REBASING OF NATIONAL ACCOUNTS
AUG 1990 - JULY 1992

A L L - I N - 1 N O T E

DATE: 07-Apr-1992 11:04am

TO: Gary Hyde (GARY HYDE)

FROM: John OConnor, IECSE (JOHN OCONNOR)

EXT.: 33805

SUBJECT: **RE: Rebasing the National Accounts -- Discussion Note**

Like the swallows returning to Capistrano or Paris letting us know whether skirts should be long or short; I count on the partial rebasing issue as a harbinger of Spring. As each year's sprout comes up, I look to see if there is something new; a novel argument I could imagine convincing Ernie Stern the MD to reverse the unequivocable position taken by Ernie Stern the SVPOP. Maybe next year.

For the record, one of the thickest folders in IECSE's official files is on partial rebasing and related benchmarking issues. I think that anyone wishing to reopen the issue should first read through it. I believe that the file answers all questions you raise and reading it could have obviated what I think is a muddled exposition in paragraphs 26-30 of your note, about what is actualy done (although even reading the technical notes of World Tables, which is our main publication for time series, should avve answered your main points).

The key analytical issue, in my view, is not mentioned in your note: The choice of base year often has a significant effect on real growth rates, as we documented in WPS 22. The Bank should be uncomfortable with the likelihood that its assessment of borrower performance varies with national compilers' decisions about a base year; and doubly so with the way its own staff compound the problem by the nearly random treatment accorded the same issues at the "cusp" between history and projections.

Partial rebasing was mandated as A FIRST STEP towards resolving this analytical issue. As with the lingering issue of domestic finance (rationalizing fiscal and monetary indicators for Standard Tables), the problem is lack of commitment to the follow-up, specifically a serious IEC-CEC plan to produce Standard Attachments for CSPs, the original trigger for all this. Appointing an outside "expert" won't substitute for the comprehensive review of Standard Tables, jointly with Operations, that I have advocated for some time.

If we must address "rebasing" alone, which I do not advocate, I recommend two actions--neither of which involves sliding back into the old rut (although, again for the record, I was a strong opponent of partial rebasing in the first place, because I doubted the Bank's will to proceed further). First, there should

be a follow-up to WPS 22 (we had a concrete research proposal for this, which was turned down by the Research Committee, a few years ago). Second, for unrelated reasons we are deepening the structure of our national accounts, sectorally for agriculture and across the board for economies of the former Soviet Union; we could use these exercises to assess the costs and benefits of doing a fuller rebasing exercise, systematically.

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A L L - I N - 1 N O T E

DATE: 06-Apr-1992 04:09pm

TO: See Distribution Below

FROM: Gary Hyde, CECMG (GARY HYDE)

EXT.: 39072

SUBJECT: **Rebasing the National Accounts -- Discussion Note**

Introduction

1. This note addresses an index number problem that the Bank faces when it tries to put country data into comparable units that can be summed into regional and worldwide totals and used for intercountry comparisons. It draws on Statistical Manual Note 6.65 of December 1983, entitled "Rebasing the National Accounts at Constant Prices," as well as on personal memoranda and discussions.

2. Looking at the Bank's Standard Tables [see Statistical Manual Note 1.20 of December 1984 on the "Standard Tables System"], one sees the following identity relating Gross Domestic Product at Market Prices, GDPmp, according to industrial origin and according to expenditure:

$$Y1 + Y2 + Y3 + Y4 + Y5 + NIT = GDPmp = Cg + Cp + If + Is + X - M.$$

In words, the value added at factor cost in agriculture Y1 plus the value added in mining Y2 plus . . . manufacturing Y3 plus . . other industry Y4 plus . . . total services Y5 plus net indirect taxes less subsidies NIT equals GDPmp equals the sum of expenditures on consumption goods and services by government Cg and by the private sector Cp, on fixed investment If, on investment stocks Is, on exports X, and on imports M.

3. When measured in current prices of each year the production components add to total GDPmp, as do the expenditure components -- if only because they have been forced in order to match the value-added total. Each country usually provides the same national accounts in constant prices of some base year. At this time, for instance, one can sample the accounts provided by Bank member countries and find an array of base years, some quite recent and others as far back as the 1960s. Although international experts recommend that countries conduct extensive surveys and effect a total rebasing of the national accounts every five years or so, only a few comply. That is unfortunate, because as one moves further and further away from a base year, the impact of relative price changes is less visible in the figures -- and one may get a distorted picture of real changes.

4. Most countries try to gather enough information to construct price deflators for the above components, although a few may be computed indirectly. In fact, components are built up from subcomponents, which are in turn based on their own constituent elements, etc. A massive amount of data concerning transactions, prices, and quantities is required to calculate the aggregate measures discussed in this note.

5. To keep the following illustrations as simple as possible, some of the above components can be merged to yield this simpler accounting equation:

$$Y1 + Y2 + Y3 = GDP = C + I + X - M,$$

where Y2 refers to all industry [former Y2 + Y3 + Y4] and Y3 to total services, both measured inclusive of indirect taxes and subsidies, and where C refers to all consumption and I refers to all investment.

Two Methods Used to Shift Base Years

6. Most general-purpose price indices are base-weighted Laspeyres indices, and these are used to deflate current-value components in order to estimate volume changes over time. The deflated components can be summed to obtain overall GDP at constant prices, which can be compared with GDP at current prices to obtain an implicit deflator. This procedure is equivalent to computing a weighted arithmetic mean of the component volume changes, using base-year values as weights.

7. Until 1986, the Bank used a rescaling method to shift country data based on one year to a different year chosen as our reference base year for all reporting countries. Each component as well as total GDP was "base-slipped" to our reference year, by dividing each index number in the series by the value of that year. If the original country series of Y1 index numbers, for instance, were 1980=100, 1981=104, and 1982=110, one would divide through by 110 to obtain a new series based on 1982, viz., 1980=90.9, 1981=94.5, and 1982=100. This simple act of rescaling values preserves the original rates of change over time. It also introduces a discrepancy, however, between the rescaled GDP and the sum of the rescaled components.

8. Since 1986, the Bank has used a partial rebasing method to shift country data. Each component is rescaled as before, but total GDP is obtained as the sum of rescaled components rather than through direct rescaling. There is no discrepancy, but the original rate of GDP change has been altered. The new value of GDP from the value-added side also requires an adjustment on the expenditure side to reestablish the equation [see below].

9. The earlier procedure was predicated on the assumption that the World Bank should not alter real GDP growth rates as found in original country data. One could add an explicit line of figures entitled "Rescaling Discrepancy" so that adjusted component values would add properly to total GDP, and one might then choose to add the discrepancy to Services on the value-added side and to Consumption on the expenditure side. Such an assignment of the two discrepancies [only in very special circumstances would they be the same] was thought to be reasonable, since the deflator for services is problematic at best and the value of consumption spending is determined residually in any event.

10. Neither method is entirely satisfactory. The rescaling procedure retains original GDP and component growth rates but creates a discrepancy. The partial rebasing procedure avoids the discrepancy problem but changes GDP values and growth rates. The sign and magnitude of the error created by the Bank, in either case, depend on (a) the period of time between the country base year and the Bank reference base year, (b) the component value weights in the country base year, and (c) the pattern of component rates of volume and price change between base years.

An Illustration

11. Consider a simple illustration of only two years, 1980 and 1990. The following information has been provided by the country, in millions of local currency units:

Table 1: Value Added, by Sector

	1980		1990	
Y1	50	(50%)	90.3	(44.8%)
Y2	15	(15%)	48.1	(23.9%)
Y3	35	(35%)	63.2	(31.3%)
GDP	100	(100%)	201.6	(100.0%)

Table 2: Value Added, at 1980 Constant Prices

	1980		1990
Y1	50	(50%)	90.3/134.4= 67.2
Y2	15	(15%)	48.1/179.1= 26.9
Y3	35	(35%)	63.2/134.4= 47.0
GDP	100	(100%)	141.1

The 1990 values at 1980 prices are obtained by deflating the current-price values by the price index numbers, as shown. The figures reflect the assumptions that agriculture Y1 and services Y3 increase by 3% p.a. in volume and by 3% p.a. in prices, yielding a value increase of 6.09% p.a. Industry Y2 increases by 6% p.a., in volume and by 6% p.a. in price, implying a value increase of 12.36% p.a. As a result, the Y2 share of current value added rises sharply between the 1980 country base year and the 1990 Bank reference base year, at the expense of the Y1 and Y3 shares. The implicit GDP deflator for 1990 is 201.6/141.1 or 142.9, which means that the aggregate price level rose by 42.9% or 3.63% p.a. Measured in constant 1980 prices, GDP rose by 41.1% or 3.5% p.a. [This small difference in the split between overall price and volume changes occurs despite the assumption of equal rates of change for components.]

12. One can check the above figures: (1.429)(1.411)= 2.0163 and 2.0163 -1 = 1.0163, which means that current-price GDP rose by 101.63% or 7.26% p.a. between 1980 and 1990. Similarly, one can compute a weighted arithmetic mean of the component volume changes, using base-year values as weights: Y1 has a 34.4% gain, at weight of .50, for weighted gain of 17.2%; Y2 has a 79.1% gain, at weight of .15, for weighted gain of 11.9%; Y3 has a 34.4% gain, at weight of .35, for weighted gain of 12.0%; and the overall GDP rises in real terms by 17.2+11.9+12.0= 41.1%.

13. Now it is desired to shift the base year from 1980 to 1990:

Table 3: Value Added, at 1990 Constant Prices

	1980		1990	
Y1	50 @ 1.3439= 67.2		90.3	(44.8%)
Y2	15 @ 1.7908= 26.9		48.1	(23.9%)
Y3	35 @ 1.3439= 47.0		63.2	(31.3%)
GDP-rescaled	142.9		201.6	(100.0%)
GDP-rebased		141.1	201.6	(100.0%)

The component values are inflated to 1990 prices, as shown. If GDP is also inflated in the same manner [rescaling], one obtains a value of 142.9 for 1980. If one computes GDP by summing the three inflated components [partial rebasing], however, one obtains a value of 141.1 for 1980.

14. Thus, the discrepancy introduced through rescaling amounts to 142.9 - (67.2 + 26.9 + 47.0) = 1.8. Alternatively, the partial rebasing approach lowers the 1980 value of GDP measured in 1990 prices to 141.1 and raises the apparent real rate of GDP growth from 3.5% to 3.63% p.a., a difference of 0.13% p.a.

15. Now consider another scenario in which the above 1980 figures are retained as well as the real component growth rates, but the inflation rates are trebled. The current-price 1990 values become Y1= 159.1, Y2= 140.6, and Y3= 111.4. The values in constant 1980 prices are as follows:

Table 4: Value Added, at 1980 Constant Prices -- High Inflation

	1980		1990
Y1	50	(50%)	159.1/236.7= 67.2
Y2	15	(15%)	140.6/523.4= 26.9
Y3	35	(35%)	111.4/236.7= 47.0
GDP	100	(100%)	141.1

The implicit deflator for 1990 GDP is 411.1/141.1= 291.3, which means that the aggregate price level rose by 191.3% or 11.3% p.a. on average. The real growth rate is unchanged from the first scenario, 3.5% p.a. when measured in 1980 prices.

16. Finally, the base year is shifted from 1980 to 1990:

Table 5: Value Added, at 1990 Constant Prices -- High Inflation

	1980		1990	
Y1	50 @ 236.7=	118.4	159.1	(38.7%)
Y2	15 @ 523.4=	78.5	140.6	(34.2%)
Y3	35 @ 236.7=	82.8	111.3	(27.1%)
GDP-rescaled	291.3		411.0	(100.0%)
GDP-rebased		279.7	411.0	(100.0%)

The 1980 component values are inflated to 1990 prices, as shown. If GDP is also inflated in the same manner [rescaling], one obtains a value of 291.3 for 1980. If one obtains GDP by summing the three inflated components [partial rebasing], however, one obtains a value of 279.7 for 1980.

17. In this high-inflation scenario, the discrepancy introduced through rescaling amounts to 291.3 - (118.4 + 78.5 + 82.8) = 11.6. Alternatively, the partial rebasing approach raises the apparent real GDP growth rate from 3.5% p.a. to 3.9% p.a. [147% in 10 years], a difference of 0.4% p.a. [Note that this difference is entirely a function of the scenario; if Y2 were to grow at 9% p.a. in real terms rather than 6% p.a., for instance, the GDP growth rate difference would rise to 0.9% p.a.]

Absorbing the Rebasing Errors

18. If one chooses to rescale in the above high-inflation scenario -- which is not really so high, in comparison with many developing country experiences -- it is necessary to do something with the 11.6 discrepancy. Adding that amount to the 1980 value of the Y3 services component, in 1990 prices, raises it from 82.8 to 94.4. This causes a reduction in its growth rate between 1980 and 1990, from 3.0% p.a. to 1.7% p.a. The GDP growth rate is preserved, however, so nothing has to be passed over to the expenditure side.

19. If one chooses to use the partial rebasing procedure, on the other hand, the 1980 GDP value is adjusted downward from 291.3 to 279.7 and the expenditure side must be adjusted by the same amount. The usual approach is to adjust consumption expenditure.

20. Note that the choice between rescaling and partial rebasing applies to the expenditure side as well as to the production side of the equation. If rescaling is chosen, the 1980 values of expenditure components expressed in 1990 prices will not add to the rescaled value of GDP, and one will have a discrepancy. This expenditure-side discrepancy is not the same as the production-side discrepancy, which was merged into Y3 services.

21. Either way, the 1980 value of consumption spending is going to change when the base year is shifted from 1980 to 1990. In the rescaling procedure, it will be raised or lowered by the amount of the discrepancy between the rescaled GDP and the sum of the rescaled expenditure components: C + I + X - M. In the partial rebasing procedure, the entire adjustment in GDP from the value-added side is added to or subtracted from consumption to achieve balance.

22. If the 1980 expenditure values in current prices were C=85, I=15, X=20, and M=20, for example, such that GDP = 100, one can work through the numbers to see what happens to consumption:

Table 6: Expenditures at Current Prices -- High Inflation

	1980	1990	
C	85	315.2	(76.7%)
I	15	95.8	(23.3%)
X	20	82.2	(20.0%)
M	20	82.2	(20.0%)
GDP	100	411.0	(100.0%)

These current-price expenditure values are based on the following assumptions: consumption rises by 3.5% p.a. in

constant prices of 1980 and the consumption price deflator rises by 10.9% p.a.; investment rises by 7.0% p.a. in constant prices of 1980 and the investment deflator rises by 12.5% p.a.; and both exports and imports rise by 3.5% p.a. in constant prices of 1980 and their deflators rise by 11.3% p.a. [This scenario implies a deteriorating ICOR, which rises from 4.4 in 1980 to 5.7 in 1990 when measured in 1980 prices.] With this information, one can construct the constant-price series:

Table 7: Expenditures at 1980 Constant Prices -- High Inflation

	1980		1990	
C	85	(85%)	315.2/282.5=	111.6
I	15	(15%)	95.8/324.7=	29.5
X	20	(20%)	82.2/291.3=	28.2
M	20	(20%)	82.2/291.3=	28.2
GDP	100	(100%)		141.1

And again, one can shift to 1990 constant prices:

Table 8: Expenditures at 1990 Constant Prices -- High Inflation

	1980		1990	
C	85 @ 282.5=	240.1	315.2	(76.7%)
I	15 @ 259.4=	48.7	95.8	(23.3%)
X	20 @ 291.3=	58.3	82.2	(20.0%)
M	20 @ 291.3=	58.3	82.2	(20.0%)
GDP-rescaled	291.3		411.0	(100.0%)
GDP-rebased		288.8	411.0	(100.0%)

The rescaling discrepancy is (291.3 - 288.8 =) 2.5. If that amount were added to consumption, the latter would become 242.6. If the value-added side had been partially rebased, GDP would have been lowered to 279.7 in 1980, measured in 1990 prices. That downward adjustment in the 1980 GDP from its original or rescaled value of 291.3 to its partially rebased value of 279.7, a decline of 11.6 units, has to be merged into consumption. Thus, the adjusted 1980 consumption expenditure becomes 231.0.

23. Now one can compute Gross Domestic Savings, S, defined as GDP minus C, and compare the relative savings indicators as found in the original 1980-price data, the new 1990-price data obtained through the rescaling method, and the new 1990-price data obtained through the partial rebasing method:

Table 9: Income and Savings Comparison -- High Inflation

	1980	1990	% Increase
Original 1980 Base			
GDPmp	100	141.1	41.1%
C	85	111.6	31.3%
S	15	29.5	96.7%
S/GDPmp	15%	20.9%	...
New 1990 Base			
Rescaled			
GDPmp	291.3	411.0	41.1%
C (adj.)	242.6	315.2	29.9%
S	48.7	95.8	96.7%
S/GDPmp	16.7%	23.3%	...
Part. Rebased			
GDPmp (adj.)	279.7	411.0	46.9%
C (adj.)	231.0	315.2	36.4%
S	48.7	95.8	96.7%
S/GDPmp	17.4%	23.3%	...

One sees that domestic savings in the two 1990-base alternatives are the same in 1980, 48.7, but because GDP is adjusted downward under partial rebasing S as a percentage of GDP is higher -- 17.4% rather than 16.7%. The rate of change of S is the same in all three cases.

24. Note that X and M values have been chosen so as to hold them at an unchanging 20% share of GDP, whether measured in current or 1980 prices. This permits one to focus on the central relationships among GDP, C, I, and S without distraction. If the unit prices of X and M were to behave differently during the decade, one would wish to adjust GDP for the terms of trade change to compute "GDY" -- Gross Domestic Income in 1980 prices, before subtracting C to obtain S. If the terms of trade improved, for instance, GDY would exceed GDP and the value of S would be greater.

Conclusion

25. In view of the obvious benefit to the Bank of maintaining real GDP growth rates as reported by the member countries, while adjusting the data to permit multicountry aggregations and intercountry comparisons, one would think that the adoption of partial rebasing must promise such superior results in other respects that the net advantage over the rescaling approach is

upward, for instance, the application of a given path of growth rates to the lower, unrevised 1990 value would result in lower component values throughout the 1991-2000 series.

30. Typically, the country economist would indeed think of 1990 as a 'base year' -- i.e., the current-price, local-currency, component values of 1990 would determine the weights applicable to the projection exercise. To the extent that value shares have changed significantly between 1990 and the Bank's reference base year [1987], another implicit splicing of two time series is involved. Thus, one could have up to three data manipulations to consider -- viz., the country's total rebasing from 1980 to 1985, the Bank's partial rebasing to a 1987 reference base year, and the implicit partial rebasing of the projection to a 1990 base. The importance of preserving as much as possible of the original country data and relationships is self-evident. [Note: the Technical Notes on page 270 of the 1991 World Development Report refer to "chain-linking" via partial rebasing of data for three subperiods, 1960-75, 1976-82, and 1983-89. Without further explanation, one cannot be certain that conventional chain-indexing is involved.]

[My thanks to Rosalinda Dacumos for her helpful comments during the drafting of this note.]

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THE WORLD BANK / INTERNATIONAL FINANCE CORPORATION / MIGA

OFFICE MEMORANDUM

DATE: August 28, 1990

TO: Messrs. Fischer, Rao, Thomas

FROM: John O'Connor, IECSE

EXT: 33805

SUBJECT: Basic Texts on Index Numbers in National Accounts

It just occurred to me, on re-reading my note on partial rebasing, that you may never have had a chance to look at the standard texts on the subject. As a sampler, you may wish to glance at least at the attached pages from the UN *Manual on National Accounts at Constant Prices* and our own Statistical Manual.

Attachments

cc. Messrs. T.N. Srinivasan, Blazic

WORLD BANK (DECSE)
STATISTICAL MANUAL

III. SYSTEMS OF INDICES

23. Whenever the value data can be factored into prices and quantities, indices can be constructed to measure their relative changes. As long as basic data are available, various aggregations are possible to provide useful and appropriate indices. An integrated system of price and quantity indices based on the systems of national accounts provides a comprehensive and consistent body of data. However, a variety of indices has been developed for policy and other purposes (e.g., consumer price indices, prices received by farmers, etc.), which may be called "general purpose" indices. These may differ from the definitions and classifications of the national accounts systems.

General Purposes Indices

24. The characteristic of general purpose indices is that they are base-weighted Laspeyres indices for both price and quantities, since the primary interest is in the analysis of changes. For example, the price changes of individual commodities are usually measured by the Laspeyres producers' price or market price, the quantity changes by the Laspeyres quantity (from physical output data) indices. Both these indices compare the current year with the base period, a comparison that is easily understood and analytically useful for monitoring. That the change in the total value of the commodity cannot be derived by considering the Laspeyres price and quantity indices together is of no concern in this type of analysis.

25. Examples of other general purpose indices are price and quantity indices of exports and imports of selected commodities, the consumer price index, retail and wholesale price indices, quantity indexes of employment and unemployment, stock market indices, etc.

Integrated Indices in a National Accounting Framework

26. A national accounts system provides a comprehensive statement of all the economic activities of a country. For purposes of analyzing the flows of goods and services, national accounts at constant prices, often called "in real terms," are probably more useful than the original accounts at current prices. The valuation "at constant prices" may be interpreted as the valuation of the flows of goods and services at the prices at which those same goods and services were valued in some base year, or the valuation of monetary flows in terms of their real purchasing power over designated sets of goods and services. The national accounts at constant prices is usually made up of the flows of goods and services which can be directly factored into their own price and quantity components, so that the quantities involved can be revalued by their own prices recorded in some other period of time. These quantities at constant prices provide the indices of the change in quantities without any variation in prices and thus represent the flows of goods and services in real terms.

27. The limitations of the system of national acounts at constant prices are that the price and quantity indices are only meaningful when the value changes can be properly decomposed into price and quantity components. The UN's System of National Accounts and the Manual on National Accounts at Constant Prices clearly state that a consistent system of national accounts at constant prices can only cover the production account, i.e., the product and expenditure items. The consumption and accumulation accounts, covering income and saving,

31. The value data are incomplete when independent data on values at current prices are not available, e.g., total agricultural production. In such cases, it is usually necessary to estimate the values by extrapolating benchmark figures by means of both price and volume indices of representative items.

32. Incomplete price and quantity information occurs when the total values of transactions are known for all goods, say, but price and quantity information is available for only some goods, e.g., fixed capital formation. Here it may be assumed that the volume index for goods which were available in both years but for which there are no price and quantity data is the same as for the goods for which matching price and quantity data are available. Alternatively, it may be assumed that the price index is the same. The recommended procedure is to assume that the price index is the same and not the volume index; thus the value at constant prices of the goods available in both years is obtained by deflating the current year value by a price index, rather than by extrapolating the base year value by a volume index. This recommendation is based on the fact that price changes generally display less variation than quantity changes (the quantity relatives could vary from zero to infinity), and therefore the difference between the average changes for the items covered and not covered is likely to be less for prices than for quantities.

33. The methods for compiling the national accounts at constant prices for product or value added, expenditure and income items are discussed in Annex 2.

IV. BANK PRACTICES IN INDEX NUMBERS

34. The Bank is more of a user than producer of index numbers. It obtains the various price and quantity indices and price deflators for national accounts from international and national sources.

35. A few indices are produced by the Bank, such as the commodity price indices by EPDCS and Manufacturing Unit Value Index by EPDGL. These are described in "Current Deflators and Price Indices", Note 1.40 of this Statistical Manual.

V. REFERENCES

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substantial. That advantage is not visible in the above illustrations. I therefore repeat my November 1990 recommendation that an independent outside expert in national income accounting be called in to help a small working group review existing practice. Unless there are clear technical reasons to the contrary, serious consideration should be given to returning to the simple rescaling procedure observed until 1986.

26. Conceptually, one can distinguish among Total Rebasing, Partial Rebasing, and Rescaling of constant-price national accounts. When a country collects fresh and comprehensive information sufficient to the need, it can produce a New Series of accounts based on a new year. That is Total Rebasing. One might envision an Old Series based on 1980 and ending in 1985, for example, and a New Series based on 1985 and ending in 1990. The component weights of the Old Series are those of the current value shares in 1980, and the component weights of the New Series are those of the current value shares in 1985. How should the two series be spliced together to yield a 1980-90 time series?

27. If I understand correctly, the current Bank method of joining a new, totally-rebased series with an existing series might be described as "extrapolated partial rebasing." It would accept the new 1985-90 component values and enter them into the electronic database, and apply the old-series annual growth rates to the new 1985 figures to extend the series backward to 1984, 1983, 1982, 1981, and 1980. It would then sum the component values in each of those years to obtain GDP values.

28. Similarly, country projections submitted for the Unified Survey exercise are scanned to extract real year-to-year component growth rates, which are then applied to the latest historical year in the IEC electronic file. This is a "safe-guard" procedure, to maintain time-series consistency in the event of last-minute changes in historical data by the country economist at the time of making the projection. The "Phase One" historical data ending in, say, 1990 have been checked and approved by IEC for entry into BESD and the Economic Indicator Tables that must be attached to Country Briefs. Then the country economist adopts 1990 as a base year and projects to the year 2000. If he/she changes the 1990 figures during the "Phase Two" projection exercise, the safeguard procedure effectively overrides the revision by applying the 1991 growth rates to the approved historical values of 1990.

29. If there are significant revisions to the 1990 data, and perhaps to earlier years as well, they will not be reflected in the SAVEM tables generated by the Survey exercise. Moreover, the projected component values will be different from those submitted by the country economist. If an original 1990 value were revised

UN MANUAL ON NATIONAL ACCOUNTS AT CONSTANT PRICES

Chapter I

COVERAGE OF THE ACCOUNTS AT CONSTANT PRICES

The possibilities of deflation

1.1 As pointed out in SNA, 1/ there are two ways in which the expression "at constant prices" may be interpreted. The first is by valuing flows of goods or services at the prices at which those same goods and services were valued in some base year. The second is by valuing monetary flows in terms of their real purchasing power over designated sets of goods and services; that is, by deflating monetary flows by price indices relating to quite separate flows of goods and services. If the second interpretation is adopted, any monetary flow whatsoever can be expressed at "constant prices", and it appears as though a complete set of accounts at current prices, including transfers, financial transactions and balancing items, might be revalued at constant prices. This second interpretation is rejected here and in SNA for the following reasons.

1.2 The principal reason is that there are generally no unique or even obvious price deflators to choose. Consider, for example, a current transfer from A to B: should this be deflated by a price index based on what A typically purchases or typically sells, or should it be deflated by what B typically purchases or sells? Already there are four possible deflators, which may diverge significantly, especially if A and B are quite different kinds of economic units. But there are also many other possibilities. The transfer could be deflated by some more general index relating, say, to total consumption, capital formation or even GDP as a whole. In practice, there are many possible deflators to choose from. Thus, the choice of deflator is inevitably subjective and to some extent arbitrary. Nor is there any evidence from discussion of these problems in economic literature that any consensus is likely to emerge about what is the best or most appropriate deflator for each individual flow. The situation is infinitely more complicated for the system of accounts as a whole when decisions have to be taken about deflators for a whole series of individual items: the number of possible permutations and combinations - in effect alternative systems of accounts at constant prices - is very large indeed.

1.3 An additional problem is that the introduction of deflators into a system of accounts inevitably leads to a breakdown of the accounting constraints so that new balancing items have to be introduced into the accounts at constant prices which have no counterparts in the system at current prices. The reason for this can be explained as follows. Suppose an account at current prices is written as an equation of the form $\Sigma x = \Sigma y$ where the xs and ys denote entries on the two sides of the accounts. If all of the xs and ys are now deflated - that is, divided by numbers which generally differ from one x or y to another and which are independently chosen - it is obvious that the sum of the deflated xs will no longer equal the sum of the deflated ys except as a pure coincidence. Equality will be achieved only if the deflators are not independent but themselves subject

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1/ See SNA, paras. 4.1 to 4.9.

to special constraints of a kind which do not occur in practice. Thus, new balancing items have to be introduced into the accounts at constant prices which serve purely to bring the two sides of the accounts into a kind of spurious equality. These balancing items are not to be conceived as statistical discrepancies as they are not attributable to errors in the data. They are difficult to interpret because they depend on the particular choice of deflators for the various items in the accounts which, as already emphasized, are inevitably to some degree arbitrary and subjective.

1.4 These problems arise because of the introduction of deflators: they are not inherent in accounts at constant prices. Thus, an account in which the total supply of some group of commodities is balanced against their total uses at current prices will continue to balance identically when those commodities are revalued at the prices of some other period. Problems of the kind described in the previous paragraph occur when some item, instead of being factored into its own price and quantity components, is deflated by a price index relating to some other quite distinct flow of goods and services.

1.5 It is, therefore, recommended in this manual that the expression "accounts at constant prices" be interpreted in its literal and narrow sense to refer to accounts made up of flows of goods and services which can be directly factored into their own price and quantity components, so that the quantities involved can be revalued by their own prices recorded in some other period of time. Even this limited objective poses major theoretical and practical problems.

1.6 The decision to impose those limits on national accounts at constant prices means that this manual will not deal with the question of "trading gains or losses". These occur when the relative prices of goods entering into international trade change, thus affecting the "real income" of trading countries as measured by their command over imports. Dramatic changes in relative price occurred in the early 1950s and mid 1970s when some raw material prices rose sharply in relation to prices of manufactured goods, but relative price movements in other periods, though less widespread and spectacular, have had a serious impact on individual countries. "Trading gains" may also arise between regions or sectors within a single country, for example when prices of agricultural goods move differently from those of manufactures. Although the measurement of trading gains is clearly useful for certain kinds of economic analysis such gains should not be recorded in the accounts for purposes of international reporting. The literature on ways of measuring these trading gains is extensive,2/ reflecting the point made above that there is no single "correct" deflator for measuring real income flows.

1.7 Before leaving this topic, it is important to make clear that it is not being suggested here that it is inappropriate or illegitimate to deflate various monetary

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2/ See for example, J. L. Nicholson, "The effects of international trade on the measurement of real national income", paper presented at the Sixth European Conference of the International Association for Research in Income and Wealth, 1959; Y. Kurabayashi, "The impact of changes in terms of trade on a system of national accounts: an attempted synthesis", The Review of Income and Wealth, Series 17, No. 3, September 1971; R. Courbis, "Comptabilité nationale à prix constants et à productivité constante", The Review of Income and Wealth, Series 15, No. 1, March 1969.

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UN MANUAL ON NATIONAL ACCOUNTS AT CONSTANT PRICES

Chapter III

CHOICE OF INDEX NUMBERS

Introduction

3.1 The measurement of flows of goods and services at constant prices is equivalent to compiling volume indices, as the relative movements in a series at constant prices are the same as those for some volume index or other. The expression "volume measure" is used in this manual to refer to either a flow of goods and services at constant prices or to a volume index, whereas the expression "volume index" is used in the narrower sense of an index as generally understood which is scaled to be equal to 100 in the base year. It is necessary to devote some attention to the choice of appropriate index number formulae and to examine some conventional index number problems.

3.2 It is not proposed to spend much time on index numbers in this manual for two reasons. First, there is a large literature on index numbers already in existence to which reference may be made and which there is no point in duplicating here. 1/ Index number problems of a general kind will not be discussed here and only those aspects of index number problems which are of special interest to the compilation of accounts at constant prices will be considered. Secondly, it is necessary to keep a sense of proportion about index numbers in the context of a manual of this kind. It is easy to become preoccupied with purely technical index number problems when the real problems lie elsewhere. Much greater and more fundamental problems are generated by the treatment of the basic data which have to be fed into whatever form of index number is used. Nevertheless, it is obviously necessary to give due consideration to the kind of index number formula which is most appropriate for the compilation of national accounts at constant prices.

3.3 Given that the objective is to compute various flows of goods and services at constant prices, there seems to be very little choice available in practice. Let us assume that the constant prices used are those actually prevailing in some base year, and let the base year be 0 and the current year t. Then, a series at constant prices can be written as:

$$\Sigma p_0 q_0, \ \Sigma p_0 q_1, \quad \ldots \quad \Sigma p_0 q_{t-1}, \ \Sigma p_0 q_t$$

Dividing through by $\Sigma p_0 q_0$, a series of Laspeyres volume indices is obtained, a conclusion which is virtually dictated by the specification of the objective. There are, however, some related issues which require further consideration.

Additive consistency

3.4 In most discussions of the appropriate form of index number a single index is under a consideration designed for a specific purpose, such as a consumers' price index or an index of industrial production. In a system of accounts, however, volume measures have to be compiled for a multiplicity of different flows of goods

1/ For an authoritative treatment of index numbers see R. G. D. Allen, Index Numbers in Theory and Practice, (London, Macmillan, 1975). This work also includes an extensive bibliography. See also Guidelines on Principles of a System of Price and Quantity Statistics.... (chap. IV).

and services within an accounting framework, and it is essential that they should be mutually consistent. It is necessary, therefore, to examine whether or not indices are additively consistent, a property which is not usually considered in most discussions of index numbers. Additive consistency simply requires that components of totals should continue to add up to their totals when revalued at base year prices just as they do at current prices. Flows of goods and services at base year prices may be obtained either by multiplying the base year values by volume indices or, alternatively, by deflating current values by price indices. The question arises, therefore, as to which types of indices do, or do not, preserve additive consistency in the revalued flows. Not surprisingly, the only volume index which necessarily preserves additive consistency is a weighted arithmetic average of the quantity relatives which uses the base year values as weights - that is, a Laspeyres volume index. From this it follows that price deflation requires the use of Paasche price indices, given the well known symmetry between Laspeyres and Paasche price and volume indices. Only then will the revalued entries in accounts continue to add up identically to their totals. This is an essential prerequisite in the present context since otherwise there would have to be a massive proliferation of balancing items throughout the accounts as a balancing item would be needed whenever any flow is disaggregated. Moreover, the balancing items would lack any economic or statistical significance and would become merely a source of irritation to users.

3.5 In recent years, there has been increasing advocacy of chain indices, especially as approximations to Divisia indices. 2/ There is no doubt that chain indices do have a number of attractions, particularly when users are mainly concerned with recent short-term movements. Their systematic use for national accounts at constant prices is not feasible, however, as these indices are not additively consistent. Suppose that chain volume indices were to be calculated for all the various flows of goods and services in the accounts. In order to convert them into accounts at constant prices the base year values would have to be multiplied by these volume indices, but the resulting flows would no longer be additively consistent. One possible solution would be to use chain volume indices at the lowest possible levels of aggregation and then simply derive the totals or aggregates by addition, as in the accounts at current prices. This procedure would, however, mean that the volume measures for the aggregates - on which interest may be mainly focused - would themselves cease to be chain indices but mongrels with indeterminate properties lacking any clear interpretation.

Changes of base year

3.6 The next question is the number of years for which the accounts should be allowed to run without changing the base year. The more remote the base year becomes, the less relevant are its prices for purposes of valuing current flows of goods and services. The base year prices gradually become less and less "characteristic" of current flows as the base year recedes into the past.

3.7 When the base year is changed, there are two ways in which it may be done in practice. The first method is to revalue not only all years subsequent to the new base year at the new prices but also all the years preceding the new base year in

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2/ See Guidelines on Principles of a System of Price and Quantity Statistics ... paras. 134-137.

order to have an unbroken series extending on either side of the new base year. This procedure has much to recommend it from the point of view of the users but it is, of course, very expensive and demanding in terms of statistical resources. Previous data at constant prices are, in effect, scrapped and replaced by the new data. It does, of course, have the disadvantage that data for the early years are inevitably revalued at prices which are increasingly remote as the base year moves forward, but this disadvantage is much more than offset in the eyes of most users by having the data for recent years revalued at more relevant prices. Some countries do systematically recalculate all their previous constant price data in this way when the base year is changed, but most countries follow the second, and less costly, method, which is described in the next paragraph.

3.8 The second method is to leave the data for all years up to and including the new base year unchanged and simply to use the new base year prices for valuing all flows of goods and services from the new base year onwards. The disadvantage of this method is, of course, that longer-period comparisons can only be made by linking data using the previous base year prices to those using the new prices. Thus, very long comparisons can only be made by constructing what is, in effect, a chain index in which the individual links are comparisons between each base year and the previous base year. This means that it becomes impossible to present a very long series of accounts at constant prices in which additive consistency is preserved. There is, therefore, a straightforward trade-off between the desire to maintain a reasonably up-to-date base year, which entails fairly frequent changes of base year, and the desire to maintain additive consistency over as long a period of years as possible (and also, incidentally, the desire to reduce the costs involved in regular rebasing).

3.9 It is difficult to know what is the optimal procedure in the face of this trade-off, but the consensus seems to be that the base year should be changed not more frequently than every five years and not less frequently than every 10 years. On balance, users probably prefer rebasing every five years, although rebasing as often as this may be unrealistic in terms of the demands it makes on the resources available in most statistical offices. Of course, the trade-off is largely avoided if rebasing is carried out by the first method described above, but this method is even more demanding statistically than the second. It is recommended here, therefore, that the first objective should be to change the base year every 10 years, with rebasing every five years as a second objective as soon as resources permit. It is also recommended that the second method of rebasing should be replaced by the first method whenever resources make it possible. It is, of course, desirable to set up working procedures for calculating data at constant prices which will facilitate changing over to a new set of prices subsequently, and statistical work programmes, including computer systems, should take this factor into account.

3.10 It is often stated that the year chosen for a base year should be a "normal" one. While the avoidance of abnormal years as base years seems a fairly innocuous objective, it may not be so easy in practice for most countries to distinguish normal from abnormal years, especially until some time has elapsed. Moreoever, it brings arbitrary and subjective elements into the choice of statistical procedures, which is somewhat objectionable. Furthermore, it may conflict with the policy of regular rebasing at stated intervals and provide an excuse for allowing series to run on for too long. Finally, there are advantages to be gained from some measure of international agreement on the years to be used as base years by all countries: for example, 1970, 1980, 1990 etc. with 1975, 1985 etc. as optional extras for

countries which can afford them. Taking all factors into consideration it is better to agree on a policy in advance without waiting for a 'normal' year to come along: in any case, rebasing inevitably involves recourse to data which can only be obtained from detailed censuses or other statistical inquiries which must, of course, be planned long in advance.

Approximations to Laspeyres volume measures

3.11 In practice, flows of goods and services at base year prices are often calculated by deflating values at current prices by appropriate price indices. The choice of methodology depends, of course, on data availabilities and will inevitably vary from country to country, but experience suggests that the use of price deflation is fairly widespread, at least among developed market economies. The relative merits of price deflation against the use of direct volume measures will be considered at greater length in a later section, but there is one aspect of this which it is appropriate to consider in this chapter.

3.12 In order to obtain Laspeyres volume measures, it is necessary to deflate current values by Paasche price indices. Unfortunately, however, the price indices which are actually compiled by statistical offices are almost invariably of the Laspeyres type for very good reasons. First, users tend to prefer Laspeyres-type indices because of their ease of interpretation and, secondly, the compilers have to obtain the weights once only, for the base year. In other words, both users and compilers of price indices tend to have a strong preference for Laspeyres over Paasche, just as users and compilers of volume indices also tend to prefer Laspeyres to Paasche. The price indices available for deflating national accounts therefore tend to be of the wrong kind.

3.13 In principle, new Paasche-type indices should be calculated each year in which the prices are weighted by current quantities instead of those of the base year. In practice, however, statistical offices usually find they do not have the resources to carry out a proper reweighting at the level of individual commodities and therefore resort to cruder methods as an approximation. A method which is commonly used is to disaggregate to the maximum extent possible (but not, of course, down to the level of individual commodities) and to deflate each subaggregate by corresponding Laspeyres-type price indices (the only ones readily available). The resulting flows are then added together to make up the larger aggregates in the accounts. In terms of index numbers, this is equivalent to taking a weighted arithmetic average of the relative changes in volume for each of the subaggregates using base year values as weights, and it is believed that this will give a reasonably close approximation to the true Laspeyres volume index.

3.14 The resulting measures for the aggregates are clearly mongrels, neither Paasche nor Laspeyres. To obtain a true Laspeyres volume measure, a different kind of average would have to be taken of the indices for the subaggregates. Instead of taking a base-weighted arithmetic average of the indices for the subaggregates, it is necessary to calculate a <u>harmonic</u> average of the indices using <u>current</u> values as weights. Intuitively, it would seem that the procedure actually followed would yield a result which numerically would lie between the true Laspeyres and Paasche indices. The question arises, therefore, of whether the resulting figure is likely to lie closer to the Laspeyres or to the Paasche index. It is difficult to generalize about this <u>a priori</u> because the result depends on matters of fact which may vary from case to case, but it is useful to elucidate the factors which affect the result.

3.15 The difference between a Laspeyres and a Paasche price (or volume) index depends on the size of the covariance between the price and quantity relatives. When substitution effects predominate, this covariance is negative which means that the Laspeyres index is greater than the Paasche. The size of the difference is greater, the greater the absolute value of the covariance, which in turn depends upon the amount of dispersion among the price and quantity relatives and the strength of the (usually negative) correlation between them. 3/ The problem in the present context is to know whether the correlation between the price and quantity relatives occurs mainly between commodities within the same subaggregate or between commodities in different subaggregates. While there is not sufficient evidence on which to base any firm generalizations it can be argued a priori that the negative correlation between prices and quantity relatives will tend to be greatest for close substitutes which will, of course, tend to be found within the same subaggregate. This will tend to reduce the effectiveness of the approximation. 4/

3.16 These comments are not to be taken as meaning that the approximate method should be avoided, since it will usually be the only practical possibility. They do, however, underline the need to disaggregate to the maximum extent feasible. They also emphasize the importance of fairly frequent updating of the base year since the divergence between Paasche-type and Laspeyres-type indices usually becomes marked only over long periods.

3/ See R. G. D. Allen, op. cit., pp. 62-65, for a detailed elaboration of the factors responsible for the difference between Laspeyres and Paasche indices.

4/ Some empirical studies on the validity of the approximation are described in United States Department of Commerce, Indexes of Production, (Washington D.C.), November 1971, and F. B. Horner, "Effect of grouping of data on the divergence between Laspeyres and Paasche forms of quantum indexes", The Review of Income and Wealth, Series 17, No. 3, September 1971.

THE WORLD BANK / INTERNATIONAL FINANCE CORPORATION / MIGA

OFFICE MEMORANDUM

DATE: August 26, 1990

TO: Messrs. Fischer, Rao, Thomas

FROM: John O'Connor, IECSE

EXT: 33805

SUBJECT: Possible Objectives in Discussing Partial Rebasing

Partial rebasing is the tip of a methodological iceberg. Strangely beautiful from afar, there are risks in approaching and we should stay away unless we have a good reason for getting close; and then we should proceed slowly and with a chart that shows where others saw submerged sections long before reaching the visible peak. This note offers the chart.

The deepest and widest perimeter of the iceberg is marked off in the study we commissioned from Azam and Guillamont, *Methodological Problems in Cross-Country Analyses of Economic Growth* (PPR Working Paper 22, June 1988). That gave a hierarchy of relevant decisions beginning with the choice among closely related indicators (GDP, GNP, GNY) and data sources (World Bank, IMF, etc.), and only then of base year (country idiosynchratic or made somewhat more comparable by partially rebased, with the uniform base year then variable); we also outlined the problem of biased country and period selection for data pooling (country aggregation into regions, etc., is a special form of data pooling). That study went on to consider the even wider range of methodological choices involved in deciding among independent variables in growth models.

On the issue at hand, Azam-Guillamont studied 73 countries and found that base year shifts caused the annual average growth rate to vary by more than +/- 0.5% in about half the cases; and by more than +/- 1.0% in 22 cases. However, they also concluded (page 10) that "in conformity with the econometric theory of measurement errors (for example, Stewart and Wallis, 1981), the differences in the measurement of the dependent variable have little effect on the results of the econometric estimates of the factors affecting growth." We proposed further research but were turned down by the Research Committee.

On a shallower but still fairly deep plane, there is our balancing act between SNA which advocates Laspeyeres for constant price indicators (with infrequent rebasing and chain linking) and internal Bank edicts that steer us around intractable index number problems. This can be seen beneath the surface of debates not only about "partial rebasing" but also about constant dollar series and additivity of country results into regions, etc. There are no international protocols; it is a matter of opinion whether one or another approach would be preferable. But these decisions cannot be made piecemeal.

A coherent approach has to recognize that a given aggregate, e.g., GNP, can be decomposed in more than one dimension (production, expenditure, and income); that the temporal plasticity of the term, value, can be variously attributed to price or quantity variance; that value may be fixed (or varied) with national or international price structures; and that the objective of the exercise may be to study the indicator itself or some other indicator, which may not be easily linked back to the given indicator (e.g., relating GNP to time-to-time income distribution surveys). This is my rewrite of Azam-Guillamont's statement (page 10) that "if the choice of base year does not seem to entail any bias in estimating the coefficients, it can skew the selection of independent variables."

Close to the surface, there is the Stern-Kreuger decision to partially rebase national accounts time series to 1980, taken in 1986 to unblock work on Standard Tables (and specifically to link history and projections). I was a strong opponent of this until it became writ; I am now against change until we see clear analytical reasons to prefer another option; I see better uses for time and money spent than an intractable problem.

Which brings us to the surface activity, as we fulfill the initial protocol. Use of a single base year, for partial rebasing, was dictated by limited systems resources. By adding partial rebasing exercises for an earlier (1970) and more recent (1987) year, and then chain-linking, we not only conform more closely with SNA guidelines; we mitigate the aberrant results we found with the mandated "Holsen-Harrison" method. This confirmed Azam-Guillamont's view about variability of results with base year shifts, without a clear pattern.

To see what is involved, I attach a chart where the top row shows that the "famous" effect on Africa is mainly Nigeria; the bottom row that most countries (including Nigeria) will not change much. No country changes growth rate in 1973-84 because we retain the 1980 base.

As imperfect as this may be, side-studies convince me it will be very costly to do more. At the country level, I commissioned a small study of partial rebasing by D.S. Prasada Rao, which I attach for information. His method is basically an average of possible base years; we've also a variant (closer to a moving weight system) by Ello Lancieri. Either would be expensive to implement - and not necessarily yield more sensible numbers.

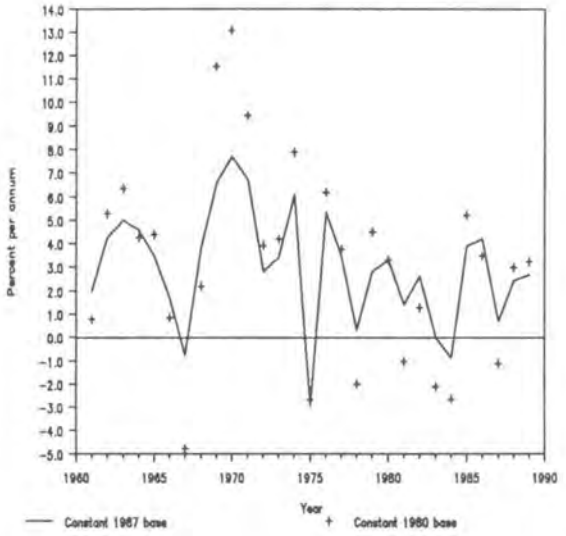
At the regional level, when we group countries, the index number and systems issues rise exponentially. Each component (country) of the regional index is itself subject to recalculation. Complex chains of recalculations, to satisfy whatever procedure is agreed for redistributing "rescaling deviations" which cannot really be eliminated, occur as any component is revised. Even if we gave up currentness, we cannot now replicate the systems used at the country level because our systems do not actually store regional numbers (as a cost saving measure, since maintenance of regional aggregates, say in the Fund's EIS system, requires a complex of equations inter-relating all elements, and an inverse equation tree to determine which items to update when new information comes in).

Attachments
cc. Messrs. T.N. Srinivasan, Blazic

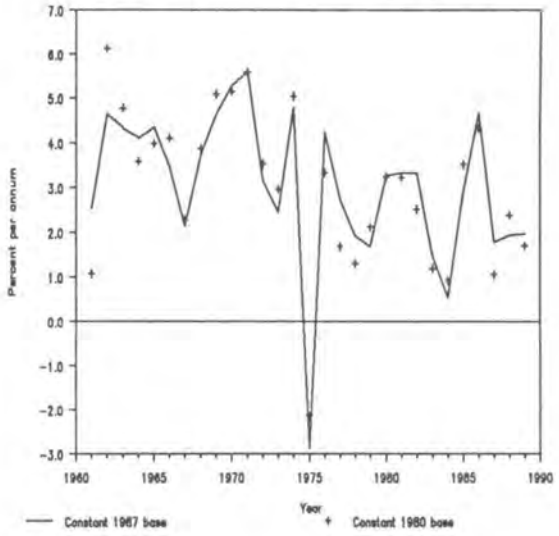
Effects of Base Year Shift

GDP Growth: 1980 and 1987 Base

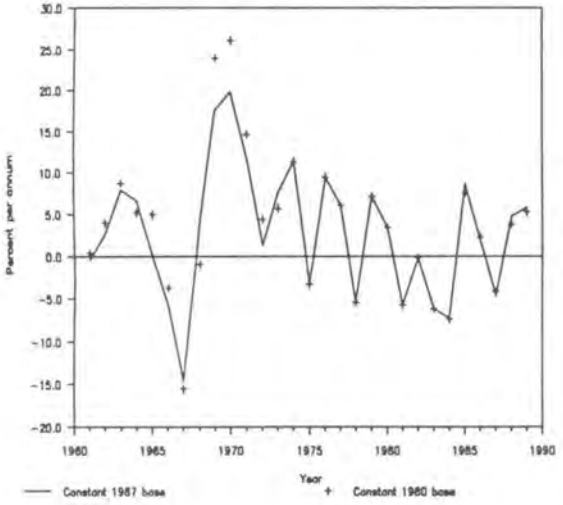
Sub-Saharan Africa



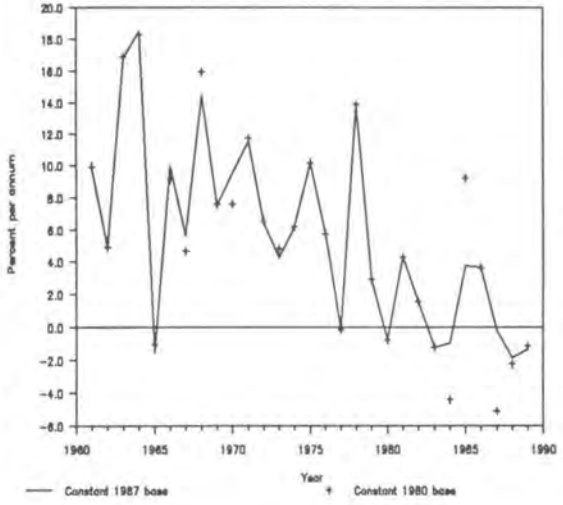
Sub-Saharan Africa excluding Nigeria



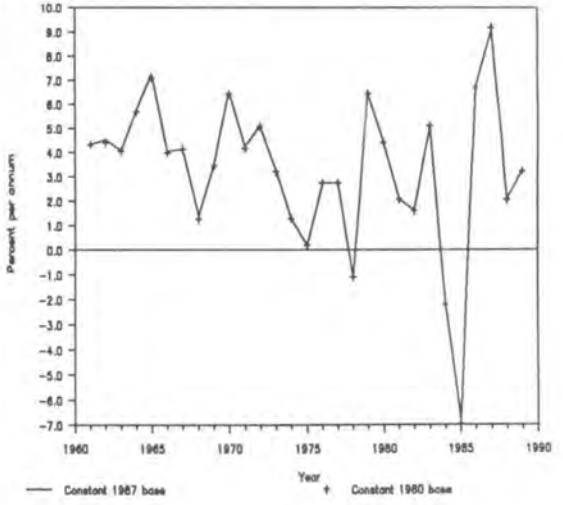
Nigeria



Cote d'Ivoire



Ethiopia



John
F.y.i. re Partial Re-basing
re the "ideal solution" (?)

Mr. Ward

PROBLEM OF REBASING NATIONAL ACCOUNTS: A RECONSIDERATION AND A NEW SOLUTION

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The author wishes to gratefully acknowledge many useful discussions on this problem with John O'Connor, D. Cieslikowski and Sultan Ahmad during his brief visit to the Bank.

PROBLEM OF REBASING NATIONAL ACCOUNTS: A RECONSIDERATION AND A NEW SOLUTION

Introduction

It is a common practice adopted by nations to publish national accounts on a regular basis. National accounts are usually published on an annual basis and expressed in current prices. To facilitate temporal comparisons of national accounts, various component aggregates of such accounts are also calculated on the basis of constant prices. Compilation of national accounts at constant prices is a problem considered at length in the SNA of the United Nations and continues to attract considerable interest in the present revision of the SNA.

A key consideration in the compilation of national accounts at constant prices is the choice or selection of an appropriate base year. Most national accountants are aware of the problems associated with the continued use of a given base year and, as a result, endeavour to change the base period from time to time. While the practices in different countries vary from country to country, it is a sound practice to shift the base year roughly every ten years. An important consideration in such decisions is the differences in the relative prices in the current period and the base period. It is well recognized that if the price structure in the current period is vastly different from that of the base period, it is possible that the national accounts at constant prices may have negative entries for those aggregates which are basically balancing items [see T.P. Hill, *National Accounts at Constant Prices*, U.N. Publication]. Notwithstanding the above mentioned problems, almost all the countries produce national accounts at constant prices and shift the base period as and when it is considered appropriate.

The following discussion paper examines some of the issues involved in the compilation of national accounts resulting from a shift in the base period. This problem is particularly relevant for organizations such as the World Bank that publish regular series of national accounts for the member countries with a common base period for all the countries. Such an exercise would not only involve a rebasing of various national accounts but all these

accounts need to be rebased to a common year. In this discussion paper, an attempt is made to examine the problem of rebasing national accounts based on the experiences at the World Bank in the context of shifting the base to the year 1980.

Section 1 provides a brief statement of the problem and discusses the historical background to the problem. The relevance of the problem and the need for a satisfactory solution is emphasized. Section 2 briefly describes the alternative approaches considered at the Bank and examines the limitations associated with the present approach adopted by the Bank. Section 3 emphasizes the need for an alternative strategy based on the movements in the relative price structures between the old and the new base periods. This section also describes some new procedures that could substantially improve the quality of the accounts derived after rebasing. A new method based on consistent multilateral index numbers is proposed as a solution to be applied in some of the problem cases. This method is applied in the case of the national accounts of Venezuela and the results are very encouraging. The last section concludes the report with a brief summary and a discussion of topics for future research.

1. Rebasing of the National Accounts - A Statement

In this section the rebasing problem is set out algebraically in a general framework which would facilitate the exposition and could provide additional insights into the problem.

Within the framework of the general presentation of the national accounts, the gross domestic product is disaggregated into its constituent components from the expenditure side as well as the production side. The problem considered here is one of rebasing national accounts using the national accounts at current prices and constant prices with a given base year. Essentially the problem is one of obtaining meaningful rebased national accounts using only a limited amount of information.

Algebraic Formulation

Suppose we have, for a given country, published national accounts at current and constant prices, with base period "0", for T years. Suppose the

production side disaggregation involves M sectors and the expenditure side N categories. Let V_t and V_t^0 represent the GDP figures, respectively, at current prices and constant prices with base period '0'. Let v_{it} and w_{jt} represent the expenditures at current prices respectively from the expenditure and production sides. Thus we have for t = 1,2,...,T.

NATIONAL ACCOUNTS AT CURRENT PRICES

Item / Year	0	1	2	3	...	T
Expenditure side						
1	v_{10}	v_{11}	v_{12}			v_{1T}
2	v_{20}	v_{21}				v_{2T}
3						
⋮						
N	v_{N0}	v_{N1}				v_{NT}
GDP	V_0	V_1	V_3			V_T
Production side						
1	w_{10}	w_{11}				w_{1T}
2	w_{20}	w_{21}				w_{2T}
3						
⋮						
M	w_{M0}	w_{M1}				w_{MT}

We note here that for each t,

$$\sum_{i=1}^{N} v_{it} = \sum_{j=1}^{M} w_{jt} = V_t .$$

and that some of the entries could be negative. Similarly, the following table provides the national accounts at constant prices. The table also provides the implicit deflators. Traditionally the constant price values are

used as volume levels and the deflators as price levels.

NATIONAL ACCOUNTS AT CONSTANT PRICES						
Item / Year	0	1	2	3	...	T
Expenditure side						
1	$q_{10}(p_{10})$	$q_{11}(p_{11})$				$q_{1T}(p_{1T})$
2	$q_{20}(p_{20})$	$q_{21}(p_{21})$				
3						
⋮						
N	$q_{N0}(p_{N0})$	$q_{N1}(p_{N1})$				$q_{NT}(p_{NT})$
GDP	$V_0^0(P_0)$	$V_1^0(P_1)$				$V_T^0(P_T)$
Production side						
1	$\delta_{10}(\pi_{10})$	$\delta_{11}(\pi_{11})$				$\delta_{1T}(\pi_{1T})$
2	$\delta_{20}(\pi_{20})$	$\delta_{21}(\pi_{21})$				$\delta_{2T}(\pi_{2T})$
⋮						
M	$\delta_{M0}(\pi_{M0})$	$\delta_{M1}(\pi_{M1})$				$\delta_{MT}(\pi_{MT})$

Note that: The balancing equations provide:

$$\sum_{i=1}^{N} q_{it} = \sum_{j=1}^{M} \delta_{jt}$$

Further, given '0' as the base, $p_{i0} = 1 = P_0 = \pi_{j0}$ and $q_{it} = v_{it}/p_{it}$, v_i and j and $\delta_{jt} = w_{jt}/\pi_{jt}$. The figures in the brackets are the implicit deflators. P_t represents implicit GDP deflator for period t.

The Rebasing Problem

Given these national accounts the rebased accounts could be obtained simply by adjusting for the price deflators. The implicit assumption involved in the procedure is that the indices are transitively consistent. When such a

procedure is followed, three possible GDP figures at constant prices with the new base year 's' are available.

1) By simple rescaling of the GDP totals, we have

$$V_0^s \quad V_1^s \quad . \; . \; . \quad V_T^s$$

where $V_t^s = V_t^0 \cdot P_s$

GDP at 's' prices = GDP at '0' prices × implicit GDP deflator

2) By rebasing the expenditure side components,

$$V_t^s = \sum_{i=1}^{N} q_{it}^s = \sum_i q_{it}^0 \cdot p_{is}$$

q_{it}^s = Exp. at 's' prices = Exp. at '0' prices × deflator

3) By rebasing the production side components,

$$V_t^s = \sum_{j=1}^{M} \delta_{jt}^s = \sum \delta_{jt}^0 \cdot \pi_{js}$$

δ_{jt}^s = Prod. at 's' prices = Prod. at '0' prices × deflator

The main problem is that the three GDP totals above are generally different leading to 'rebasing' or 'rescaling' deviations.

2. Possible Solutions Considered at the Bank

The main solutions considered at the Bank are: (i) the Holsen-Harrison proposal of Partial Rebasing; and (ii) EDP proposal based on rescaled GDP figures. These proposals briefly are:

The Holsen-Harrison Proposal (Partial Rebasing): The starting point for the proposal is the composition of GDP by industrial origin. Each component is rescaled to the new base year and the resulting components are added to yield the GDP at the new base year's prices. Then the expenditure side components are also rescaled and any discrepancy between their sum and the GDP is introduced as a residual item on the expenditure side.

EDP Proposal (Rescaling GDP): The first step in the proposal is to rescale the GDP figures to yield GDP at the new reference/base year. Then the expenditure side and the industry of origin components are separately rescaled. Deviations of the rescaled component totals from the rescaled GDP figures are introduced as residual/statistical discrepancy items on both sides of the national accounts.

At the present time the Holsen-Harrison proposal based on partial rebasing of national accounts is followed in the preparation of rebased national accounts. It is clear that lengthy inter-departmental discussions have been undertaken to debate the relative merits of the two proposals under consideration. Though it is somewhat out of place to get involved in such a debate, the following points may be raised as general deficiencies of the two procedures.

1. The partial rebasing proposal is asymmetric in its treatment of the entries from the expenditure side and the industry of origin side. Unless there are strong arguments to convince the accuracy of the production side entries and, at the same time, unreliability of the expenditure side, this procedure could introduce bias into the rebased account.

2. As is evident from the rebased national accounts, the magnitude of rescaled deviations could be alarmingly large, and the presence of such sizeable deviations could render the rebased accounts useless.

3. The EDP proposal of rescaled GDP appears to be more balanced in its approach and symmetric in its treatment of the two sides of the national accounts. However the main assumption involved in such an approach is that the implicit GDP deflators are transitive. But most national accounts deflators are based on a Laspeyres-type index number formula which is not transitive. As a result the preservation of the GDP growth rates achieved by the EDP proposal which, it is argued, is its main feature, is somewhat superficial.

A quick examination of the numerous office memoranda on this subject would reveal many other problems encountered in the practical application of these procedures.

3. New Proposals

In this section we examine an alternative strategy after having a new look at this somewhat old and formidable index number problem. A brief

examination of the rebased national accounts using the partial rebasing technique suggests that the main problems emanate in the cases where the relative price structures change substantially during the period between the original base period "0" and the new base period "s". Using an algebraic formulation of the EDP proposal, the following analytical results can be proved.

1. If the relative price structures are fairly stable between the periods "0" and "s", then the rescaled deviations on both sides of the accounts would be very small. In fact, if the relative prices are identical, then the rescaling deviations are zero.

   Remark: This suggests that if the rebasing exercise is undertaken at regular, and reasonable, intervals then rescaled deviations pose no problem.

2. If the relative price structures deviate by a small margin, then the rescaled deviations would exist and could be of a non-trivial magnitude.

   Remark: In this context, which probably is the most prevalent (or common) in practice, it is necessary to deal with the rescaled deviations. The existence of these rescaled deviations is mainly attributable to the presence of the Laspeyres index and Paasche index spread which is a result of the large differences in relative prices.

3. If there are structural shifts in relative prices, then the rescaled deviations would be substantial, the magnitude of such deviations depending upon the size of the structural shift.

   Remark: This is definitely the main cause of the presence of large rescaled deviations in many countries which experienced huge shifts in prices of oil and other minerals.

In my view, a proper solution to this problem should be based on the movements in the relative prices over the two base periods and the final prescription should be based on a measure of variability or similarity of the two price structures. Based on this assertion it is not a sound strategy to sought a single method to handle all possible cases. The following proposals are based on this rationale and these are set out below.

Method I: Weighted Least Squares Method

This is to be used in cases where only minor shifts in relative prices occur between the two time periods. The following steps may be followed.

Step 1: As in the EDP proposal, rescale the GDP figures to the new base. The rescaled GDP would be quite reasonable even though the deflators are not transitive as there are no major shifts.

Step 2: Rebase the various components of the expenditure side and production side of the national accounts. This would result, in most cases, rescaling deviations on both sides.

Step 3: Use least squares procedure to derive adjusted rebased components which add up to the rescaled GDP. It would be necessary to use weighted least squares, with weights proportional to the shares of the components of the GDP. I note that any *a priori* information regarding the sources of the rescaling deviations could be incorporated through the choice of weights in the least squares.

The resulting solution, for each component, can be easily shown to be equal to the initially rebased component plus an adjustment factor that is equal to an appropriate portion of the rescaled deviation.

Remarks:

1. Since the proposal is being used only in those cases where the relative prices are reasonably stable, the final solutions for the components would be meaningful.

2. This proposal is somewhat similar to a proposal made by Bergstrom referred to in a draft attachment prepared by D. Cieslikowski on 22 November, 1985.

3. The resulting rebased national accounts would have the ideal property of preserving the real GDP growth rates and would have zero rescaling deviations.

4. This procedure would be ideal in cases where the rebasing exercise is undertaken over a short interval of time.

Method 2: A New Rebasing Method Based on Consistent Multilateral Index Numbers

As noted earlier, major rescaling deviations arise out of an application of the partial rebasing or rescaling GDP in the compilation of rebased national accounts. For a number of countries, such as Venezuela, the rescaling deviations are very substantial and presence of such large discrepancies could cast shadows of doubt on the national accounts presented.

An important observation made here is that such large discrepancies arise only in the case of those countries that have experienced major shifts in relative prices over the original base period and the rebasing year. In such cases it may be necessary to use methods that are not conventionally employed in the preparation of national accounts at constant prices and the subsequent rebasing exercises.

In the presence of substantial variation in the relative prices over the span of time periods under consideration, more reliable comparisons can be obtained if temporal comparisons are undertaken on the basis of an average structure of relative prices and search for a procedure that yields implicit GDP deflators that are transitive. Transitivity of GDP deflators guarantee the preservation of GDP growth rates after any rebasing exercise. Such methods are widely used in the context of spatial comparisons but are seldom used for temporal comparisons. However, there are no index number methods that are suitable for use in tackling the present rebasing problem.

In this report I propose a new method, which is based on the same philosophy as the methods for the spatial comparisons, which seems to handle the rebasing problem adequately. However, the proposed method falls short of a perfect solution in that it does not produce rebased national accounts with zero rescaled deviations. But it is encouraging to note that the proposed method results in rescaling deviations of a much smaller scale.

A Brief Description of the New Method

The following is a brief algebraic description of the method proposed here for use in the preparation of rebased national accounts in the presence of major shifts in relative prices between the two base periods.

Using the data described in Section 1, the method solves for:

N - average prices denoted by $P_1, P_2, \ldots, P_N$ for each item on the expenditure side;

M - average prices denoted by $\pi_1, \pi_2, \ldots, \pi_N$ for each item on the production side; and

T - purchasing power parities $R_1, R_2, \ldots, R_T$ one for each period, with $R_s = 1$ indicating that 's' is the new base period.

All these prices and parities are solved using the following system of interrelated linear equations:

For each i = 1,2,...,N

$$P_i = \sum_{t=1}^{T} R_t \, p_{it} \, q_{it} \; / \; \sum_{t=1}^{T} q_{it} \; ;$$

For each j = 1,2,...,M

$$\pi_j = \sum_{t=1}^{T} R_t \, \pi_{jt} \, \delta_{jt} \; / \; \sum_{t=1}^{T} \delta_{jt} \; ;$$

and for each time period t,

$$R_t = \frac{\sum_{i=1}^{N} P_i \, q_{it} + \sum_{j=1}^{M} \pi_j \, \delta_{jt}}{\sum_{i} p_{it} \, q_{it} + \sum_{j=1}^{M} \pi_{jt} \, \delta_{jt}}$$

The rationale for the specification of these equations is fully explained in a more detailed paper entitled "An Improved Method for Rebasing National Accounts" which is under preparation. The mathematical properties, including the existence of positive solutions, are established.

This system can be solved to yield numerical values for P_i's, π_j's and R_t's, once one of the parities is fixed at unity. Usually fix $R_t = 1$ for t = base period under consideration. In the problem under consideration here where accounts are rebased to year 's', we set $R_s = 1$ and solve for all the unknowns. Then for each time period t:

(1) The rescaled component i on expenditure side is given by $P_i \, q_{it}$, and the GDP total made up of rescaled expenditure side component is given by

$$V^e_{st} = \sum_{i=1}^{N} P_i \, q_{it}$$

This leads to column (3) of the Table of results.

(2) The rescaled component j on the production side is given by $\pi_j \delta_{jt}$ and the resulting GDP total is

$$V^P_{st} = \sum_{j=1}^{M} \pi_j \delta_{jt}$$

This results in column (4) of the Table.

(3) The rescaled GDP, obtained by converting GDP totals at current prices to constant prices with base year s, are given by

$$V_{st} = R_t \cdot V_t = R_t \cdot \sum_{i=1}^{N} p_{it} q_{it}$$

$$= R_t \cdot \sum_{j=1}^{N} \pi_{jt} q_{jt}$$

These figures are in column (2) of the Table 2.

If the totals for GDP in (1) - (3) are identical then the rescaling deviations would be zero. Unfortunately this procedure does not produce perfect results with no rescaling deviations. Magnitudes of these deviations are presented in columns (6) and (8) of the table.

My search for the perfect solution has been unsuccessful and I am beginning to think that, within the framework considered here and the limitations on available data, such a procedure may not exist. Until this can be established analytically, the search must continue.

The method discussed here incidentally provides a generalization of the aggregation procedure used in the ICP that can be used in the inter-country comparison of national accounts encompassing the expenditure side and production side entries of the national accounts.

The proposed method is applied in the case of Venezuela which is considered to be one of the problem countries that have experienced major shifts in relative prices following the oil crisis. Detailed calculations are provided in the paper on the new method and only the rescaled deviations from the proposed method are presented below. These deviations should indicate the

efficacy of the procedure in leading to meaningful rebased national accounts.

Results

Results provided in the table are extracted from the detailed calculations, which are presented in the attached paper, resulting from the application of the new procedure suggested here. Column (2) provides the rebased GDP totals with 1980 as base year. The implicit GDP totals from this procedure are transitive and in any subsequent rebasing exercises, simple adjustment for the new base year would provide the rebased GDP figures with growth rates that are essentially preserved.

Columns (3) and (4) provide the GDP totals obtained by rescaling, respectively, the expenditure are production side components. It is quite encouraging to see that these two totals are not too different, specially keeping in mind that the original current price series itself has discrepancies between the expenditure side and production side totals. The observed differences between columns (3) and (4) need to be examined bearing this in mind.

Column (5) provides the rebasing deviations resulting from the application of the Holsen-Harrison method of partial rebasing. These deviations are the actual differences between production and expenditure side totals and are not net of private consumption expenditure (as is presented in some of the Bank tables which are presented in the other paper).

Column (6) provides the actual rescaling deviations from expenditure side obtained as a difference between columns (2) and (3). Column (7) shows the deviations from the new method as a percentage of the deviations from the Holsen-Harrison approach. The deviations from the new method vary from about 5 per cent in year 1974, to about 12 per cent in the year 1985. This clearly establishes the superiority of the proposed method relative to the method presently employed at the Bank.

Columns (8) and (9) present the industry-of-origin side of the story. The results are once again very encouraging, specially if the discrepancies in the original constant price series are taken into consideration.

Details of the results and intermediate calculations are provided in the

TABLE: A COMPARISON OF THE RESCALED DEVIATIONS FROM THE PROPOSED METHOD

AND FROM THE PARTIAL REBASING (H-H) METHOD - CASE OF VENEZUELA

GROSS DOMESTIC PRODUCT					RESCALED DEVIATIONS				
YEAR	AT CURRENT PRICES	AT CONSTANT PRICE WITH BASE YEAR = 1980 BASED ON THE NEW METHOD			Partial Rebasing (H-H Method)	New Method Proposed Here			
						Expenditure Side		Industry-of-Origin	
		RESCALED GDP	RESCALED EXPENDITURE COMPONENTS	RESCALED INDUSTRY-OF-ORIGIN TOTAL		Deviation Col.(2)-Col.(3)	As a % of Col.(5)	Deviation Col.(2)-Col.(4)	As a % of Col.(5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1965	37 316	156 500	171 635	141 364	- 144 455	- 15 135	(10.5)	15 136	(10.5)
1966	39 180	159 109	173 599	144 620	- 140 478	- 14 490	(10.3)	14 489	(10.3)
1967	40 710	165 188	181 042	149 334	- 149 358	- 15 854	(10.6)	15 854	(10.6)
1968	44 580	175 435	190 723	160 147	- 150 235	- 15 288	(10.1)	15 288	(10.1)
1969	46 334	180 695	197 057	164 333	- 153 858	- 16 362	(10.6)	16 362	(10.6)
1970	52 025	196 065	210 366	179 782	- 146 282	- 14 301	(9.8)	16 283	(11.1)
1971	57 141	198 252	210 197	185 342	- 132 527	- 11 945	(9.0)	12 910	(9.7)
1972	61 502	200 908	210 248	192 341	- 112 515	- 9 340	(8.3)	8 567	(7.6)
1973	73 253	213 959	224 059	205 740	- 123 148	- 10 100	(8.2)	8 219	(6.7)
1974	112 234	213 070	211 395	216 105	36 472	1 675	(4.6)	- 3 035	(8.3)
1975	118 098	221 627	217 090	229 985	70 164	4 537	(6.5)	- 8 358	(11.9)
1976	135 104	239 334	233 005	250 919	86 794	6 329	(7.3)	- 11 585	(13.3)
1977	155 706	254 882	247 957	269 318	97 331	6 925	(7.1)	- 14 436	(16.7)
1978	169 060	258 876	250 406	277 311	113 798	8 470	(7.4)	- 18 435	(16.2)
1979	207 737	262 682	252 323	280 152	120 469	10 350	(8.6)	- 17 470	(14.5)
1980	254 201	254 201	242 763	272 374	136 578	11 438	(8.4)	- 18 773	(13.7)
1981	285 208	253 884	241 663	275 041	137 992	12 221	(8.9)	- 21 157	(15.3)
1982	291 268	254 824	243 526	273 997	130 248	11 298	(8.6)	- 19 173	(14.7)
1983	290 492	241 292	229 316	264 149	113 023	11 976	(10.6)	- 22 857	(20.2)
1984	347 530	239 487	227 087	265 376	114 599	12 400	(10.8)	- 25 889	(22.6)
1985	372 031	239 315	225 604	265 373	119 761	13 711	(11.4)	- 26 058	(21.8)
1986	397 592	250 711	239 234	278 820	126 431	11 477	(9.1)	- 28 109	(22.2)

NOTE: (1) A feature of the proposed method is that the rescaled GDP is in the middle of production side and expenditure side rescaled GDP figures. As a result the rescaling deviations from production and expenditure sides would be of same magnitude in absolute terms, and would be of opposite signs.

(2) In the case under consideration the original GDP figures at current prices have a discrepancy, from the year 1970 onwards, between the expenditure side total and the production side total. This has resulted in differences in rescaling deviations observed in columns (4) and (5). This tends to exaggerate the rescaling deviations from the production side and the resulting percentages computed.

paper on the new methodology.

4. Conclusion

This brief report summarizes my efforts in understanding and solving the rebasing problem encountered at the Bank in the preparation of national accounts with 1980 as the new base year.

Some of the salient features of the report are the following:

1) It argues in favour of a new strategy that calls for the application of different methods in different cases depending on the extent of shifts in the relative prices. This is somewhat different from the present strategy of following one single method, the Holsen-Harrison partial rebasing method.

2) In the real problem cases where the Holsen-Harrison approach resulted in very large rescaling deviation that render the rebased national accounts useless and uninterpretable, a new method based on consistent multilateral index numbers is proposed.

3) The new method proposed here is applied in the case of Venezuela which proves to be a problem case when the Holsen-Harrison method was applied. The results based on the new method are very encouraging and the rescaling deviations associated with the new method are very small relative to those from the Holsen-Harrison method.

While the results reported here are very encouraging, research work should continue in the search of a method that would result in perfectly consistent rebased national accounts with zero rescaled deviations. Until then it appears that the new method proposed in this consultancy report should provide a useful method for compiling a meaningful set of rebased national accounts.

THE WORLD BANK
INTERNATIONAL FINANCE CORPORATION
MULTILATERAL INVESTMENT GUARANTEE AGENCY

July 1, 1992

Drawer file rebasing

Mr. D. C. Rao

D.C.:

In case you did not see it, this is a pop version of the problem involved in using national approaches to rebasing national accounts. I especially like the closing paragraph. For all its faults, our partial rebasing method makes more sense than this current US approach.

John C. O'Connor

cc: Mr. Chander

Did America Ever Make Anything?

How Official Statistics Keep Shrinking the Nation's Industrial Past

By Arnold Packer

WILL MANUFACTURING be in our future? No one knows for sure. What may be more surprising is that, judging from the numbers on the past and present structure of the U.S. economy that the government periodically issues, we cannot even be sure that manufacturing will always be in our past.

The backward trend revealed in the changing official view of the 1950 economy points clearly to that conclusion. Today, for example, the government says that manufacturing accounted for one-fifth of our economic output in 1950, measured in "real" (inflation-adjusted) 1982 dollars—roughly the same proportion for which it now accounts.

Some years ago, however, when the government's yardstick was 1972 dollars, manufacturing was reported to be one-fourth of that same 1950 economy. Earlier, when the yardstick was 1958 dollars, manufacturing was measured by the government at 30 percent of "real" 1950 GNP. (A simple check of current and past Economic Reports of the President will show this curious revisionist trend.)

From these official revisions, it appears that manufacturing is retroactively losing 5 percentage points of its share of 1950 GNP each decade. At this rate, by the time we reach the middle of the next century, manufacturing will not have been present at all in the U.S. economy of 1950.

Arnold Packer was executive director of the Labor Department's SCANS project and will become a senior fellow at the Johns Hopkins Institute for Policy Studies in May.

The shrinking importance of manufacturing in our economic past may seem strange to people who remember when smoky industrial plants were a dominant feature of America's urban landscape. On the other hand, the apparent constancy thus produced in official measures of manufacturing's importance in the U.S. economy gives solace to economists who might otherwise worry that America's industrial base is eroding.

If all this sounds confusing, think about how the books are kept in the Department of Commerce where, every 10 years or so, the statisticians shrink manufacturing's past significance.

Imagine an economy with a manufacturing sector that produces only autos and a service sector that provides only haircuts. In 1950, everyone gets their hair cut once a month and buys a car once every six years. One auto is "worth" six years of barbering or 72 monthly haircuts.

Move the clock forward 40 years to 1990. Now assume (economists' favorite word) that productivity had increased in manufacturing autos but not in barbering services. The same number of barbers can produce only the same number of haircuts, but the same number of auto workers can produce four times as many cars as they did in 1950. Assume further that 1990s consumers buy a car every three years and get two haircuts a month. Because productivity grew, economic output doubled in 40 years.

In output terms, in our imaginary economy, the ratio of cars to haircuts remains unchanged; there are 72 heads shorn for every car produced, both in 1950 and 1990. Manufacturing's share of economic output has not changed. But because manufacturing productivity increased faster than demand for autos, some auto workers lost their jobs and became barbers. In employment terms, there are fewer workers in manufacturing (making autos) and more in services (giving haircuts).

If that is all that had been happening in our economy, the economists' revised numbers would not be so confusing; the backward revisions would not show any change in the 1950 share of GNP—though the Labor Department's numbers would show fewer manufacturing workers. And indeed, back in the real world, employment in manufacturing has shrunk by half (from 34 percent of workers in 1950 to 17 percent in 1990).

But that doesn't explain why the economists feel the need to rewrite past economic history to show that manufacturing's share of 1950 output, recorded at some 30 percent of GNP only a couple of decades ago, was, in fact, no larger than its current level of slightly more than 20 percent. Why must the statisticians pretend, in effect, that all those 1950 steel and auto factories were really giving haircuts, not building cars?

The source of the mystery is that the 1990 auto was not the same as that produced in 1950 and the 1990 "styling" was not the same as the 1950 crewcut. Every five or 10 years the statisticians at Commerce have to figure out how many haircuts are really "worth" one auto. That estimate is required when Commerce's Bureau of Economic Analysis changes from "constant" 1958 dollars to constant 1972 or 1982 dollars.

How do the statisticians find out how many haircuts a new car is worth? By checking what people pay. So, if in 1992, the price of an auto is equal to only 60 haircuts (rather than 72 haircuts), then all the back data will reflect this ratio. When our mythical haircut/auto economy of 1950 is adjusted to 1992 dollars, the 1950 economy's output of autos will turn out to be less than its output of haircuts. Manufacturing's share of the 1950 economy will have shrunk because every 1950 auto is now worth less than 72 haircuts.

PETER HOEY—THE WASHINGTON POST

If this is the answer then, oh Carnac the Magnificent, what is the question? It surely is not: What is the share of manufacturing in GNP? It should be: What is the share of good jobs in our economy? And for those who are unlucky enough not to have gone to college, the answer is . . . (silence please) . . . There are fewer good jobs.

For example, close to half (42.7 percent) of 25- to 54-year-old African-American males with 12 years of education did not earn enough in 1989 to keep a family of four out of poverty. In 1969, that ratio was only one in five. For whites, the number of low-earners so defined increased from 8.3 percent in 1969 to 22.6 percent in 1989.

Since 1950, high-paid, low-skill jobs, in manufacturing or elsewhere, have all but disappeared. This grim reality is what should concern us—not whether the statisticians, for reasons perfectly valid to their own concerns, adjust the past to appear different from what it was. The skills required in both the manufacturing and service sectors have changed. The truly relevant question, then, is how to respond to the new situation.

A good part of the answer is to increase productivity—and the number of good jobs—in services. Another part of the answer is to improve education and training. A step in that direction is the report, issued by the secretary of labor this month, by SCANS (the Secretary's Commission on Achieving Necessary Skills). That report identifies the skills that appear to determine whether jobs pay well in either manufacturing or services and suggests ways to improve education and the number of good jobs in our country.

Economists use funny words, or rather they use words in funny ways. Real dollars are intangible and constant dollars vary when the base year is changed. Recessions end but unemployment does not fall. The economists' real problem is not so much providing the wrong answers as it is not asking the right questions, such as: Where will the good jobs come from, and how will Americans get them?

To Stanley Fischer

From Ajay Chhibber

Subject : GDP per capita calculations

In response to your request Peter Pedroni has prepared a short note and pictures comparing the different methods for calculating GDP per capita. Peter shows that the method Lancieri chooses using inflation differentials smooths out the short-term fluctuations in exchange rate movements. Unfortunately, it also smoothes out any permanent changes in the real exchange rate which should affect a country's permanent income. It does this because it assumes a constant real exchange rate .

In contrast , with our present method the real exchange rate is fluctuating due to both fundamental changes as well as short run phenomena. We need a method that adjusts for the fundamental permanent changes in the real exchange rate but not to the short run fluctuations. This is not easy.

One solution is to use inflation differentials but periodically update the base year say every five years. This changes the real exchange rate every five years but keeps it fixed over that five year period.

c.c. Johannes Linn, Cheryl Gray

A Comment on Lancieri's Method for International GDP Comparisons

Peter Pedroni

Comparison of economic output denominated in different national currencies is important for international policy analysis, but also constitutes a serious practical and theoretical challenge. If exchange rates change in response to more than just international output differentials, then clearly comparisons based on such exchange rates are not indicative. Yet this is not to imply that the exchange rate does not carry any information regarding the comparabiliy of international economic output, and many economists seek to exploit this fact as an alternative to lengthy "non-price" type comparisons. However, the dilemma lies in statistically extracting only this relevant information, and is further complicated by the lack of an empirically viable theory of exchange rate determination.

Thus, the more pragmatic methods tend to be less ambitious and merely hope to limit comparison to a time frame in which this "relevant information" has not changed much, and simply "smooth out" any fluctuations assumed to be induced by other factors. More concretely, we can think of nominal exchange rate movements to be determined by the relative movements of the price levels of the two currencies, as well as by all those factors that influence the real exchange rate, such as movement in the terms of trade (of goods or assets), as determined by perceptions of international supply and demand conditions. To the extent that any changes in such factors are merely temporary, then their impact on exchange rates should not be allowed to influence our

GDP comparisons. For example, in light of a particular fiscal expenditure or readjustment program that impacts the exchange rate in a significant but temporary manner, we may not wish to register the correspondingly large fluctuation in converted GDP values. To this end, proceedures are used to either eliminate or dampen these fluctuations.

Lancieri, for example, proposes to entirely eliminate such fluctuations by converting GDP at "adusted" exchange rates, which implicitly hold the real exchange rate constant and then compensate the nominal rate by inflation differentials. Thus, if the real exchange rate is known at time t, and defined to be

$$e \equiv E \frac{P^*}{P} ,$$

where E is the nominal dollar to local currency exchange rate and P*, P the local and US price levels respectively, so that incremental changes are given by

$$\hat{e} \equiv \hat{E} + (\pi^* - \pi) ,$$

where $(\pi^* - \pi)$ is the inflation differential as given by the respective GDP deflators, then Lancieri's "adjusted" exchange rate is defined to follow the path

$$\hat{q} \equiv (\pi^* - \pi) .$$

Thus, the direction of movement of Lancieri's inflation adjusted exchange rate is well defined and easily established given the availability of GDP deflators for each country. Clearly,

however, this does not establish a unique level for

$$q = \frac{P^*}{P} ,$$

since it depends arbitrarily on the index years for P^* and P. A simple substitution,

$$q = \frac{e}{E} ,$$

illustrates that one may consider this, equivalently, to be a problem of choosing the real exchange rate given data only for the nominal exchange rate.

Lancieri proposes the following solution. He asserts that since nominal exchange rates fluctuate around a stable long term "equilibrium" value, then one need merely find an "average" value of the nominal rate over a long enougn time period and this should indicate the equilibrium value. One could simply draw whatever line bests fits through the data for nominal exchange rates, and hence choose as the equilibrium rate f, that which minimizes the absolute distance from E;

$$\min \hat{\sum_i} | E_i - f_i | .$$

Thus we would have a tentative solution for determining the long term "equilibrium" rate. But since information is easily available about some of the variables that determine the "equilibrium" exchange rate, then Lancieri suggests using this information to better arrive at the equilibrium rate. Hence, instead of just fitting a straight line through the data,

Lanzieri fits a line that reflects the information about inflation differentials, namely a line that moves according to $\hat{q}$. Hence, Lanzieri chooses the equilibrium rate such the the space between a line sloped according the the movement of inflation differentials and a series of nominal exchange rates is minimized, ie:

$$\min \sum_{i}^{n} |E_i - q_i| .$$

The fact that this implies that there must be an i such that

$$q_i = E_i = e_i$$

results simply from a mean value theorem, or in other words, from the fact that if the long run equilibrium rate is arrived upon as an "averaging" of the nominal rate, then, at least at one point, they must coincide. Hence for any year that they do coincide, this will be a year in which the nominal exhange rate is equal to the implied equilibrium rate. Thus it should be considered merely a matter of analytic convenience that Lancieri's method can also be thought of as equivalent to determining a base year, or point in time, t=i, on which the real exchange rate is based. If we accept Lancieri's assertions about exchange rate behavior, this should not in and of itself illicit concerns about "problems of fixing a base year."

Any discomfort that this may cause, however, may be well justified and can be traced to one seemingly innocuous but very strong assumption that Lancieri makes, namely that nominal

exchange rates fluctuate about their long term equilibrium rate, so that an appropriate averaging ("fitting") of nominal rates will reveal the equilibrium rate. As a matter of fact, though, there is strong reason to believe that exchange rate movements do not follow a stationary process. In practical terms, this implies that the fluctuations of E need not be bounded or generated by the same distribution over time and are not necessarily anchored to any mean long term level, so that the long term rate can not be estimated as an "average" of the short term rates.

Aside from this theoretical obstruction to determining the equilibrium rate as Lancieri proposes, there may also be more immediate objections to the manner in which Lancieri uses the equilibrium rate once he has claimed to have estimated it. As discussed, Lanzieri's method is analytically equivalent to determining a period in which e=E and then establishing an "adjusted" rate such that $\hat{q} = \pi^* - \pi$, so that if t_o is a year in which $e_i = E_i$, then

$$q_t = E_{t_o} + \sum_{i=t_o}^{t} (\pi_i^* - \pi_i).$$

Thus, what Lancieri is implicitly doing, is determining a base year for which the nominal rate is the real rate, and then keeping the real exhange rate fixed over the period in which he calculates the adjusted rate according to relative price level movements. Recall that, in our description of nominal exchange rates as affected by relative movements in price levels as well

as movement of all those variables determining the real exhange rate, the implicit goal in extracting relevant information from the exchange rate for international GDP comparisons, was to eliminate temporary fluctuations that did not reflect lasting changes in welfare. In this context, what Lanzieri's method would imply, is that once a real exchange rate is determined, it should be fixed at that level for the duration of the comparison of GDP over time, since any movement of the real rate is temporary. Clearly, this need not be the case. It is quite likely that a country experience a permanent change in its terms of trade due to differential qrowth rates or technical changes, etc., and we would want the resulting impact on the exchange rate to be registered as a change in welfare. Lancieri's adjusted rates would not be appropriate over periods when significant permanent adjustment of real rates has occurred. Thus, Lancieri faces a dilemma; assuming his method for estimating equilibrium rates were valid, presumably he would need a long series of nominal rates for a stable estimate, and yet the longer the series, the less desirable is the assumption of a fixed real rate.

In short, there are two basic objections to Lancieri's method. The first regards the proceedure for estimating the long run "equilibrium" exchange rate. The second involves the assumption of unchanging real exchange rates. The first is a problem inherent in the nature of exchange rates and cannot easily be resolved. The second can be viewed as a tradeoff

between necessary shortcomings, and is a matter of choice depending on ones needs. Furthermore, the two problems are separable. If the "equilibrium" exhange rate were in fact known at a given point in time, or a superior method for estimating it were used, then one may still choose to adjust that rate over time according to inflation differentials as Lanzieri suggests. Of course this is nothing new, but is simply an application of the principle of purchasing power parity determination of exchange rates. The literature has long been full of evidence indicating that this principle does not in fact hold, as well as why we should not expect it to. (If it did, exchange rate conversions of GDP would not present a problem in the first place). Instead we should view the decision to adjust by inflation differentials as a tradeoff. It is perfectly reasonable to argue that inflation differentials represent by far the most reliable and significant data available among the variables affecting the nominal exhange rate, and that the best information to be redeemed from exchange rates for GDP comparisons comes by adusting for this data and considering only a span of time over which the assumption that "all other" variables (those affecting the real exchange rate) have not permanently changed. Obviously this span of time would be different for each country and each portion of its history. Thus, if the same span of time is used to compare GDP across countries, the comparisons will be most valid among those experiencing the least net real exhange rate movement over the

period.

The World Bank, on the other hand, in using an inflation adjusted three year moving average,

$$Q_t = \left\{ E_t + \left(\frac{P_t^*}{P_{t-1}^*} \Big/ \frac{P_t}{P_{t-1}} \right) E_{t-1} + \left(\frac{P_t^*}{P_{t-2}^*} \Big/ \frac{P_t}{P_{t-2}} \right) E_{t-2} \right\} \frac{1}{3}$$

for its "adjusted" exchange rate, implicitly asumes that a period of three years is the appropriate one over which for all countries, and for all periods, the "other variables" affecting real rates have not changed permanently. Thus by using a three year moving average, the method essentially assumes that the real exchange rate has not changed in the previous three years, and adjusts for the relative price movements over those three years in determining the current adjusted rate. Here the opposite end of the tradeoff is likely to present itself. What if the real exchange rate moves temporarily, but for a period greater than three years? This certainly would be a credible scenario for the case of many LDCs undergoing fiscal adjustment programs. In this case it would be preferable to extend the number of years to allow for full readjustment so that the temporary over- or undervaluations are not incorporated into the adjusted rates.

Furthermore, notice that this method also cannot aviod the problem of determining the long-run "equilibrium" exchange rate. Here, rather than determining the equilibrium rate by averaging nominal rates over as long a period as possible, instead an inflation weighted average of only the past three years is taken. Although there is no good theoretical basis for establishing the

equilibrium rate by averaging increasingly larger series of nominal rates, neither is there a good theoretical reason to claim that this period's nominal rate, or any average of the last three years, is the long run equilibrium rate. Certainly, using a three year moving average will smooth out any sharp annual fluctuations, but if for example the exchange rate is moving down towards its equilibrium level, then last year's overvaluation will be greater than this year's, and to use a moving average means making an adjustment in the wrong direction. In terms of "fixing a base year," neither method is superior to the other. The problem is merely observed more explicitly in Lancieri's method, since the base year may be set at a point in time distant from the current period, thereby appearing less credible.

Ideally, then, we would want a process that could legitimately estimate the long term equilibrium exchange rate for some point in time. In the absence of an empirically viable model of exchange rate determination, this is unlikely. Thus, for the time being, we are limited to subjectively guessing that value. In the absence of a good guess, however, the current rate is as good as any. For projections around that point, we can pick a fundamental variable such as the inflation rates and use these to project as for in either direction as can be asserted that no other fundamental variable has permanently changed. The best comparisons, then, are not likely to span identical periods of time for different countries.

Clearly, if some standard interval of time is desired for

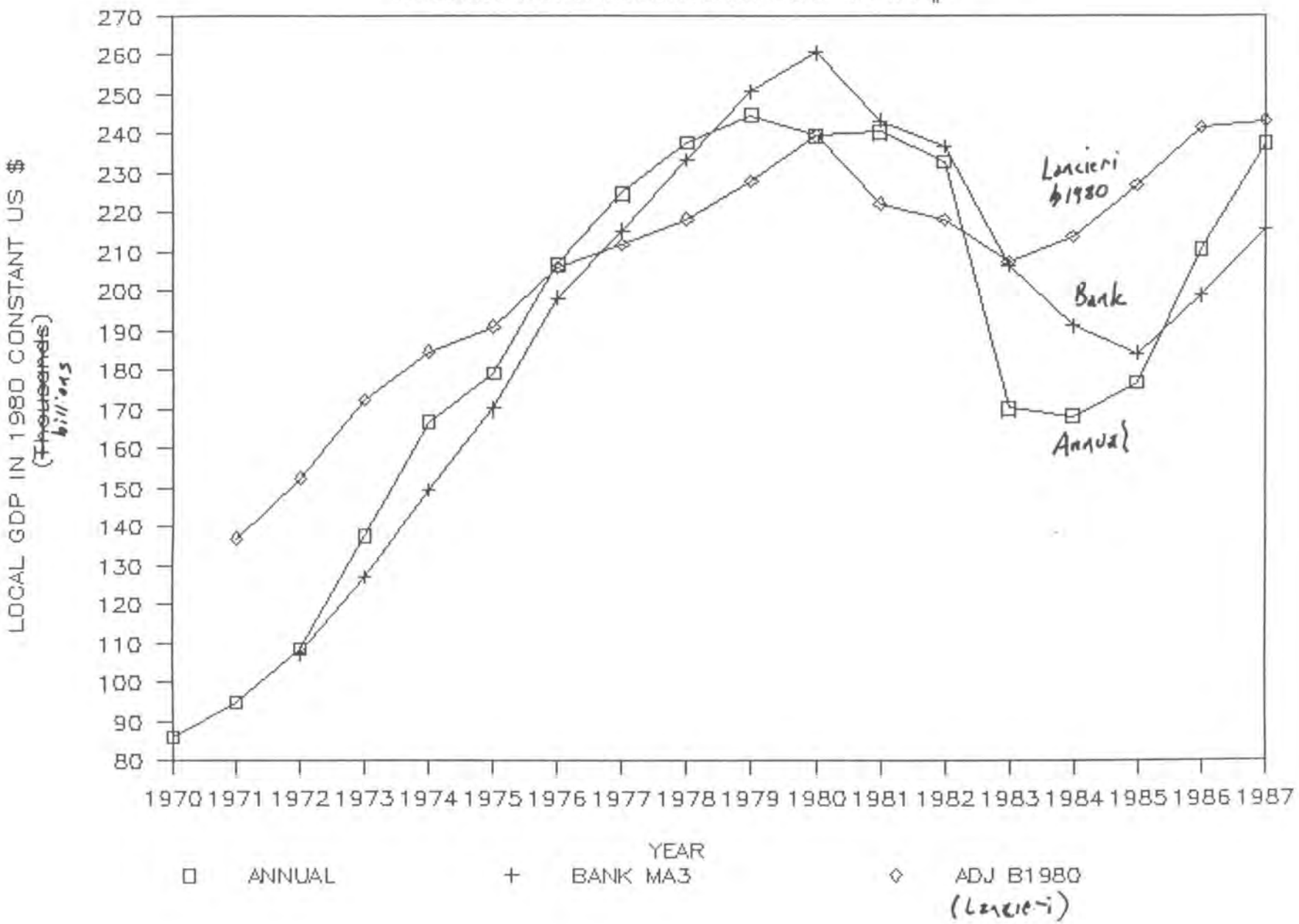
comparison between different countries, such as ten years from 1975 to 1985, then Lancieri's methiod will be better to the extent that there have been no large permanent realignments of the real exchange rate during that interval, while the Bank's method will be better to the extent that there have been such perminant realignments, but that temporary cycles tend to be shorter lived than three years. A good guess would be that for most significant intervals of time, especially for LDCs, that the Bank's method of allowing for real exchange rate movement beyond three years gives misleading impressions less often than Lancieri's might, although certainly it is likely that the optimal period may be somewhat greater than three years when considering countries with large fiscal imbalances.

Attached are some line graphs of what the two methods would make international comparisons of GDP look like as contrasted to conversions at annual nominal exchange rates. Caution should be taken, however, not to interpret the prettier as the better. Ultimately, which is better can not be evaluated merely from the comparison alone, since smoother does not necessarily mean truer. After all, a straight line would be smoothest.

Note for Graphs: It was suggested that I create line graphs illustrating what GDP figures looked like when converted into US Dollars based on the methods of the World Bank and Lancieri with various base years for Brazil, Chile, Cote d'Ivoire, Indonesia, Mexico, Philippines, Thailand, Turkey, and Zimbabwe from 1970 t0 1987. The first of each pair compares conversions using annual average exchange rates (IFS rf rates), World Bank three year inflation adjusted moving average rates, and Lanzieri's adjusted rates with a 1980 base. The second of each compares conversions based on Lanzieri's method with base years 1975, 1980, 1985 against the backdrop of annual average conversions. None of these is necessarily the base year indicated by Lancieri's estimation proceedure, but that is easily visualized by placing a line of the same shape so that it is exactly centered against the backdrop of the annually converted line (ie: minimize the space between the two lines). Wherever this visualized line coincides with the annually converted line can be considered a base year. All local currency GDP data is from IFS and has been converted into billions of constant 1980 US Dollars.

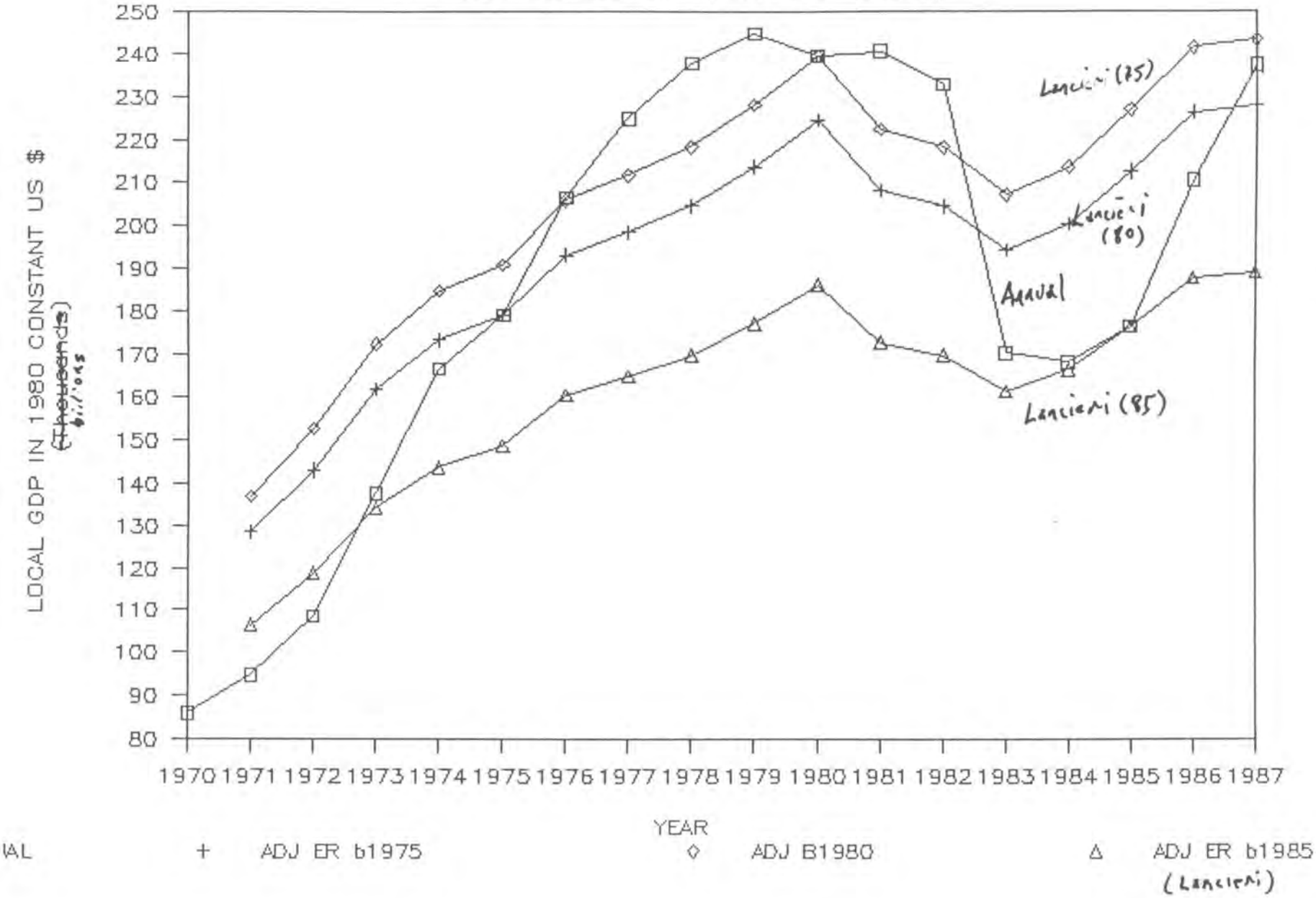
BRAZIL

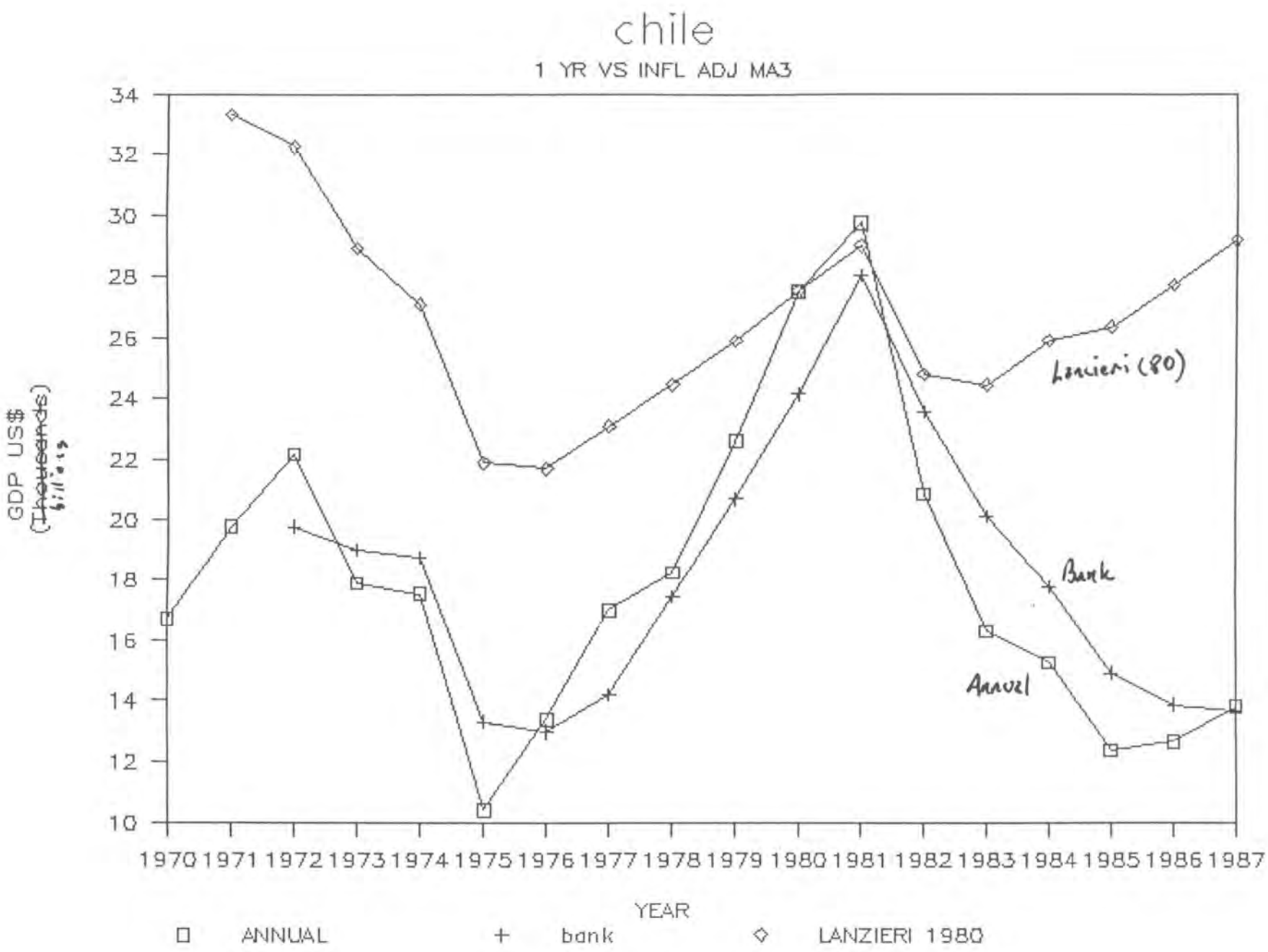
METHODS FOR CONVERTING DOM GDP TO US $



BRAZIL

METHODS FOR CONVERTING DOM GDP TO US $

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1 YR VS INFL ADJ MA3
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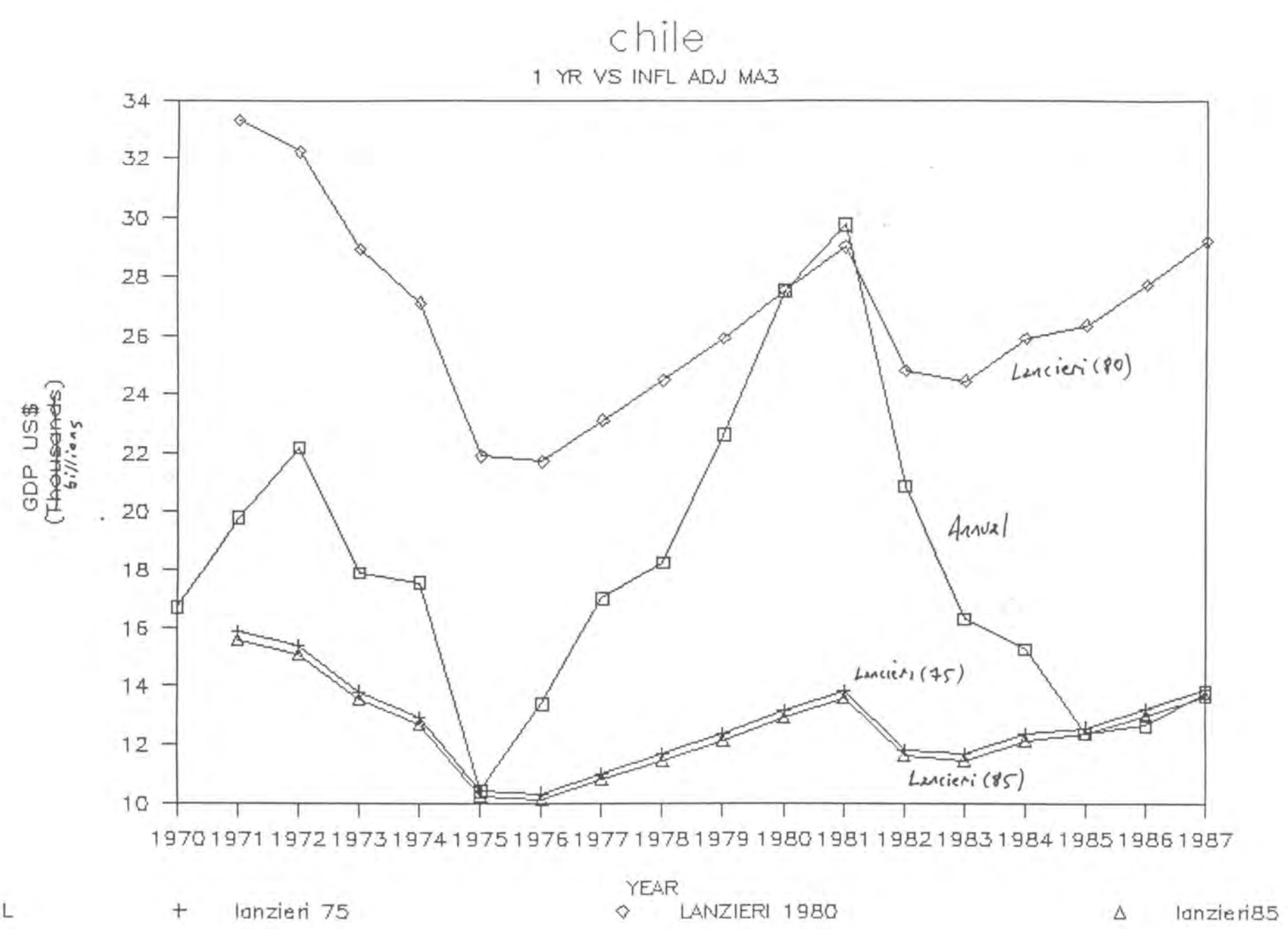
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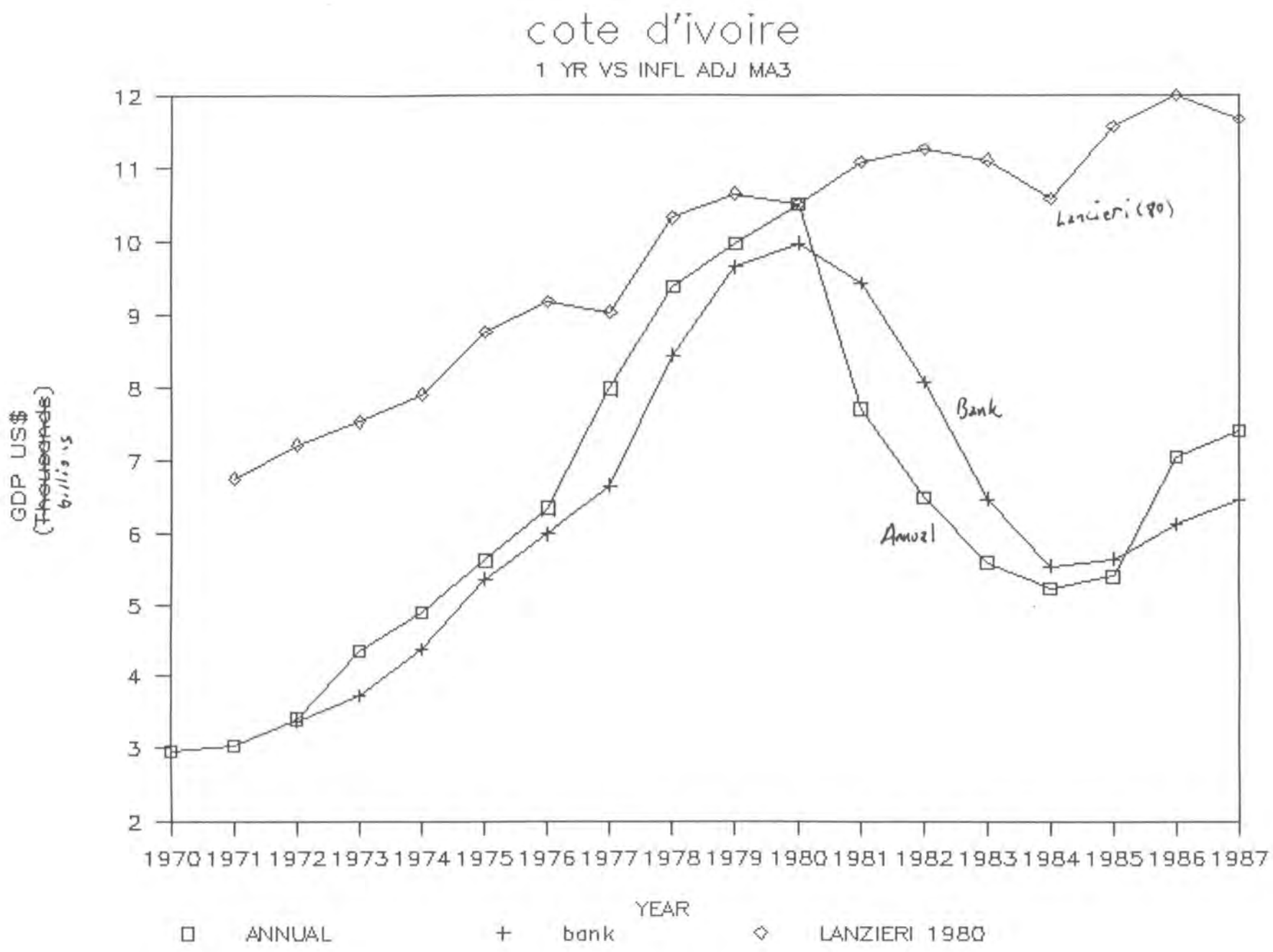
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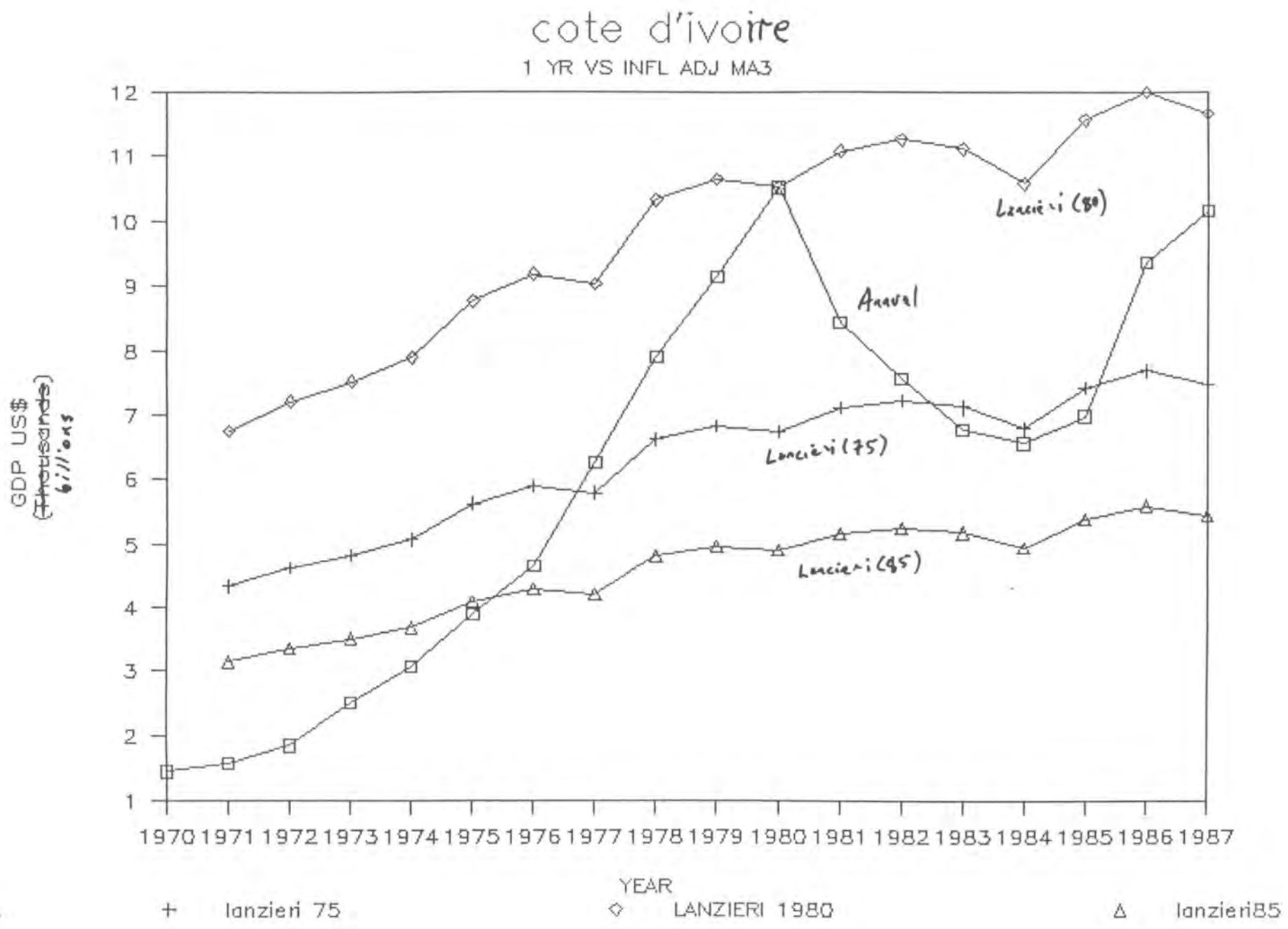
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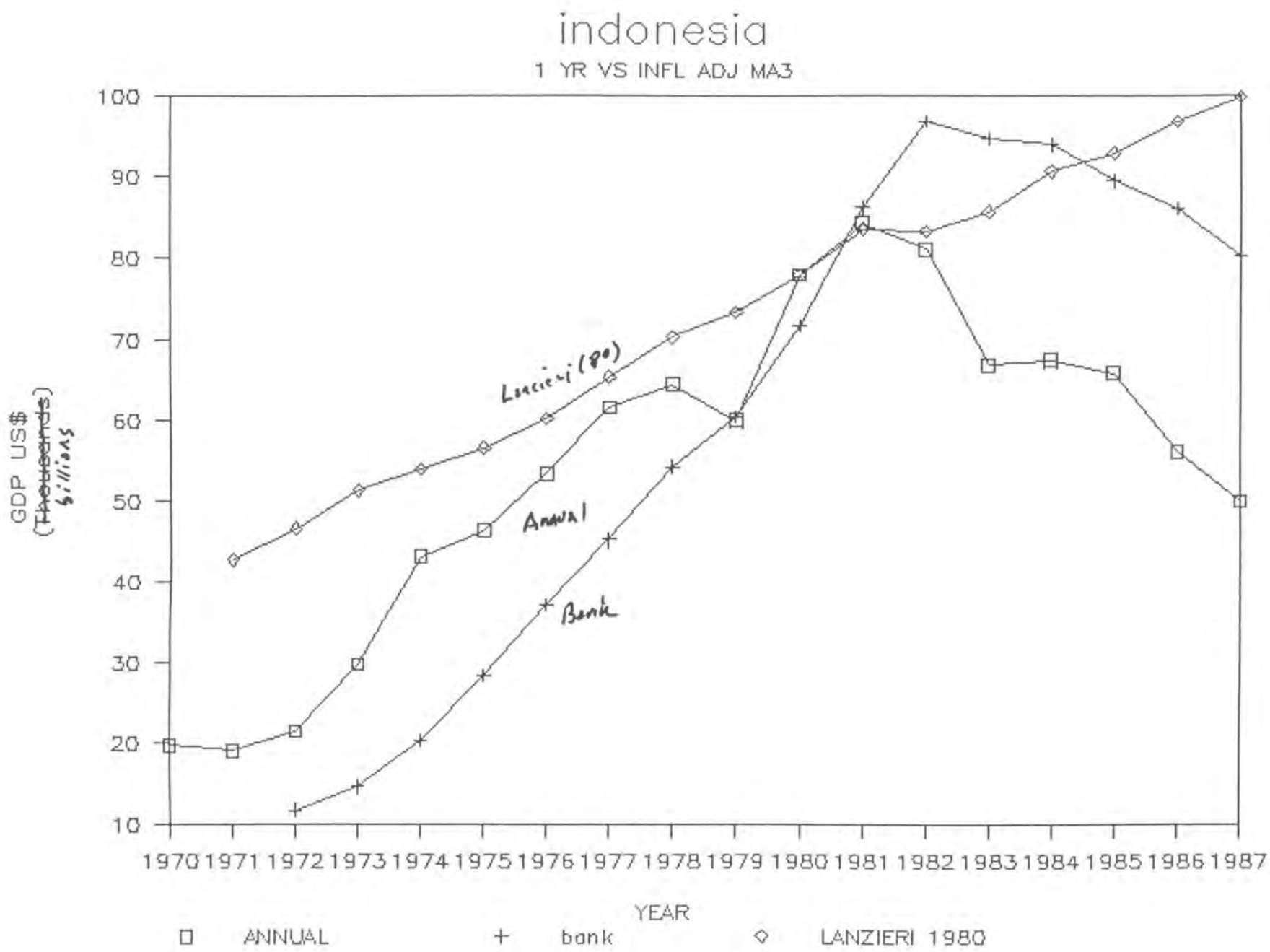
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GDP US$
(Thousands)
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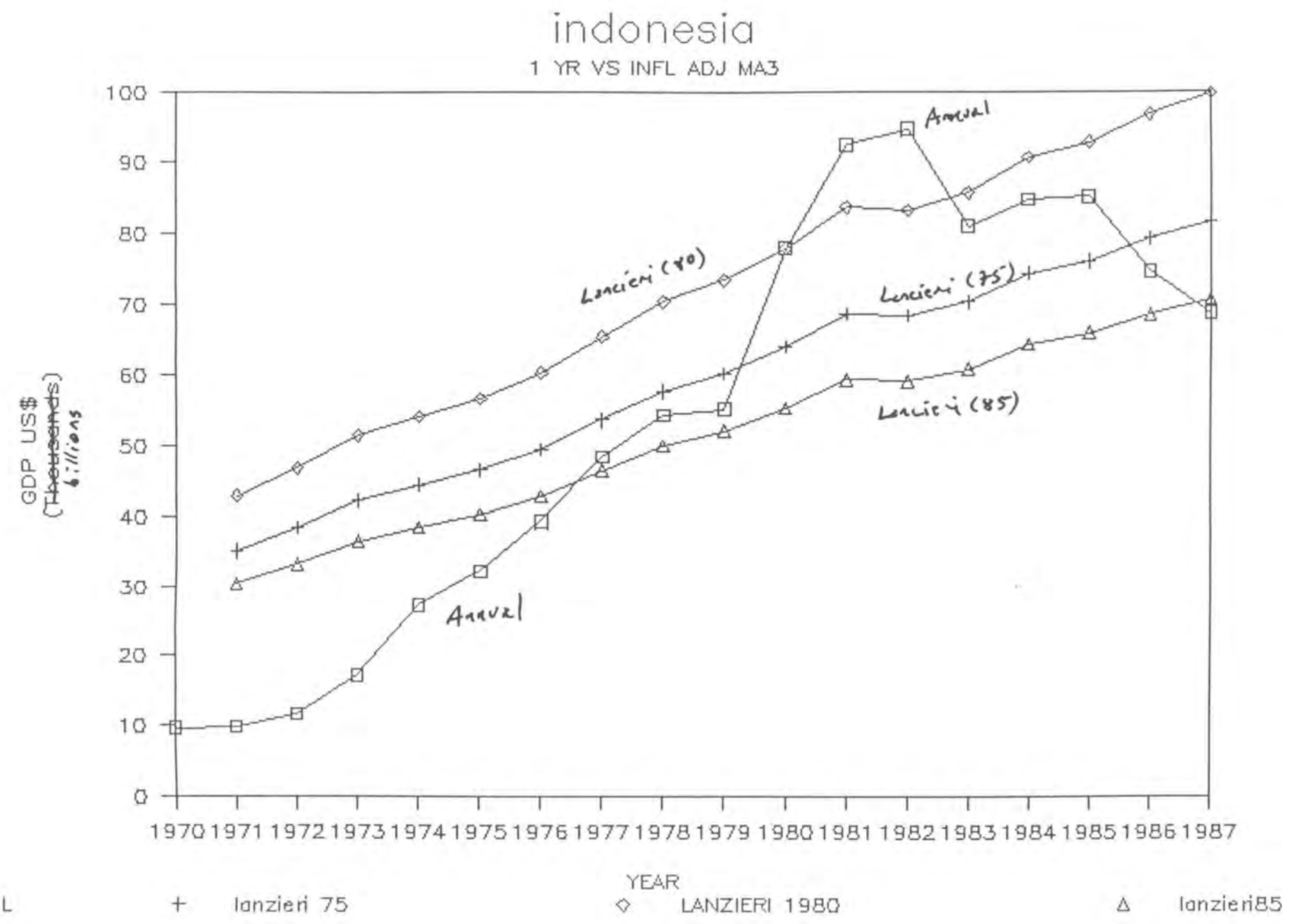
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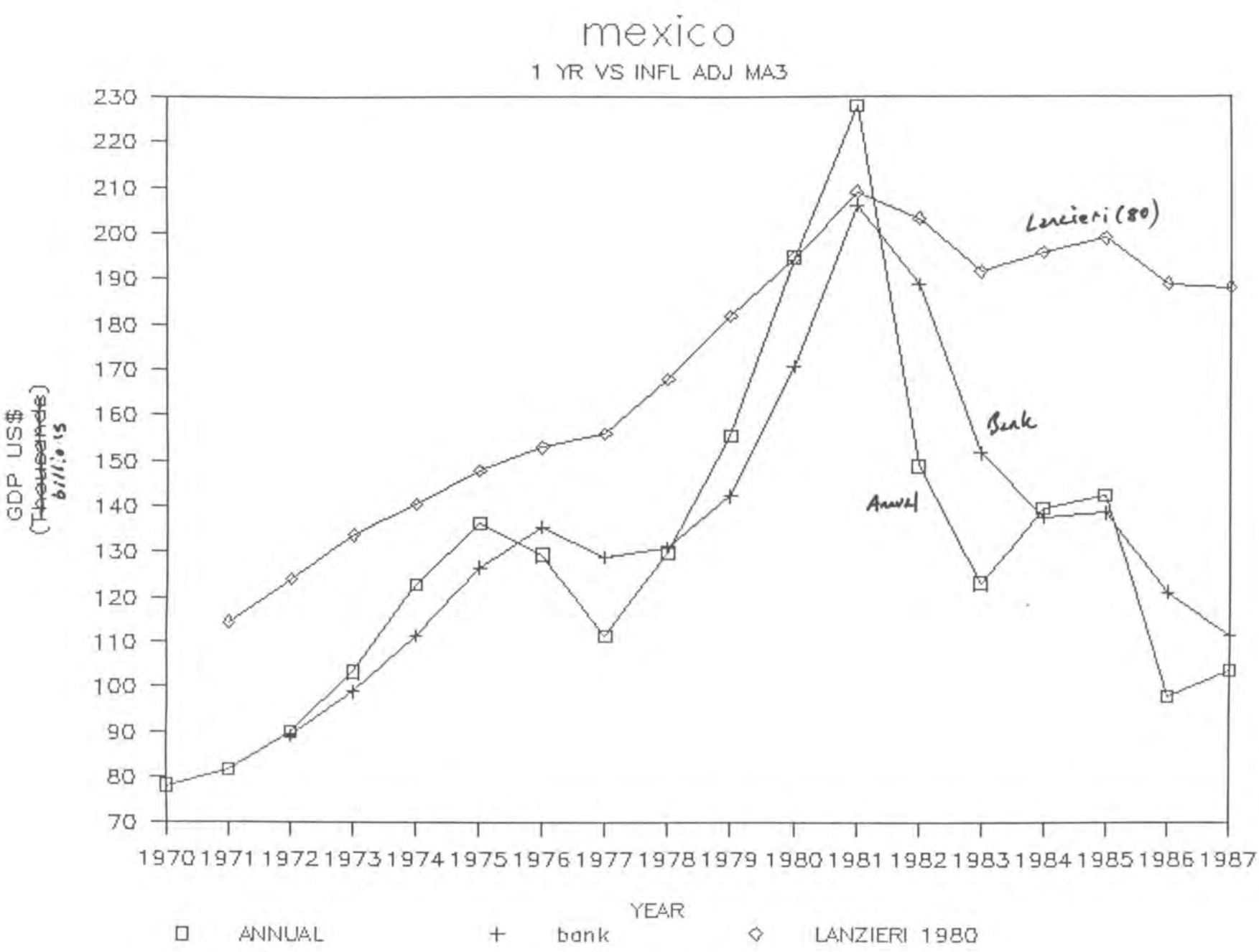
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1 YR VS INFL ADJ MA3
GDP US$
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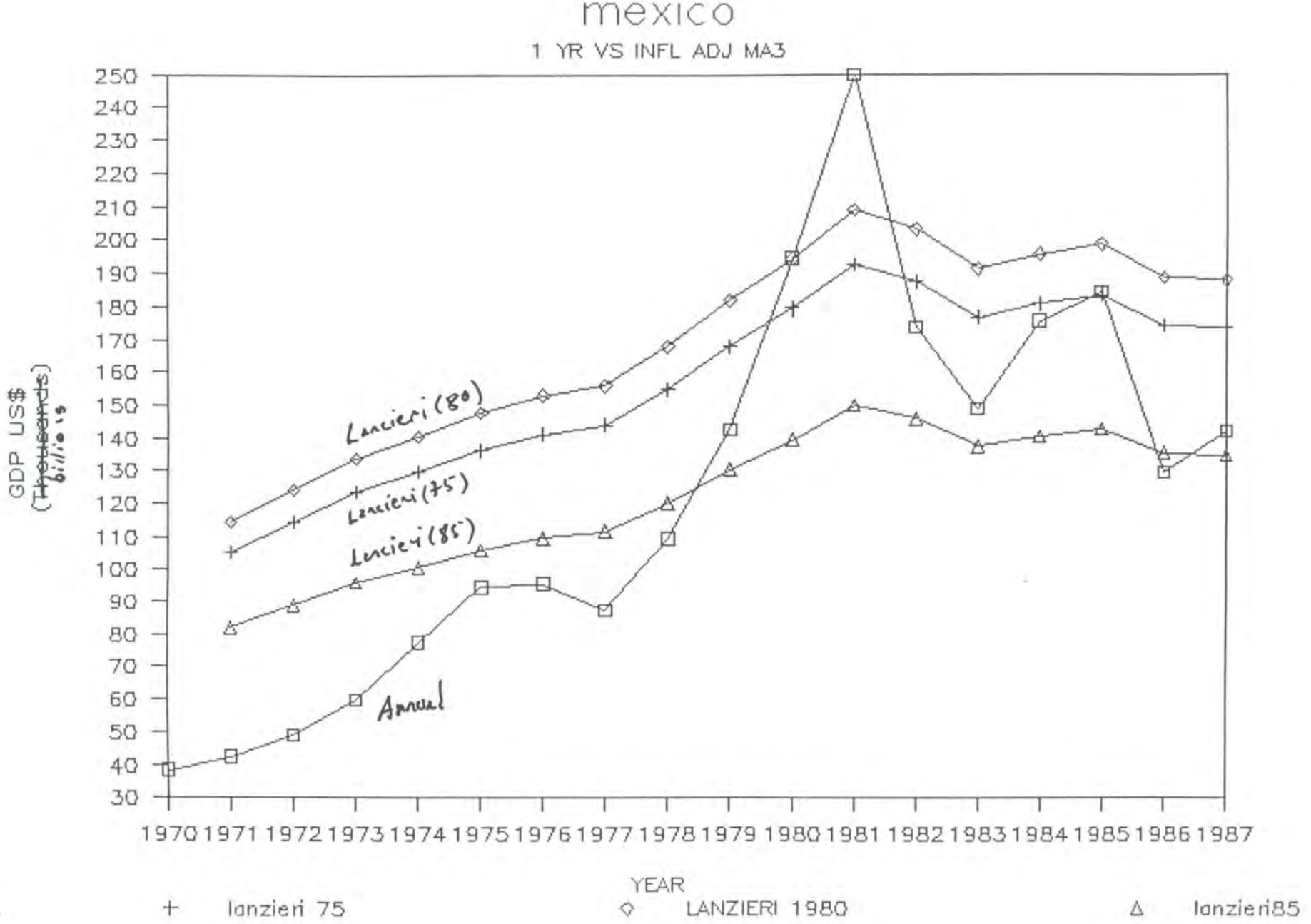
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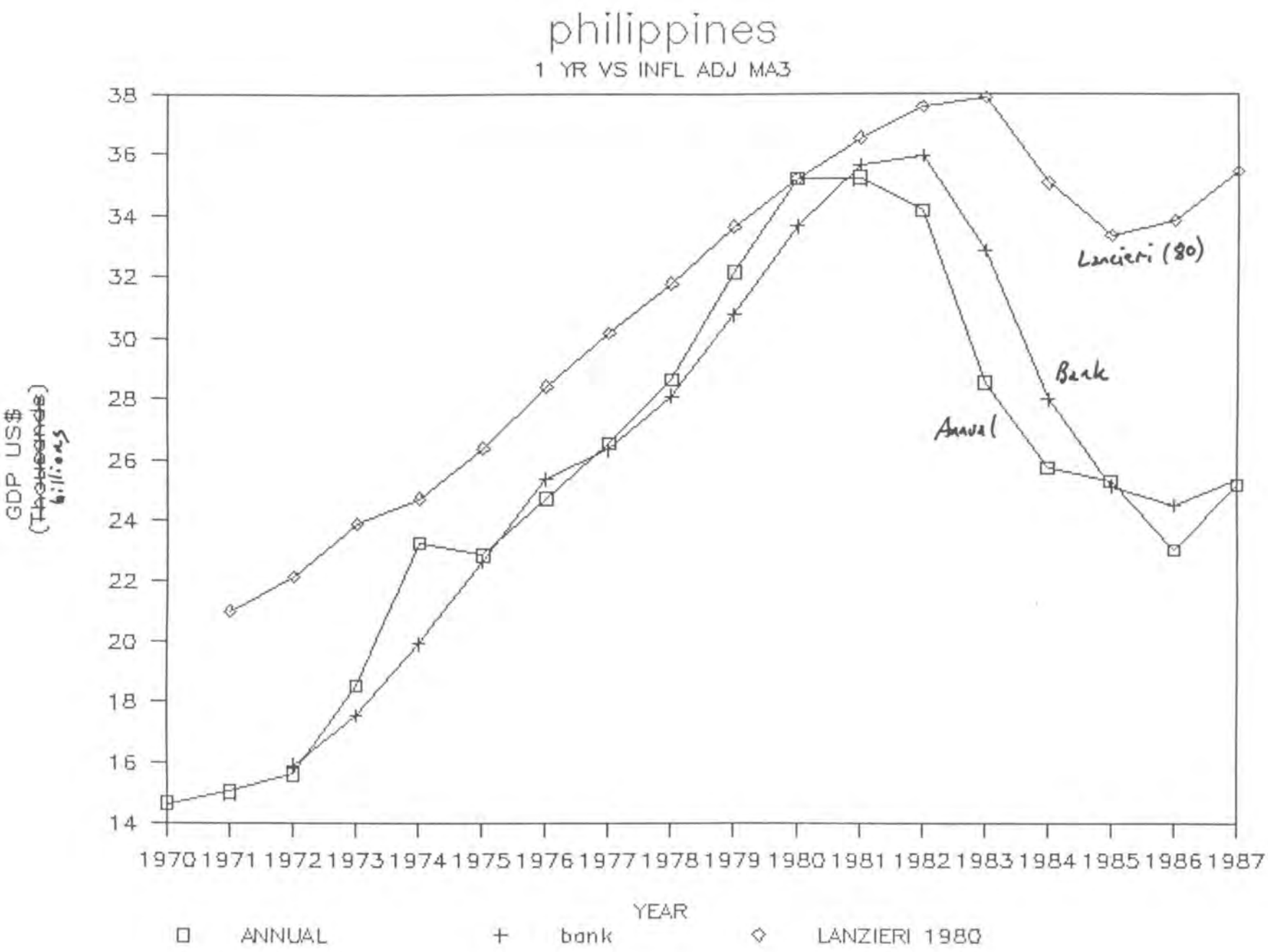
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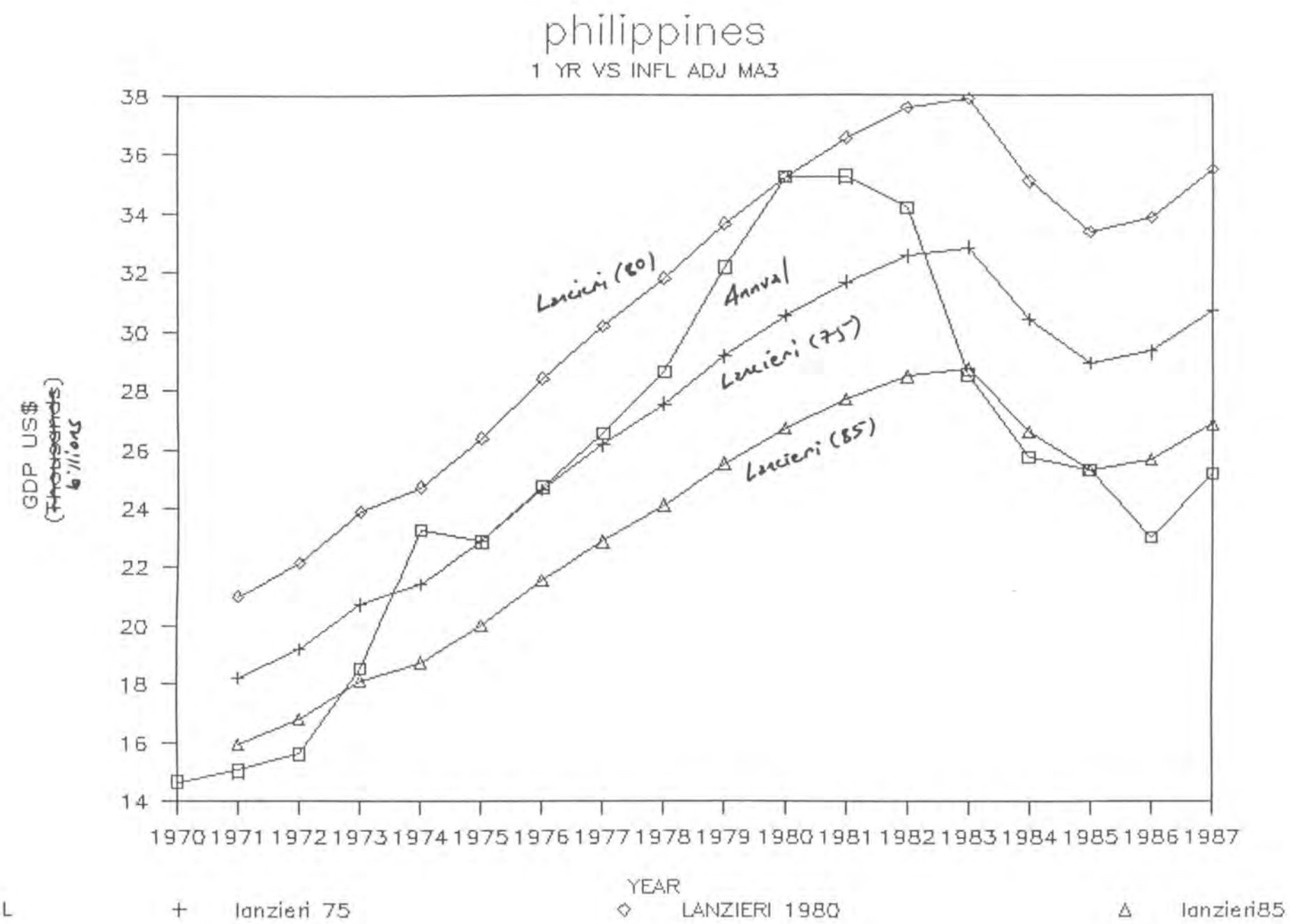
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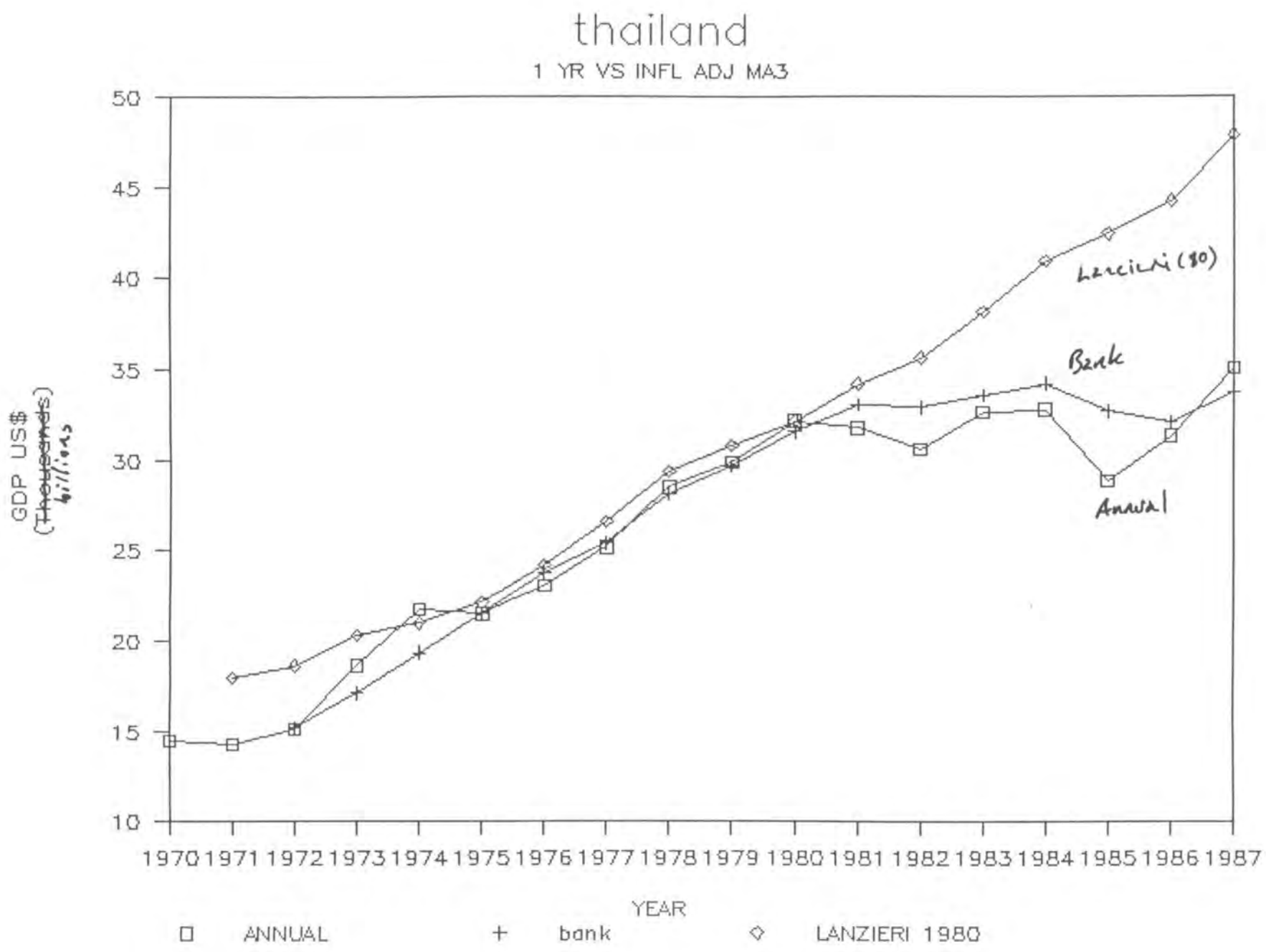
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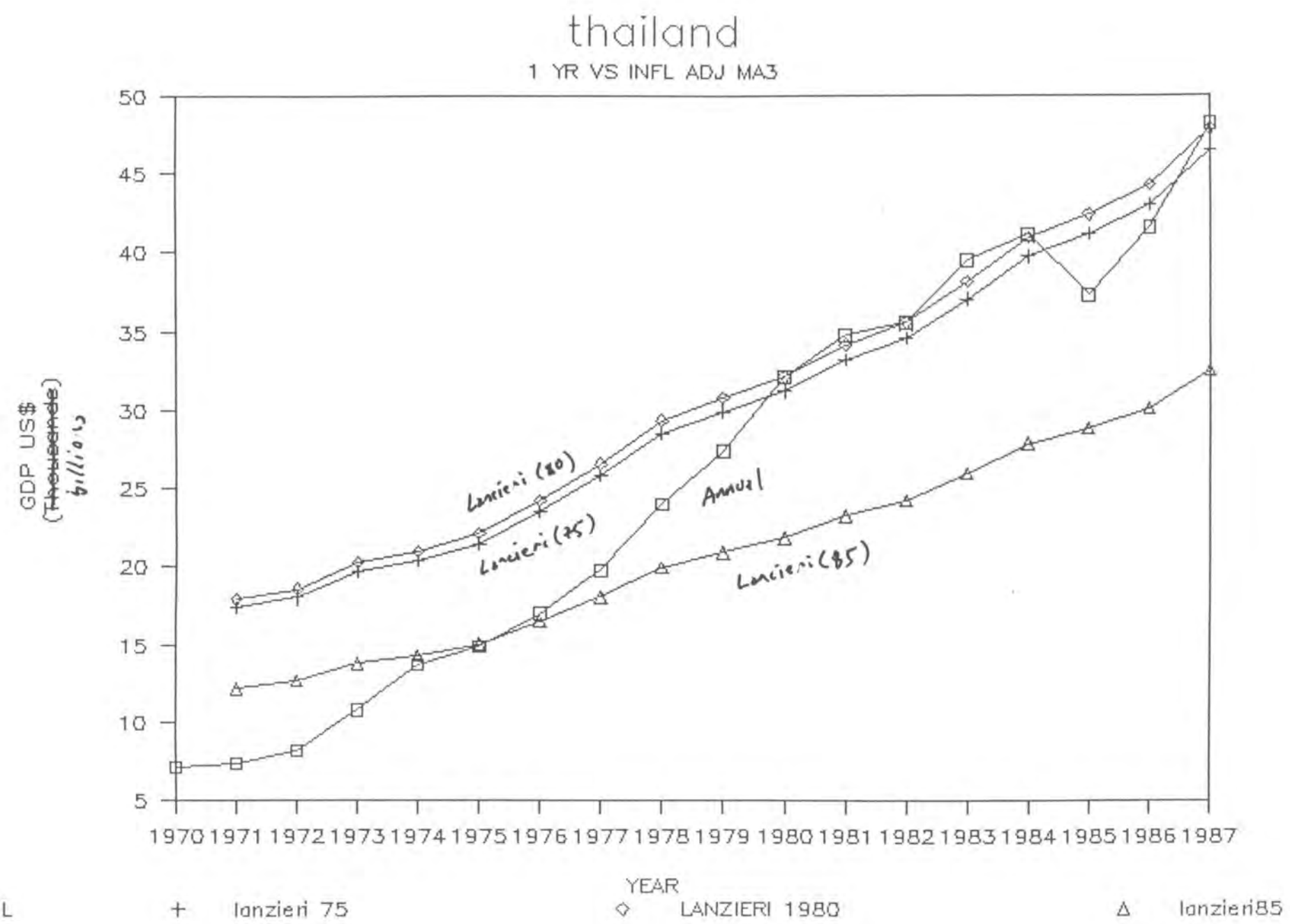
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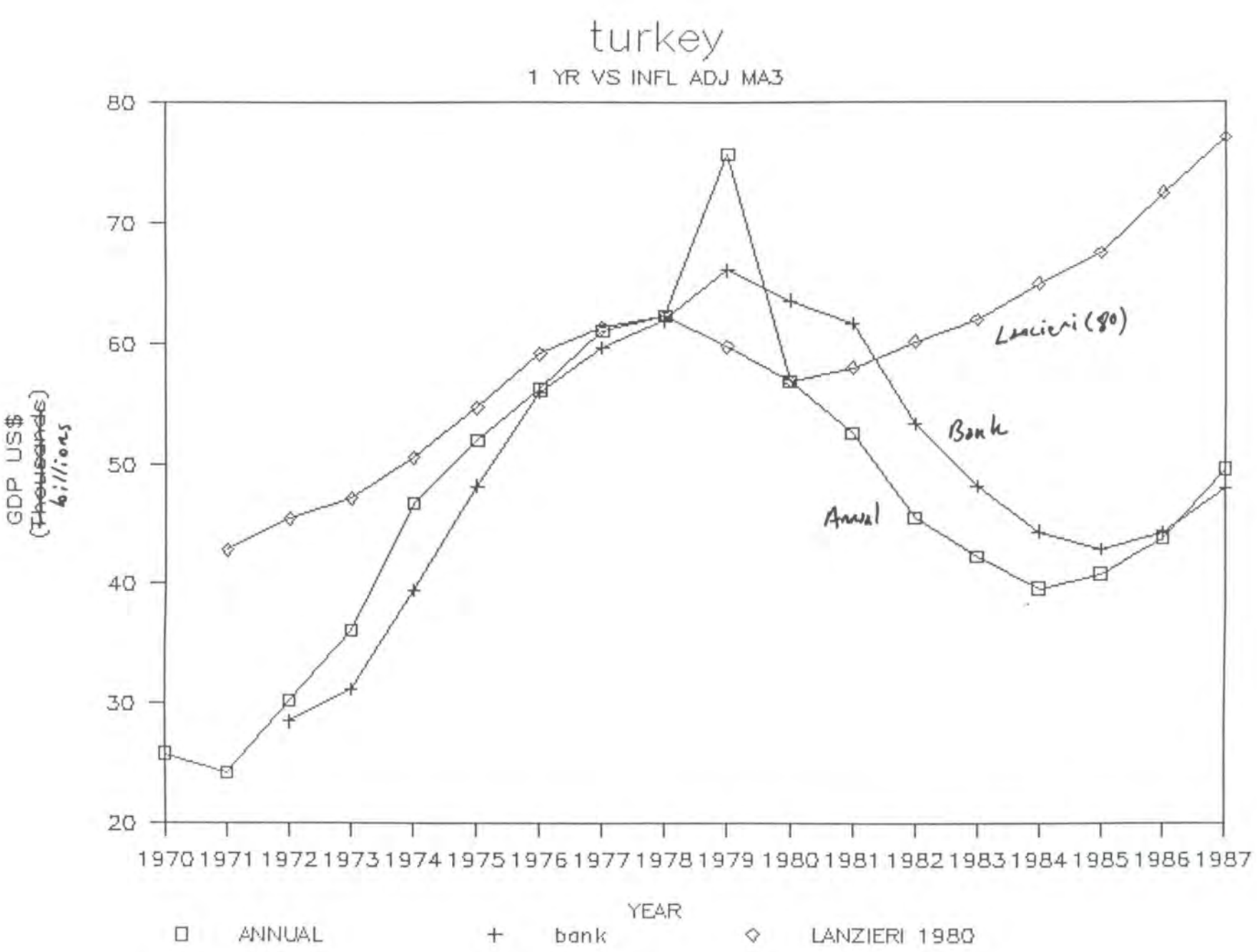
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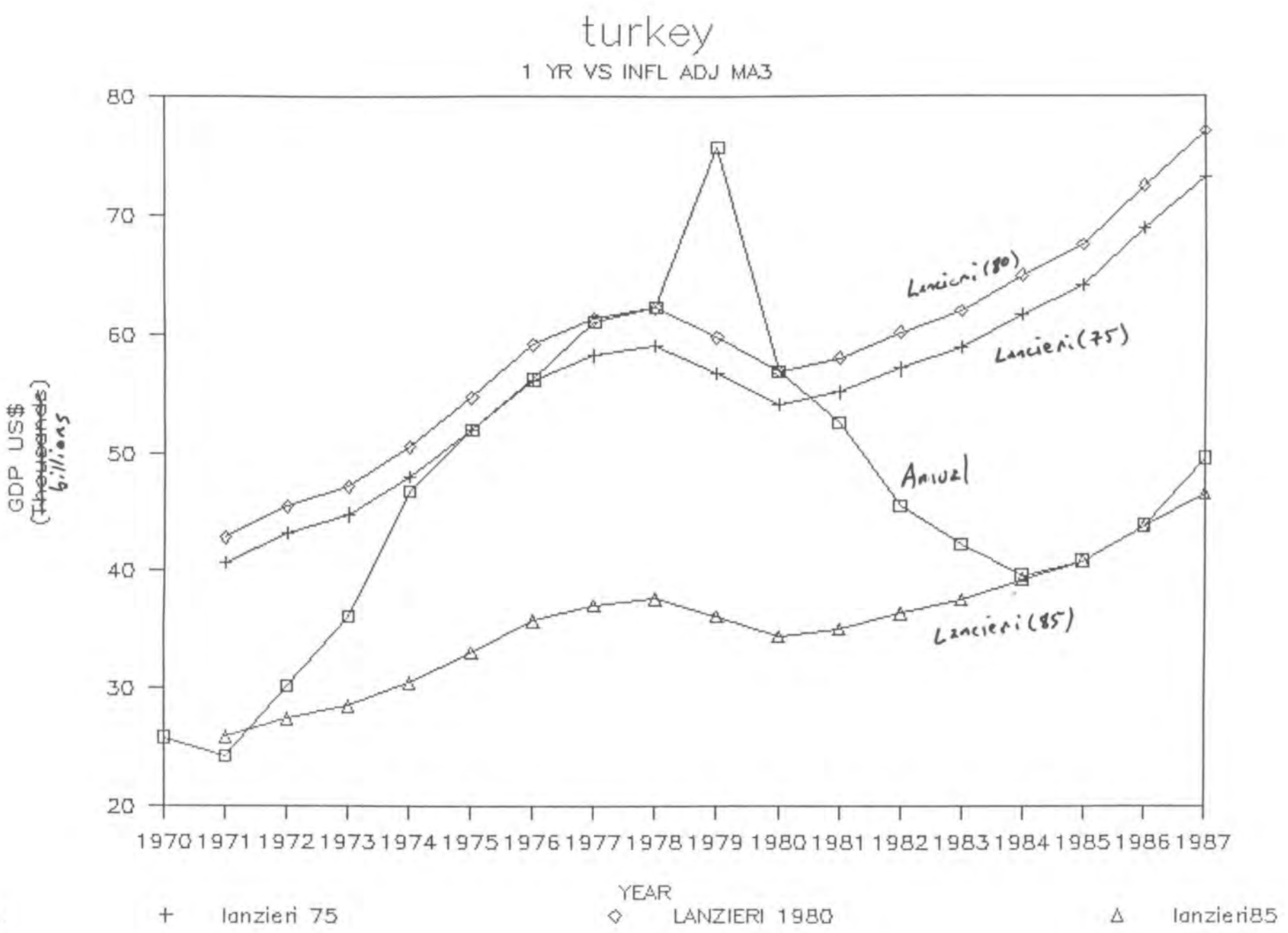
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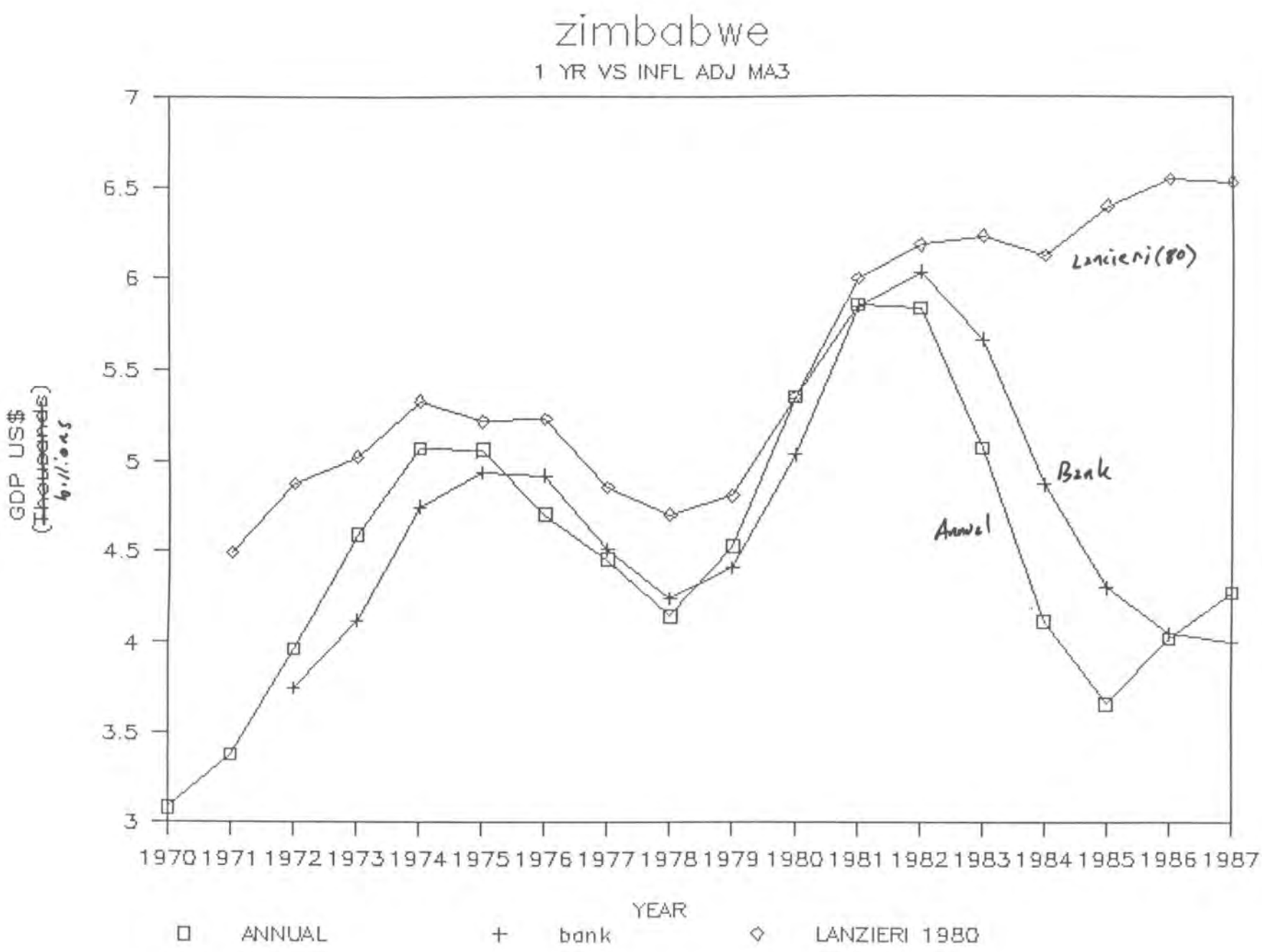
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