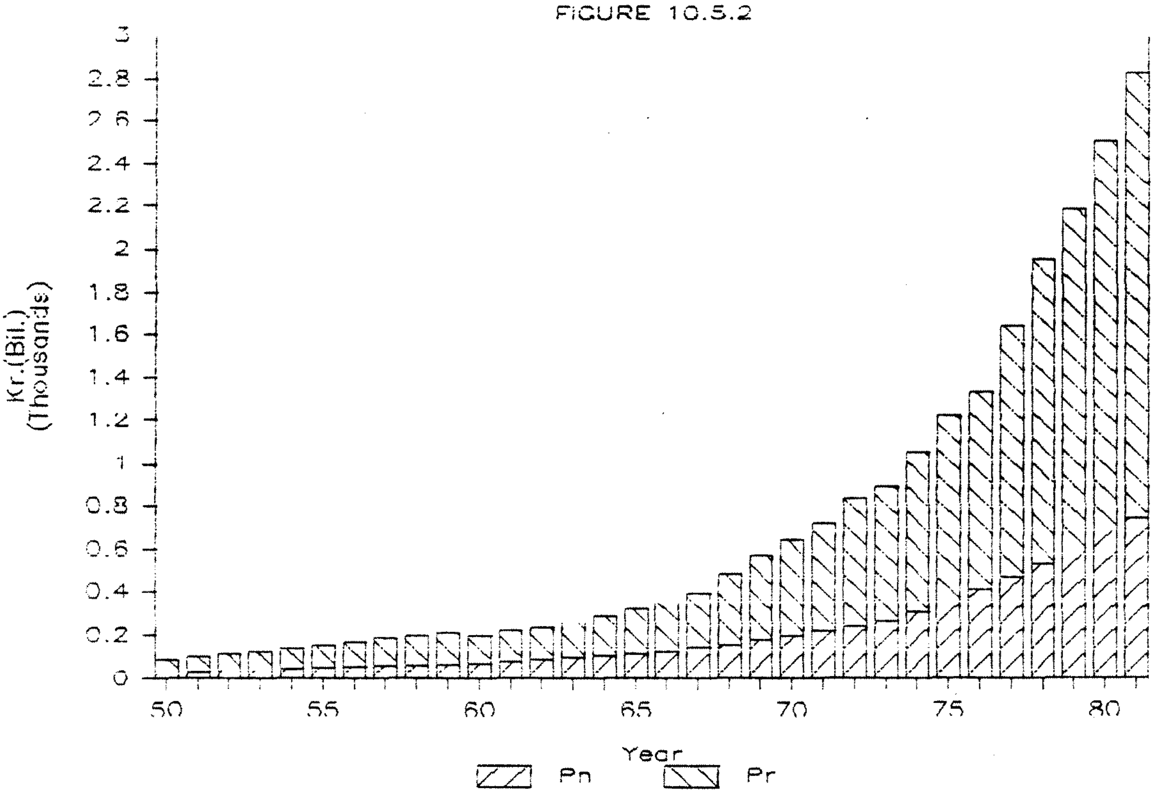
Adjusted Post Giro Turnover

FIGURE 10.5.1



Post Giro Payment Credits

FIGURE 10.5.2



10.6. Derivation and Analysis of Total Payments in Sweden

On the basis of the analysis undertaken in the preceding sections, it is now possible to derive both the credit and debit measures of total payments in Sweden as described in the aggregate payments matrix of Section 10.2. The credit measure of total payments ($[MV]_c$) is given by:

$$[MV]_c = C \cdot V^c + D^b \cdot V^b + D^p \cdot V^p = C^g + \tau + P_n + P_r + B_n + B_r + B_w + B_d \quad (10.6$$

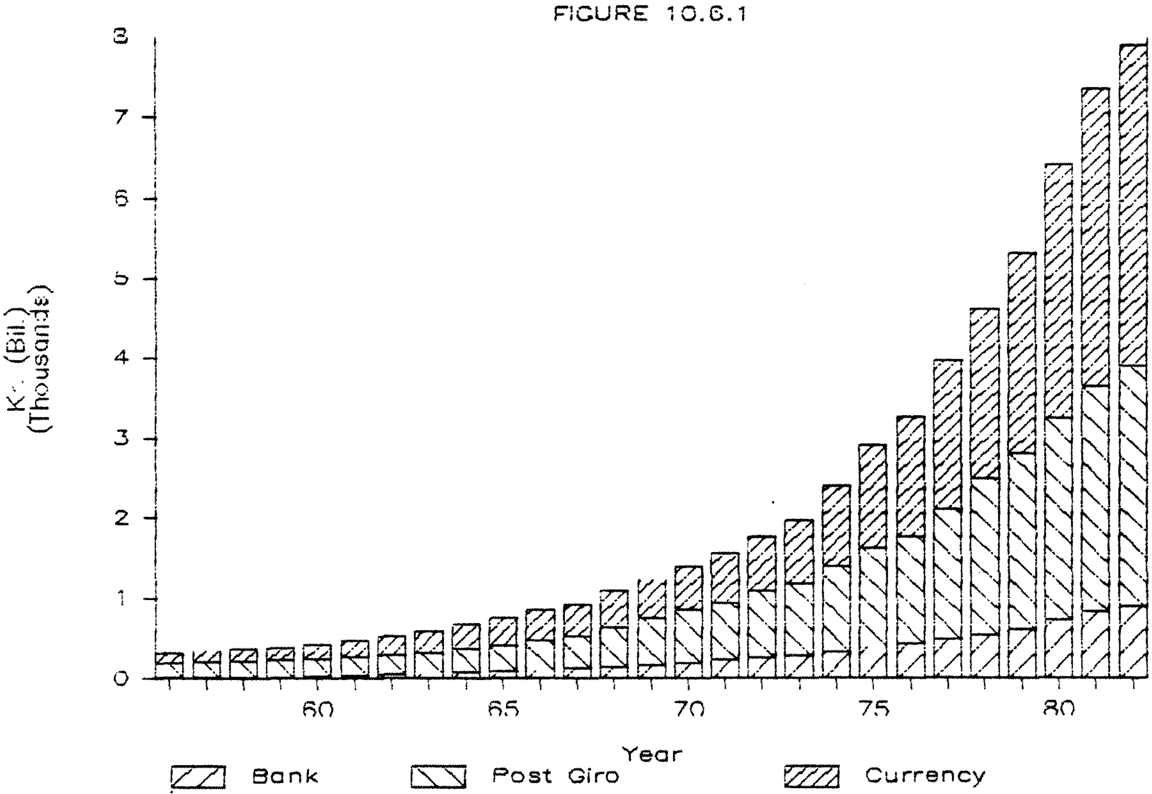
and the total volume of debit payments ($[MV]_d$) is given by:

$$[MV]_d = C^g + \pi + P_o + P_r + B_o + B_r + B_w + B_n \quad (10.6$$

Figure (10.6.1) displays the credit measure of total payments in Sweden as the sum of currency, post giro, and bank payments. The fraction of Sweden's total credit payments made up by each of the constituent components is displayed in Figure (10.6.2). Bank payments are seen to represent less than 15% of total payment credits in Sweden, whereas Post Giro payments account for more than 40% of total payments over the period of study. Cash payments exceed even postal payments as a percent of total payments during the mid 1960's and again in the post 1975 period. As revealed by Figure (10.6.2), the establishment of the bank giro system resulted in a transfer of total payments from the postal system to the banks. Between 1967 and 1972, the post giro payments appear to have become better substitutes for cash payments as reflected in the growth of

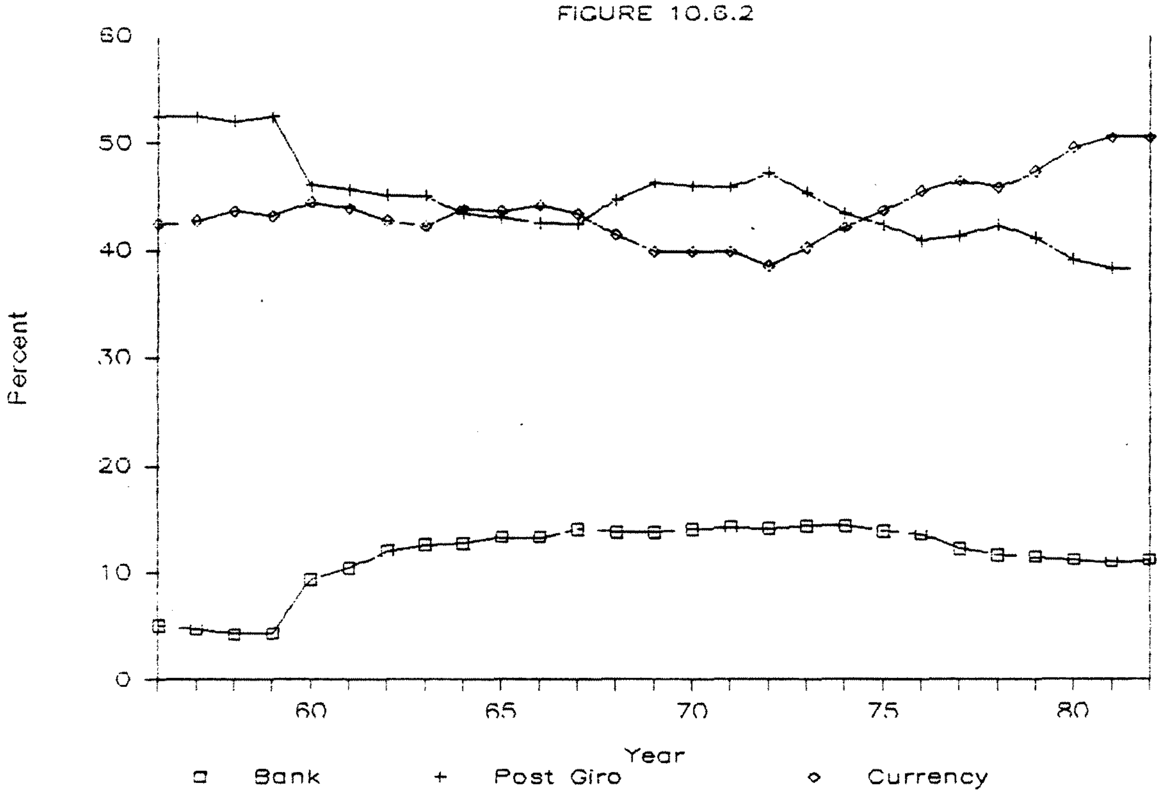
Total Swedish Payment Credits

FIGURE 10.6.1



Composition of Total Payment Credits

FIGURE 10.6.2



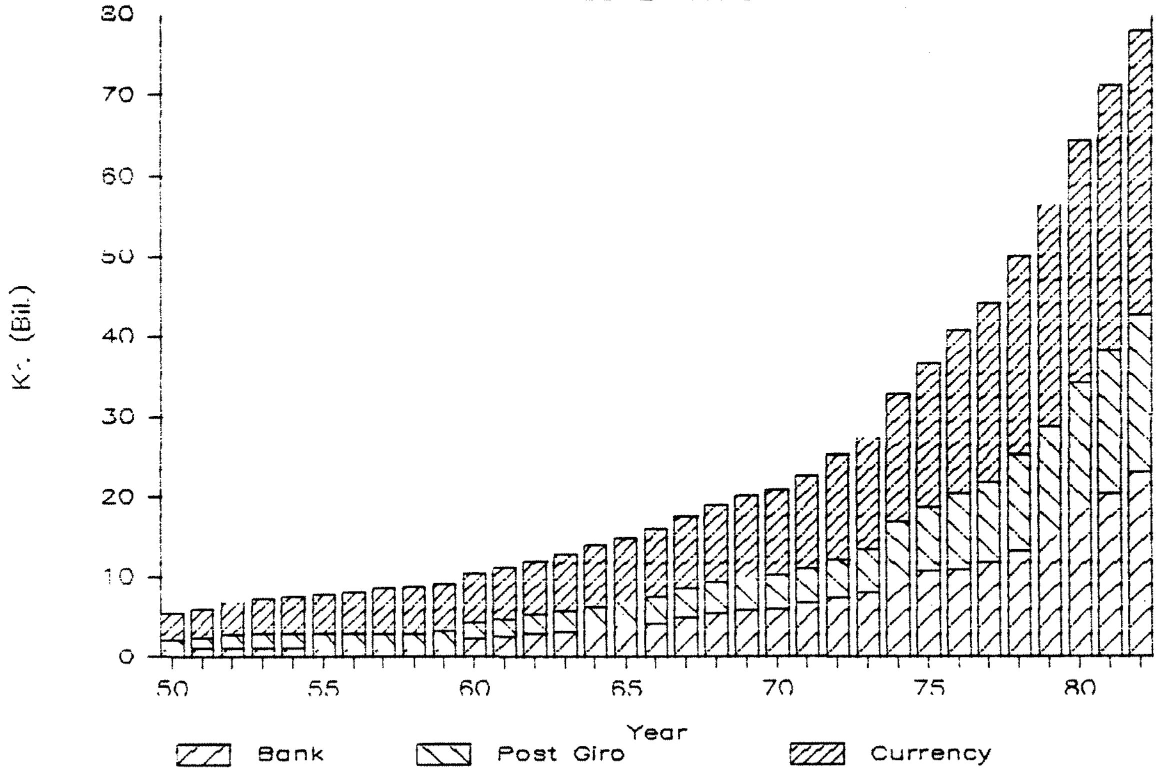
the former at the expense of the latter. This tendency of substitution of postal payments for cash payments was reversed after 1972, as cash payments appear to have reasserted their dominant role in the Swedish payments system.

Figures (10.6.3) and (10.6.4) display the final estimates of Sweden's money supply and its composition. The money supply is composed exclusively of those assets which do the work of "money", namely, to function as a final medium of exchange. The largest component of Sweden's money supply consists of the stock of currency. Since the establishment of the bank giro, checkable and giro transferable demand deposits at the banks represent the second largest component of the money stock, with giro transferable postal deposits representing the smallest component. A comparison of the payments estimates in Figures (10.6.1 and 10.6.2) with those of the stocks of money, [Figures (10.6.3 and 10.6.4)] reveals that monetary stocks are not an accurate indicator of the flows of payments generated by the stocks. Indeed, the relative volume of payments effected by the different exchange media are determined principally by relative differences in the turnover of each payment medium.

The aggregate payment velocity of money is displayed in Figure (10.6.5), and Figure (10.6.6) correspondingly shows the average estimated yearly velocity for each medium of exchange. Bank demand deposits, which since 1960, have exceeded postal deposits, nevertheless, effect a considerably smaller percentage of total payments, due to their lower average velocity. Postal demand deposits, representing the smallest component of the money supply, nevertheless, effect a substantial percentage of total payments,

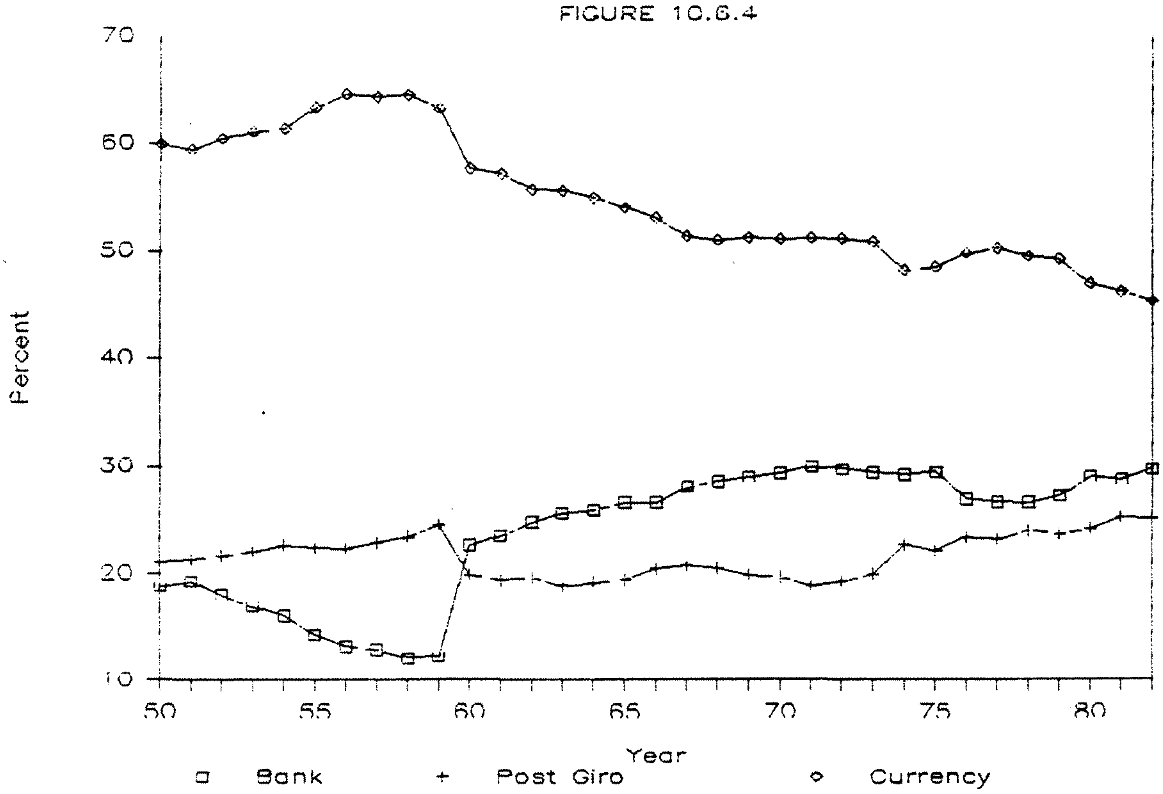
Money Supply of Sweden

FIGURE 10.6.3



Composition of Sweden's Money Supply

FIGURE 10.6.4



owing to the sizable turnover on these deposits.

The previously described shift of currency payments to postal payments that occurred during the late 1960's and early 70's, resulted from an increase in the velocity of postal payments, rather than from a shift of currency into postal accounts. This period in Sweden's financial history is marked by the establishment of giro linked wage and salary accounts. Wages and salaries, previously paid in cash, were now directly deposited in the newly established wage and salary accounts. Although this structural shift is partially reflected in the decline in the currency supply and corresponding increases in both post and bank demand balances, the major impact appears to have come through an increase in the frequency of use of the postal giro accounts.

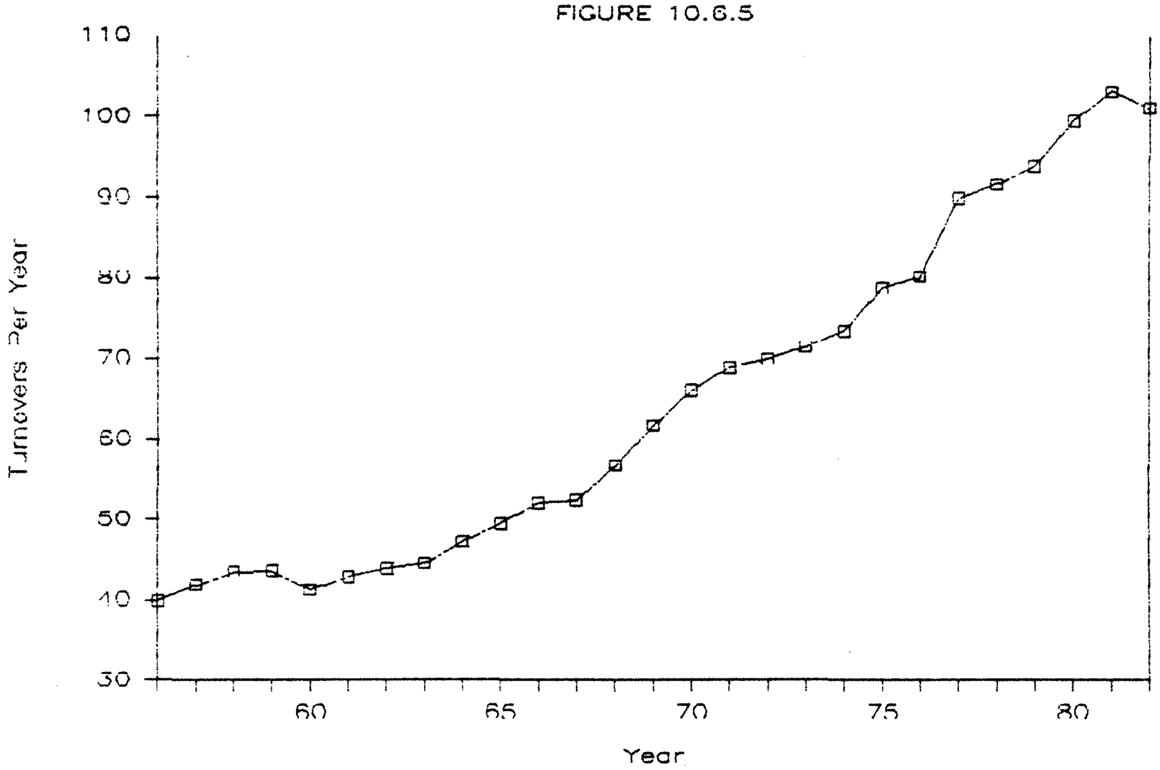
During the period of study, currency remained the largest component of the total money supply, and also served to effect between 40 - 50% of Swedish payments. The post giro demand accounts, which comprise the smallest fraction of the monetary stock, nevertheless effected more than 40% of all payments as a result of the significantly higher turnover on these giro accounts. Bank demand deposits, comprising almost 30% of the nation's money supply, nevertheless, effected only 10% of the nation's total payments.

In summary, Swedish payments during the period 1956 -1982 increased approximately twenty five fold. This increase in total payments resulted from a tenfold increase in the total supply of money, and a two and a half fold increase in the average payment velocity of money.

The former lack of estimates of any nation's total payments,

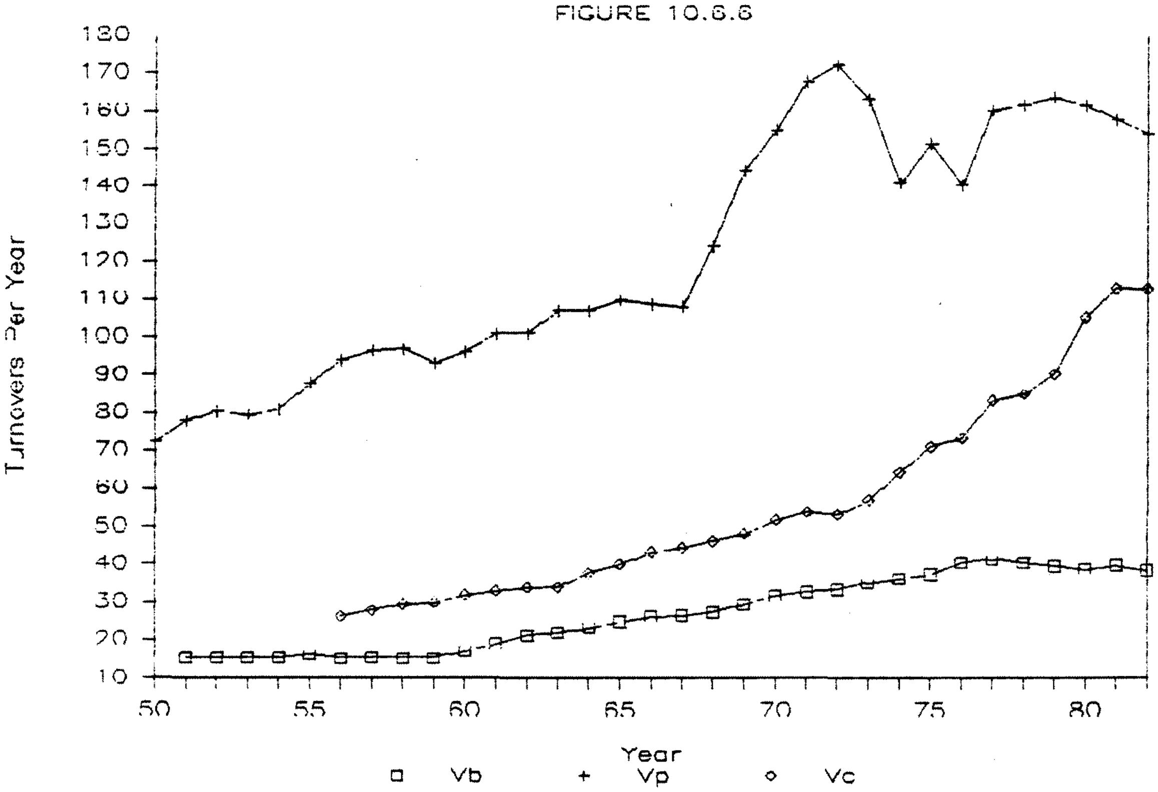
Payment Velocity of Money

FIGURE 10.6.5



Components of Payment Velocity

FIGURE 10.6.6



has significantly effected the course of empirical work in monetary economics. Despite the fact that virtually all theoretical models of money demand are based on a transactions theory, empirical applications of the theory have resorted to expedient of using income as a proxy variable for transactions (or more correctly, payments). The ready availability of national accounts estimates of national income and product, and the absence of corresponding payments estimates, has made this practice almost universal. One corollary of this practice has been the attention given to "income" velocity rather than to "payment" velocity. Income velocity (V_y) is defined as,

$$V_y \equiv \frac{P \cdot y}{M} \quad . \qquad (10.3.4)$$

Figures (10.6.7) and (10.6.8) display estimates of Sweden's income velocity and its components. During the period of study, income velocity fluctuated between five and seven turnovers per year, whereas overall payments velocity increased from forty to one hundred turnovers per year.

Figure (10.6.9) displays the ratio of the payment velocity to income velocity. This ratio is of considerable importance, since most modern monetary analysis implicitly assumes a proportional relationship between total payments and income, or equivalently, that payment velocity is a constant multiple of income velocity.[9]

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9. For example, Lars Jonung (1978) attempts to analyse the long run demand for money in Sweden, on the basis of a model suggested by

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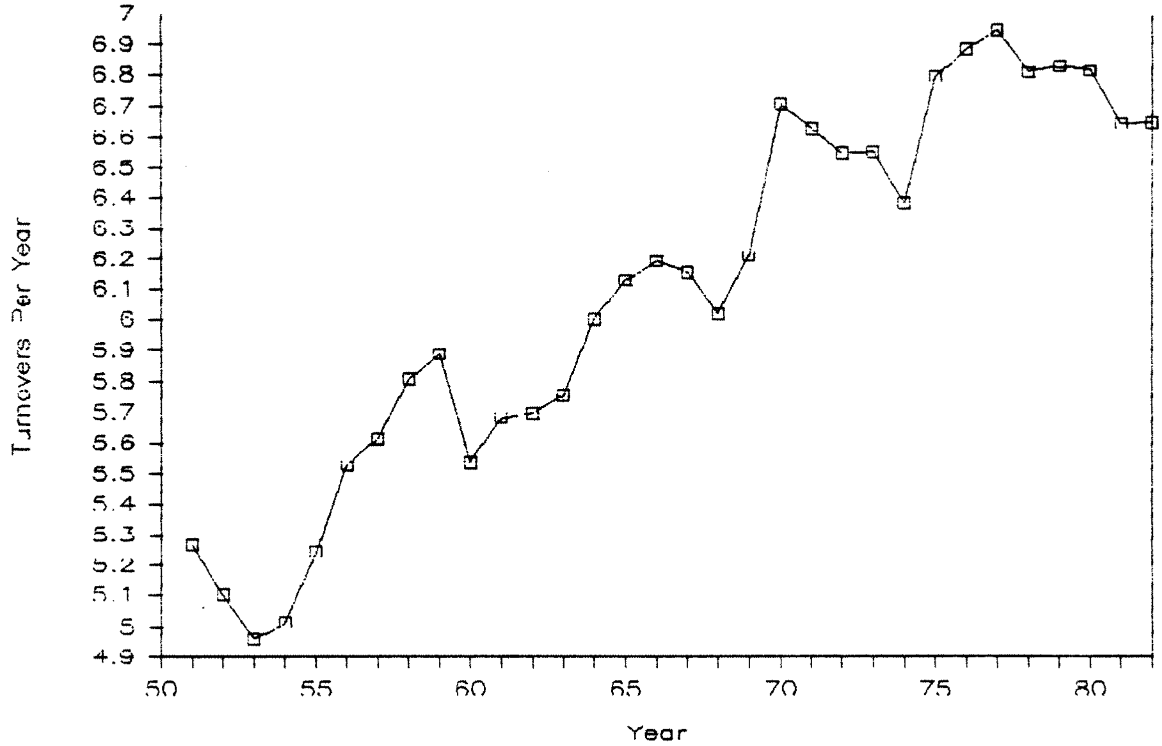
Wicksell (1902) which clearly specifies "transactions" (payment) velocity as the critical variable. Yet Jonung's entire empirical analysis is based on estimates of "income" velocity. Jonung follows an empirical tradition which is well established in the works of Friedman; Meltzer; Goldfeld; Laidler; Myhrman and the present author. This empirical tradition of substituting income velocity for payment velocity has survived despite repeated predictive failures of estimated money demand functions, solely, because of the lack of data on the total volume of payments.

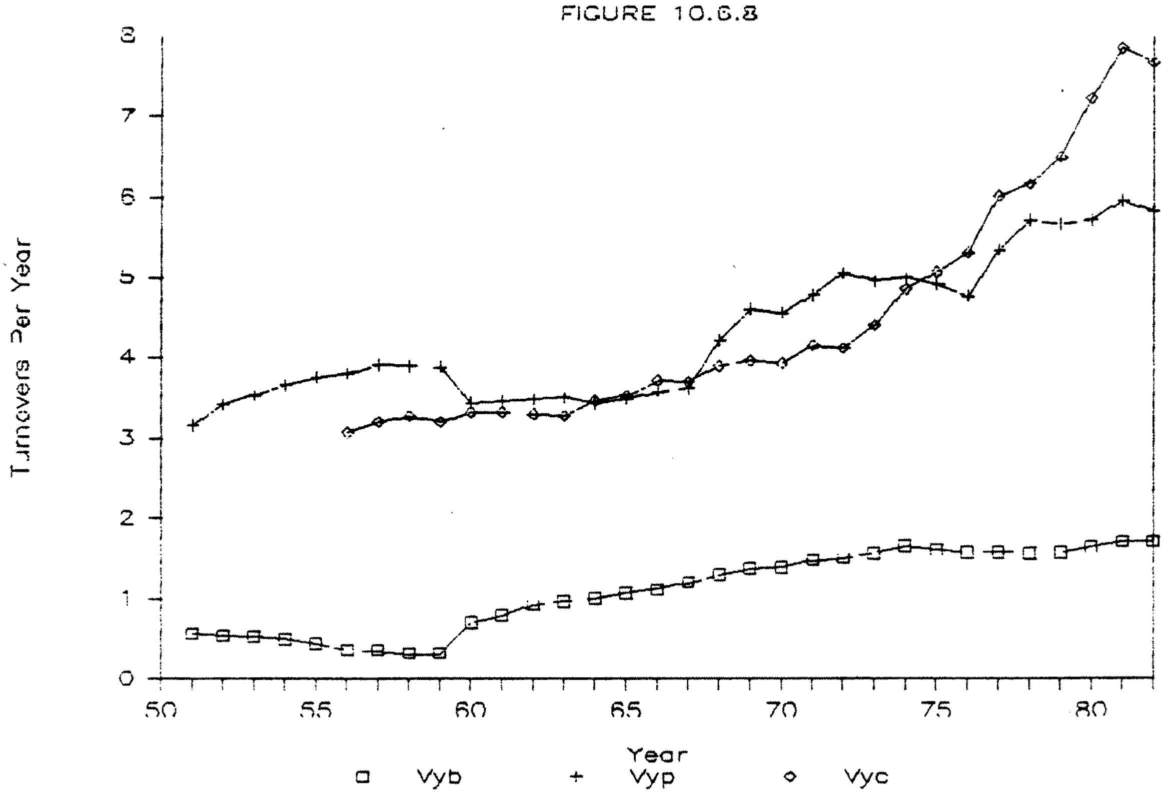
Income Velocity of Money

FIGURE 10.6.7



Composition of Income Velocity

FIGURE 10.6.8



Persson (1979),[10] recognized that the" difference between theory and results might be the consequence of GNP being an inappropriate proxy value for the volume of transactions". In an effort to correct this long standing problem, he estimated Swedish money demand functions based on internal data on post giro and bank giro total turnover statistics. His measure of total "transactions" understated total payments by the exclusion of currency payments, and overstated total payments by failing to net out double counting that is implicit in the aggregate of turnover statistics.[11] Despite the shortcomings of Persson's estimate of transactions, his estimated demand functions, based on a transactions, rather than an income scale variable, resulted in empirical estimates that correspond more closely to their expected theoretical values.

The finding, [Figure (10.6.9)] that the ratio of payment to income velocity is not constant, suggests that the newly estimated series of total payments should be used as the appropriate scale variable in the estimation of money demand functions for Sweden. Such money demand functions will be conceptually consistent with the theoretical specifications from which they are derived.

The foregoing calculations all utilized the credit measure of total payments displayed in Figure (10.6.1). As shown in section 10.2, total payments can also be estimated as total debits to the accounts of each medium of exchange. Figure (10.6.1) displays the

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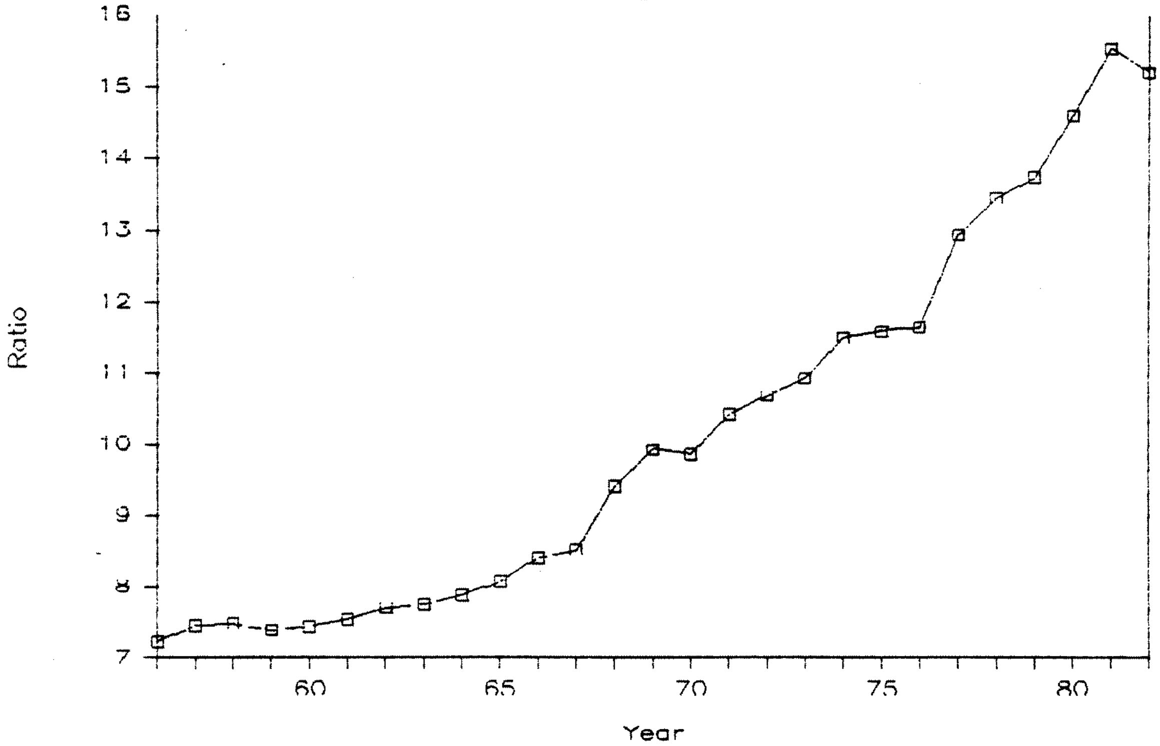
10. Persson, T. "Alternative Transactions Variables in Money Demand Equations: A Note on the Baumol-Tobin Theory" Institute for International Studies, University of Stockholm.

11. See the Payment Matrix (Table 10.2.3) for the correct procedure.

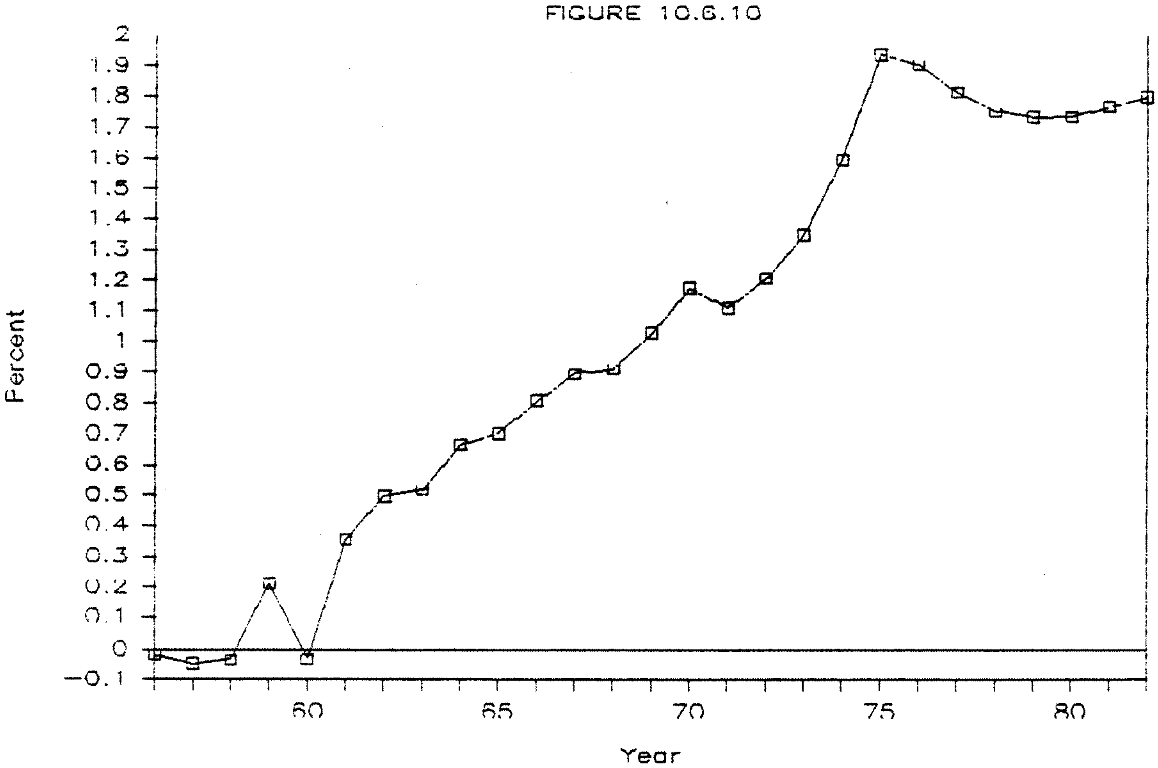
Ratio of Payment to Income Velocity

FIGURE 10.6.9



Discrepancy in Total Payments Estimate

FIGURE 10.6.10



percentage discrepancy between the total credit and the total debit estimate of total payments in Sweden. The discrepancy between the two measures is never more than 2% of the total credit payment estimate, although the discrepancy measure reveals that the credit measure of total payments exceeded the debit measure in all years after 1960. Use of the debit measure of total payments will not substantively change any of the foregoing conclusions.

11.1 The Estimation of Total Transactions

Given the estimate of the total volume of payments in the Swedish economy (MV), we now seek to examine the other side of the coin, namely, the total volume of transactions (PT). The guiding conceptual framework is Fisher's equation of exchange:

$$M \cdot V = P \cdot T \qquad (11.1.1)$$

The importance of this apparently simple identity arises from its emphasis that in a monetary economy, a monetary payment is the other side of every trade. Having decomposed the monetary payments into the stock of the medium of exchange and its total turnover, it is now necessary to find an appropriate decomposition of the right hand side of equation (11.1.1) so that it can be estimated empirically.

The aggregative perspective of macroeconomic analysis suggests the usefulness of a final decomposition of transactions into its price and volume of trade components. As an intermediate step, we seek a decomposition that fully reflects the dual nature of a monetary economy. That is, to identify and estimate <u>all</u> transactions that involve exchanges of something for money. Conventional national accounting approaches surprisingly ignore the equation of exchange identity, despite the fact that it offers a high level constraint on the measurement of economic activity involving both the transactions flows related to current production and the transaction flows related to asset exchanges. Few would question the usefulness of the Keynesian income- expenditure identity as a powerful tool for organizing and cross checking information on economic activity concerned with current production and the factor incomes generated by the production process. The equation of exchange identity, similarly offers a means of estimating and analysing total economic activity from the dual perspective of monetary payments on the one hand, and real goods and asset transactions on the other. The transactions perspective has been elaborated and refined over the last half century. Perhaps the time has come to give similar attention to the payments perspective, and more importantly, to reap the empirical and analytic harvest that is envisioned from a general merger of the payments perspective with its mature transaction bedfellow.

A natural decomposition of transactions would follow the taxonomic categories established by the national accounting frameworks that are already in place in many countries. In particular, National Income and Product Accounts (NIPA) summarize final transactions in newly produced domestic goods and services, whereas the Input - Output Accounts (IOP) summarize intermediate transactions. Income and Outlay Accounts (IOL) by sectors include both final goods and services transactions as well as net sector transfer payments. The Balance of Payment Accounts (BOP) summarize transactions for foreign goods, services and assets. Some countries have estimated Flow of Funds (FOF) accounts that summarize net transaction flows in all existing assets. Broadly following existing practice, we can decompose PT such that;

$$PT = (pt)_f + (pt)_i + (pt)_r + (pt)_F + (pt)_u \qquad (11.1.2)$$

where:

$(pt)_f$ = transactions for final goods and services.

$(pt)_i$ = intermediate transactions.

$(pt)_r$ = transfer payments.

$(pt)_F$ = financial transactions.

$(pt)_u$ = transactions in the underground economy.

This classification of transactions, corresponds closely to to the transaction components that Morris Copeland attempted to record in his pioneering effort to establish a flow of funds accounting system. [1] Copeland wished to include, "transactions in goods and services, purchases for resale as well as purchases that appear in the national income and product accounts; all transfer payment flows - grants, benefits, etc. - that pass from one sector of the economy to another; and the net money flows through financial channels from one sector to another" [2] The decomposition of transactions described above, differs from that suggested by Copeland in that we wish to estimate gross rather than net financial transactions. The emphasis on gross transactions is required in order to maintain the balance restriction imposed by the equation of

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1. Copeland, M. A Study of Money Flows in the United States National Bureau of Economic Research, New York 1952
2. ibid., p.11

exchange. Since the (MV) side of the equation of exchange already includes all payments made in the underground economy, the residual difference between (MV) and observed (PY) is identically equal to underground economy transactions.

In Sweden, the major source of information on $(pt)_f$ and $(pt)_r$ is the Income and Outlay Account, and estimates of $(pt)_i$, are contained in the Production Account. The Income and Outlay account consists of <u>transaction</u> credits and debits for each sector of the economy. The sector accounts are for:

1) Non-financial corporate and quasi-corporate enterprises.
2) Financial Institutions.
3) Central Government.
4) Local Government.
5) Social Security funds.
6) Households and Private non-profit institutions.
7) External transactions.

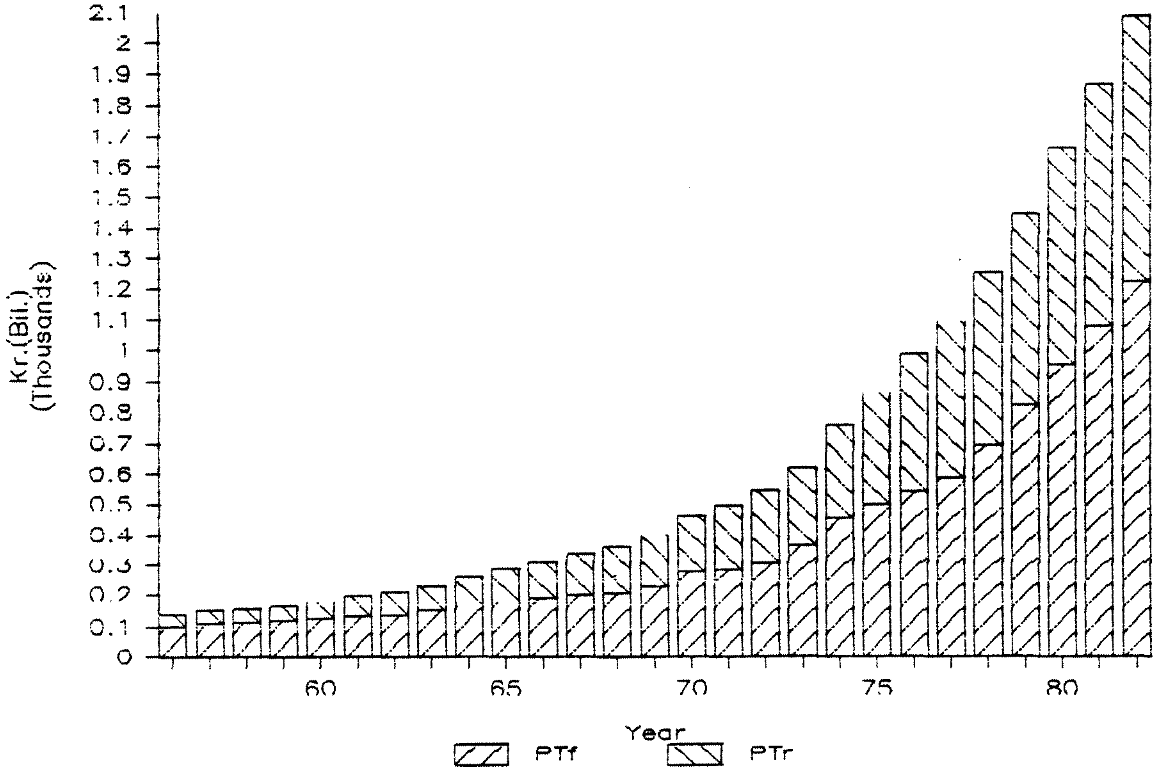
Transaction credits to each sector include net operating surplus, factor payment incomes and transfers to the sector, whereas, transaction debits to each sector are the sum of consumption, savings and transfers from the sector. The important feature of the (IOL) account, from the perspective of monetary payments is that credit and debit entries to the non government sector accounts reflect two different monetary entries, each of which must be included in the tabulation of transactions. Since every transaction is mediated by a monetary transfer, <u>each</u> credit entry in the (IOL) account represents <u>both</u> a credit and a debit to a medium of exchange account. For example, the compensation of employees, which appears as a credit to the household sector in the (IOL) accounts, simultaneously represents a payment credit to a medium of exchange account, (the receipt of wages and salaries) and a payment debit to a medium of exchange account (the payment of wages and salaries). Similarly, each (IOL) debit represents a simultaneous payment credit and debit to a medium of exchange account. Thus, final consumption expenditures of the households, (a debit to the (IOL) household sector account), represents a payment debit to a medium of exchange account of the household, and a payment credit to an enterprise medium of exchange account. In order to obtain the credit sum of all final goods $(pt)_f$ and transfers $(pt)_r$ to the economy's medium of exchange accounts, it is necessary to sum (IOL) credit <u>and</u> debit entries for all non-government sectors. Since every medium of exchange payment is correspondingly a medium of exchange receipt, the sum of all medium of exchange credits will be identically equal to the sum of all medium of exchange debits. Transfer payments from the government to a private sector account, appear as debits to the (IOL) government account but also as credits to the (IOL) private account. Such a transfer represents a monetary payment and a monetary receipt. Since it is already accounted for when summing private sector (IOL) credits, it would be double counting to also include the (IOL) credit to the government account.

Figure (11.1.1) displays the sum of final transactions $(pt)_f$ and transfer payments $(pt)_r$ as calculated from the (IOL) accounts.

Estimates of intermediate transactions for Sweden are available from the Production Account. In other countries, these would be estimated from the Input- Output Accounts. The salient

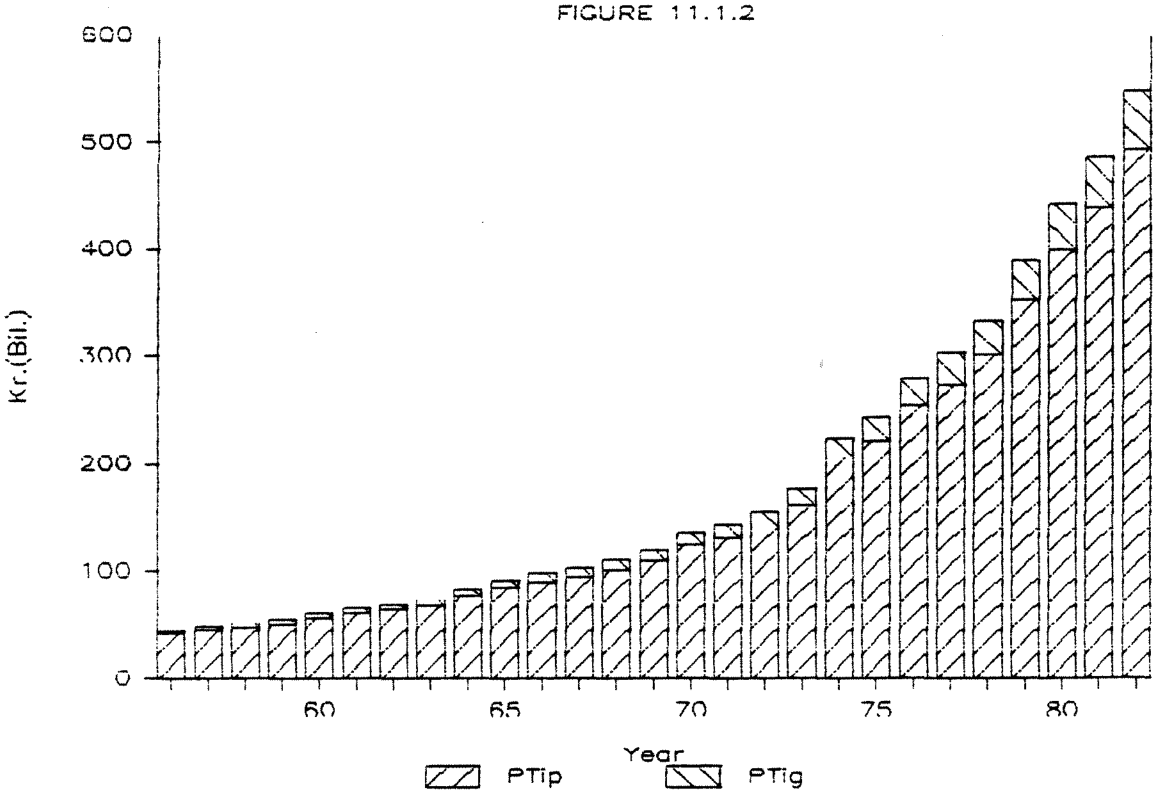
Final and Transfer Transactions

FIGURE 11.1.1



Intermediate Transactions

FIGURE 11.1.2



feature of the construction of the Production Account and the (IOP) account is that each credit and debit entry reflects the same transaction. That is, the purchase of an intermediate product from one sector, is exactly reflected in the sale of that intermediate product from the other sector. Every transaction in intermediate products gives rise to a payment credit to a medium of exchange account, (the receipt of money for the sale of the intermediate good) and correspondingly, a payment debit to a medium of exchange account (the payment of money for the purchase of the intermediate good). Thus, intermediate transactions $(pt)_i$ are measured either by the sum of intermediate purchases, or by the sum of intermediate sales. Data on total intermediate transactions have been obtained directly from Statistics Sweden [3] and are displayed in Figure (11.1.2). The sum of intermediate payments is composed of intermediate payments in the private sector and intermediate payments associated with government services.

The most difficult problem encountered in attempting to estimate the total volume of transactions, arises from the lack of published data on the <u>gross</u> volume of financial transactions. By financial transactions, we mean the transactions associated with the acquisition and sale of non-money assets. Such transactions include the sales and purchases of existing non-money assets as well as new issues and redemptions. Financial transactions include transfers of existing real estate; time and savings deposits; equities; bonds; etc., where the domestic medium of exchange is used to effect the

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3. I am indebted to M. Larsson for the provision of these data.

transfer. Since each asset transfer is mediated by a credit and a debit to a medium of exchange account, all such transfers are already captured on the payment side of the equation of exchange. This gross sum of transactions must therefore also be included on the transactions side of the ledger.

Published data on gross asset transactions in Sweden are limited to stock and bond turnovers and issues and redemptions of Swedish bonds. These asset transactions are displayed in Figure (11.1.3).

In Sweden, as is the case in other countries, the financial accounts, and the capital transactions accounts permit an examination of changes in financial assets and liabilities as well as estimates of gross savings. However, since none of the existing accounting systems have employed the higher order constraint imposed by Fisher's equation of exchange, transaction flows have been estimated on a "net" basis, rather than on the "gross" flow basis required by the equation of exchange identity.

In the absence of published data on the gross financial transactions we wish to include, it is necessary to obtain an estimate of these flows by other means. Cramer (1980) and Spindt (1985) approximated financial transactions by simply taking them as the residual between an estimate of payments and some other readily available components of total transactions.[4] Such a procedure is conceptually incorrect because it ignores the existence of

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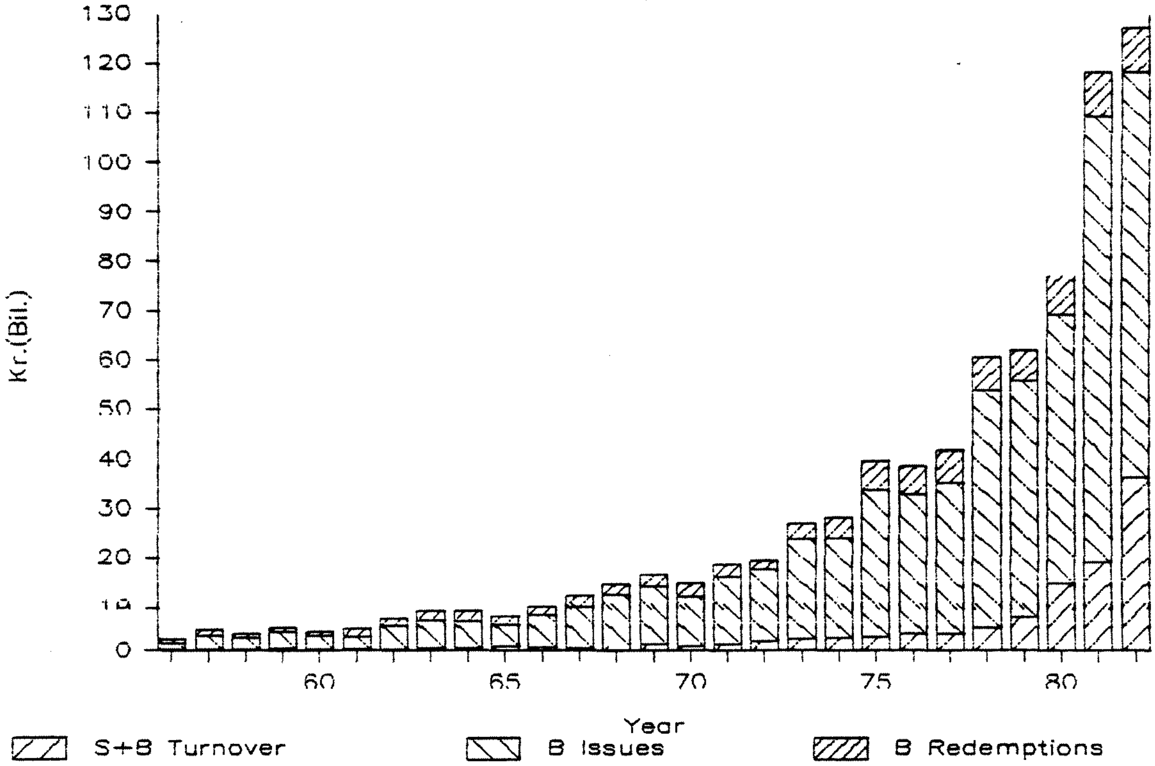
4. Cramer, J. " The Regular and Irregular Circulation of Money." Paper presented at the 1980 meetings of the American Economics Association, University of Amsterdam, 1980, and Spindt, P. " Money is What Money Does: Aggregation and the Equation of Exchange" Journal of Political Economy vol 93 No.1 1985.

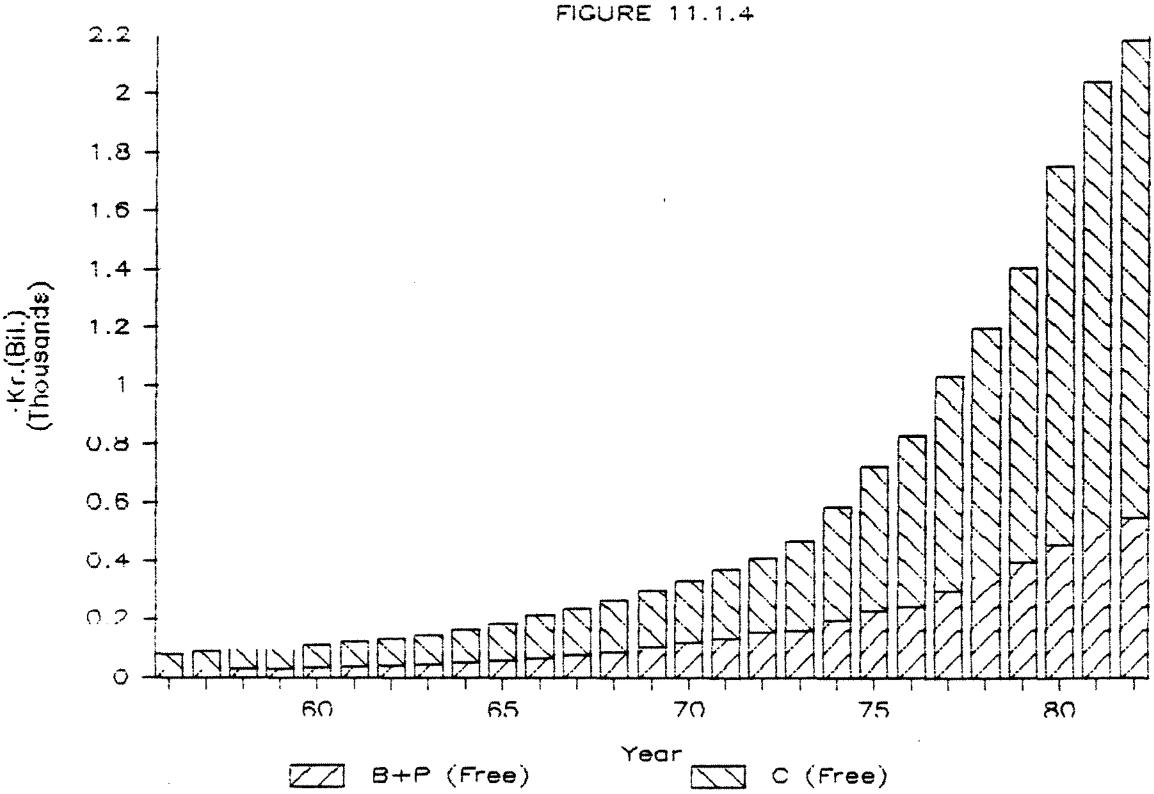
Stock and Bond Transactions

FIGURE 11.1.3



Other Financial Transactions

FIGURE 11.1.4



($D^{d'}$) as the dependent variable in the demand deposit equation where ($D^{d'}$) is total demand deposit debits minus stock and bond transactions. The opportunity cost of currency (r_c) is taken as the average interest rate obtainable on time and savings deposits and the opportunity cost of holding demand deposits (r_d) is taken as the difference between the average interest rates paid on time and savings accounts and the average interest rate payable on demand accounts.[3] The variable (z) is income raised to the fourth power and in the absence of direct information on brokerage costs, we assume that they follow a time trend (T). The constant terms of the estimated regressions are:

$$\alpha_c = L(\Upsilon_h) - L(\alpha)$$

$$\delta_d = L(\Upsilon_h) - L(\delta).$$

Given the estimated regression values of the constant terms (α_c) and (δ_d), the fractions (α) and (δ) are derived as:

$$\hat{\alpha} = \exp\ [L(\Upsilon_h) - \hat{\alpha}_c] \qquad (11.1.6)$$

$$\hat{\delta} = \exp\ [L(\Upsilon_h) - \hat{\delta}_d] \qquad (11.1.7)$$

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3. Average interest rates are computed as weighted averages of the separate interest rates payable on long term deposits subject to 12 month's notice, capital accumulation accounts, savings accounts and wage and salary accounts. See Statistical Yearbooks of the Riksbank.

The regression estimates of equations (11.1.5) and (11.1.6) are displayed in Table (11.1.1).

Table 11.1.1

REGRESSION ESTIMATES OF CURRENCY DEBIT EQUATION

1956 - 1981

Dependent Variable $L(C^d)$

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
αc	-0.4972848	0.0808735	-6.1489189
L(rc)	0.0305482	0.0671897	0.4546556
L(z)	0.3863640	0.0123590	31.261838
L(T)	-0.1882962	0.0288470	-6.5274038
MA(1)	0.8546662	0.2359983	3.6214932

R-squared	0.997835	Mean of dependent var	6.201608
Adjusted R-squared	0.997423	S.D. of dependent var	1.009508
S.E. of regression	0.051251	Sum of squared resid	0.055161
Durbin-Watson stat	1.972337	F-statistic	2419.623

According to the Miller-Orr model, the expected value of β_1 and β_2 is .33, and the corresponding expected value of γ_h = .2289. On the basis of the estimated regression models in Table (11.1.1), β_2 is seen to be highly significant with an estimated value very close to that suggested by the Miller- Orr model. Taking the estimated value of β_2 as the basis for determining the value of γ_h, we arrive at estimates of (α) and (δ) that suggest that 44% of total currency debits represent financial debits, whereas, 16% of demand

REGRESSION ESTIMATES OF DEMAND DEPOSIT DEBIT EQUATION

1956 - 1981

Dependent Variable is $L(D^{d'})$

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
δd	0.3177904	0.0609148	5.2169697
L(rp)	-0.0683735	0.0211242	-3.2367423
L(z)	0.3232395	0.0068030	47.514538
L(T)	-0.0275611	0.0238378	-1.1561900
MA(1)	0.6951196	0.2204944	3.1525499

R-squared	0.998036	Mean of dependent var	6.445185
Adjusted R-squared	0.997661	S.D. of dependent var	0.931562
S.E. of regression	0.045049	Sum of squared resid	0.042617
Durbin-Watson stat	1.999076	F-statistic	2667.401

deposit debits, net of stock and bond market transactions, represent other financial debits. Figure (11.1.4) displays the estimated values for other financial transactions using the free form estimates of the Miller-Orr model.

Alternatively, the Miller-Orr model can be estimated in the constrained form:

$$L(C^d) = \alpha_c + \beta_4 L(Q^c) + \mu$$

$$L(D^{d'}) = \delta_d + \beta_4 L(Q^d) + \mu$$

where (Q^c) and (Q^d) correspond to the bracketed terms on the right hand side of equation (11.1.3). Estimates of the constrained version of the model are displayed in Table (11.1.2).

Table 11.1.2

REGRESSION ESTIMATES OF CONSTRAINED CURRENCY DEBIT EQUATION

1956 - 1981

Dependent Variable $L(C^d)$

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
αc	-0.1253925	0.1370277	-0.9150882
L(Qc)	0.3838375	0.0081920	46.855085
MA(1)	0.7723367	0.1880356	4.1073953

R-squared	0.989993	Mean of dependent var	6.201608
Adjusted R-squared	0.989123	S.D. of dependent var	1.009508
S.E. of regression	0.105284	Sum of squared resid	0.254946
Durbin-Watson stat	2.251832	F-statistic	1137.733

REGRESSION ESTIMATE OF CONSTRAINED DEMAND DEPOSIT DEBIT EQUATION

1956 - 1981

Dependent Variable $L(D^{d'})$

	COEFFICIENT	STANDARD ERROR	T-STATISTIC
δd	0.6478911	0.2798377	2.3152383
L(Qd)	0.3750478	0.0178963	20.956775
MA(1)	0.8620429	0.2072955	4.1585225

R-squared	0.954769	Mean of dependent var	6.445185
Adjusted R-squared	0.950836	S.D. of dependent var	0.931562
S.E. of regression	0.206555	Sum of squared resid	0.981293
Durbin-Watson stat	2.011760	F-statistic	242.7511

The estimated values of β_4 in both equations are highly significant and are the same order of magnitude as suggested by the Miller- Orr model. The resulting estimates of α and δ are 30% and 14% respectively. The volume of other financial transactions implied by the constrained form of the estimated equations are displayed in Figure (11.1.5). The final results of the investigation will be affected by the form of the Miller -Orr model utilized.

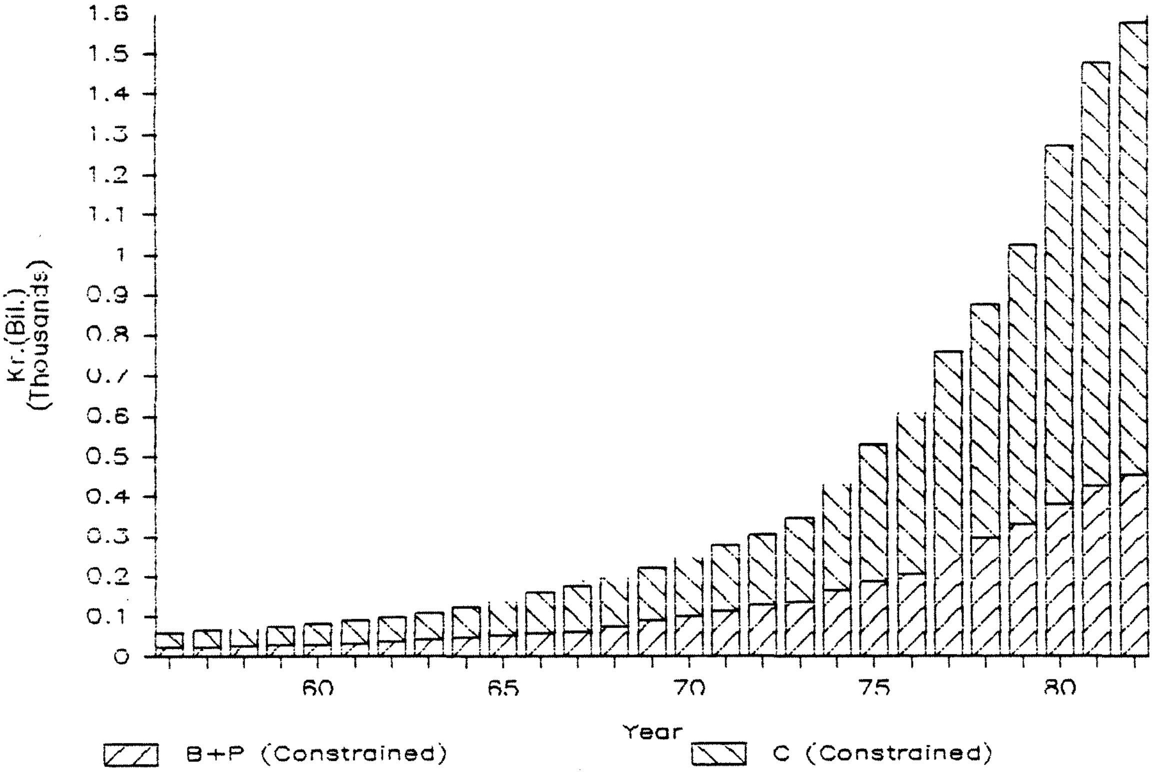
11.2 Derivation and Analysis of Total Transactions in Sweden

On the basis of the foregoing analysis, we derive the final estimates of total observed transactions in Sweden. Figure (11.2.1), displays observed PT as estimated by both the free and constrained versions of the Miller-Orr model. Figure (11.2.2) in turn, displays the components of PT employing the estimates of other financial transactions derived from the free form estimates. Between 50 - 60% of total observed PT is composed of transactions related to the production of final goods and services and transfer payments. Over the time period studied, all financial transactions account for between 30 -35% of PT and approximately 15% of PT is made up of transactions in intermediate production.

If we assume that the largest component of other financial payments (excluding transactions in equities and bonds) represents transfers into and out of non-money time and savings accounts, then, on the basis of published estimates of the stock of these deposits, it is possible to derive the implied turnover for these time and savings accounts. Figure (11.2.3) displays the stock of time and savings accounts and Figure (11.2.4) displays the estimated turnover on these accounts for both the free and the constrained versions of the Miller-Orr model estimates. The rise in turnovers during the middle and end of the 1970's may partially reflect the growth in transfers between wage and salary accounts and higher yielding time and savings accounts, as well as increased activity between currency

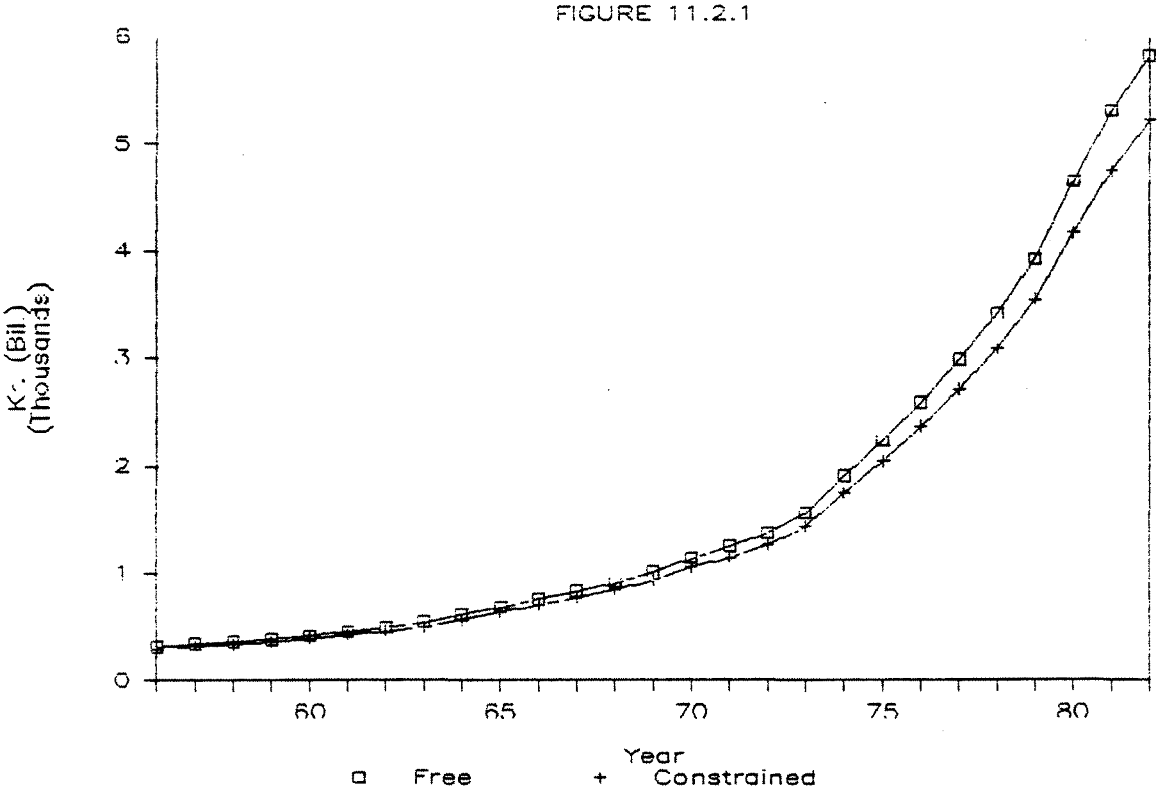
Other Financial Transactions

FIGURE 11.1.5



Estimated PT

FIGURE 11.2.1

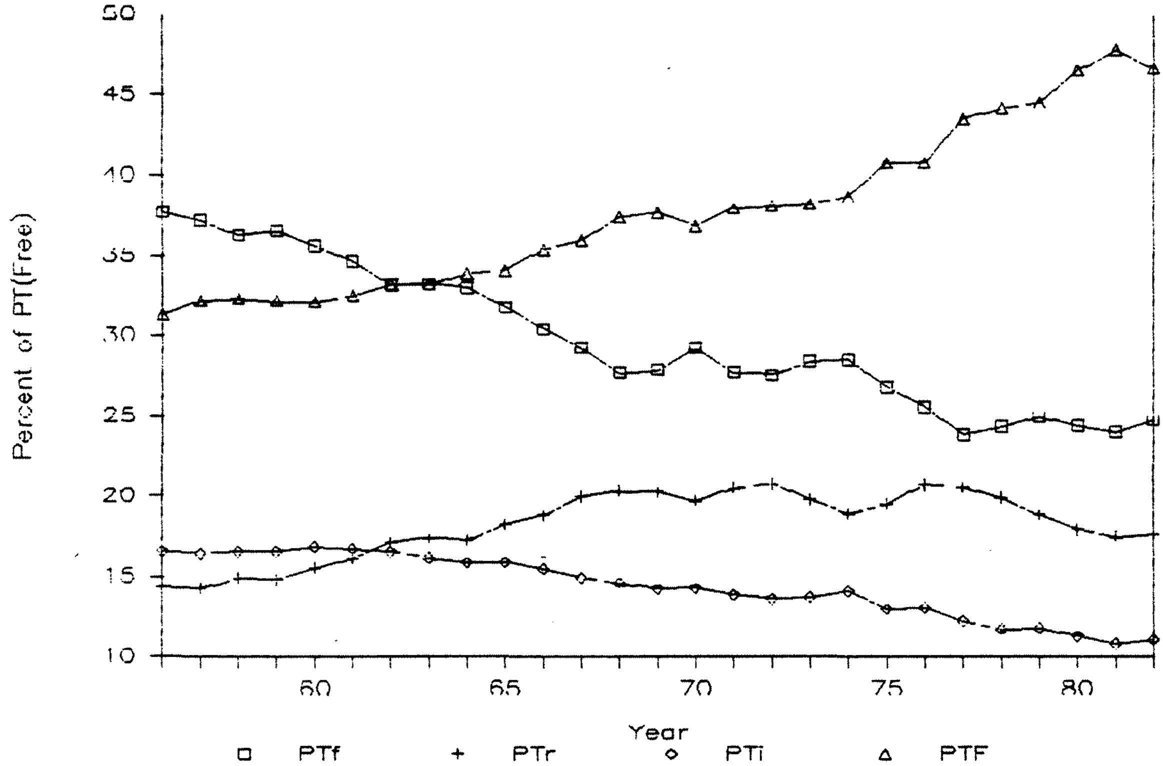


and time and savings accounts.

The final estimates of observed PT can now be compared to the estimated volume of Swedish payments. Figure (11.2.5) displays the discrepancy between MV and PT for the period 1956 -1982. The disparity between measured payments and transactions appears to have been very small during the first decade covered by this study. Between 1965 and 1976, the disparity grew steadily larger, and accelerated dramatically between 1976 and 1981. It is only in the last year of the study, that the disparity showed no further growth. The interpretation and analysis of the observed discrepancy between measured payments and measured transactions is taken up in the next chapter.

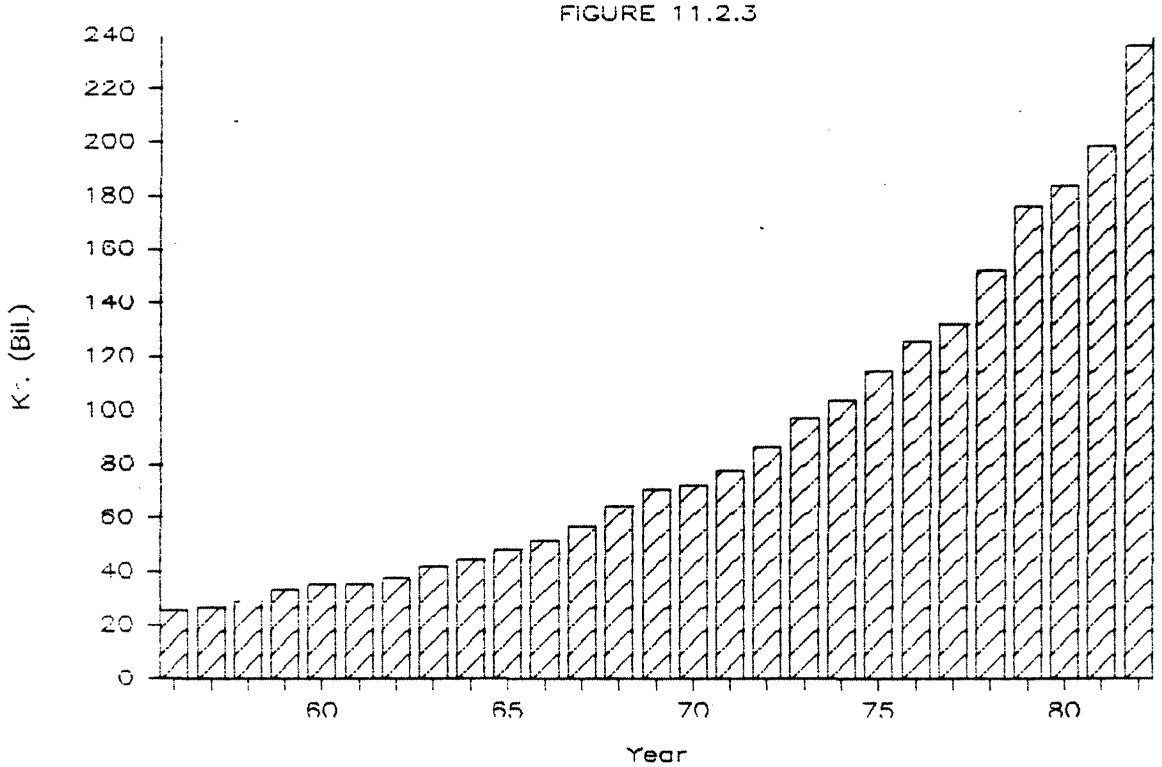
Components of PT(Free)

FIGURE 11.2.2



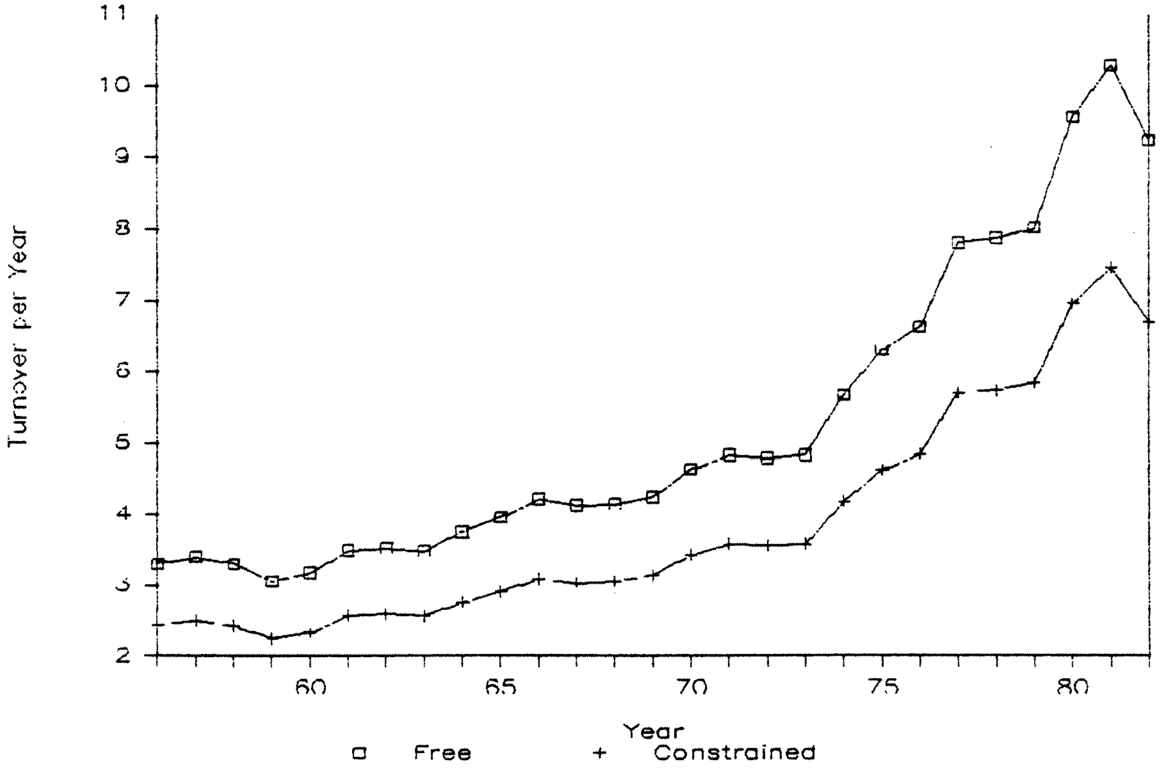
Total Time and Savings Deposits

FIGURE 11.2.3



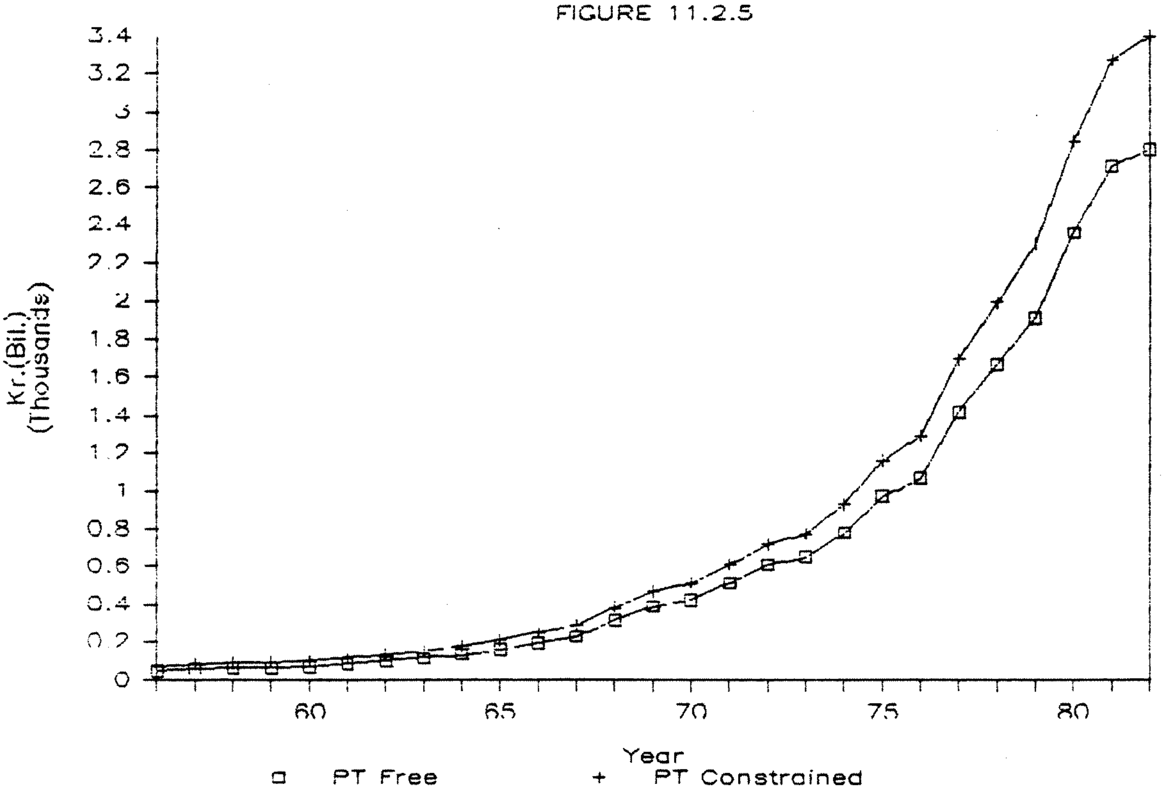
Velocity of Time and Savings Deposits

FIGURE 11.2.4



MV – PT

FIGURE 11.2.5



12.1 The Measurement and Analysis of the Underground Economy

The Payment-Transactions (P-T) method for estimating the size and growth of the underground economy is founded on the identity of the equation of exchange. This is but one application of this powerful, yet oft neglected, identity that links the monetary side of economic activity with the real trade activity. The purpose of this chapter is to examine the equation of exchange in greater detail, and to utilize the foregoing empirical estimates of total payments and recorded transactions to gain some insights into the relative size and growth of the underground economy. If we have been successful in measuring total payments and recorded transactions with some degree of accuracy, then the discrepancy between total payments and recorded transactions, by definition, represents "unrecorded" transactions that reflect the sum of all monetary trades that take place in the "underground economy".

The derivation and estimation of the sum of all unrecorded transactions, yields direct insights into the issue of the overall size and growth of underground economic activity. Various assumptions can then be employed in order to arrive at estimates of the total amount of income generated by these underground activities (unrecorded income). Estimates of unreported fiscal income and the consequent loss of tax revenues due to tax evasion, require further disaggregation of unrecorded transactions into taxable and non taxable components. The purpose of this chapter is to combine the relevant information on total payments and total transactions in such a manner as to arrive at an estimate of unreported transactions. These estimates can then be used to estimate both economic and fiscal measures of "underground" income.

Since every monetary payment in the economy simultaneously gives rise to a corresponding transaction, the equation of exchange identity provides a useful framework for the classification and ultimate analysis of all economic activity involving the medium of exchange. The equation of exchange relies on what Fisher called "the fundamental peculiarity which money alone of all goods possesses,- that fact that it has no power to satisfy human wants except a power to purchase things which do have such power".[1] Focusing exclusively on the medium of exchange function of money, the equation of exchange decomposes the flow of total expenditures in trade into its monetary payment components and its corresponding transactions components representing real trades of goods, services, assets and titles to ownership. The Fisherian identity:

$$M \cdot V = P \cdot T \qquad (12.1.1)$$

is however, deceptively simple, particularly when it is to be employed for the purpose of quantitative analysis. Each term in the equation of exchange represents a complex aggregate involving disparate dimensional entities that must be appropriately combined in order to avoid both inconsistency and ambiguity. Given the aggregative nature of the equation of exchange, each of its components must be constructed as a weighted average or index of non

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1. The Purchasing Power of Money, p.32.

comparable micro components. In a world with K assets that serve the medium of exchange function and N unique goods, assets or titles that can be traded, equation (12.1.1) is of the form:

$$\sum_{k=1}^{K} m_k v_k = \sum_{j=1}^{N} p_j q_j \qquad (12.1.2)$$

where k = 1....K and j = 1 ...N. As Warburton (1953) [2] pointed out, the incommensurability of the units in which we measure the individual components of the equation of exchange, requires that each component be defined relative to some base time period. [3] Warburton's suggestion that the equation of exchange be expunged of dimensional units is analogous to the use of elasticities in microeconomics, whose prime purpose is to circumvent units of measurement problems when comparing the sensitivity of supply and demand responses for different goods to changes in their prices. Warburton's solution to the problem of non comparable units is to redefine the components of the equation of exchange in time relative terms such that:

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2. C. Warburton, "Elementary Algebra and the Equation of Exchange" American Economic Review June, 1953

3. A formal proof of Warburton's assertion is found in an recent paper by Paul Spindt, " Money is What Money Does: A Revealed Production Approach to Monetary Aggregates" Board of Governors of the Federal reserve System, 1984. Spindt provides a formal proof of the proposition that there do not exist pairs of measures of M(m',v') and T(q',p') that simultaneously satisfy equations (12.1.1) and (12.1.2), and, also avoid the dimensional ambiguities inherent in attempting to combine non comparable units of measurement.

$$\bar{M} = \frac{\Sigma\ m_k^t\ v_t^0}{\Sigma\ m_k^0\ v_k^0} \quad , \quad \bar{V} = \frac{\Sigma\ m_k^t\ v_k^t}{\Sigma\ m_k^t\ v_k^0}$$

and,

$$\bar{T} = \frac{\Sigma\ p_j^t\ q_j^0}{\Sigma\ p_j^0\ q_j^0} \quad , \quad \bar{P} = \frac{\Sigma\ p_j^t\ q_j^t}{\Sigma\ p_j^t\ q_k^0} \quad .$$

In this particular formulation, both the money stock and the volume of transactions are defined as a Laspeyres index and the velocity of circulation and prices are defined as a Paasche index.

The equation of exchange, can now be viewed as applying to successive time periods such that,

$$\frac{\Sigma\ m_k^t v_k^t}{\Sigma\ m_k^0 v_k^0} = \frac{\Sigma\ p_j^t q_j^t}{\Sigma\ p_j^0\ q_j^0} \quad . \qquad (12.1.3)$$

The equation of exchange, incorporating the foregoing definitions is then;

$$\bar{M} \cdot \bar{V} = \bar{P} \cdot \bar{T} \qquad (12.1.4)$$

Thus, total payments relative to some base period must be identically equal to total transactions relative to the same base period. If all monetary payments are captured in $\bar{M} \cdot \bar{V}$, but only recorded transactions $(\bar{P} \cdot \bar{T})_r$ are measured on the right hand side of equation (12.1.4), then it follows that:

$$(\bar{P} \cdot \bar{V})_u = (\bar{M} \cdot \bar{V}) - (\bar{P} \cdot \bar{T})_r \qquad (12.1.5)$$

where $(\bar{P} \cdot \bar{T})_u$ is defined as the volume of underground or unrecorded transactions relative to some time period. $(\bar{P} \cdot \bar{T})_u$ represents a conceptually exact measure of all transaction activities in the underground economy.

12.1.1 The Estimation of Index Number Measures of Payments and Transactions

On the basis of the estimates of payments and recorded transactions in the previous chapters, it is now possible to construct indices of total payments, recorded transactions, and unrecorded transactions. Moreover, it is possible to construct meaningful measures of the aggregate money supply and velocity that circumvent the conceptual problems inherent in any simple sum of a stock or turnover magnitude.[4]

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4. In the United States, there is growing dissatisfaction with

In Sweden, three assets serve the medium of exchange function. These are currency, bank demand deposits and postal demand deposits. Given estimates of the stocks of each of these assets and their respective payment velocities, we construct an time relative index of $(\bar{M} \cdot \bar{V})$ using the foregoing definitions. Figure (12.1.1) displays the relative growth of total payments in Sweden for the period 1956 -1982. Figure (12.1.2) shows the decomposition of total payments as separate indices for $\bar{M}$ and $\bar{V}$. The Laspeyres money index weights each medium of exchange by the work that it performs in effecting trade. Similarly, the aggregate Paashe payment velocity index weights each component of velocity by the relevant medium of exchange stock.
The dramatic increases in the volume of payments relative to 1956 can be seen to have been caused largely by the tenfold increase in the money supply during the period. Payments velocity during the same period approximately doubled.

An analogous index can be derived for the volume of transactions. The published index of stock exchange prices[5] is used to weight stock and bond transactions and the Personal Consumption Deflator is used to weight the remaining recorded transactions. Figure (12.1.3) displays the resulting estimate of the recorded transactions index $(\bar{P} \cdot \bar{V})_r$, and Figure (12.1.4) displays the decomposition of the recorded transaction index into its price and transaction volume components. During the period 1956 - 1960, prices

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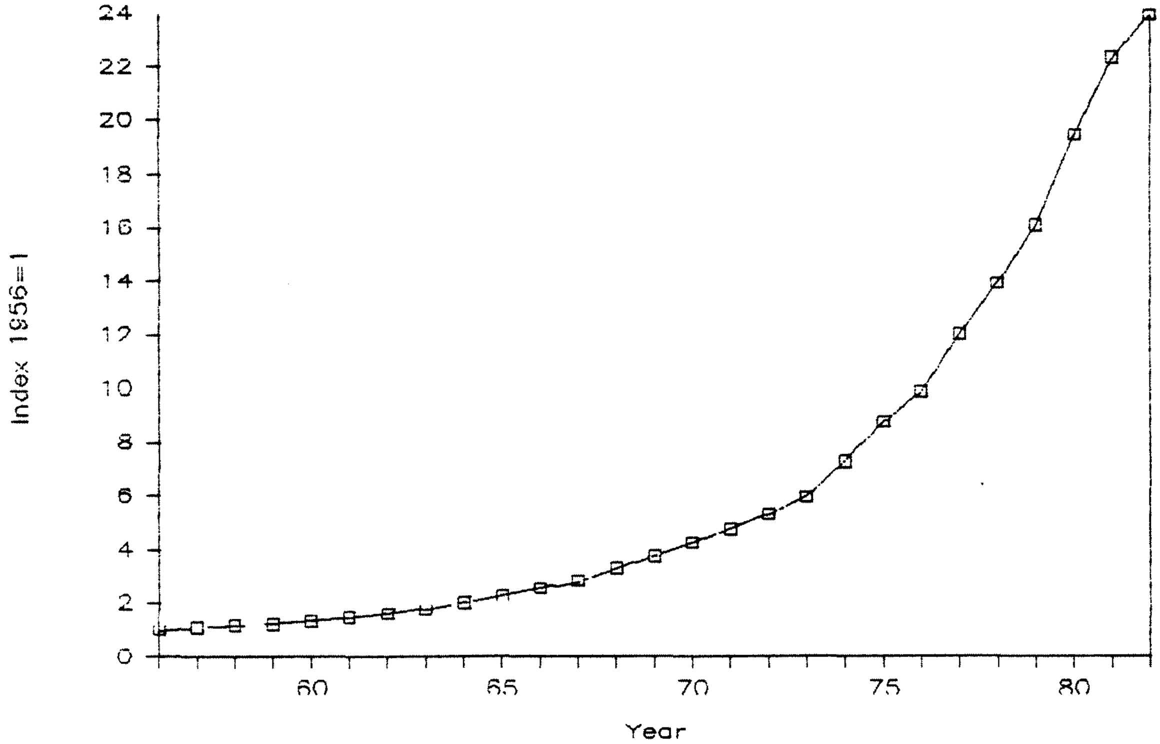
the use of conventional money supply aggregates, particularly in the face increased financial innovation. The failure of money demand functions, has led to increased emphasis on the use of Divisia monetary aggregates. See Barnett, Offenbacher and Spindt, "The New Divisia Monetary Aggregates" Journal of Political Economy Vol 92, No. 6 1984.

5. See Statistisk arsbok for the General Index of share prices

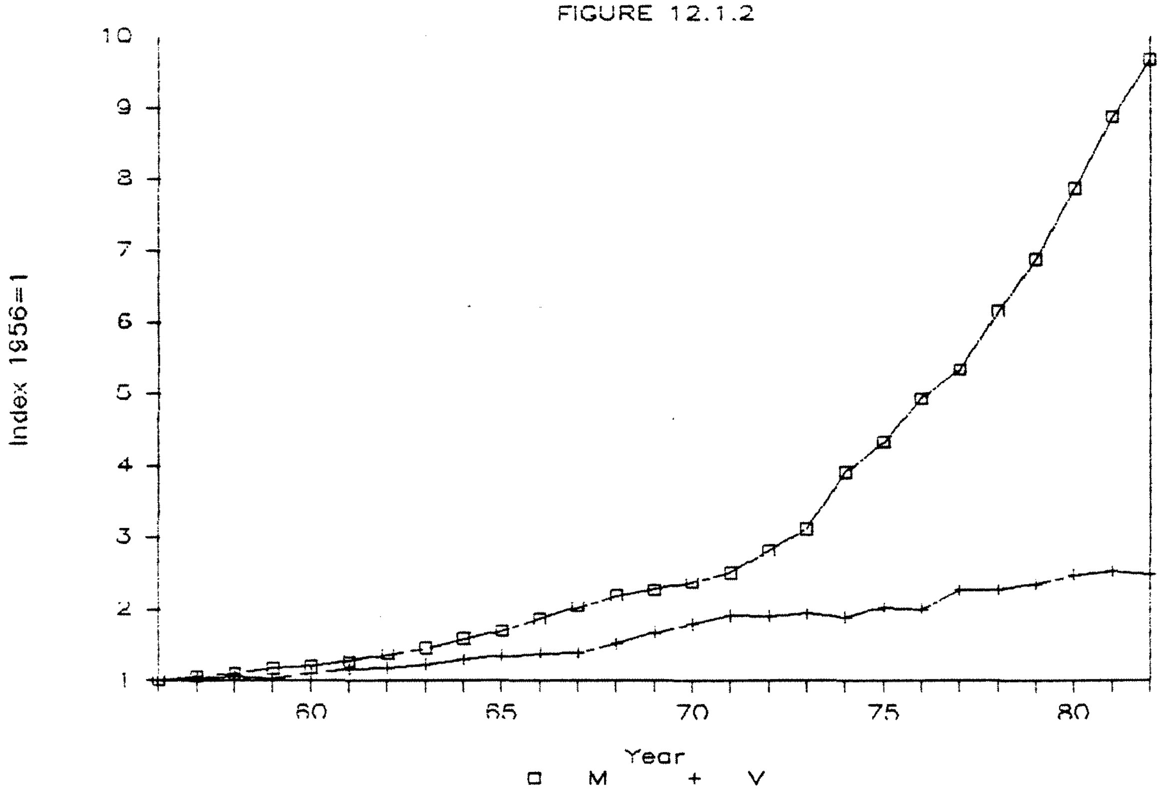
Index of MV

FIGURE 12.1.1



Laspeyres M – Paasche V

FIGURE 12.1.2



and the volume of trade grew together, whereas during the period 1960 - 1976, the relative volume of trade exceeded the growth of prices. This relationship was reversed in the post 1976 period with prices growing faster than the real volume of trade.

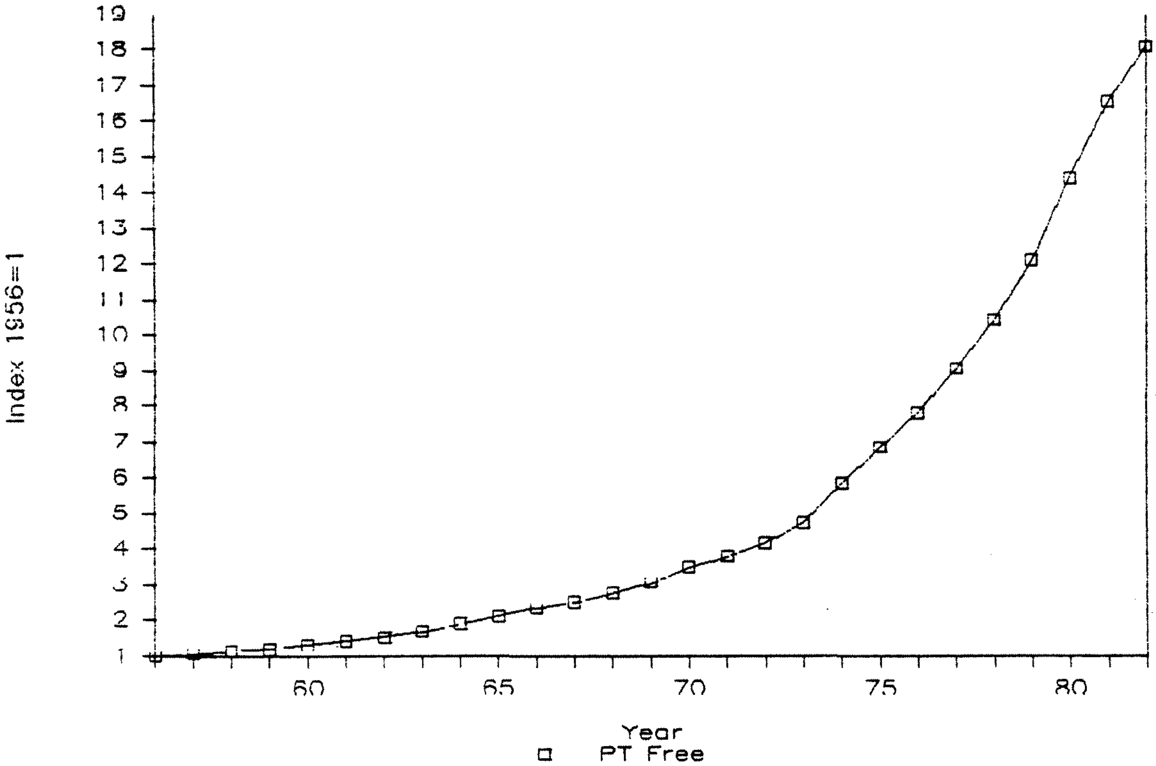
Figure (12.1.5) presents estimates of the index of $(\bar{P}\cdot\bar{T})_u$, namely, the volume of unrecorded transactions. The lower curve represents the estimate of unrecorded transactions based on the estimate of other financial transactions from the Miller-Orr model with free coefficient estimates, whereas the upper curve displays unrecorded transactions based on the constrained Miller -Orr estimates. The final estimates of unrecorded transactions are of course sensitive to the estimate of financial transactions.

The index of unrecorded transactions displayed in Figure (12.1.5), shows almost no increase during the first decade of the study, more rapid growth between 1965 and 1975, and an acceleration during the last years of the 1970,s. The estimate of unrecorded transactions as a percentage of total payments is displayed in Figure (12.1.6). By 1981, when unrecorded transactions reached their peak, the percentage of total payments that were not recorded in the transactions estimate amounted to 25 -27% of total payments.

The construction of any estimate of unrecorded income must rely on some assumptions concerning the relationship between unrecorded transactions and the income that such transactions might produce. An index of unrecorded income can be constructed by assuming that the ratio of transactions to income in the recorded economy $(\Psi)_r$ is identical to that in the unrecorded economy $(\Psi)_u$. Thus,

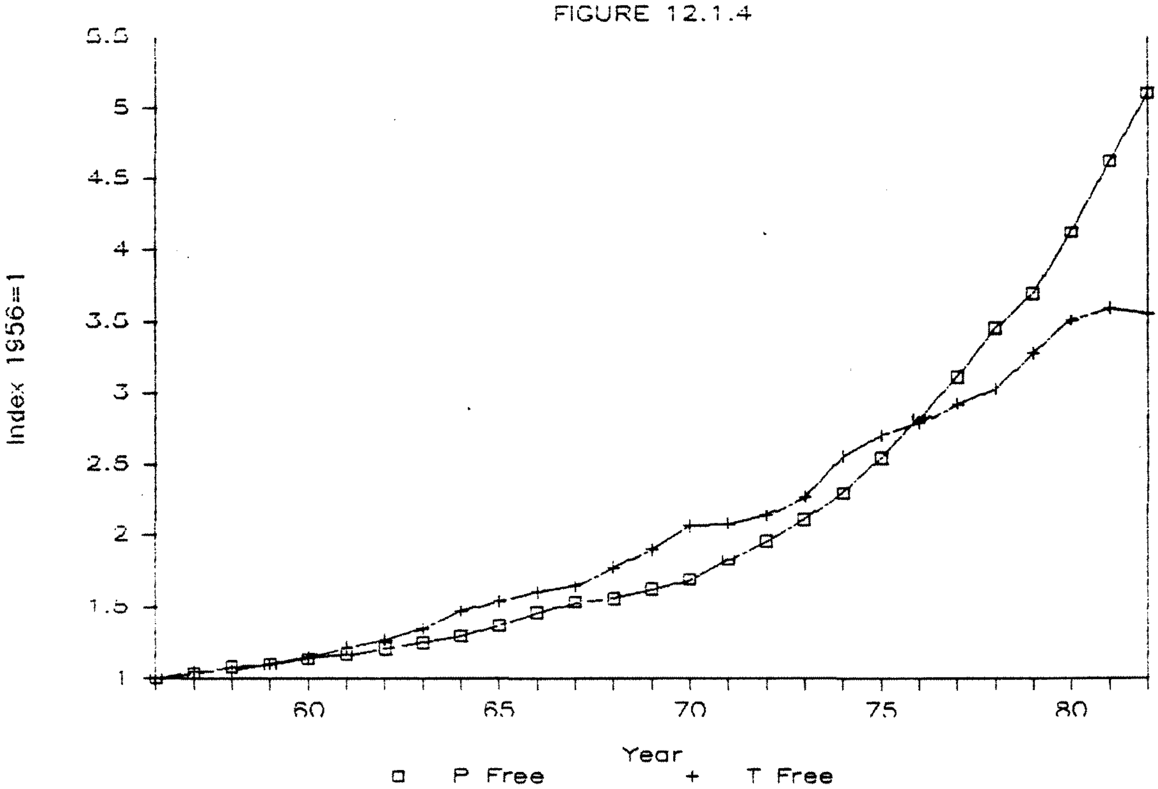
Index PT

FIGURE 12.1.3



Paasche P – Laspeyres T

FIGURE 12.1.4



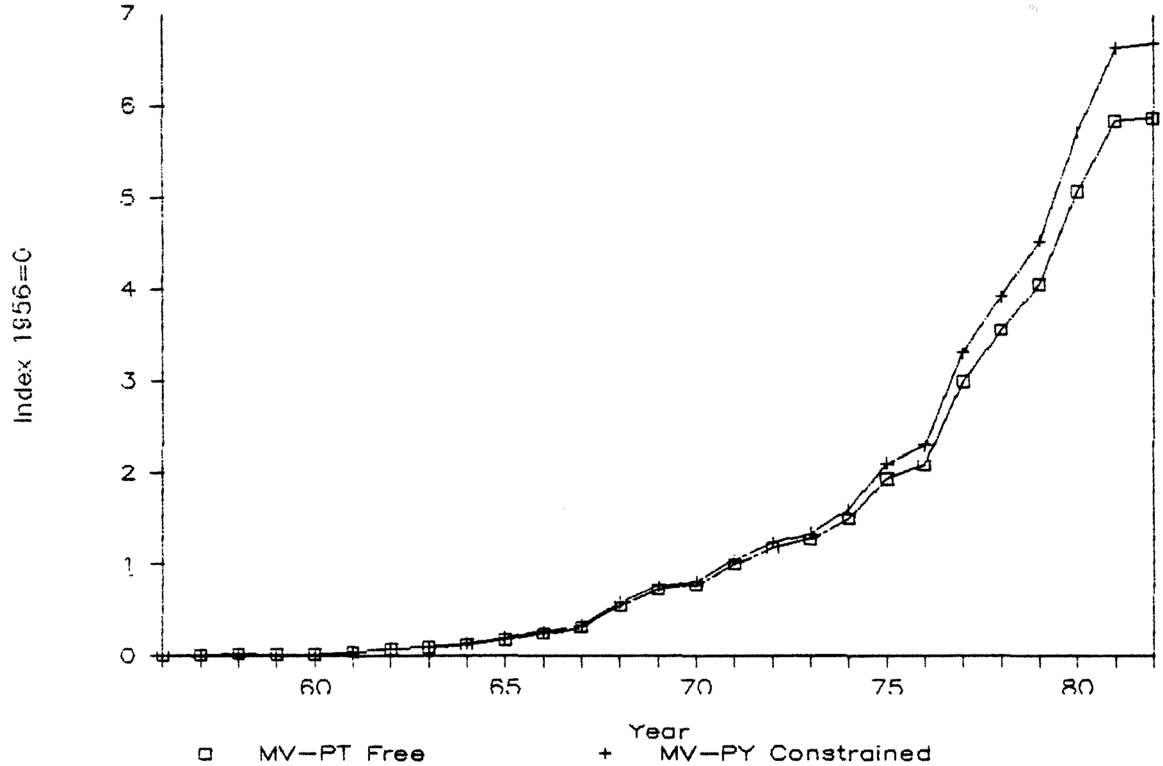
$$\hat{Y}_u = \frac{(P \cdot T)_u}{(\Psi)_r} \qquad (12.1.6)$$

Figure (12.1.7) displays the resulting estimate of unrecorded income, (Free estimate) and Figure (12.18) displays the index estimate of total Swedish income as the sum of recorded and estimated unrecorded income. Figure (12.1.9) displays estimated total income based on the constrained estimate of financial transactions. Finally, Figure (12.1.10) displays the percent of total income that has been estimated as unrecorded income, using both the free and constrained versions of the estimate for financial transactions.

Several alternative estimates of unrecorded income can further be estimated by employing different assumptions concerning the relationship between unrecorded income and unrecorded transactions in both the official and the unrecorded sectors. It is also possible to construct estimates of unreported taxable income and corresponding tax revenue losses, but such estimates require particular assumptions concerning the fractions of unrecorded transactions that would in principle be taxed if fully reported to the government. These taxable income components, must then be weighted by an appropriate tax rate applying to the particular type of income in order to estimate the resulting losses in tax revenue.

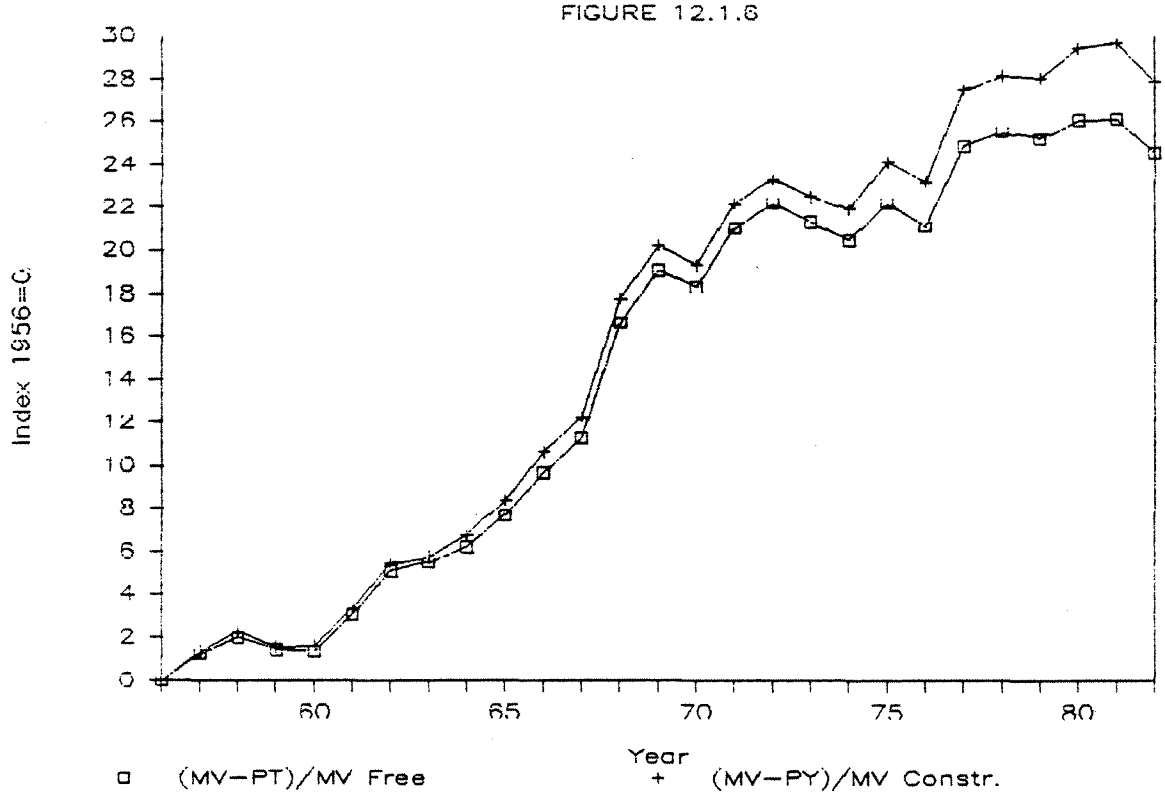
Estimated Unrecorded Transactions

FIGURE 12.1.5



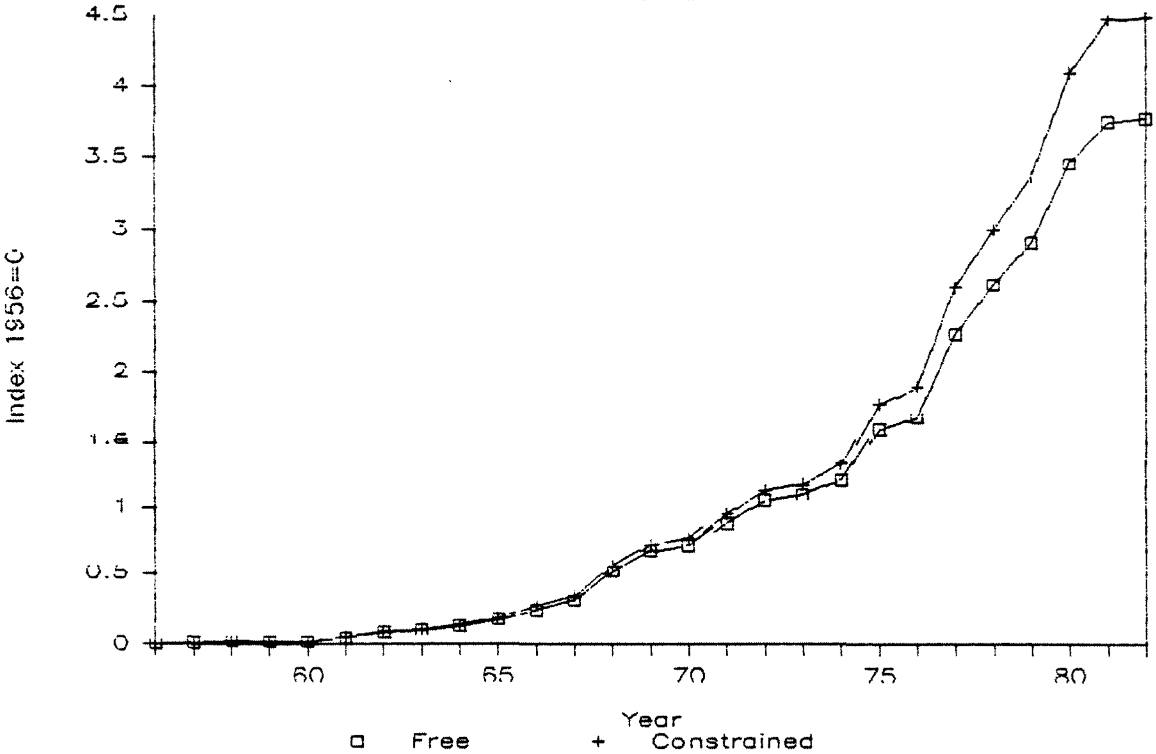
Percent Unrecorded Transactions

FIGURE 12.1.6



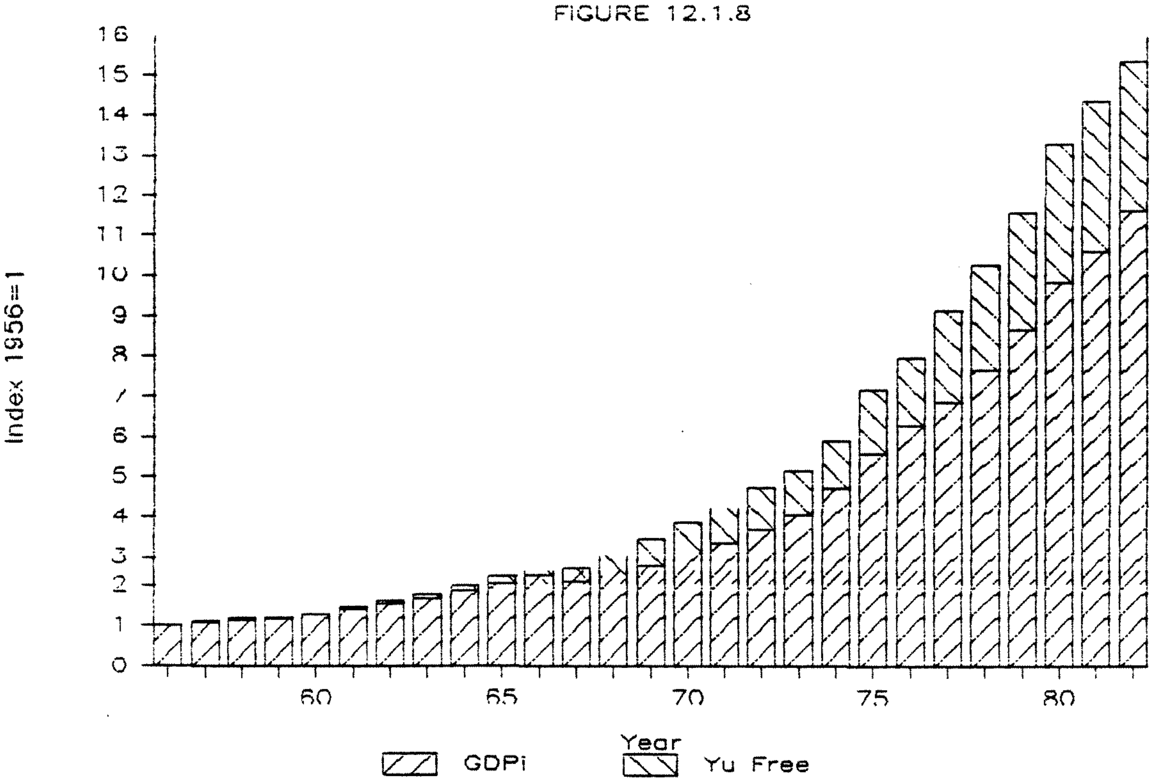
Estimated Unrecorded Income

FIGURE 12.1.7



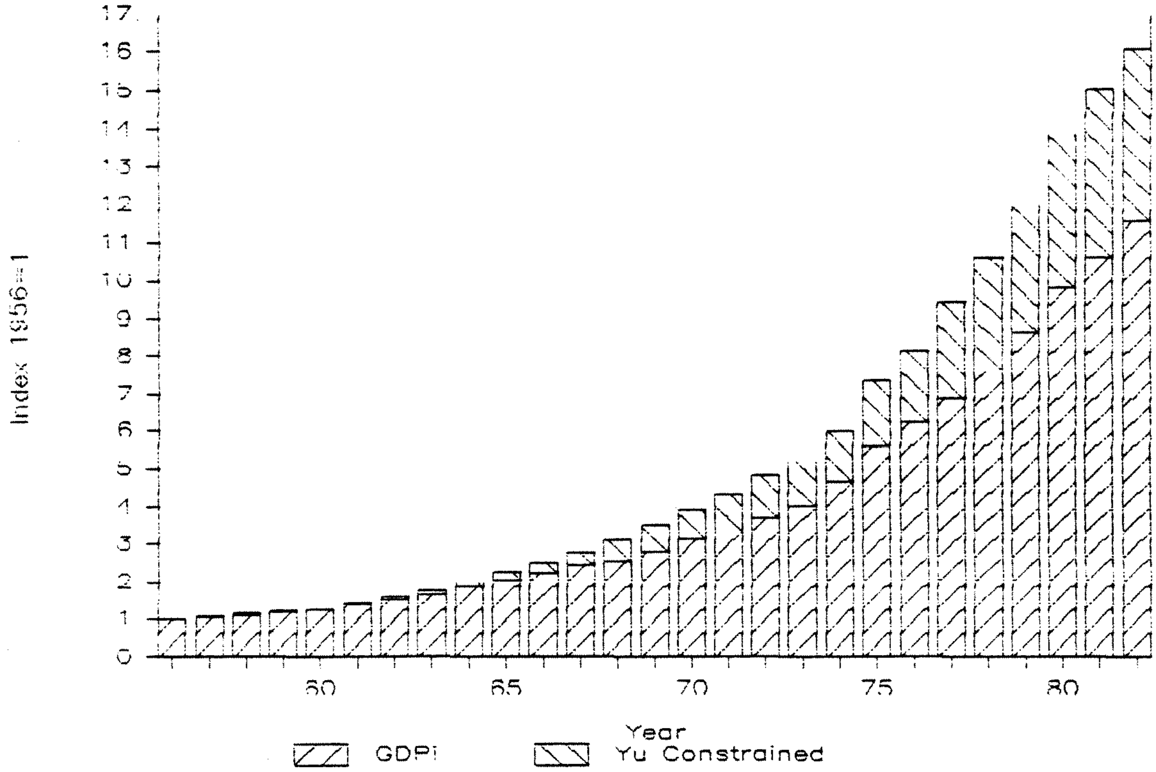
Estimated Total Income

FIGURE 12.1.8



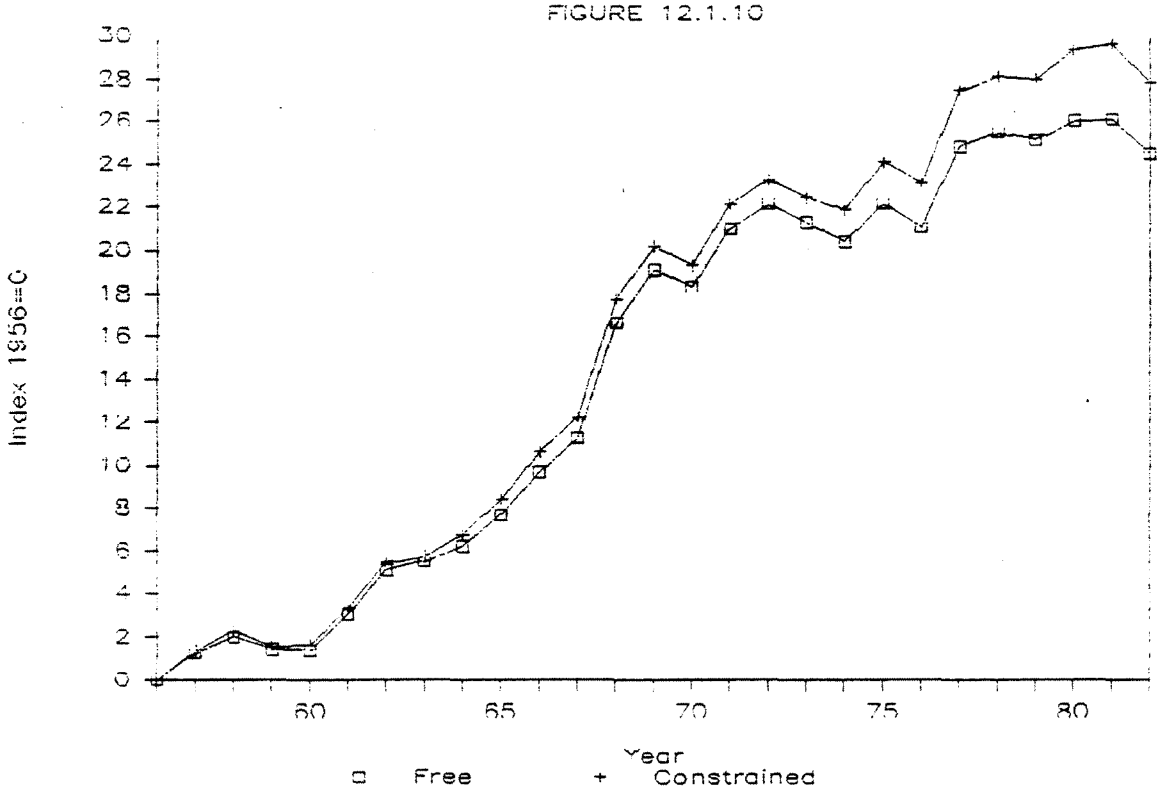
Estimated Total Income

FIGURE 12.1.9



Percent of Total Income Unrecorded

FIGURE 12.1.10



APPENDIX A
CURRENCY DATA
SWEDEN 1949-1982

Table A1.1

VALUE OF NOTES BY DENOMINATION (BIL. KR.)

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
49	0.03	0.40	1.75	0.49	0.52	0.10
50	0.04	0.46	1.89	0.50	0.53	0.10
51	0.04	0.53	2.32	0.53	0.56	0.11
52	0.05	0.61	2.71	0.52	0.58	0.11
53	0.06	0.68	2.90	0.51	0.58	0.11
54	0.06	0.74	3.08	0.51	0.59	0.12
55	0.06	0.77	3.26	0.51	0.60	0.12
56	0.07	0.82	3.48	0.52	0.59	0.12
57	0.06	0.87	3.65	0.51	0.63	0.13
58	0.07	0.91	3.83	0.49	0.62	0.13
59	0.10	1.00	3.94	0.49	0.62	0.13
60	0.09	1.04	4.16	0.49	0.64	0.14
61	0.10	1.14	4.38	0.48	0.63	0.13
62	0.11	1.27	4.64	0.50	0.67	0.15
63	0.12	1.43	4.99	0.51	0.68	0.15
64	0.12	1.61	5.31	0.50	0.69	0.15
65	0.14	1.77	5.46	0.51	0.72	0.14
66	0.15	1.95	5.77	0.53	0.73	0.16
67	0.17	2.15	6.18	0.54	0.75	0.17
68	0.18	2.41	6.49	0.54	0.79	0.18
69	0.18	2.58	6.62	0.59	0.81	0.18
70	0.17	2.70	6.89	0.56	0.80	0.19
71	0.19	3.11	7.79	0.58	0.83	0.19
72	0.21	3.53	8.54	0.59	0.86	0.19
73	0.22	4.00	9.30	0.61	0.90	0.20
74	0.25	4.71	10.51	0.64	0.95	0.22
75	0.30	5.81	12.04	0.70	1.02	0.24
76	0.36	6.79	12.91	0.73	1.07	0.25
77	0.40	7.67	14.20	0.76	1.12	0.28
78	0.50	9.24	15.73	0.80	1.17	0.28
79	0.70	11.04	17.48	0.85	1.24	0.30
80	0.80	12.91	18.23	0.88	1.30	0.32
81	0.93	14.87	18.68	0.90	1.34	0.33
82	1.15	16.79	18.46	0.90	1.36	0.32

Table A1.2

PERCENTAGE OF THE VALUE OF NOTES IN CIRCULATION BY DENOMINATION

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
49	0.99	12.09	53.34	14.95	15.72	2.90
50	1.01	12.99	53.74	14.23	15.21	2.82
51	1.03	13.02	56.81	12.90	13.66	2.59
52	1.07	13.33	59.31	11.26	12.65	2.38
53	1.16	14.05	60.00	10.58	12.03	2.19
54	1.16	14.53	60.56	9.97	11.51	2.26
55	1.11	14.55	61.23	9.54	11.33	2.24
56	1.25	14.65	62.19	9.26	10.49	2.17
57	1.03	14.89	62.49	8.67	10.76	2.17
58	1.16	15.10	63.24	8.13	10.29	2.08
59	1.59	15.90	62.79	7.76	9.96	2.00
60	1.37	15.90	63.48	7.43	9.74	2.08
61	1.46	16.59	63.75	7.04	9.22	1.95
62	1.50	17.31	63.26	6.84	9.10	1.99
63	1.53	18.18	63.40	6.44	8.59	1.87
64	1.43	19.21	63.34	6.02	8.17	1.83
65	1.60	20.26	62.43	5.88	8.19	1.65
66	1.61	20.99	62.06	5.67	7.91	1.77
67	1.71	21.58	62.06	5.41	7.53	1.71
68	1.70	22.76	61.36	5.07	7.43	1.68
69	1.64	23.53	60.33	5.43	7.39	1.68
70	1.50	23.84	60.93	4.98	7.11	1.64
71	1.50	24.51	61.35	4.56	6.56	1.52
72	1.51	25.35	61.31	4.27	6.19	1.38
73	1.44	26.27	61.07	3.99	5.90	1.33
74	1.45	27.27	60.82	3.70	5.50	1.27
75	1.49	28.90	59.88	3.48	5.06	1.19
76	1.63	30.70	58.40	3.30	4.82	1.15
77	1.64	31.41	58.14	3.11	4.57	1.14
78	1.80	33.32	56.73	2.88	4.24	1.03
79	2.21	34.92	55.29	2.70	3.92	0.96
80	2.32	37.49	52.93	2.57	3.77	0.93
81	2.51	40.13	50.41	2.44	3.62	0.90
82	2.94	43.07	47.36	2.31	3.50	0.82

Table A1.3

NUMBER OF NOTES WITH THE PUBLIC (000)

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	7	820	34815	10365	58750	24250
57	6	869	36475	10120	62800	25330
58	7	914	38282	9844	62281	25183
59	10	997	39368	9735	62431	25065
60	9	1043	41636	9742	63900	27256
61	10	1140	43800	9670	63330	26760
62	11	1270	46400	10040	66730	29190
63	12	1430	49870	10130	67560	29370
64	12	1610	53100	10090	68510	30650
65	14	1770	54550	10280	71530	28800
66	15	1950	57660	10540	73470	32810
67	17	2150	61830	10770	75030	34120
68	18	2408	64920	10732	78581	35506
69	18	2580	66150	11896	80990	36846
70	17	2698	68937	11263	80413	37203
71	19	3112	77908	11589	83335	38686
72	21	3530	85386	11895	86151	38307
73	22	4001	93000	12158	89810	40512
74	25	4710	105060	12770	94980	43920
75	30	5811	120394	14007	101752	47721
76	36	6788	129118	14579	106631	50628
77	40	7670	141990	15190	111510	55720
78	50	9240	157290	15980	117440	56950
79	70	11040	174810	17060	124090	60920
80	80	12910	182270	17670	129770	64100

Table A1.4

NUMBER OF NOTES WITHDRAWN FROM THE PUBLIC (000)

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	2	70	5960	3975	28930	17550
57	2	69	6485	4257	29363	15947
58	3	80	6932	4068	26958	15522
59	3	109	7625	3888	28542	15403
60	3	127	7484	3815	28219	15499
61	3	140	7580	3710	27570	15190
62	3	150	8840	4400	30020	16240
63	3	130	8470	4370	27510	16440
64	4	150	9030	4450	28600	16800
65	3	160	9320	5770	27120	15340
66	3	142	15650	8635	43998	23930
67	3	170	20340	13590	71390	17940
68	3	207	21083	9442	47268	20648
69	4	280	20643	10016	50552	21879
70	4	339	25175	12002	67954	27830
71	4	317	23562	10120	54145	22451
72	3	412	32193	13249	73675	30154
73	3	454	32653	13530	74351	28054
74	3	510	36250	14540	74870	33470
75	3	603	37706	15387	82851	38314
76	3	477	42453	16435	91408	41301
77	5	1390	48970	17820	90320	42410
78	5	1900	60010	18860	108180	45850
79	0	1600	63050	20290	122710	54790
80	10	1790	70860	21240	148180	55344

Table A1.5

NUMBER OF NEW NOTES ISSUED (000)

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	3	120	8215	4210	27430	17930
57	2	118	8145	4012	33413	17027
58	4	125	8739	3792	26439	15375
59	6	192	8709	3779	28690	15285
60	3	173	9752	3822	29778	17690
61	4	240	9700	3690	26910	14690
62	4	268	11450	4760	33420	18680
63	3	290	11940	4460	28340	16620
64	4	320	12260	4410	29550	18080
65	5	320	10770	5960	30140	13490
66	5	320	18760	8890	45940	27940
67	5	370	24510	13820	72950	19250
68	4	470	24180	9400	50820	22030
69	4	440	21860	11190	52970	23210
70	4	458	27970	11380	67300	28200
71	4	730	32540	10450	57160	23940
72	5	830	39671	13554	76483	29775
73	1	916	40267	13797	78010	30259
74	0	1220	48310	15150	80040	36880
75	9	1703	53037	16629	89620	42113
76	9	1454	51177	17007	96288	44207
77	9	2270	61840	18430	95200	45500
78	10	3470	75310	19650	114110	49080
79	20	3400	80570	21370	129360	58760
80	10	3660	78320	21850	153860	58520

Table A1.6

ACTUAL AVERAGE LIFETIME BY DENOMINATION

YEAR	10000 KR.	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	2.80	8.63	4.91	2.53	2.08	1.37
57	3.00	9.29	4.99	2.45	2.00	1.54
58	2.00	8.92	4.89	2.50	2.33	1.63
59	2.22	6.62	4.82	2.54	2.18	1.63
60	3.00	6.95	4.83	2.55	2.20	1.64
61	2.86	6.00	5.07	2.61	2.32	1.79
62	3.14	6.08	4.57	2.19	2.10	1.67
63	4.00	6.81	4.89	2.29	2.42	1.78
64	3.00	6.85	4.99	2.28	2.36	1.76
65	3.50	7.38	5.43	1.75	2.50	2.00
66	3.75	8.44	3.35	1.20	1.63	1.27
67	4.25	7.96	2.76	0.79	1.04	1.83
68	5.14	7.11	2.87	1.14	1.60	1.66
69	4.50	7.17	3.11	1.12	1.56	1.63
70	4.25	6.77	2.59	0.96	1.19	1.33
71	4.75	5.94	2.78	1.13	1.50	1.67
72	5.25	5.68	2.38	0.89	1.15	1.28
73	11.00	5.84	2.55	0.89	1.18	1.39
74	16.67	5.45	2.48	0.86	1.23	1.25
75	5.00	5.04	2.65	0.88	1.18	1.19
76	6.00	7.03	2.76	0.87	1.14	1.18
77	5.71	4.19	2.56	0.84	1.20	1.27
78	6.67	3.44	2.32	0.83	1.06	1.20
79	7.00	4.42	2.43	0.82	0.98	1.07
80	8.00	4.74	2.44	0.82	0.86	1.13

Table A1.7

ESTIMATED AVERAGE LIFETIME BY DENOMINATION

YEAR	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	8.26	4.43	3.60	2.21	1.80
57	7.84	4.21	3.41	2.10	1.70
58	7.59	4.07	3.30	2.03	1.65
59	7.58	4.06	3.30	2.03	1.65
60	7.21	3.87	3.14	1.93	1.57
61	6.99	3.75	3.04	1.87	1.52
62	6.98	3.75	3.04	1.87	1.52
63	6.99	3.75	3.04	1.87	1.52
64	6.40	3.43	2.79	1.71	1.39
65	5.94	3.19	2.57	1.58	1.29
66	5.63	2.91	2.42	1.49	1.25
67	5.61	2.91	2.39	1.47	1.27
68	5.44	2.82	2.30	1.42	1.25
69	5.10	2.64	2.14	1.32	1.20
70	4.80	2.49	2.02	1.24	1.15
71	4.80	2.49	2.02	1.24	1.15
72	4.87	2.52	2.05	1.26	1.16
73	4.63	2.40	1.95	1.20	1.10
74	4.17	2.16	1.75	1.08	0.99
75	5.28	2.74	2.21	1.36	1.23
76	4.87	2.54	2.02	1.25	1.11
77	4.22	2.20	1.74	1.07	0.93
78	3.98	2.09	1.63	1.00	0.84
79	3.60	1.90	1.46	0.90	0.73
80	3.49	1.57	1.27	0.78	0.74
81	3.70	1.47	1.20	0.74	0.69
82	3.26	1.46	1.19	0.73	0.69

Table A1.8

ESTIMATED TOTAL INCOME PRODUCING TRANSACTIONS PER NOTE
(PHYSICAL REDEMTION METHOD)

YEAR	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	122.07	131.20	131.20	131.20	131.20
57	122.07	131.20	131.20	131.20	131.20
58	122.07	131.20	131.20	131.20	131.20
59	122.07	131.20	131.20	131.20	131.20
60	122.07	131.20	131.20	131.20	131.20
61	122.07	131.20	131.20	131.20	131.20
62	122.07	131.20	131.20	131.20	131.20
63	122.07	131.20	131.20	131.20	131.20
64	122.07	131.20	131.20	131.20	131.20
65	122.07	131.20	130.31	130.31	131.20
66	122.07	126.70	129.41	129.41	133.85
67	122.07	126.70	128.51	128.51	136.46
68	122.07	126.70	127.61	127.61	139.04
69	122.07	126.70	126.70	126.70	141.58
70	122.07	126.70	126.70	126.70	144.09
71	122.07	126.70	126.70	126.70	144.09
72	122.07	126.70	126.70	126.70	144.09
73	122.07	126.70	126.70	126.70	144.09
74	122.07	126.70	126.70	126.70	144.09
75	165.54	172.25	170.93	170.93	191.34
76	158.61	165.54	162.79	162.79	178.78
77	151.46	158.61	154.35	154.35	165.54
78	144.05	151.46	145.56	145.56	151.46
79	136.35	144.05	136.35	136.35	136.35
80	151.46	136.35	136.35	136.35	158.61
81	151.46	136.35	136.35	136.35	158.61
82	151.46	136.35	136.35	136.35	158.61

Table A1.9

ESTIMATED VELOCITY OF CURRENCY BY DENOMINATION
(PHYSICAL REDEMPTION METHOD)

YEAR	1000 KR.	100 KR.	50 KR.	10 KR.	5 KR.
56	14.77	29.60	36.48	59.29	73.09
57	15.57	31.18	38.44	62.47	77.01
58	16.09	32.23	39.73	64.58	79.60
59	16.11	32.28	39.79	64.66	79.71
60	16.93	33.91	41.80	67.94	83.74
61	17.46	34.98	43.12	70.08	86.38
62	17.48	35.02	43.17	70.17	86.49
63	17.46	34.97	43.11	70.06	86.36
64	19.07	38.20	47.09	76.53	94.33
65	20.56	41.19	50.77	82.51	101.71
66	21.70	43.47	53.58	87.09	107.35
67	21.75	43.58	53.72	87.32	107.63
68	22.43	44.93	55.38	90.01	110.95
69	23.94	47.97	59.13	96.10	118.46
70	25.43	50.95	62.81	102.08	125.84
71	25.43	50.94	62.79	102.06	125.80
72	25.07	50.23	61.92	100.63	124.04
73	26.37	52.83	65.13	105.85	130.47
74	29.27	58.65	72.29	117.49	144.83
75	31.35	62.82	77.43	125.85	155.13
76	32.56	65.23	80.41	130.69	161.10
77	35.93	71.98	88.73	144.20	177.76
78	36.23	72.59	89.48	145.43	179.27
79	37.83	75.79	93.42	151.84	187.16
80	43.34	86.83	107.03	173.96	214.43
81	46.18	92.51	114.03	185.34	228.46
82	46.50	93.17	114.85	186.70	230.14

APPENDIX B

BANK GIRO AND POST GIRO DATA

B.1 BANK DATA

Demand Deposit Data

In order to undertake any historically oriented study of the Swedish Economy, it is necessary to gather together all of the relevant time series data on a consistent basis. As with data series for most countries, Swedish time series have undergone their share of revision, reflecting both improvements in data measures and changes in the definition of variables. It is the latter problem which is particularly troublesome for some of the basic series upon which this study must rely, and therefore a major effort was undertaken to construct estimates of time series data which maintained consistent definitions throughout the period of study.

To my knowledge, earlier studies employing monetary statistics have not made these necessary adjustments, with the result, that substantive findings have been seriously affected. In order to avoid this pitfall, and hopefully to provide future researchers with consistent time series on some key monetary variables, the following notes describe in detail the problems which have been encountered with the published data series, and the efforts made to construct consistent time series data.

Commercial Bank Demand Deposits

Commercial bank demand deposits held by the public (a primary component of most measures of the stock of money) are composed of the following items:

1) Sight deposits

2) Giro deposit accounts and accounts subject to 14 days notice

3) Accounts for payment of wages and salaries

Figure (B.1) displays the aggregate sum of the above components of demand deposits as published in the Sveriges Riksbank [SR] Statistical Yearbook for the years 1950 -1982. The figures are yearly averages of end of month figures. Figure (B.1) reveals two abrupt discontinuities in the time series. The first occurs between 1968 and 1969, the second between 1973 and 1974. These discontinuities do not reflect behavioral changes, but are entirely due to conceptual changes in the monetary statistics.

The dramatic fall in deposits which occurs between 1968 and 1969 is due to a change in the definition of what constitutes "the public".[1] Prior to 1969, credit companies and insurance companies were included in the definition of "the public" whereas in subsequent years, these companies were excluded from "the public" and are combined in the accounts of "Swedish Financial Institutions". The SR[69] reports sight deposits and giro deposits for December 1968 for both the old and the new treatment.

The significant rise in the demand deposit aggregate which is

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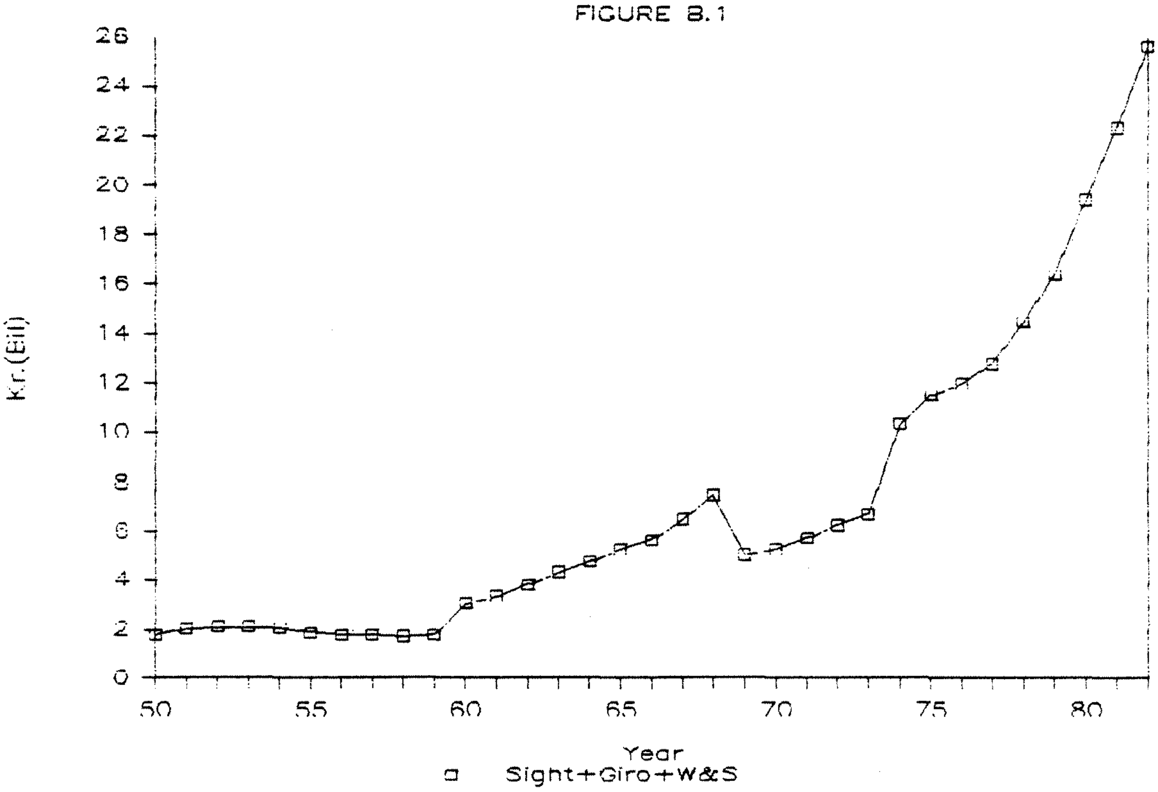
1. See SR[69] p.32*-33* for a complete discussion of the conceptual changes in the data.

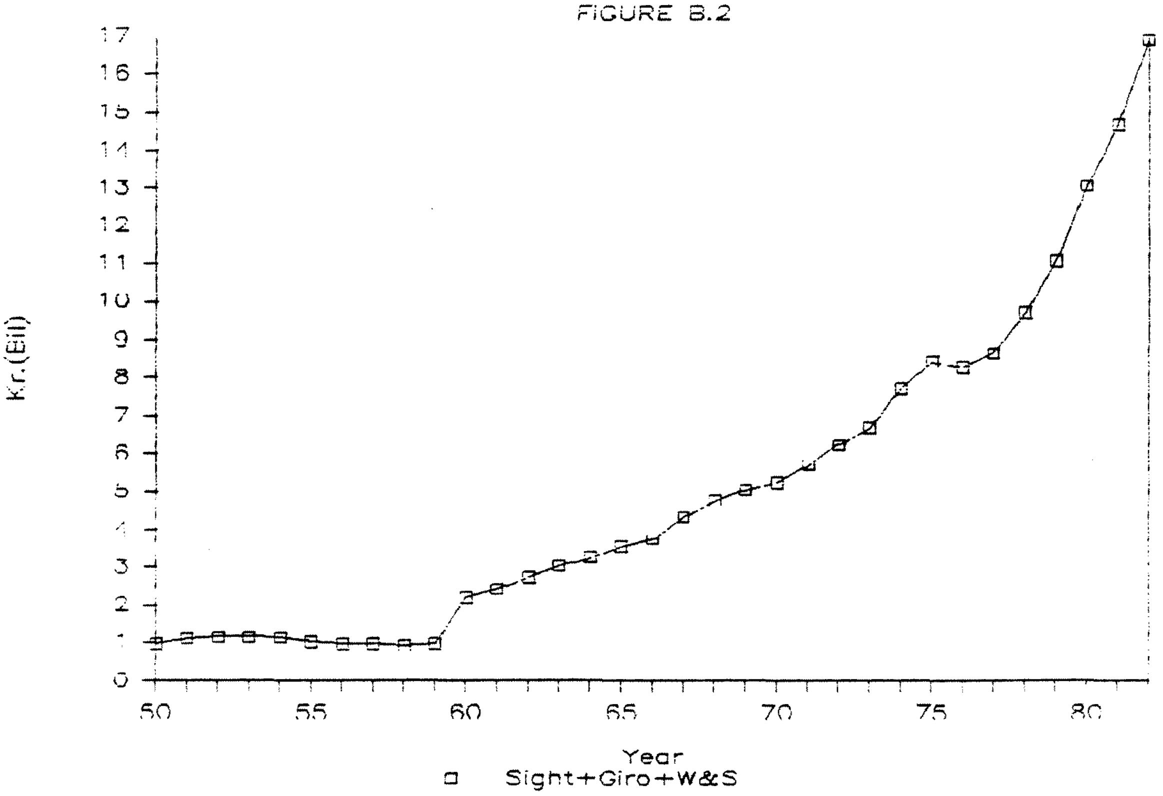
PUBLISHED C.B. DEMAND DEPOSITS

FIGURE B.1



ADJUSTED C.B. DEMAND DEPOSITS

FIGURE B.2



observed in Figure (B.1) between 1973 and 1974, reflects another change in accounting procedures rather than any change in economic behavior. This second major discontinuity in the data resulted from the inclusion of the accounts of the Post och Kreditbank (PK) in the aggregated accounts of commercial banks. The state controlled PK Bank, whose balance sheet and income statement was formerly published under separate headings by the Riksbank, does perform many of the same functions as other commercial banks. However, its activities are closely linked to the Postal Service which handles the accounting for many of the PK bank functions. [2] The consolidation of the PK bank accounts with those of other commercial banks occurred in July 1974, with the result of significantly increasing the published statistics on commercial bank deposits.

For the purposes of the analysis required for this investigation, it was necessary to construct a conceptually consistent time series on demand deposits in commercial banks. Such an adjustment has two distinct advantages:

1) It creates a consistent definition of deposits held by "the public" for the purpose of analysing the velocity of demand deposits over time.

2) It permits the separation of commercial bank deposits from PK bank deposits, thus allowing a independent coherent analysis of the bank giro function and the post giro function. Since the PK bank deposit accounts are closely linked with the

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2. See The Swedish Post Office Annual Report July 1980 - June 1981

Post giro system, their exclusion from the commercial bank data, permits a more detailed analysis of both payment subsystems.

In order to deal with these two major conceptual discontinuities in the bank deposit series, an effort was made to construct a single series of commercial bank demand deposits held by "the public" which excluded credit and insurance companies from the definition of "the public" and excluded PK bank deposits from the definition of "commercial banks". These adjustments were accomplished as follows:

1) For the period 1950 - 1968, during which the published series had included credit companies and insurance companies in the definition of the public, the published series was multiplied by the ratio of the new series (excluding credit and insurance companies) to the old series as shown for December 1968, the only period for which data are available for both series. The effect of the adjustment is to carry backward in time the current definition of the "public" employed by the Sveriges Riksbank. This adjustment corrects for the discontinuity in the level of the demand deposit series, but does not take account of any changes in the composition of deposits between credit and insurance companies on the one hand, and the rest of the "public" on the other.[3]

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3. The adjustment was carried out on an item by item basis by type of account. The correction factor for sight deposits was .5565. The correction factor for giro deposit accounts and deposits subject to 14 days notice was .9914.

2) For the period 1974 - 1982, PK demand deposits were eliminated from the published series by multiplying each component of the new series by the ratio of the old component to the new component.[4] The sight deposit account required no adjustment.

The newly adjusted consistent time series for Commercial Bank demand deposits is displayed in Figure (B.2). Figure (B.3) displays the old and the new series for Total Demand Deposits which includes the demand deposits of savings banks and cooperative banks as well. The data underlying these adjustments are to be found in Table B.1.1.

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4. The ratio .4636 was applied to the accounts for payment of wages and salaries and similarly, the ratio .5362 was applied to the giro deposit account series. # The overlapping data are published in [SR76] Table B:6 for June 1974.

Table B.1.1

PUBLISHED COMMERCIAL BANK DEPOSIT DATA
(Kr. Bil.)

YEAR	SIGHT CB CHECK DEPOSITS	CB GIRO AND DEP SUBJECT TO NOTICE	WAGE SAL CHECKABLE	TOT CB CHECKABLE DEPOSITS OLD
49	1.72			1.72
50	1.76			1.76
51	2.01			2.01
52	2.08			2.08
53	2.08			2.08
54	2.06			2.06
55	1.86			1.86
56	1.75			1.75
57	1.76			1.76
58	1.66			1.66
59	1.75			1.75
60	1.85	1.18		3.03
61	1.95	1.35		3.30
62	2.34	1.46		3.80
63	2.80	1.50		4.30
64	3.29	1.44		4.73
65	3.81	1.44		5.25
66	4.22	1.42		5.64
67	4.79	1.67		6.46
68	6.02	1.40		7.42
69	3.20	0.76	1.07	5.03
70	3.61	0.36	1.27	5.24
71	3.90	0.35	1.45	5.70
72	4.37	0.32	1.54	6.23
73	4.76	0.25	1.66	6.67
74	5.41	0.40	4.51	10.32
75	5.71	0.39	5.37	11.47
76	5.06	0.43	6.43	11.92
77	5.06	0.32	7.37	12.75
78	5.54	0.43	8.48	14.45
79	6.41	0.39	9.57	16.37
80	7.59	*	11.82	19.41
81	8.05	*	14.29	22.34
82	9.40	*	16.22	25.62

Table B.1.1 (cont.)

ADJUSTED COMMERCIAL BANK DEPOSIT DATA
(Kr. Bil.)

YEAR	SIGHT ADJUSTED EX.INS CO.	GIRO ADJUSTED EX.INS CO.	GIRO ADJUSTED EX PK BANK	WAGE SAL CHECKABLE EX PK BANK	TOT CB CHECKABLE DEPOSITS NEW
49	0.96				0.96
50	0.98				0.98
51	1.12				1.12
52	1.16				1.16
53	1.16				1.16
54	1.15				1.15
55	1.04				1.04
56	0.97				0.97
57	0.98				0.98
58	0.92				0.92
59	0.97				0.97
60	1.03	1.17	1.17		2.20
61	1.09	1.34	1.34		2.42
62	1.30	1.45	1.45		2.75
63	1.56	1.49	1.49		3.05
64	1.83	1.43	1.43		3.26
65	2.12	1.43	1.43		3.55
66	2.35	1.41	1.41		3.76
67	2.67	1.66	1.66		4.32
68	3.35	1.39	1.39		4.74
69	3.20	0.76	0.76	1.07	5.03
70	3.61	0.36	0.36	1.27	5.24
71	3.90	0.35	0.35	1.45	5.70
72	4.37	0.32	0.32	1.54	6.23
73	4.76	0.25	0.25	1.66	6.67
74	5.41	0.40	0.22	2.09	7.71
75	5.71	0.39	0.21	2.49	8.41
76	5.06	0.43	0.23	2.98	8.27
77	5.06	0.32	0.17	3.42	8.65
78	5.54	0.43	0.23	3.93	9.70
79	6.41	0.39	0.21	4.44	11.06
80	7.59		0.00	5.48	13.07
81	8.05		0.00	6.62	14.67
82	9.40		0.00	7.52	16.92

Table B.1.1 (cont.)

ADJUSTED COMMERCIAL BANK DEPOSIT DATA
(Kr.Bil.)

YEAR	SAVINGS BANKS CHECKABLE	SAVB GIRO PLUS NOTICE	COOP BANKS CHECKABLE	COOP BANKS WAGE+SALARY DEPOSITS	TOTAL NEW DEMAND DEPOSITS	TOTAL OLD DEMAND DEPOSITS
49			0.04		1.00	1.76
50			0.05		1.03	1.81
51			0.06		1.18	2.07
52			0.08		1.24	2.16
53			0.08		1.24	2.16
54			0.08		1.23	2.14
55			0.08		1.12	1.94
56			0.09		1.06	1.84
57	0.01	0.01	0.10		1.10	1.88
58	0.01	0.02	0.10		1.05	1.79
59	0.02	0.01	0.11		1.11	1.89
60	0.03	0.01	0.12		2.36	3.19
61	0.04	0.02	0.13		2.61	3.49
62	0.06	0.02	0.14		2.97	4.02
63	0.09	0.02	0.17		3.33	4.58
64	0.13	0.02	0.21		3.62	5.09
65	0.18	0.02	0.24		3.99	5.69
66	0.24	0.03	0.25		4.28	6.16
67	0.32	0.04	0.26		4.94	7.08
68	0.41	0.03	0.28		5.46	8.14
69	0.47	0.03	0.30		5.83	5.83
70	0.56	0.02	0.32	0.03	6.17	6.17
71	0.62	0.02	0.42	0.04	6.80	6.80
72	0.76	0.01	0.45	0.05	7.50	7.50
73	0.79	0.02	0.54	0.07	8.09	8.09
74	1.02	0.02	0.71	0.11	9.57	12.18
75	1.29	0.02	0.91	0.18	10.81	13.87
76	1.35	0.01	1.07	0.23	10.93	14.58
77	1.59	0.02	1.16	0.31	11.73	15.83
78	1.91	0.03	1.20	0.45	13.29	18.04
79	2.53	0.02	1.26	0.51	15.38	20.69
80	3.75	*	1.29	0.54	18.65	24.99
81	4.01	*	1.23	0.55	20.46	28.13
82	4.42	*	1.16	0.67	23.16	31.87

B.2. POST GIRO DATA

Post Giro Deposits

In order to construct a temporally consistent data series on Post Giro Deposits, it is necessary to deal with the same discontinuity which affects Bank Deposit data, namely, the consolidation of the PK Bank with the commercial banks. The impact of this consolidation on Post Giro data results from the fact that in July, 1974, the interest bearing accounts of the Post Giro were transferred to the PK Bank, and subsequently included among the ports of commercial banks.

The longest time series for Post Giro deposits is reported in the Sveriges Riksbank [SR] Statistical Yearbook.[5] This series is the sum of interest and non interest bearing Post Giro Deposits, and should not be confused with a separate listing of Post Office Bank Savings Deposits. Since the concern of the present undertaking is solely to focus on the medium of exchange function, it is the former series, linked to the giro payments system which is of relevance. The historical data on the Post Giro Cheque Service [PGCS] deposits are displayed in Figure(B.4) from 1950 to 1973, the last year in which the series was published. After that date, the interest bearing Post Giro accounts were transferred to the PK Bank, and

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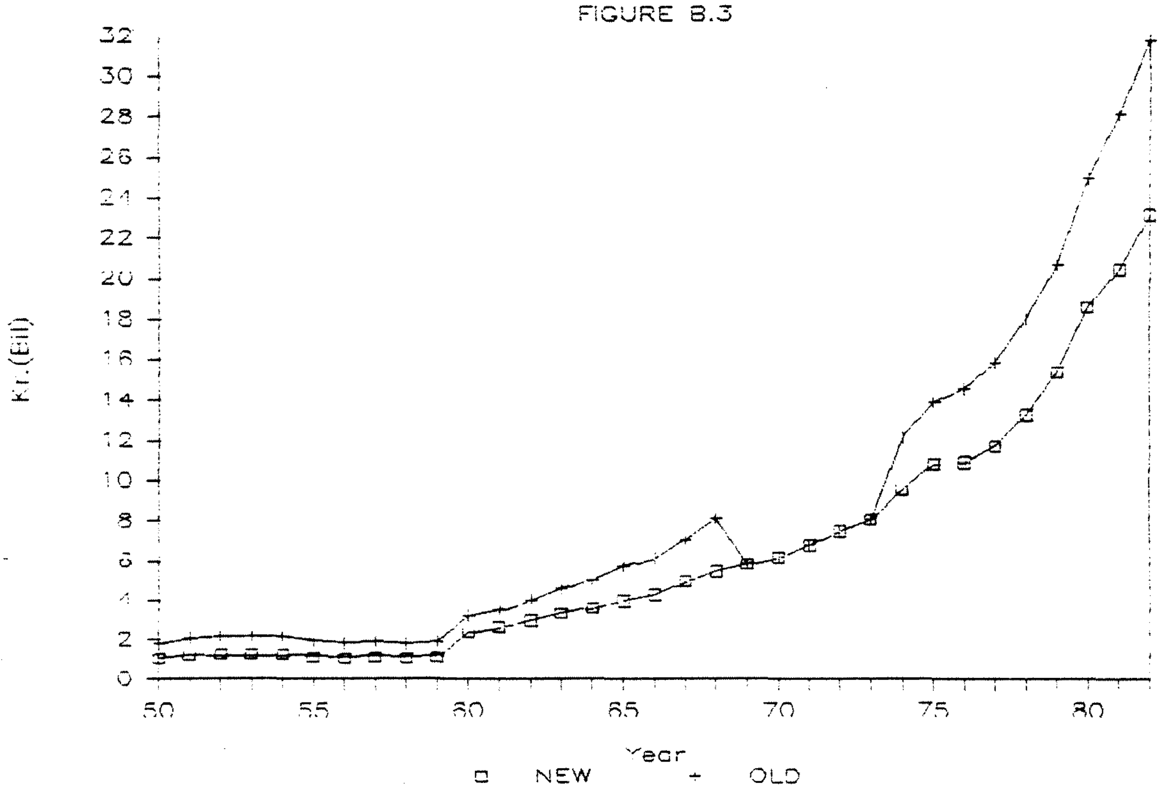
5. The series is first listed under the heading "Deposits at the Post Cheque Service" and subsequently, under the heading "Deposits at the Post Giro Service" {:1941-50 Tab.46; 1950-55 Tab.51; 1956-65 Tab.57; 1965-69 Tab.C.11; 1970-74 Tab.C.7.}

TOTAL DEMAND DEPOSITS

FIGURE B.3

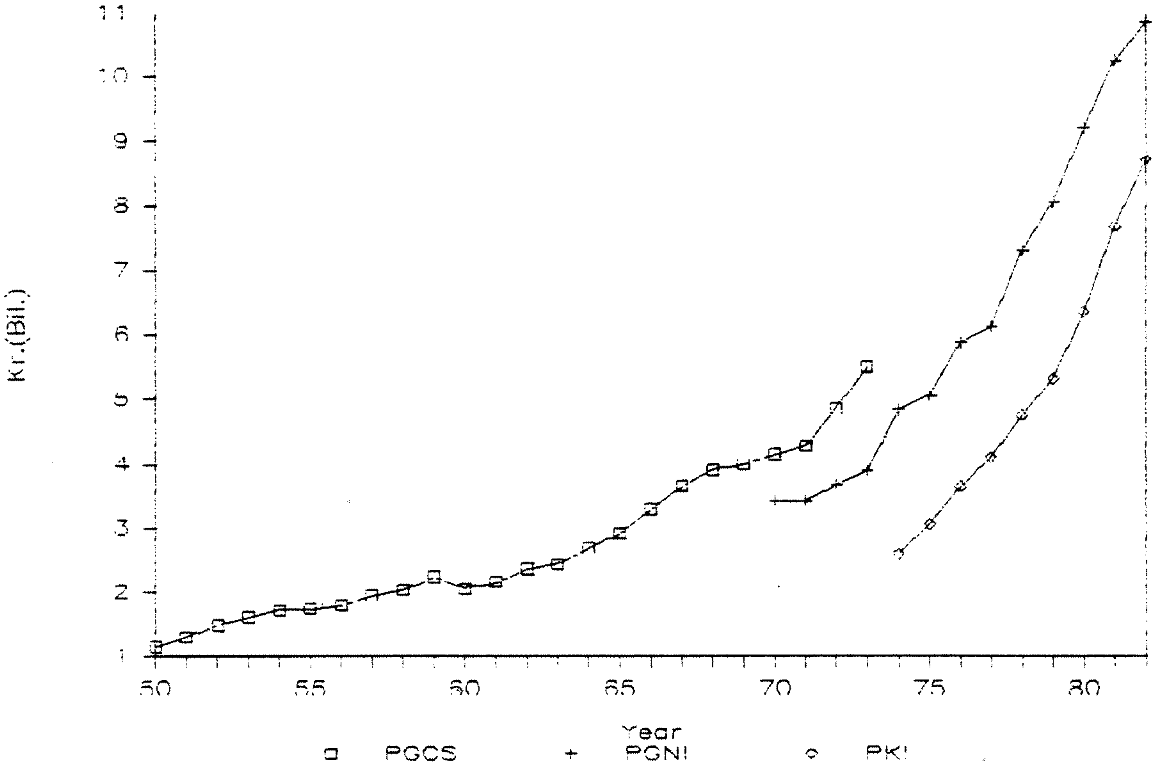


these deposit figures could no longer be segregated from deposits of the commercial banks, except, as was described in the preceding section. From 1974 to the present, only the non interest bearing Post Giro accounts [PGNI] are recorded, and these data are also displayed in Figure (B.4). The final series displayed in Figure (B.4) labeled [PKI] is the estimate of PK Bank interest bearing accounts derived from the procedure described in the foregoing section.

Figure(B.5) displays an estimate of interest bearing accounts for 1970 -74 [PGCS-PGNI] which is derived as the difference between all Post Giro accounts and non interest bearing accounts for the five year period during which both series overlap. Figure (B.5) also displays the estimate of PK Bank (giro and wage and salary accounts) interest bearing accounts for 1974 - 1982. As can be seen from Figure (B.5), the actual value of interest bearing accounts is only slightly lower than the estimated figure, and this is due to the fact that the former data point is an average for only the first six months of 1974. It therefore appears as if the estimate of the PK Bank interest bearing accounts is quite accurate and it is used to construct a consistent time series on all Post Giro deposit accounts. The final estimate of Total Post Giro Deposits, and its components are found in Table B.2.1 of Appendix B.

POST GIRO DEPOSIT DATA

FIGURE B.4



INTEREST BEARING POST GIRO ACCOUNTS

FIGURE B.5

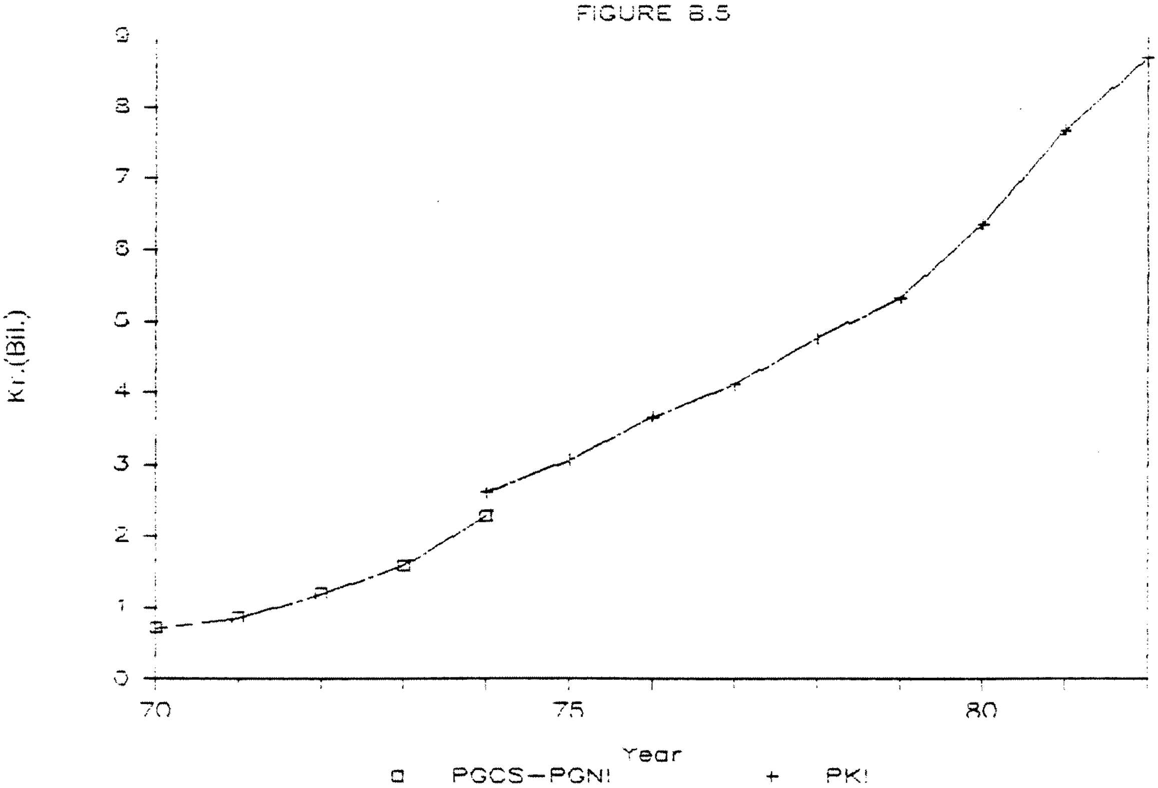


Table B.2.1

APPENDIX B-2

POST GIRO DEPOSIT DATA

SWEDEN 1949 – 1982

YEAR	POST CHECK SERVICE DEPOSITS	POST GIRO BEARING NO INTEREST	POST GIRO BEARING INTEREST	TOT W&S &GIRO ALLOCATED TO PK BANK	ESTIMATED TOTAL POST GIRO DEPOSITS
49	1.08				
50	1.16				1.16
51	1.31				1.31
52	1.50				1.50
53	1.61				1.61
54	1.73				1.73
55	1.75				1.75
56	1.81				1.81
57	1.95				1.95
58	2.04				2.04
59	2.24				2.24
60	2.07				2.07
61	2.16				2.16
62	2.36				2.36
63	2.45				2.45
64	2.69				2.69
65	2.92				2.92
66	3.30				3.30
67	3.65				3.65
68	3.90				3.90
69	3.99				3.99
70	4.14	3.42	0.72		4.14
71	4.28	3.42	0.85		4.28
72	4.85	3.67	1.18		4.85
73	5.48	3.90	1.59		5.48
74		4.84	2.28	2.60	7.44
75		5.05		3.06	8.11
76		5.88		3.65	9.53
77		6.11		4.10	10.21
78		7.30		4.75	12.05
79		8.05		5.31	13.36
80		9.19		6.34	15.53
81		10.26		7.67	17.93
82		10.85		8.70	19.55

Post Giro Turnover Data

Data on Post Giro transactions have been regularly published in the Statistical Yearbook of the Sveriges Riksbank and the the Statistical Abstract of Sweden, however, care must be exercised in order to obtain consistent and meaningful estimates of payments made via the Post Giro system. The published data are collected by the Post Girot for administrative purposes in order to reflect the total volume of gross post giro turnover. While these data are of great value for managerial purposes, they require major adjustment in order to eliminate various forms of double counting from the perspective of monetary analysis. In particular, the estimates of post giro turnover, published between 1949 and 1972, include both credits and debits to giro accounts resulting from transfer payments. Moreover, this turnover series includes transfer payments made between government agencies. The data series published between 1973 and 1979 eliminate the problem of double counting of transfer credits and debits, and the series published for the most recent years also eliminate inter-agency government transfer payments. The [SR] published monthly averages of Post Giro Turnover for each of the foregoing definitions is displayed in Col (1-3) in Table B.2.2

Table B.2.2

APPENDIX B.2

POST GIRO TURNOVER DATA

SWEDEN 1949-1982

YEAR	(1) MONTHLY GROSS TURNOVER	(2) MONTHLY DEBIT TURNOVER	(3) MONTHLY NET DEBIT TURNOVER	(4) TOTAL GROSS TURNOVER	(5) TOTAL DEBIT TRANSFERS	(6) TOTAL DEBIT TURNOVER	(7) TOTAL NET DEBIT TURNOVER
49	13.12			157.44	53.50	103.94	103.94
50	13.95			167.40	57.10	110.30	110.35
51	16.92			203.04	69.20	133.84	133.84
52	20.08			240.96	81.40	159.56	159.48
53	21.36			256.32	86.60	169.72	169.72
54	23.33			279.96	94.90	185.06	185.06
55	25.63			307.56	104.70	202.86	202.86
56	28.24			338.88	116.30	222.58	222.58
57	31.26			375.12	128.30	246.82	246.82
58	32.88			394.56	136.00	258.56	258.56
59	34.68			416.16	143.10	273.06	273.06
60	33.15			397.80	129.30	268.50	268.50
61	36.34			436.08	141.20	294.88	290.59
62	39.76			477.12	153.20	323.92	318.75
63	43.59			523.08	167.60	355.48	349.31
64	47.90			574.80	183.00	391.80	385.28
65	53.47			641.64	203.30	438.34	429.79
66	59.65			715.80	227.00	488.80	473.94
67	65.63			787.56	248.60	538.96	515.71
68	80.74			968.88	326.80	642.08	613.13
69	95.78			1149.36	397.60	751.76	717.28
70	106.85			1282.20	441.80	840.40	800.77
71	119.92			1439.04	498.50	940.54	889.03
72	135.71			1628.52	569.00	1059.52	995.13
73		96.56				1158.72	1083.66
74		112.21				1346.52	1260.38
75		130.35				1564.20	1457.73
76		158.52				1902.24	1728.69
77		203.54				2442.48	2078.60
78		258.51				3102.12	2448.85
79		295.62				3547.44	2752.76
80			266.72				3200.64
81			294.02				3528.24
82			313.42				3761.04

Table B.2.2 (cont)

APPENDIX B.2
POST GIRO DATA
SWEDEN 1949 - 1982

YEAR	(8) ESTIMATED INT.GOV. TRANSFERS	(9) NEW TOTAL NET DEBIT TURNOVER	(10) NEW TOTAL NET DEBIT TRANSFERS	(11) INPAYMENTS	(12) OUTPAYMENTS	(13) FINAL TOTAL NET DEBIT TURNOVER
49	0.00			25.30	25.20	103.93
50	0.00			26.70	26.60	110.36
51	0.00			32.50	32.00	133.78
52	0.00			39.00	39.10	159.50
53	0.00			41.70	41.50	169.69
54	0.00			45.10	45.10	185.05
55	0.00			49.10	49.10	202.87
56	0.00			53.20	53.00	222.57
57	0.00			59.30	59.20	246.82
58	0.00			61.30	61.30	258.61
59	0.00			65.50	64.50	273.03
60	0.00			69.30	70.00	268.53
61	4.29			77.00	76.60	294.86
62	5.17			85.30	85.40	323.86
63	6.17			94.00	93.90	355.42
64	6.52			104.50	104.30	391.81
65	8.55			117.20	117.70	438.25
66	14.86			130.60	130.80	488.34
67	23.25			145.00	145.00	538.49
68	28.95			157.40	157.50	641.66
69	34.48			176.70	176.90	751.24
70	39.63			199.10	198.90	839.84
71	51.51			220.20	221.20	939.86
72	64.39			245.20	224.60	1059.47
73	75.06			265.40	264.30	1158.77
74	86.14			305.00	299.00	1346.46
75	106.47			356.30	338.30	1564.18
76	173.55	1732.33	922.06	414.31	395.96	1732.33
77	363.88	2083.77	1165.97	470.24	447.55	2083.77
78	653.27	2454.18	1418.46	531.13	504.58	2454.17
79	794.68	2746.94	1590.97	592.70	563.27	2746.94
80		3165.17	1817.57	689.87	657.73	3165.17
81		3528.27	2082.48	744.90	700.89	3528.27
82		3761.07				3761.04

Col (4) displays the annual gross turnover, and Col (5) is a series on Total Debit Transfers provided by the Post Giro Service. In order to eliminate the double counting of both credit and debit transfers, Col (5) is subtracted from Col (4), and then spliced with the data from 1973-79, with the result displayed in Col (6). Col (7) displays the Total Net Debit Turnover series provided by the Post Giro and published in the Statistisk Arsbok [SA] which excludes inter-agency government transfer payments. Col (8) displays the difference between Col (6) and Col (7), providing an estimate of the size of inter-agency transfers for the years before these transfers were eliminated from the published [SR] statistics. Col (9) and Col (10) display the most recent data published in both [SR] and [SA]. Col (11) and (12) are total inpayments and outpayments and Col (13) displays the final estimate of debit turnover, net of inter-agency government transfers. Net transfers are then derived as the difference between Col (13) and the sum of Col (11) and (12).