Monetary Integration Between the Israeli,
Jordanian and Palestinian Economies

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MONETARY INTEGRATION BETWEEN THE ISRAELI, JORDANIAN AND PALESTINIAN ECONOMIES

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The peace process between Israel and the Palestinians raises some interesting economic questions concerning integration between the West Bank, Gaza and Israel. In this paper we describe past and current arrangements between Israel, the occupied territories and Jordan, focusing particularly on trade and labour flows. We then compare the similarity of economic performance of the four regions, employing recent developments in the statistical analysis of macroeconomic data due to Blanchard and Quah (1989), which enable to extract the shocks to the economies. Our findings indicate that under the past and current economic relations, Israel, the West Bank and Gaza were closely integrated, whereas economic integration between the occupied territories and Jordan was much weaker. Based on these past circumstances, the (imposed) monetary union between Israel and the Palestinian Economy was warranted. However, optimal monetary arrangements in the future will depend on the extent of changes in real flows and on a satisfactory settlement of the seigniorage issue.

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I. Introduction

The peace process between Israel and the Palestinians raises some interesting economic questions. Is the existing monetary union between the West Bank, Gaza and Israel optimal? Should it be continued in the emerging new political and economic environment?

Our aim in this paper is to study the past and the present for the lessons that can be drawn for the future, but also for its own sake. Clearly, the monetary union is the outcome of war and occupation and not of free negotiations. Hence, its optimality to the West Bank and Gaza, is suspected. Hamed and Shaban (1993) hint that Israel imposed the currency union to collect seigniorage from the Palestinians. While the seigniorage point is well taken there are other important costs and benefits of monetary unions.[1]

The benefits from a monetary union are that transactions can be made more efficiently, since one money is used as a unit of account and medium of exchange. Having several monies is cumbersome, and introduces uncertainty and transaction costs. These benefits of a common currency increase with the volume of trade between the economies.

The costs of a monetary union are associated with the loss of an independent monetary policy. Robert Mundell who initiated the modern discussion of optimal currency areas (OCA), considered a change of demand which is an external shock to the economy that can be accommodated with the appropriate monetary policy (Mundell, 1961). In a common currency regime, there might be a loss of output due to the lengthy adjustment process. Alternatively, if two countries are subject to the same shocks and their structure is similar, then they will use the same monetary policy even without a monetary union,

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[1] For another attempt to assess the seigniorage see Arnon and Spivak (1995).

hence there is no cost to a monetary union under such conditions.

Mundell mentioned another criterion for monetary integration: if labour and other factors of production are mobile between two regions, then a common monetary policy can be used even if the regions are subject to different shocks, because the movement of labour will restore equilibrium.

In a reaction to Mundell, McKinnon (1963) emphasised the dangers of independent currencies with flexible exchange rates. The arguments raised by McKinnon seem very relevant for the Middle East countries. He contends that small open countries cannot use monetary policy (i.e. devaluation) to foster employment because the depreciation of the currency is translated into inflation, and has no real effects. Israel's inflation is a classic example of such mechanism.

Thus, the benefits and costs of alternative monetary arrangements depend on the openness of the different regions vis-a-vis the others; their level of integration, and in particular how free is the movement of the factors of production; the similarity of the economies' structures and the correlation of the external shocks that they face.

The rest of the paper investigates these topics. In Section II we describe the trade and labour movements and existing arrangements between Israel, the occupied territories and Jordan, including the recent Paris *Protocol on Economic Relations* (1994) which has shaped the current 'interim phase' officially in effect until 1999.[2] It will provide the evidence necessary to evaluate the monetary union under the present situation as well as the background for future arrangements.

In section III we study the similarity of economic performance of the four regions.

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[2] We will use the terms West Bank and Gaza, the occupied territories, the Palestinian economy and the Areas interchangeably.

We elaborate on this issue in section IV where we employ recent developments in the statistical analysis of macroeconomic data due to Blanchard and Quah (1989). This analysis uncovers the underlying exogenous shocks to the economy which give rise to the observed time series of major macroeconomic variables such as output growth, unemployment and inflation. The shocks of the more permanent nature are also called, "supply" shocks and the transitory shocks are also called "demand" shocks. This is due to a critical assumption that only supply shocks have a lasting effect on output. We then compare the shocks in the various economies in order to determine how similar they are.

The current paper is in line with similar work of recent authors, who assessed the desirability of a monetary union in the NAFTA (North American Free Trade Agreements) countries and in Europe and Asia (see Bayoumi-Eichengreen, 1994a and 1994b). They conclude that there is no case for a common currency in NAFTA, since NAFTA in comparison with the EU, is exposed to more diverse shocks. As to Europe itself they argue that a clear DM block exists, where one currency might be the optimal solution.

Our own findings suggest that under the past and present economic relationship, Israel, the West Bank and Gaza were closely integrated. On the other hand, the Israeli Shekel performance as a stable currency was far from satisfactory. Together with the Israeli currency the Palestinians received inflation, picking up to more than 400% in 1984. As for the future, the expected political transformation will cause changes in the trade patterns between the Palestinians and Israel, Jordan and other countries. The expected decline of trade with Israel, in addition to the yet unresolved issue concerning seigniorage, point to the need to reconsider the existing institutional setup.

II. The Economic Relationship 1967-1994

This section presents the institutional arrangements which determined the economic relations between Israel (I), the West Bank (W) and Gaza (G), and Jordan (J). We describe both the pre-1993 setup and the evolving new conditions, as of 1994 and on.

First, we will look at measures for openness of the regions and their trade linkages. In Table 1 we present total exports and imports as ratios of GDP, as well as the trade structure between the four regions.

Table 1
Inter-regional Exports and Imports as Ratio of GDP

	Ex\GDP	of which: to I	to J	Im\GDP	of which: from I	from J
1968-77:						
W	0.23	0.13	0.09	0.72	0.61	0.04
G	0.33	0.16	0.06	1.03	0.90	0.03
I	0.32	--	NA	0.57	--	NA
J	0.20	NA	--	0.57	NA	--
1978-87:						
W	0.24	0.14	0.09	0.65	0.57	0.01
G	0.45	0.35	0.08	1.31	1.19	0
I	0.42	--	NA	0.60	--	NA
J	0.36	NA	--	0.79	NA	--

Clearly, both W and G are very open to trade and their major trading partner is Israel. Gaza, which is smaller than W, is more open to trade. Note, however, that there

is more trade between the West Bank and Jordan than between Gaza and Jordan. Thus,

the trade balance deficit reported in Table 1 is covered by the remittances of Palestinian

workers in Israel.

Table 2

Employees Residents of the West Bank and Gaza who Work in

Israel As Percent of Total

	Total Employees of the Region		Total Employed Persons of the region	
	W	**G**	**W**	**G**
1970-1972	51%	39%	17%	20%
1973-1977	98%	106%	28%	35%
1978-1987	102%	183%	30%	43%

The increasing importance of work in Israel and the high mobility of labour are evident.

The smaller economy of Gaza is even more dependent on Israel than the West Bank.

Over the years the labour markets for Palestinian wage earners were closely related.[3]

Since 1967 a forced customs union existed between Israel and the Areas.

Movement of industrial goods was relatively free, though some important administrative

restrictions prevented Palestinians from setting up factories and selling their goods in

Israel[4]. Restrictions were even tougher on agricultural goods.

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[3] Arnon and Gottlieb [1993] also show that wages for Palestinian workers in Israel and in the Areas moved together in most of the period.

[4]   An important instrument in preventing competition from 'Palestinian' goods was the use of quality control.

The movement of labour from the Areas to Israel was monitored by Israel, and was subject to security considerations, though during 1967-1987 there was practically free entry for labourers. Concerning capital movements, both from Israel to the WB & G and from the world in large, they were very limited throughout the period, due to economic conditions in the Areas and some forms of administrative restrictions. Capital movements between the Areas and Jordan were somewhat freer, apparently due to the close connections linking the two banks of the Jordan River.

The monetary system in the Areas was a dual currency union. Both Israeli and Jordanian currencies were used in the Areas. The JD was a legal tender only in the West Bank and the Shekel was a legal tender in both the West Bank and Gaza. However, the JD was not used in Israel and the Shekel was not used in Jordan. The exchange rate between the Shekel and the JD was determined indirectly in the international currency market. The banking system was underdeveloped; few Israeli banks functioned in the Areas, dealing with the Israelis living in the Areas and, to some extent with Palestinians. Their activity in intermediation was very limited. All existing banks were closed in 1967; the first to reopen was the Bank of Palestine in Gaza in 1981, and the second, more important one, the Cairo-Amman bank in the West Bank, in 1986.[5]

The interim agreement between Israel and the PLO which provides the agenda for the coming five years includes a part on the economic dimensions. These were agreed upon in the *Protocol on Economic Relation* which was signed in Paris on April 29, 1994 (See: Protocol, 1994). The Protocol deserves a close reading since it supposedly reflects

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[5] In April 1994 the first branch of the Bank of Jordan was reopened in Ramalla. Since then, The Arab Bank, The Jordan Gulf Bank, The Commercial Bank of Palestine and the Arab Land Bank started operations in the territories. As of the end of 1994, close to twenty bank branches of all the above-mentioned banks combined are active in the West Bank; half of them belong to the Cairo-Amman Bank.

the new economic conditions which will soon rule the Areas.

The interim agreement states that except for a list of several goods, limited in quantities, "the Israeli rates of customs ... shall serve as the minimum basis for the Palestinian Authority". (Article III 5a). VAT will be 15 to 16 percent, similar to Israel's current rate of 17 percent. As to the flow of goods between the Areas and Israel, "There will be free movements of industrial goods free of any restriction between the two sides, subject to each side legislation". (Article IX,1). As for agricultural products, a special arrangement restricts the exports of five goods to Israel specifying quotas that will disappear gradually within five years.

The extent of labour movement from the West Bank and Gaza to Israel will be determined by both Israel and the Palestinian authorities. Similar restrictions applies to movement in the other direction. There are no specified restrictions on capital movements.

The Israeli and Jordanian currencies will continue to circulate in the Areas. Both currencies will be legal tenders in both the W and in G. The issue of an independent Palestinian currency was deferred for later negotiations.

A Palestinian Monetary Authority (PMA) will be established, having all the functions of a central bank, except for the issuing of a Palestinian currency. The functions of the PMA include: licensing and supervision of banks, supervision of foreign exchange transactions and lending of last resort. It will also be responsible for the determination of the reserve ratio imposed on the banks[6], and for the operation of "a discount window and the supply of temporary finance for banks operating in the Areas". Thus, the PMA will facilitate the development of a banking system in the Areas.

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[6] However, the reserve ratio for NIS deposits cannot deviate from that of the Bank of Israel. See article IV, 11b.

Though, as stated above, the issue of capital movements was not mentioned explicitly in the Protocol, it was agreed that "the Palestinian authority will have the authorities, powers, and responsibilities regarding the regulation and supervision of capital activities in the Areas" (Article IV 21).

We see that the protocol legitimizes the customs union, labour movement and monetary union between Israel and the Palestinian economy. Our summary indicates that the degree of integration between Israel and the Areas is somewhat an interim case between the European Union and NAFTA. In the EU, there is free movement of commodities, labour and capital. There is yet no common currency. In NAFTA, there is free movement of goods and capital, but restricted movement of labour; each participant in NAFTA retains its own currency and monetary authority. Between Israel and the Areas, there is almost free movement of goods, a substantial movement of labour, very limited movement of capital; the Israeli NIS is a circulating currency. Between Israel and Jordan there is very little economic relationship. Between the WB&G and Jordan there are restrictions on the movement of goods and of labour, there is almost free movement of capital and the Jordanian Dinar is also a circulating currency in the West Bank and Gaza.

III. How Similar Were Past Performances?

The return of the optimum currency areas literature during the last few years is related to the new wave of economic integration as reflected in the rise of the EEC and then the EU, and the creation of NAFTA and other Free Trade agreements. (See e.g. Masson-Taylor 1992, Bean 1992, Bayoumi-Eichengreen 1994a, 1994b). The basic

*considerations remain the same as in the original contribution of the 60s. On the one

hand the degree of economic integration, as manifested by the amount of restrictions on

the flows of capital and labour, and on the other hand the degree of the resemblance of

the shocks to the economies. These factors determine whether it will be worthwhile to

have one currency or more. If the economies have relatively 'open' borders and are

facing the same shocks they should have the same currency. If they are relatively

'closed' and face different shocks they should have different currencies.

Assessing the uniformity of a region, comprised of several economies, is not a

simple task. Traditionally researchers looked at the growth rates of GDP and the levels of

inflation in the various regions.[7] However, though one can learn from such a

comparison, and we will present some results below, past performances might not 'prove'

the case for, or against, one currency and one monetary policy. Past performances might

be the result of, at least, two types of causes. One is best represented by the case where

different performances are the outcome of the different structures of the economies which

comprise the area under discussion. The other refers to the case where different external

shocks to the different economies are to be 'blamed' for the manifested variation in

performance. In both cases adoption of different monetary policies in the various regions

could increase welfare.

Due to the work done by Blanchard and Quah (1989) we can distinguish between

the performance and its possible causes. From the data we compute the probable

transitory and permanent shocks which resulted in the actual performance of the

economy. These will be used in turn to assess how correlated are the shocks between the

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[7]   Comparing the basic levels of important macroeconomic variables should not be neglected, however, since
the aim is to evaluate the advantages of having monetary policy, the focus here is more about changes in the
economies than about their relative size.

different regions. The method was used, with some modification, by Bayoumi and

Eichengreen (1994a, 1994b) in the context of monetary integration. Their interest was

the NAFTA arrangement and whether it meets the criteria for a common currency area.

Their findings led them to conclude that since the shocks to the NAFTA countries were

more diversified than those to the EU, it is less recommended that NAFTA will move to

a monetary integration.

Let us first examine the relative performances of the four regions, trying to

establish whether there are significant comovements in the major variables. The data

which we evaluate are the annual growth rates of GDP and the rates of inflation in Israel

(I), Jordan (J), the West Bank (W) and the Gaza Strip (G) from 1968 to 1992. The price

data for the West Bank and Gaza is denominated in Shekels. We used GDP data and not

GNP, since it does not include remittances for labour in Israel and thus represents better

the real economies. The period covers the post-1967 war years, for which we have

reliable figures.

Table 3

Correlations Between Inflation rates 1968-1992

	ΔPI	ΔPJ	ΔPW
ΔPI	———		
ΔPJ	-0.209	---	
ΔPW	0.997*	-0.212	———
ΔPG	0.994*	-0.197	0.998*

*Significant at the 1% level.

Table 3 clearly documents the close association between inflation rates in I, W and G. In this case it is not difficult to conclude that the Israeli inflation process lead its way to the other two economies. This reflects again the strong trade linkages between I, W and G and the mobility of labor shown in Tables 1 and 2. While smaller and insignificant even at the 5% level, the negative correlations between I and J and between J and, both W and G, might seem surprising at first look. However, at a second thought the negative relationship apparently reflects the basic differences in the timing of stabilisation policies in the two economies. Jordan managed to reduce the inflation rates in the early 80's, just when Israel's inflation accelerated. These were the years of the post second oil shock. The opposite was true for the years 1973-1974. The negative correlation between J and W & G are a reflection of the I-J negative correlation.

The correlations between GDP's growth rates tell a different story (see Table 4). First, the correlations are smaller. Secondly, I and both W and G are positively related and Gaza is not related to the West Bank. Jordan is positively related to W and negatively to G. Theses findings indicate the stronger ties between W and J, whereas different forces are at work in the Gazan economy. (See also Table 1).[8]

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[8] The data include the years of the Intifada. Excluding those years (1988-1992) does not alter the above description.

Table 4

Correlations Between Growth rates of GDP 1969-1992

	ΔYI	ΔYJ	ΔYW
ΔYI	-----		
ΔYJ	-0.182	-----	
ΔYW	0.278	0.257	-----
ΔYG	0.280	-0.220	-0.002

All Correlations are insignificant at the 10% level.

The data, so far, suggest that there is more then one family of economies in our sample. Jordan's economy was not behaving as if it was part of the same family of economies as Israel, whereas the West Bank seems to be associated with the Israeli economy concerning inflation and with both Israel and Jordan concerning GDP's growth rates. The Gazan economy is almost similar to the West Bank concerning inflation, but very different from the Jordanian economy with regards to real growth rates. Indeed the structure of the Gazan economy is different: It is more dependent on outside jobs for its labour, it is less industrialised, its population growth is higher, and its standards of living are lower than in the West Bank.

It is interesting to compare the order of magnitude of the correlations in the Middle East to that of North America. The 0.99 inflation correlations found between Israel, the WB and G is similar to that found within the US between New England and California, or within Canada. (Bayoumi-Eichengreen, 1994a). As for the other geographic regions reported in Bayoumi-Eichengreen (1994b) the correlations are much lower. Apparently, a common currency is a necessary but not sufficient condition for such degree of price similarity. The correlations

between Canada and US are lower, and so are all those reported in Bayoumi and Eichengreen (1994b). However, within the US, correlation between the South West and the Plains is 0.85 (see Table 8 in Bayoumi-Eichengreen, 1994a and Table 8 in 1994b).

Output changes' correlations are lower than the price correlations for the North American regions. But the within country correlations range from 0.44 to 0.94, larger then all our positive correlations. Mexico's correlation with the South West is 0.62, pointing to more integration than Israel and W&G.

IV. Identifying the Transitory and Permanent Shocks

The procedure used to identify the shocks to the various economies was proposed by Blanchard & Quah (1989) and extended to inflation rates and real growth rates by Bayoumi (1992). The procedure which is described in the appendix was applied to various cases by Bayoumi and Eichengreen (1994a, 1994b).

Using this method we computed the shocks to the four economies. In table 5 we present the correlation between the transitory shocks and in Table 6 between the permanent shocks.

Table 5

Correlation between Transitory Shocks in Israel (I), Jordan (J), West Bank (W) and Gaza (G), 1969-1992

	I	J	W
I	--		
J	-0.265	--	
W	0.595*	-0.117	--
G	0.112	0.034	0.041

* Significant at the 1% level.

Table 6

Correlations between Permanent Shocks in Israel (I), Jordan (J), West Bank (W) and Gaza (G), 1986-1992

	I	J	W
I	--		
J	0.076	--	
W	0.964*	0.095	--
G	0.892*	-0.060	0.915*

*Significant at the 1% level.

The transitory shocks are not correlated significantly, albeit those of I and W (see Table 5 and Figure 1.) However, the permanent shocks of I, W and G are highly correlated as can be seen in Table 6 and in Figure 2. . Those correlations remain high, and significant, even if we exclude the years 1984-86, when Israel and the West Bank and Gaza experienced a dramatic change in the economic environment from very high inflation rates to relatively low ones.

A possible explanation for the similarity of the permanent shocks of I, W and G is the exposure of the economies to identical external permanent shocks, like the stabilization program of 1985. This heterodox program succeeded in reducing Israel's inflation rate sharply through exchange rate freeze, fiscal stringent policy, temporary price controls and monetary contractions, which together constituted a new political

consensus. These permanent shocks determined the inflationary process in I, W and G, and their similar pattern reflects the similarity of the inflationary processes. However, we believe that a more convincing, though by no means contradictory, explanation has its roots at the close links between the labour and goods markets of the three economies. As mentioned above, if wages change in Israel for both Israeli labourers and Palestinian working in Israel, wages in the West Bank and Gaza will move in the same direction.[9] Thus, permanent shocks are correlated because changes in wages are highly correlated, i.e., the movement of labour between economies transmits the permanent shocks. This mechanism works too slowly to transmit transitory shocks. The correlation between permanent as well as transitory shocks concerning J, W and G are much lower. The co-movements of the shocks are captured in Figures 3 and 4.

The correlations between I, G and W are in line with those reported by Bayoumi and Eichengreen for the Mark block (Germany and her Northern European neighbors) as well as for the Asian blocks: Japan, Korea, and Tawian on the one hand and Hong Kong, Indonesia, Malaysia, Singapore and (possibly) Thailand, on the other.

Our findings show clearly the existence of regional integration between Israel and the West Bank and Gaza that was caused by the political circumstances. They allegedly support the case for a Shekel block for Israel and the occupied territories for the period under consideration, according to the OCA theory.[10] Indeed the permanent shocks were almost the same and even the transitory shocks between Israel and the West Bank were significantly correlated.

It thus seems reasonable for the economies to use a common monetary policy, i.e.,

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[9] See Arnon and Gottlieb (1993) for an econometric analysis of this relationship.

[10] It was not optimal from the seigniorage aspect, because this income went to Israel and Jordan.

have a monetary union. However, this conclusion concerning monetary policy tacitly

assumes that this common monetary policy is a good one. If one of the goals of monetary

policy is to control inflation, the 400% inflation in Israel in 1984 refutes the assumption.

Had the Areas been better off in the 80s with another currency that was more

stable, like the dollar or mark? They would have lost the benefits of the monetary union

with Israel: the ease of getting wages in Shekels and of Shekel import and export

transactions. They would have benefitted from the stability of their currency. It is hard to

weigh the two magnitudes one against the other. Furthermore, one must recall the dual

currency system in the Areas. We know that the Jordanian Dinar was used as a store of

value, thus lessening the cost of the Shekel inflation.

Lessons for the Future

Should the monetary union be continued under symmetric peaceful political

relations between Israel, the Areas and Jordan? That depends, of course, on the economic

relations. Arnon, and Weinblatt (1994) estimated that even with free trade agreements,

the total export from Israel to the Palestinian economy will be halved and imports will

remain the same relative to their current values reported in Table 1. However, the trade

between Jordan and the Palestinian economy will be much smaller (ibid, Table 6).

Without free trade agreements both exports and imports will decline to one fourth of their

free trade values.

The benefit for the Palestinian economy from a monetary union with Israel will

thus decrease but still be sizable, especially if Palestinian employment in Israel will be

significant. The Israeli currency is expected to be relatively stable, so the cost of a

monetary union will not be high, assuming the continuation of present and past structure.

Furthermore, as discussed in the introduction, it is an illusion that a small economy can lead an independent monetary policy without creating instability.

However, the issue of an independent currency is far from being a pure matter of economics. Given the political constraints, we expect a currency board which might use the U.S. dollar or other currencies as its reserve currencies to become a probable outcome. It will also solve the problem of collecting seigniorage.[11] Although our findings suggest that the Israeli shekel is more appropriate on pure economic terms, politically it would be less favorable.

V.   Conclusion

In this paper we addressed the issue of the desirability of the monetary union between Israel and the Palestinian economy. It was found, using the criteria of the optimal currency areas literature, that the economies were sufficiently integrated to warrant the monetary union. However, two caveats should be added: the seigniorage that was reaped by Israel and the burden of inflation to Shekel users in the Areas.

Our estimates for the future show a lesser degree of integration with less trade between Israel and the Palestinian economy. However, if free trade agreements are in effect, Israel will still be a major trading partner, pointing to the benefits of a continuation of the monetary union. However, we expect that important political considerations will require an alternative monetary arrangement, probably a currency board with the U.S. dollars or another currency, as the reserve currency.

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[11] See Schwartz (1992) and Osband and Villaneuva (1993) for an updated discussion of currency boards.

Appendix

Consider a system of equations such as:

$$X_t = B(1)X_{t-1} + B(2)X_{t-2} + ... + B(n)X_{t-n} + V_t$$

where X_t is the column vector variables, B(i) matrices and V_t is a vector of residuals.

This system is the well-known VAR and can be estimated (given an adequate data set).

It can also be written as:

$$B(L)X_t = V_t$$

where B(L) represents the polynomial lag operator, B(0) = I and cov(V) = $E(V_t V'_t)$ = Ω

where Ω is the covariance matrix of the VAR's residuals. We can also write $X_t = C(L)V_t$

and compute $C(L) = B^{-1}(L)$.

We would like to estimate a structural form, which cannot be estimated directly,

such as:

$$X_t = A(0)\epsilon_t + A(1)\epsilon_{t-1} + A(2)\epsilon_{t-2} + ... = \sum_{i=0}^{\infty} A(i)\epsilon_{t-i} = A(L)\epsilon_t$$

where ϵ_t represent the shocks to the structural equation.

For example, in our case,

$$\begin{bmatrix} \Delta Y_t \\ \Delta P_t \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} a_{11}(i) & a_{12}(i) \\ a_{21}(i) & a_{22}(i) \end{bmatrix} \begin{bmatrix} \epsilon d_{t-i} \\ \epsilon s_{t-i} \end{bmatrix}$$

where ΔY_t, ΔP_t are the rates of change in GDP and prices and ϵd_{t-i} and ϵs_{t-i} are the lagged

transitory shocks and permanent shocks.[12] Thus, ΔY_t and ΔP_t are determined by current and past shocks of two types: one which has a permanent effect on GDP and one which does not as will be explained below. We assume that for each period the two shocks are independent although this assumption might not be realistic in some cases.

To identify the structural shocks we will define a matrix S, so that $S\epsilon_t = V_t$. Then,

$$A(L)\epsilon_t = C(L)S\epsilon_t$$

Thus, if we can compute S, the structural model can be identified; if $E(\epsilon_t\epsilon'_t) = I$, then: $cov(V) = E(v_tv'_t) = E(S\ \epsilon_t\ \epsilon'_tS') = SS'$. In the standard VAR analysis it is assumed rather arbitrarily that:

$$S = \begin{bmatrix} S_{11} & 0 \\ S_{12} & S_{22} \end{bmatrix}$$

It allows the computation of S from the covariance matrix of the residuals Ω, since $SS'=\Omega$.

Blanchard and Quah (1989) employed an alternative restriction based on economic reasoning, which, though controversial, enables a non-arbitrary solution. They argued that demand shocks do not have a permanent impact on GDP, while supply shocks do.

Thus, they assumed

$$\sum_{i=0}^{\infty} a_{11}(i) = 0$$

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[12] As mentioned above, in the literature the transitory shocks are described sometimes as demand shocks and the permanent shocks as supply shocks, in line with the standard AS/AD macroeconomic model. However, this interpretation implies more than the procedure suggests.

It follows that

$$X_t = A(L)\epsilon_t = C(L)V_t = C(L)S\epsilon_t$$

and hence $A(L) = C(L)S$ and in particular $\Sigma C_{11}(i)S_{11} + \Sigma C_{12}(i)S_{21} = 0$.

Since $\Sigma C_{11}(i)$ and $\Sigma C_{12}(i)$ can be computed, this restriction on the four elements of S adds up to the three others which result from the fact that $SS' = \Omega$.

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Transitory Shocks in I, W and G

Figure 1

ETI ----- ETW --- ETG
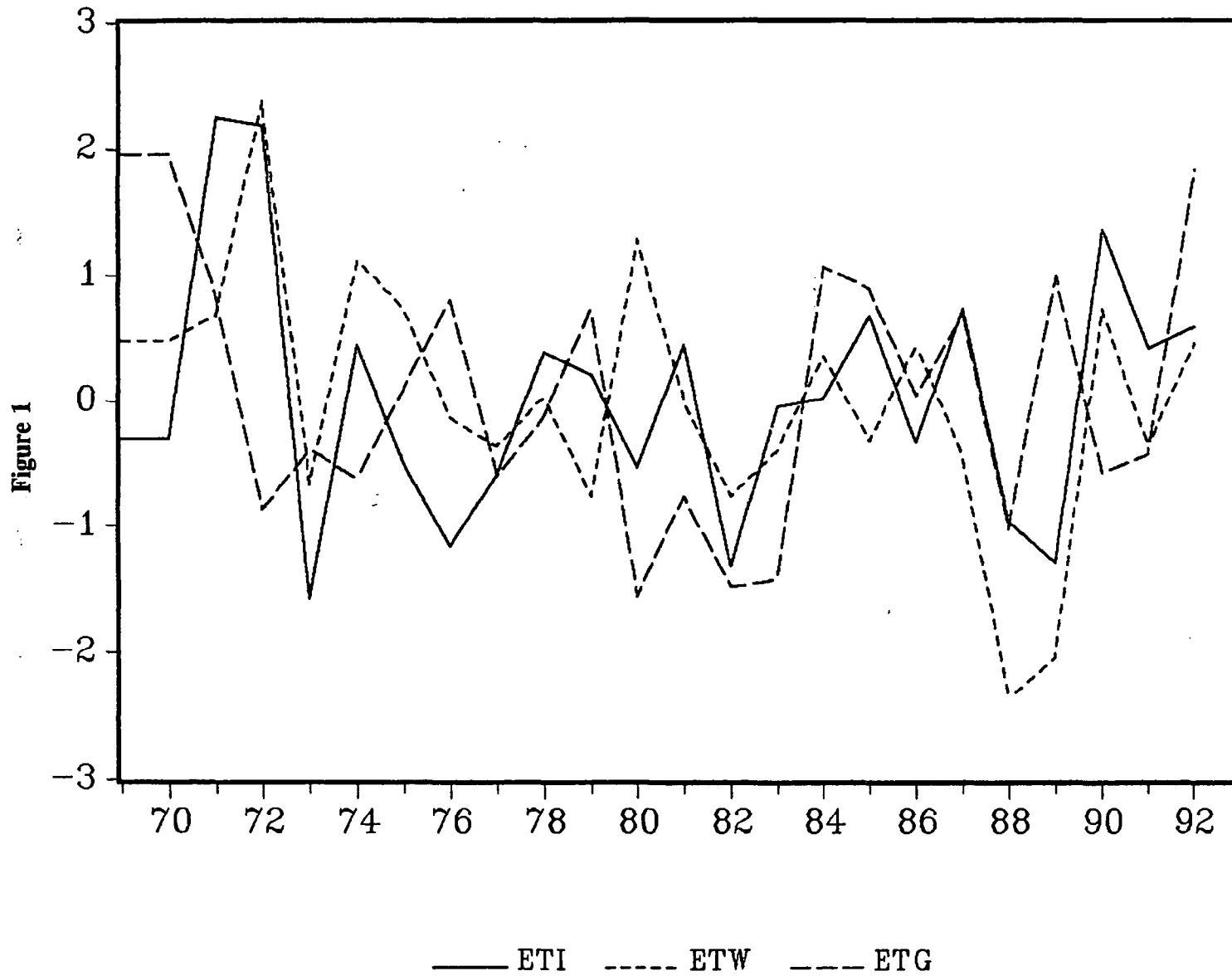
Permanent Shocks in I, W and G

Figure 2

——— EPI   ----- EPW   --- EPG
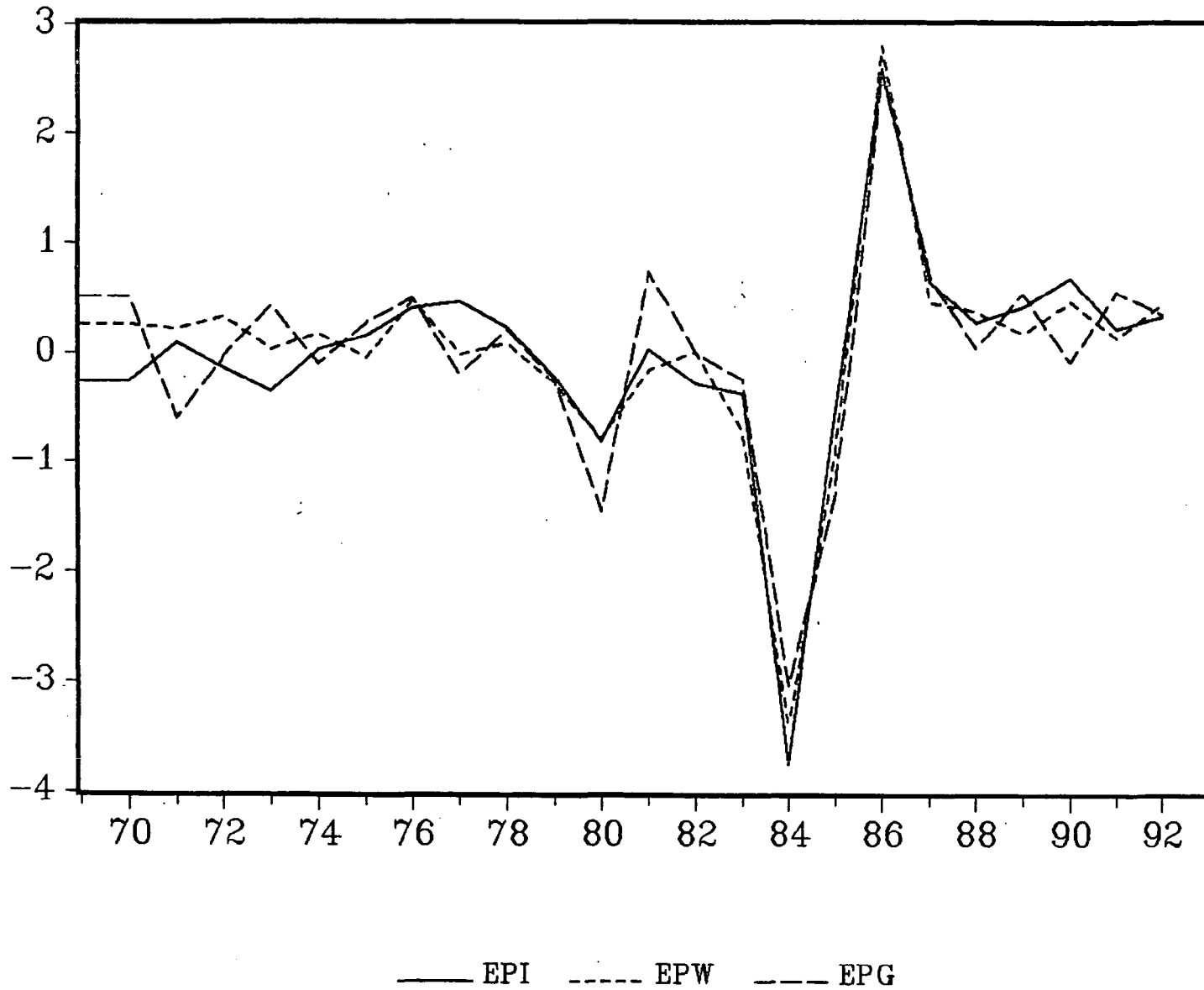
Transitory Shocks in J, W and G

ETJ ----- ETW --- ETG

Figure 3

26
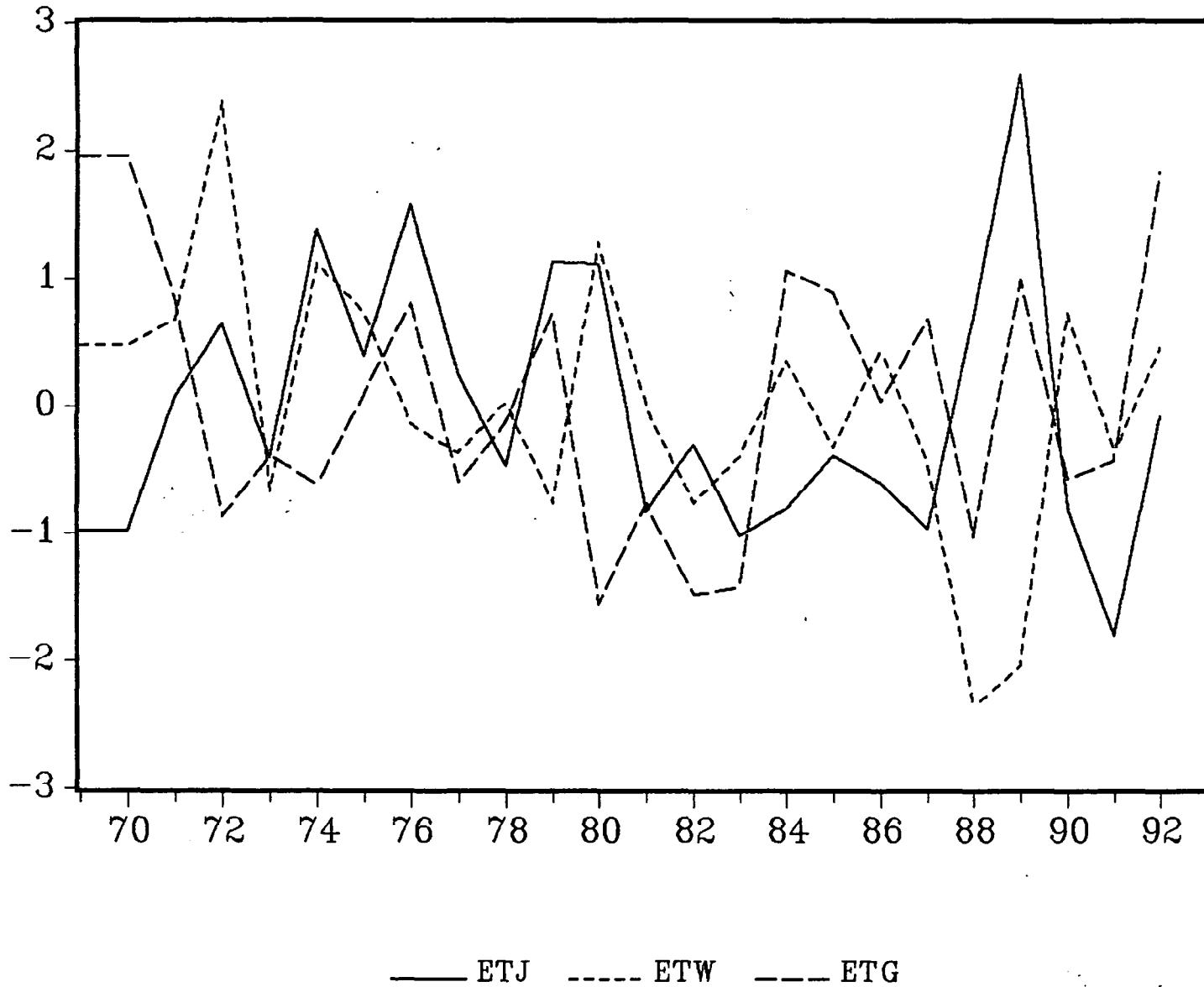
Permanent Shocks in J, W and G

———— EPJ　　----- EPW　　——— EPG
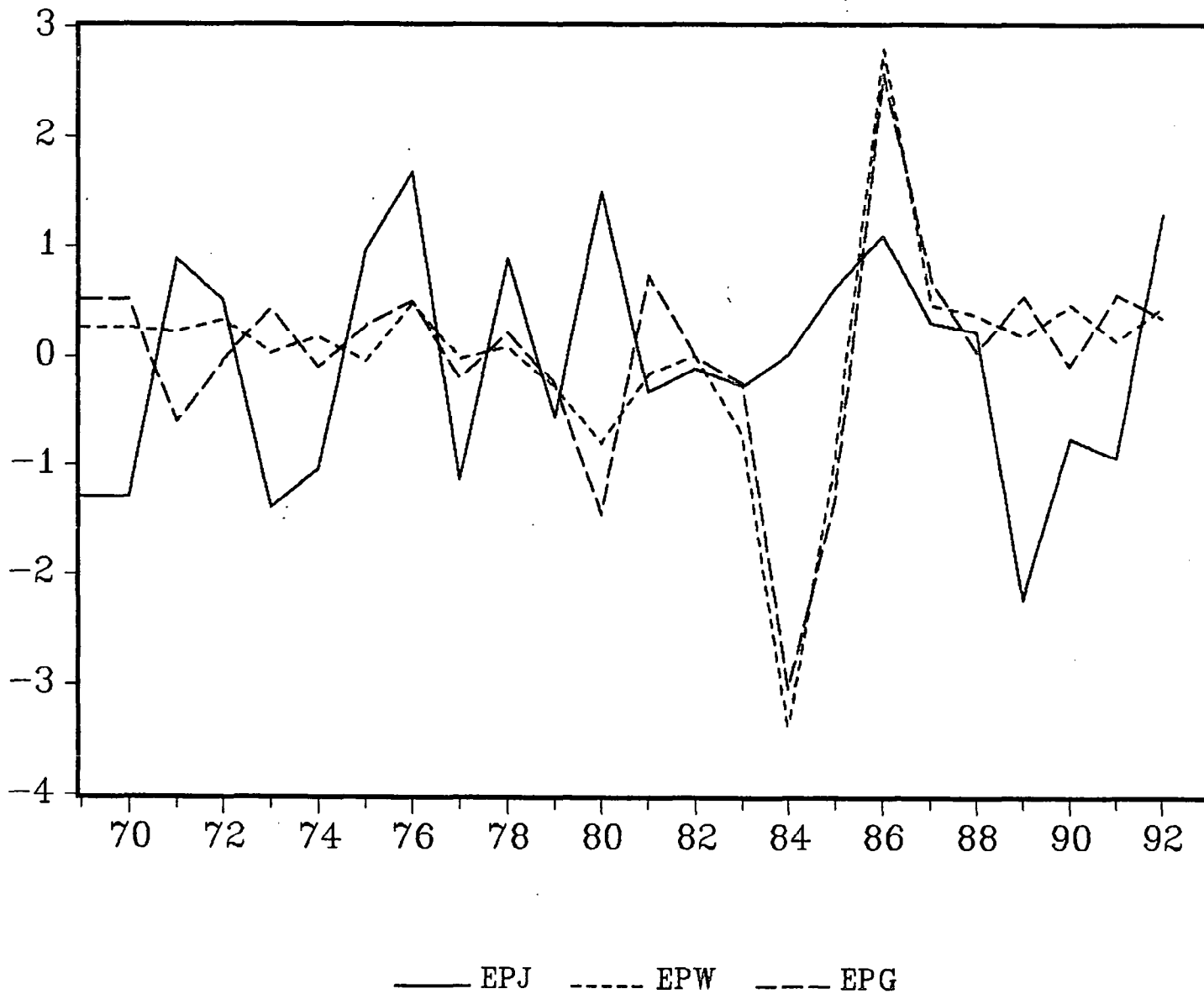
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