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**Article**

## "The Existence of a World Demand for Money Function". A Reply

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# The Existence of a World Demand for Money Function

## A Reply

By S. F. Frowen, Guildford and G. Kouris, London

In his comments *Zis* (1978) maintains, in short, that there is neither theoretical nor empirical foundation in the claim that our findings of a significant interest elasticity and instability of the world demand for money support Keynesian propositions. This would imply that the *Parkin* (1976) conclusions that world inflation can be controlled by controlling the world money supply is correct.

In his comments *Zis* erroneously assumes that in our view demand for money functions are identical in all countries. In fact, we entirely agree with him that the individual country functions might well differ. As explained in the *Frowen and Kouris* paper (1977, page 3), our results refer to the sample of the ten pooled countries and inevitably our estimated elasticities would represent an *average* behaviour identical to the *world* behaviour reflected in the results obtained by *Gray, Ward and Zis* (1976) when grouping the ten countries together and estimating a function on the aggregate variables. In both cases the hypothesis tested is the same. *Zis* is no doubt aware that traditionally in macro economics many issues such as consumption or production behaviour have been approached both by using time series and cross-section analysis. Our methodology is simply a combination of the two approaches which has the distinct advantage firstly of being able to operate with a sample large enough to take account of differences between each cross-section unit and secondly of virtually eliminating the distributed lag bias.

Our starting point was that because of differences in the demand-for-money behaviour across regions, a simple aggregation of the relevant data of countries to be considered in a study at world level totally neglects these differences. There is no need to remind *Zis* that *Friedman* (1963), in his study on money holdings expressed in terms

of weekly incomes across countries, such as the U.S., Israel, India, Yugoslavia etc., showed that the ratios are somewhat different between countries. It is precisely these kinds of heterogeneities that we wished to screen out in an attempt to estimate a world demand for money. Although under a fixed exchange rate regime the money supplies of individual countries could legitimately be viewed as one entity, it is quite logical to assume that spending patterns (and thus the desired demand to hold money balances) diverges between countries. Thus these differences when not allowed for in a world aggregate would impair the validity of the exercise. For this reason we allowed for such differences and upon statistical testing found them significant.

As to the criticism that the interpretation of our results lacks theoretical foundation in so far as the claim supporting the Keynesian case is concerned, the point *Zis* makes does not seem to be at all profound. When one sets out to estimate a world demand for money function under the assumption that during a fixed exchange rate period the entire world can be viewed as one economy ... etc., it follows by definition that both the monetarist and the Keynesian theories can be applied as if we were dealing with an individual country. For example, in the same way as we regard England, Wales and Scotland as integral parts of one closed economy, the United Kingdom, we can also regard the individual countries included in our study as integral parts of a fixed exchange rate world, a world which for all practical purposes is just another closed economy.

We are grateful to *Zis* for raising the question of the conversion to dollars of the national money supply and national income series. This provides us with the opportunity of commenting on what appears to us as an inconsistency in the *Gray, Ward and Zis* paper, an inconsistency we neglected to point out earlier. When aggregation over a number of countries with dissimilar currencies takes place, both the money stock and income must be converted to a common unit of measurement, say the U. S. dollar. There are basically three alternatives to this approach. Firstly, to convert both magnitudes by using current exchange rates, i. e. the exchange rate prevailing at each quarter (option chosen by G. W. Z.). Secondly, to use constant exchange rates for a given year throughout. Thirdly, to convert the money supply by using current exchange rates and income by using constant exchange rates (alternative chosen by us). A fourth option, to convert money by using constant exchange rates and income by current exchange rates, is

logically precluded as will be made evident in the arguments that follow.

There are strong arguments for using constant exchange rates in converting real national GNPs to a common denominator. This is because we want the variation of GNP over time to reflect changes in living standards and thus explain the transactions demand for money. When GNP is converted at current exchange rates we artificially impart an extra variation on the series which has nothing to do with actual changes in income. For example, in the 1967/68 period real GNP in the U. K. rose by about 2.3 % while at the same time the external value of the pound against the dollar declined by 14 %. This means that if the U. K. GNP is converted into U.S. dollars it would depict a sharp fall of 11.7 % from 1967 to 1968! This would clearly be absurd and such an anomaly can only be avoided if GNP is converted at constant exchange rates. In reality what we actually need is purchasing power parities so that a proper weighting could be given to national GNPs before aggregation takes place. Purchasing power parities for the years and the number of countries covered in our study unfortunately do not exist. Thus the second best method is to use as weights the exchange rates prevailing at a given point in time which for conversion purposes would be kept constant during the whole period. At least in this way the true variation of GNPs is not distorted.

Likewise one may argue that national money stocks should also be converted at constant exchange rates so that changes in the money supply would reflect only the rise in money that actually circulates within countries. If instead we express national money supplies in dollar terms by using current exchange rates, the money supplies across countries would appear at times to rise or slow down in response to exchange rate changes rather than to changes in the real growth rate of the money supply that takes place within the domestic economy. Thus whenever there has been an appreciation of the DM, the money supply in Germany, viewed in terms of dollars, would seem to have increased even if at the given year of appreciation the actual stock of money had not risen by one extra DM.

Hence following the G. W. Z. theory that under fixed exchange rates the entire world can be viewed as one economy where every country constitutes a mere region in it, there are powerful arguments for wishing to explain in this world the true movements of the money supply, incomes and inflation rates and not the distorted ones that arise

when we take into account fluctuations in the external values of domestic currencies. In these circumstances it is proper to use constant exchange rates for converting both incomes and money stocks.

Nevertheless, G. W. Z. chose to convert GNPs and money stocks using current exchange rates. Thus the variables used for their empirical work are subject to a distortion. Furthermore, there is an even more serious argument against the use of current exchange rates. Take, for example, a hypothetical case where during a period of three years both real income and the money supply within a country have remained constant while externally the national currency has depreciated against the dollar. The mere conversion of income and money into dollars at current exchange rates will create an artificial positive correlation between the two variables while in reality there was none. This procedure would lead to a world demand for money which is more stable than would otherwise be the case. This is due, of course, to the conversion into dollars which quite falsely made the correlation between variations in the money supply and variations in income stronger than it really is. We would not be surprised if at times the use of current exchange rates produced a stable world demand for money even under floating exchange rates. In fact, by following this method the more frequent the fluctuations in exchange rates the stronger the association between money and income and thus the better defined the demand for money would appear on estimation.

The reasoning outlined so far points to the fact that for world aggregates the best procedure is to use constant exchange rates. We have followed a middle course, however, in that we used constant exchange rates for converting GNPs but current exchange rates for converting money stocks. The justification for doing so is as follows: there are three possible types of exchange rate regimes, namely rigidly fixed exchange rates, freely floating exchange rates and an adjustable peg system with periodic changes in parities. In the first case, estimating a world demand for money is a legitimate exercise. In the second case there is no fixed link between national currencies and thus the exercise is a void one. In the third case, however, which is the one that characterised the period under investigation, a world demand for money may be identified but it must be recognised that every time an exchange rate change has taken place, the validity of the whole exercise is impaired. If one is to be honest in empirical estimation, some allowance for the "shocks" that the world demand for money has



sustained, must be made. To our mind, one way of allowing for these shocks is to convert the money supply at the current exchange rate so that whenever there has been a realignment of exchange rates, the distortion is taken care of in the world demand for money function. This method appears to be preferable to disregarding the fact that some fluctuation in exchange rates has occurred during the period under review and to using constant exchange rates as if this period had been one of rigid exchange rates.

Instead, we maintain that the use of current exchange rates for converting the money supply and constant exchange rates for converting income is probably the best procedure to follow. In this way even when there are fluctuations in the money stock caused by exchange rate changes, which of course are not accounted for in the explanatory side of the equation, this will be primarily absorbed by the error term. According to the G. W. Z. approach, however, this extra source of variability will be absorbed directly by the income variable thus producing an income elasticity which would be biased upward.

We now come to what appears to be the crux of the matter, namely the statistical and economic differences between the G. W. Z. study and ours. To start with we restate what G. W. Z. regard as their best model, which in fact is the specification we have chosen ourselves. Using the aggregate data of the ten countries for the period 1957 (2) - 1971 (2) we estimate the function:

$$M_t = a + bY_t + cr_t + dM_{t-1}$$

where all variables are in natural logarithms and  $M_{t-1}$  is the result of a partial adjustment hypothesis on the dependent variable.

The interest rate used is the Eurodollar rate. The results obtained are as follows:

$$M_t = - 1.1887 + 0.1794 Y_t - 0.02269 r_t + 0.7911 M_{t-1}$$

(4.57)      (7.49)      (6.68)      (17.24)

$$R^2 = 0.997 \quad DW = 1.30$$

These results came as a surprise to us since they are not identical to those quoted by G. W. Z. for the same time period and identical specification\*. In fact, the results quoted by G. W. Z. were as follows:

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\* The basic difference is that the GNPs series that we used were actual quarterly figures while the series used by G. W. Z. were obtained by interpolation from annual figures.

$$M_t = 0.663 + 0.234 Y_t - 0.0125 R_t + 0.610 M_{t-1}$$

$$R^2 = 0.99$$

Our use of the G. W. Z. data reveal a much higher lagged money stock coefficient which implies a slower speed of adjustment. Concentrating on the empirical results, as one would expect, the lagged money stock variable is explaining too much, thus reducing the income effect to explaining very little, the classical case of the distributed lag bias. In most cases where lagged endogenous variables are used as regressors they tend to dominate the explanatory side of the equation, so that the rest of the coefficients are biased downwards. In this sense the distributed lag bias appears to be similar to the type of bias encountered in the presence of multi-collinearity which is detrimental to the correct estimation of any of the coefficients. As is well known this bias vanishes only as the sample increases (i. e. asymptotically) something we claim to have accomplished in our study. A measure of the bias could be obtained from comparing the simple correlation coefficient between  $Y_t$  and  $M_t$  (which is 0.985) and the overall multiple correlation coefficient (which is 0.998). Apparently these are quite close.

One can proceed by using first differences of logs instead of levels so that the association between  $Y_t$  and  $M_t$  (and hence the bias) becomes weaker. The results are as follows:

span 1957 (3) - 1971 (2)

$$DM = 0.3083 DY_t - 0.0225 Dr_t + 0.5805 DM_{t-1}$$

$$(4.69) \qquad (3.69) \qquad (5.81)$$

$$R^2 = 0.554 \quad DW = 1.94$$

where the operator  $D$  signifies first differences. The results look plausible with the lagged money stock becoming less significant and the partial adjustment coefficient taking a reasonable value of 0.42. The simple correlation coefficient between  $DY_t$  and  $DM_{t-1}$  is 0.35 while the multiple correlation coefficient is 0.75. The size of the former is less than half the size of the latter, revealing that the distributed lag bias has been considerably reduced. We can now test, by splitting the period, whether the world demand for money is stable or not. We will follow the G. W. Z. procedure of estimating the same function to the first forty and the last forty observations. We are aware, of course, that by so doing the overlap between the two sub-samples is quite considerable (twenty-three observations), and hence there is an in-built

stability already in the function. By again using first differences we obtained the following results:

span = 1957 (3) - 1967 (2)

$$DM_t = 0.3352 DY_t - 0.0275 Dr_t + 0.5606 DM_{t-1}$$

(4.81)                      (3.56)                      (4.95)

$$R^2 = 0.588 \quad DW = 1.70$$

simple correlation between  $DY_t$  and  $DM_{t-1} = 0.396, R = 0.767.$

span = 1961 (3) - 1971 (2)

$$DM_t = 0.2950 DY_t - 0.0177 Dr_t + 0.5283 DM_{t-1}$$

(3.36)                      (2.61)                      (4.24)

$$R^2 = 0.411 \quad DW = 1.83$$

simple correlation between  $DY_t$  and  $DM_{t-1} = 0.151, R = 0.641.$

*Long Run Elasticities*

SPAN	Y	R	Adjustment parameter
1957 (3) - 1971 (2) .....	0.735	- 0.054	0.420
1957 (3) - 1967 (2) .....	0.763	- 0.063	0.439
1961 (3) - 1971 (2) .....	0.625	- 0.038	0.472

The interest elasticity is very significant in both periods in contrast to the G. W. Z. results who found it insignificant. In both periods the function is well defined (especially for an equation expressed in differences) although in the second period the explanatory power deteriorates. Our simple indicator of the distributed lag bias shows that it has been to a considerable extent weakened by the use of first differences.

In conclusion, the aggregate data reveal that an interest rate effect is very significant in the world demand for money. The function seems to be quite unstable if fitted in different time periods as the interest elasticity is almost half in value, while the income elasticity is reduced by about 20 %. Adjustments towards the desired money holding, however, tend to be more stable over time. In general, these results agree quite closely with our own findings, where the pooling method was used, and we see no grounds for any criticism of our study by Zis.



In fact, quite the opposite: our empirical investigation demonstrates that if some allowance for the distributed lag bias is made and better quality data are used, the G. W. Z. results tend to be reversed completely.

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### Zusammenfassung

#### Die Existenz einer internationalen Geldnachfragefunktion

##### Eine Replik

Mit diesem Beitrag wollen wir der Behauptung von *Zis* entgegenzutreten, daß unsere Arbeit über die Existenz einer internationalen Geldnachfragefunktion sowohl der theoretischen als auch der empirischen Gültigkeit entbehrt. Die Behauptungen von *Zis* können sowohl durch die entwickelten theoretischen Behauptungen als auch durch die durchgeführten ökonometrischen Tests völlig widerlegt werden. Wir halten die Behauptung aufrecht, daß die zu testende Hypothese gültig ist, ob man nun das Verhalten der internationalen Geldnachfragefunktion testet, indem man Ländergruppen zusammenfaßt, oder diese Länder in einer zusammengefaßten Zeitreihen-Kreuzstichprobe behandelt. Darüber hinaus ist unsere Technik der Aggregation ökonometrisch höherwertig, weil sie das Problem der Multikollinearität und die Verzerrungen der Lag-Verteilung vermindert. Wenn man tatsächlich den Versuch unternimmt, einen Teil der Verzerrungen der Lag-Verteilung aus den Daten von G. W. *Zis* zu eliminieren, dann ändern sich ihre Resultate vollständig und stimmen in der Tendenz mit unseren überein.

Was die Frage anbelangt, welches der geeignetste Weg sei, nationale Geldvariablen auf einen gemeinsamen Nenner zu bringen, so haben wir darüber hinreichend diskutiert und kamen zu dem Schluß, daß der Ansatz von G. W. *Zis*, die laufenden Wechselkurse zu benutzen, eine positive Verzerrung auf

die Einkommenselastizität beinhaltet. Besonders hinsichtlich dieses Punktes glauben wir, daß die von uns befolgte Methode besser geeignet ist, diese Art von Verzerrungen zu vermeiden.

## Summary

### The Existence of a World Demand for Money Function

#### A Reply

This paper comprises an answer to G. Zis's allegations that our work on the "Existence of a World Demand for Money Function" lacks both theoretical and empirical validity. As shown by the theoretical arguments developed as well as by the econometric tests that were carried out, the allegations of Zis can be completely reversed. We maintain that, whether the behaviour of the world demand for money function is investigated by aggregating a group of countries or by treating these countries in a pooled time series cross-section sample, the testable hypothesis is equivalent. Furthermore, our pooling technique is econometrically superior because it lessens the problem of multicollinearity and distributed lag bias. In fact when an endeavour is made to eliminate part of the distributed lag bias from the G. W. Z. data their results are reversed completely and tend to agree with ours. As to which is the best way of converting national monetary variables to a common denominator, the extensive discussion presented here points to the conclusion that the G. W. Z. approach of using current exchange rates, imparts a positive bias on the income elasticity. Especially on this point we believe that the methodology we followed is better designed to cater for this type of bias.

## Résumé

### L'existence d'une fonction internationale de demande monétaire

#### Une réplique

Par cet article, nous entendons nous inscrire en faux contre les affirmations de Zis alléguant l'irrecevabilité tant théorique qu'empirique de notre travail sur l'existence d'une fonction internationale de demande monétaire. Les allégations de Zis peuvent être complètement réfutées aussi bien par les considérations théoriques développées que par les tests économétriques réalisés. Nous maintenons que l'hypothèse à tester est valide, que l'on teste le comportement de la fonction internationale de demande monétaire en rassemblant des groupes de pays ou que l'on traite ces pays dans un test groupé de points croisés en séries chronologiques. Par ailleurs, notre tech-

nique de l'agrégation est économétriquement de qualité supérieure, car elle réduit le problème de la multicolinéarité et les distorsions de la répartition des délais. Et si l'on entreprend effectivement d'éliminer des données de  $Z_{it}$  une part des distorsions précitées, ses résultats s'en trouvent complètement modifiés et concordent tendanciellement avec les nôtres.

La question du meilleur moyen de réduire à un dénominateur commun des variables monétaires nationales a été suffisamment longuement débattue et nous avons conclu que l'équation de  $Z_{it}$  qui utilise les taux courants de change inclut une distorsion positive sur l'élasticité des revenus. A propos de ce point en particulier, nous pensons que la méthode suivie par nous est mieux à même d'écarter ce genre de déformations.