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**REVISION OF TIME SERIES IN RUSSIAN NATIONAL ACCOUNTS  
FOR THE PERIOD 1995-2002**

**Special report prepared by the Russian State Committee on Statistics\***

**Summary**

This paper describes the experience of the Russian State Committee on Statistics in revising time series of national accounts in constant and current prices. The main decisions taken are examined, in particular in relation to structural changes and approval of annual and subannual indicators, as well as problems associated with the transition to the new classification of types of economic activity.

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## I. INTRODUCTION

1. In 2003 the Russian State Committee on Statistics published revised time series of national accounts. This was practically the first time that such a large-scale effort had been carried out in the history of the Russian SNA. The previous major revision, dating from 1995, related to nominal and real values of GDP, including its main components, for the period 1991-1994. Subsequently for a considerable period the compilation of series of SNA indicators reflected ongoing statistical changes.
2. The series available at that time generally met the requirements of experts in macroeconomic analysis, including the principal users of macrostatistics - the Ministry of Economic Development and Trade, the Ministry of Finance and the Bank of Russia. These series contained sufficient information for analysis of current trends and the forecasting of such trends. At the same time, the data in these series contained some problems which needed to be addressed from the viewpoint of statistical methodology.
3. One of the main problems was that almost all the indicators were originally constructed on the basis of chaining of data from paired (two consecutive) years. This principle was used to compile all the original data by industry, on which the calculations of national accounts indicators are based. Correspondingly, the national accounts data were also compiled on the basis of real rates and deflators for paired years. In practice the existing series of SNA indicators in this period did not use a fixed base year.
4. The need also arose to refine the economic context of individual indicators of the activities of economic agents; in many cases - to change the information base underlying the macroeconomic indicators. The reason was the rapid change in the regulatory framework governing the activities of economic agents, resulting from the change in the socio-economic structure of Russia. Changes in the methodology used for calculating individual indicators gave rise to a need to revise the retrospective data, both in current and in constant prices.
5. Another important problem was the fact that over almost 10 years the indicators of national accounts included individual changes in data from industrial statistics. Meanwhile, methodological improvements and improvements in calculations in the various sectors of statistics were not always synchronized with one another. As a result the composite national accounts data were sometimes based on heterogeneous basic information, which to different degrees reflected the changes in other sectors of statistics.
6. A substantive result of the revision of the SNA indicators for 1995-2002 was the construction of time series of indicators using base years, and the systemic regulation of different industrial statistical measurements in the framework of national accounts. The indicators used in the production and use accounts were brought methodologically into line throughout the time series, both in current and in constant prices.

7. In conjunction with the revision of annual data, the necessary changes were made in the subannual data. Correlation of the quarterly values of the volume indices and indices of prices with their annual values was carried out for all the indicators in the system.

## II. MAIN CHANGES IN SECTORAL STATISTICS UP TO 2003

8. The updating of industrial statistical information for the period 1995 to 2002 related to the nominal and real values of the indicators and was prompted by a number of factors:

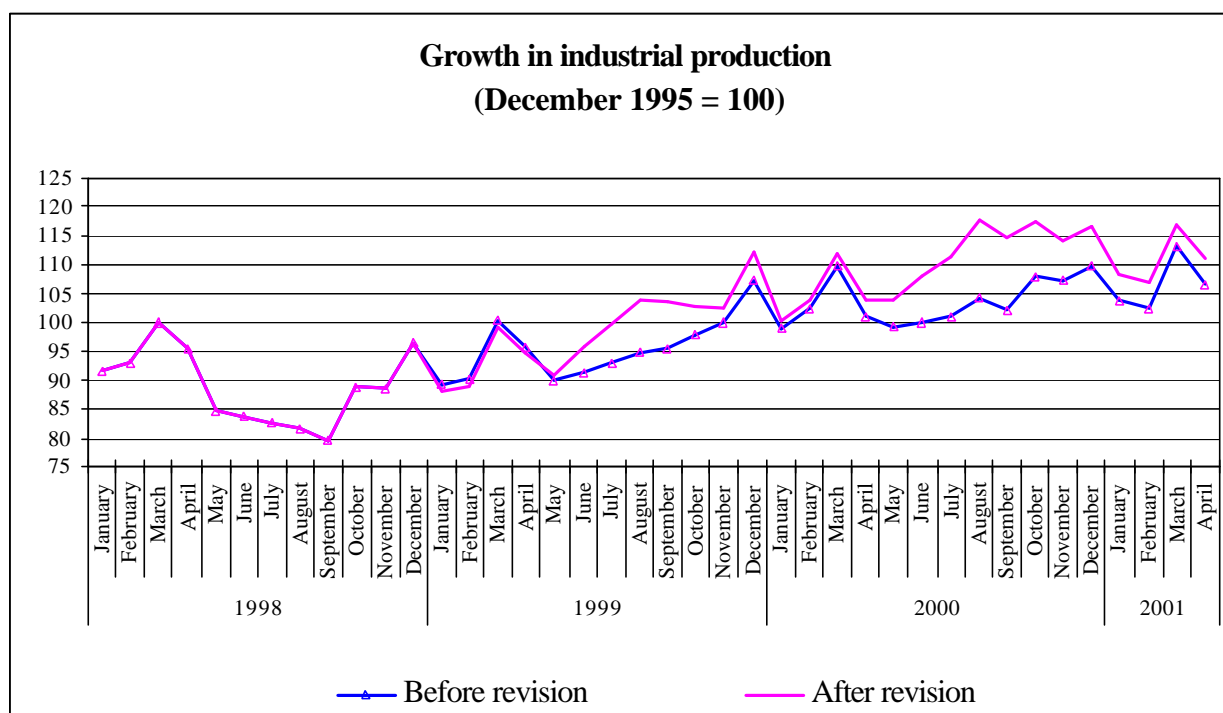
- The receipt of additional sources of information, following the conduct of simultaneous surveys, such as a survey of small enterprises, and a survey of non-profit institutions serving households (2001);
- The revision of time series due to a change in base year;
- Adjustment of the values of individual indicators by enterprises and organizations for preceding years.

9. A survey of small enterprises in all economic sectors in 2002 made it possible to obtain a detailed breakdown of these enterprises by sector, and evaluate the scale of their activities in producing goods and services. On the basis of the results obtained from the survey by individual industries, some changes were introduced in the volume indices for previous years. Thus, for example, in the trade sector, the volumes of retail turnover for the period 1998 to 2001 were increased by 0.2-0.9% in respect of small enterprises, while in a number of service sectors, the volume of these services was modified by 0.5-4% for the same period.

10. In 2001 a revision of the time series of volume indices by branches of industry was carried out, prompted by the change in the base year.

11. When calculating the index of industrial production, 1995 was previously used as the base. The 1998 crisis led to substantial structural shifts, which made it necessary to change the base year. The year 1999 was chosen as the base year, as it was the first after the crisis year with the new industrial structure. As a result of the revision, the indices for 1999-2000 were recalculated using the new base year (1999), and also taking into account the adjusted information on production and distribution of goods and services by month.

12. Revision of the trend in industrial production produced the results set out in the graph below.



13. The indicators of real values of investment in fixed assets underwent substantial changes for 1998 as a whole and by quarter. Adjustment of this indicator was linked with the fact that the fourth quarter of 1998 saw substantial growth in imports of machinery and equipment and the volume of construction work for which payment was made in foreign currency. The price index for construction and assembly work which was used to revalue the actual volume of investment in comparable prices did not take into account changes in prices for imported machinery and equipment, while in August 1998 the rouble fell fourfold against the dollar. Because of the increase in the price deflator, the volume index of investment in fixed assets for 1998 dropped from 93% to 88%, i.e. by 5%.

### III. REVISION OF NATIONAL ACCOUNTS INDICATORS TO ENSURE THEIR METHODOLOGICAL COMPARABILITY THROUGHOUT THE TIME SERIES

14. In Russian practice, the preparation of national accounts for each reporting year is accompanied by a revision of the data from the preceding year to ensure methodological comparability. As a result of this method, the comparability of indicators for paired years is ensured, but the comparability of the economic content of the homogeneous indicators for the entire time series is broken. During the process of revision of the national accounts for the period 1995 to 2002, all accounts in current prices were brought methodologically into line for the entire series.

15. The most significant corrections were linked to changes in the methodology for the calculation of consumption of fixed capital, as well as a change in the method of subannual breakdown of the output of industries providing non-market services, and final consumption expenditure of State institutions.

16. The methodology for calculating consumption of fixed capital that was used until 1998 was based on the indicator of wear and tear of fixed assets, which was imputed in accordance with established rules and reflected in the statistical record as recalculated in annual average prices. The methodology adopted in 1999 takes into account the real pattern of reduction in the technical characteristics of fixed assets during actual periods of their operation, taking into account their age structure. The correction of the values of consumption of fixed capital led to a change in the output and value added of industries providing non-market services, and also the final consumption expenditure of State institutions, calculated as the sum of current expenditure and consumption of fixed capital. The change in the methodology used to calculate consumption of fixed capital reduced the output of education by 6-10%, that of health by 6-7%, and that of culture by over 20%.

17. The subannual breakdown of output and intermediate consumption of non-market services, and also of final consumption expenditure of State institutions and non-profit institutions serving households, was formerly effected on the basis of the actual financing of expenditure from the State budget and did not reflect the actual volumes of services produced by these industries. In the revised series the quarterly output of industries providing non-market services in annual average prices is calculated on the basis of the uniform distribution of the annual values of current expenditure and consumption of fixed capital. The quarterly output of industries in current prices for each quarter is estimated on the basis of the ratios of the consumer price indices for the quarters to the annual average index of consumer prices. This approach made it possible to obtain a more accurate picture of the subannual production of this type of service. Intermediate consumption by these industries by quarters was defined in terms of its share in output recorded in the corresponding year.

18. The revised annual data were basically brought into line with the similar indicators in the input-output tables and the balance of payments for the corresponding period.

19. The scale of the adjustments of the indicators may be gauged from the table below:

**Adjustments of the absolute volume of GDP and its components in  
current prices (as a percentage of the figure published earlier)**

	1995	1996	1997	1998	1999	2000
Gross domestic product	-7.3	-6.4	-5.5	-4.1	1.2	0.0
Final consumption expenditure	-7.2	-7.0	-6.0	-4.6	0.0	-0.5
By households	-5.3	-4.6	-4.1	-2.4	0.2	-1.3
By State institutions	-9.0	-10.4	-9.3	-3.9	-0.9	1.8
By non-profit institutions serving households	-33.4	-29.3	-16.9	-45.3	0.0	0.0
Gross capital formation	-7.2	-10.1	-11.6	-11.4	1.5	0.4
Gross fixed capital formation	-8.2	-11.6	-12.5	-12.5	1.5	7.2
Changes in inventories	-2.2	-0.9	-6.4	-24.8	0.0	-62.2
Net exports	-8.6	-5.2	-29.8	-10.7	0.0	-0.9
Exports	-1.9	-1.6	-3.1	-2.3	0.0	-0.5
Imports	-1.0	-0.9	0.7	0.2	0.0	-6.9

#### IV. SELECTION OF PRICE INDICES AND RECALCULATION OF ACCOUNTS IN CONSTANT PRICES

20. When recalculating the national accounts in constant prices, 1995 and 2000 were selected as base years.
21. Indicators of GDP in constant prices were calculated as follows:
- GDP for each year in current prices was divided into individual value components (production account - by 78 industries);
  - Each component was revalued *in annual average prices of the preceding year*;
  - The components were aggregated at the highest level (production account - 45 industries);
  - Each of the aggregated components obtained was revalued in *base-year* prices on the basis of chain indices.
22. The quarterly values of the GDP indicators were revalued in annual average prices of the current year and constant prices as follows:
- The quarterly values of the indicators for year  $t$  in current prices were revalued in annual average prices for year  $t$  on the basis of coefficients characterizing the relation between prices for the quarter and annual average prices for year  $t$ ;
  - The quarterly values of the indicators for year  $t$  in constant prices were calculated as the quotient from the division of the quarterly value of the indicator for year  $t$  in annual average prices for the preceding year ( $t-1$ ) by the index for the change in prices of the quarter of year  $t$  over the corresponding quarter of the preceding year  
or as the product of the quarterly value of the indicator for year  $t$  in constant prices multiplied by the volume index for the quarter of year  $t$  compared with the corresponding quarter of the preceding year.
23. For the revaluation of the SNA indicators, the methods of deflation and extrapolation were used, and in individual cases the method of direct valuation.
24. In order to recalculate the components of production and use of GDP in constant prices, market goods and services for which price change data were available were evaluated, as a rule, by the deflation method. Thus, for example:
- Construction output was revalued on the basis of the price indices for assembly and other construction work, calculated using technology-related models by industry and data from special surveys of prices for materials and other components of the value of construction and assembly work;

- Output of construction work performed by individuals themselves was revalued using the index of the value of 1 square metre of total (usable) area built under contract for the population;
- Output of passenger transport services was revalued using indices of passenger transport tariffs;
- Communication services were revalued using indices of change in tariffs for communication services;
- Purchases of goods by households were revalued using consumer price indices for goods.

25. Non-market services whose value in current prices is determined by nominal expenditure of the units providing them (including consumption of fixed capital) were valued in constant prices by the extrapolation method using the indices of the numbers of persons employed in institutions providing such services.

26. In order to estimate value added in constant prices, the “single deflation” method was used in most cases. The gross value added for the reporting year in current prices was deflated using the same price index as for output of the same industry. In using the extrapolation method, the volumes of gross value added in the preceding year were multiplied by the indices of change in the numbers of persons employed in the corresponding sectors.

27. To estimate the components of GDP in constant prices, the producer price indices and consumer price indices for goods and services were used. In this case the well-known problem of combining the aims of price statistics and the aims of calculating national accounts indicators was encountered. Indices of producer prices, indices of consumer prices and other price indices which are developed by price statisticians are intended first and foremost for measuring price trends. The deflation of components of GDP has another purpose - eliminating the influence of price changes on the value of these components and defining trends in their physical volume. In this connection, the use of data from price statistics to deflate the components of GDP had to take into account the following factors:

- The absence of suitable price indices for individual components of GDP because of the insufficiently detailed list of product groups in price statistics, and also the absence of prices for non-market services;
- The different coverage of types of activity in SNA indicators, in the volume indices of industries measured by industry statistics and in price indices in price statistics;
- The lack of Paasche price indices, which are better suited for deflation than the existing Laspeyres indices;
- The fact that changes in quality in the broad sense are not fully taken into account in calculating price indices;

- The use of different base periods for volume and price indices. For example, the year 1999 is used to calculate the volume index for industries, but the preceding year is used for calculating the producer price indices.

28. In this way, when revaluing SNA indicators in constant prices, the coverage and methods of calculation of the original statistical data, and in particular the data of price statistics, were analysed, a comparative analysis of the results was conducted and the most acceptable method of tackling each specific task was selected. Adjustments were made where necessary.

29. The types of price indices necessary for estimating GDP in constant prices, and the degree of their disaggregation, were determined in accordance with the classifications of groups of products and industries used in the compilation of production accounts, use-of-income accounts and capital accounts.

30. In order to estimate GDP from the production side in constant prices, the following price statistics were used:

- Producer price indices - industrial output, agricultural output, indices of producer prices in construction;
- Indices of tariffs - for goods transport, for passenger transport, for loading and unloading, for communications services;
- Price indices for rental housing (municipal and private), and for other paid services (education, medical care, legal, etc.);
- Indices of rates of tax on production and imports (by types of tax).

31. To estimate GDP from the use side in constant prices, the following range of indices was used:

- To estimate final consumption of households (in respect of purchases of goods and services) - indices of consumer prices for goods and services;
- To estimate the consumption of services in owner-occupied housing - indices of the volume of housing owned by households;
- To evaluate final consumption of households of self-produced agricultural production - indices of producer prices for agricultural production produced by the population;
- To estimate gross fixed capital formation - price indices for capital investment (including for construction and assembly work, machinery and equipment, other capital operations and expenditure); estimates for livestock were made by means of direct valuation of livestock in prices of the base year;
- To estimate net exports - price indices of exported and imported goods.



32. As a result of the work carried out:
- The indicators of intermediate consumption, output, value added by branch of the economy, final demand, taxes and subsidies on products are estimated in actual prices (tariffs) for the reporting year, annual average prices for the preceding year and annual average prices for the base year;
  - For quarterly indicators, volume indices and deflators are calculated in relation to the preceding period, the base period (the first quarter of 1995) and, taking into account the interests of users, the corresponding period of the previous year.
33. The outcome of efforts to revise the time series is clearly shown in the figure below:



34. Visually the GDP trend after the review has not undergone significant changes, but the rates of change of individual components were substantially corrected, as the data below indicate.

**Adjustments to the volume index of GDP and its components in relation to the preceding year in comparison with the figures published earlier (percentage points)**

	1996	1997	1998	1999	2000
Gross domestic product	-0.2	0.5	-0.4	1.0	1.0
Final consumption expenditure	0.5	-0.2	-0.6	1.5	-1.8
By households	-0.2	-0.4	-1.0	1.1	-2.0
By State institutions	2.3	0.0	0.4	0.0	0.6
By non-profit institutions serving households	1.1	1.0	2.2	12.8	1.4
Gross capital formation	6.6	-0.5	-16.5	-21.9	43.3
Gross fixed capital formation	-1.9	-2.2	-2.6	4.1	4.9
Changes in inventories	48.0	-1.0	6.7	221.2	-924.8
Net exports	0.8	2.9	20.8	6.9	-9.7
Exports	3.1	-1.6	0.0	1.7	-0.3
Imports	3.6	-2.7	-3.8	-7.4	12.2

35. GDP growth is published with and without seasonal adjustment. To depict the seasonally adjusted GDP trend, the standard X-12-Arima program is used.

## V. THE INFLUENCE OF STRUCTURAL CHANGES

36. Overall the work described to recalculate the time series of indicators of Russia's SNA in constant prices proceeded successfully. The most complex methodological problems which had to be addressed during implementation included the issue of the selection of the weighting structure for aggregation of individual components into the composite indicator when compiling a long series.

37. Intensive structural changes were among the major characteristic features of the development of the Russian economy over the past decade. They were manifested in various aspects of economic life - in changes in the real ratios of the volumes of production in the various sectors of the economy, the structure of investment, the structure of prices, consumption and accumulation trends, etc. This was the objective reason for serious problems in the compilation of series in constant prices.

38. Primarily this problem arose when calculating real GDP. As a result of the rather rapid changes in the structure of the economy in current prices, GDP indicators in constant prices could diverge substantially, depending on the type of calculation selected. Thus, in year  $t+2$ , gross domestic product calculated on the basis of the structure of base year  $t$  could differ significantly from the valuation obtained using the structure of weights of year  $t+1$ . In other words, even the choice of the structure of weights from two consecutive years -  $t(0)$  or  $t(1)$  - led to a difference in the results as early as the subsequent year  $t(2)$ , and one which must not be ignored. Thus, for example, when calculating the volume index of GDP for 1997, using the 1995 weighting structure, the growth rate of GDP over 1996 was 101.4%, against 101.0% when the weights for 1996 were used.

## VI. CORRELATION OF ANNUAL AND SUBANNUAL DATA

39. A separate task in the framework of the revision of the series and development of indicators in constant prices was the correlation of annual and subannual data. The main approach was based on the fact that priority is attached to the annual estimates.

40. Since the annual estimates are based on more detailed information on prices and values than the available quarterly information, correlation of the quarterly and annual indices of the physical volume and prices was carried out by adjusting the values of the quarterly changes. The adjustment methodology was based on minimizing the overall divergence of the adjusted estimates from the estimates obtained on the basis of the quarterly statistics prior to the revision of the series. The overall divergence was calculated as the sum of the squares of the divergences for all quarters of the series under consideration.

41. For the newly constructed quarterly series in constant prices, "growth rates compared with the corresponding period" were calculated - data for each quarter were correlated with the data for the corresponding quarter of the preceding year. The key criterion for further

construction of the series was the degree of correspondence between the growth rates obtained and the values published earlier. In other words, the task was to select estimates of quarterly data of the newly formed series for which the growth rates compared with the corresponding period would diverge least from the earlier published values. This approach was dictated by the fact that traditionally in Russian statistics great importance has always been attached to calculation of the growth rate compared with the corresponding period of the preceding year. As a result, for the overwhelming majority of indicators in the basic statistics, these rates are more reliable than, for example, the rates compared with the preceding quarter.

42. To adjust the indicators of the quarterly series, the following well-known approach was used:

$$(6) \quad \min_{t,q} \sum (Xconst(t,q) / Xconst(t-1,q) - rx(t,q))^2 \quad \text{---} \quad \min_{Xconst}$$

$$(7) \quad \sum_q (Xconst(t,q)) = Xb(t) \quad \text{for each } t$$

$Xb(t)$  value in year  $t$  of the indicator ? in constant prices of the base year

$Xconst(t,q)$  value of the indicator ? in constant prices in quarter  $q$  of year  $t$

$rx(t,q)$  real index of the volume of indicator ? in quarter  $q$  of year  $t$  in relation to the level of the corresponding quarter of the preceding year, published prior to the construction of the series

43. Finally, for the quarterly valuations in constant prices  $Xb(t,q)$ , values were selected from the possible  $Xconst(t,q)$  which would, in accordance with (6), minimize the aggregate divergence of the rates of the new series from the rates published earlier. A mandatory condition was equation (7) - the sums of the quarterly values for each year are equal to the corresponding values of the annual series.

44. As a result, all series of quarterly indicators of SNA in constant prices were revised and, correspondingly, the quarterly growth rates of these indicators were adjusted.

## VII. ISSUES ARISING IN THE REVISION OF THE SERIES IN CONNECTION WITH THE INTRODUCTION OF NEW CLASSIFICATIONS

45. The large-scale revision of the series of SNA indicators for the period 1995-2002 is primarily linked to improving the calculation methodology and raising the congruence of the data for various sectors of statistics. At the same time, a wholly new system of classification - the Russian Classification of Types of Economic Activity - is being introduced in Russia beginning in 2003. It is almost completely harmonized with the European classification NACE, and thus differs radically from all classifications previously used in Russia. The Russian

Classification of Branches of the National Economy provided for a higher level of aggregation of types of activities, and was thus significantly narrower than the newly adopted one in terms of the number of industries identified.

46. The transition to the new system of classification is accompanied by significant changes in the information base. In 2003 the structural survey which, up to 2002, was carried out only for industry, construction and transport is being extended to all branches of the economy. This makes it possible to obtain more systematic and consistent information on the status of output being produced by branches of the economy, and thereby to obtain a more complete information base for the compilation of national accounts.

47. From the viewpoint of national accounts methodology, the introduction of the new classification is a major step forward towards the shaping of a statistical system which is in keeping with the statistical standards essential for analysis of a market economy. With the conversion of the original information to an appropriate system of classification, those developing the national accounts hope to obtain fuller information on the structure and scale of the economy.

48. At the same time, the transition to a wholly new classification and new sources of information calls for the solution of a number of methodological and technical problems arising from the specific industrial structure of the Russian economy. In particular, the large-scale diversification of production of Russian enterprises creates some problems related to selection of the accounting unit used for the definition of branches. Even at the highest level of aggregation in the classification of types of economic activity, the degree of specialization of enterprises in most cases stands at 60-80%.

49. At present production and generation-of-income accounts are constructed within the structure of the old classification, while experimental calculation of these accounts will be carried out within the structure of the new classification for 2003 and 2004. Initial publication of the production and generation-of-income accounts for 2002-2004 is scheduled for 2005.

50. The practical introduction of a wholly new classification not only calls for considerable efforts and will take a certain amount of time, but will also raise the question of creating retrospective series of value added in the various industries.

## VIII. CONCLUSION

51. Overall the revision of Russian SNA series for the period 1995-2002 was welcomed by users. A lengthy time series, including subannual changes, was created for the first time. The results of the review were set out fairly fully in the handbook entitled "National Accounts" published in 2003.

52. As a result of the work carried out, changes were introduced in the publication of data. The volume index of GDP and its components in relation to the preceding year was previously published using prices for the preceding period, but this is now done using annual average prices of the base year.

53. The transition to the publication of indices based on annual average prices of the base year created a specific problem with the users, from the standpoint of its use in their models. The system whereby indicators are revalued in constant prices by chaining indices and then linking the sum of the value added and GDP figures obtained is theoretically correct, and enables a system of mutually coordinated indices to be obtained. However, in practice, indices calculated on the basis of prices and structures of the preceding year are more convenient for the purpose of analysing the economic situation and performing forecasting calculations. In a context of substantial structural changes, the influence of the base structure on the results of the valuations can be significant.

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