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### MACROECONOMIC FORECASTS FOR THE EURO-ZONE AND SOME POLICY IMPLICATIONS.

Antoni Espasa, Rebeca Albacete, Román Mínguez and Eva Senra\*

#### Abstract

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This paper deals with the recent evolution, perspectives and some policy considerations for the Euro-Zone on the basis of the analysis of inflation, GDP and Industrial Production in EMU.

The analysis shows that the year on year rates of growth will recover from the third quarter of 2002 for GDP and from October 2002 for Industrial Production. Regarding inflation, the ECB target of 2% will be attained between March and November 2002, but after this month, and during 2003 inflation will be around 2,1%.

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**Keywords:** forecasting, disaggregating, inflation, GDP, industrial production.

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4th march 2002

### **O. Main results and Conclusions**

- I. Inflation in the Euro-Zone: recent evolution, perspectives and some policy considerations.**
- II. Univariate Disaggregated Forecasts for GDP in the Euro-Zone**
- III. Modelling and forecasting MU industrial production index / forecasts from (December 2001)**

## **Abstract**

This paper deals with the recent evolution, perspectives and some policy considerations for the Euro-Zone on the basis of the analysis of inflation, GDP and Industrial Production in EMU.

The analysis shows that the year on year rates of growth will recover from the third quarter of 2002 for GDP and from October 2002 for Industrial Production. Regarding inflation, the ECB target of 2% will be attained between March and November 2002, but after this month, and during 2003 inflation will be around 2,1%.

## 0. MAIN RESULTS AND CONCLUSIONS

This paper points out different forecasting models for inflation, GDP -and its main components from the demand and supply sides- and industrial production .

The main results are as follows.

Looking at the year-on-year rates of growth the recovery on GDP will not start till the third quarter of 2002. For the industrial production the recovery will not take place till October 2002. The recovery will not be very strong and the average annual rates of growth of GDP for 2002 is forecasted as 1.5% and for 2003 as 2.1%. for the industrial production index these rates will have a 1.6% negative value in 2002 and 1.8% in 2003.

During the recession along 2001 the inflation in the euro-zone has been showing systematic increase, due mainly to the behaviour of core inflation and particular in markets for industrial goods excluding energy. This has generated an important adverse inflation differential in these last markets with respect USA. It is expected that the inflation target will be attained between March and November 2002 but after this month and during 2003 inflation in the euro-zone will be around 2.1%. Since credibility of the ECB is of great importance it seems convenient to redefine the inflation target by an interval.

After Maastricht a process of nominal convergency is taking place and countries with lower prices are experiencing higher inflation rates than countries with higher prices. This is what can be expected for the same type of goods and services. Therefore it seems important to follow if nominal convergency is also accompanied by a convergency in quality. In this respect it will be convenient that Eurostat provides data on quality of goods and consumers satisfaction for the EU and for the member countries.

It must be said that for monitoring inflation the measure from HICP are not enough. In particular HICP does not include properly the cost of using houses in property. Consequently construction price indexes constitute an important information source to study the inflation behaviour in a economy. Important improvements on these indexes will be helpful to make appropriate diagnosis on inflation.

The single market for goods and services is a potential factor pushing for higher rates of growth. It also constitutes an structural change which helps to keep inflation low as it seems to be the case during the last three years.

Nevertheless a single market will be deficient if a single financial services market is not operating. Measures to accelerate the introduction of single financial services markets will help to reduce inflation.

In prices of manufactured goods the Monetary Union is experiencing an adverse and consolidated inflation differential with respect USA. This differential has been increasing through 2001, once that the euro had

already been depreciated with respect its initial value in 1999. In order to reduce and eventually to eliminate this differential a higher rate of technology incorporation is required in Europe. Measures promoting this technology incorporation at the firm level will reduce inflation and induce greater economic growth.

Also public investment on more efficient infrastructure will reduce the cost of running the economy and will push growth. A reallocation of the European budget drastically reducing subsidies which only add income to some economic agents and increasing subsidies for public infrastructure projects seem a right measure to adopt.

Measures to promote more adaptable labour markets based on agreements between unions and employers association.

## **I. INFLATION IN THE EURO-AREA: RECENT EVOLUTION AND PERSPECTIVES AND SOME POLICY CONSIDERATIONS.**

### **I.1 Recent Evolution And Perspectives.**

During the last three years the inflation in the euro zone has been showing a systematic increase (see plot 1). Thus the annual rate has passed from an average value of 1.1% in 1998 to a year-on-year rate of 2.1% in December 2001. Non-processed and energy prices have been responsible for this in 2002 -see table 1-, but the main factor behind these higher inflation rates in 2001 has been core inflation. We define it as the resulting inflation after excluding energy and non-processed food prices from HICP, but the results and conclusions are practically the same if the core measure is determined eliminating also processed food prices from HICP. Core inflation in the euro-zone has passed from an average annual rate of 1.1% in 1999 to a year-on-year rate of 2.5% in December 2001 (see plot 2).

The corresponding rates for the US core inflation have been 2.1 and 2.7%. Therefore, the increase in prices during these years in the euro-zone has been general and in the core part of them the increment has been higher than in US.

Core inflation can be broken down in inflation in good markets and in services markets. The core inflation for services in the euro-zone has increased from 1.5%, the annual average rate in 1999, to 2.8% the year-on-year rate in December 2001. The evolution of these rates has been similar in US but from a higher level, going from 2.7 to 4.0% (see plot 4). It is observed then that in spite of the depreciation of the euro with respect the dollar about a 25% during these three years, the inflation in the service sector in the euro zone has maintained a favorable differential of 1.2 percentage points with respect US. This has been so because the service sector is quite closed to the international trade.

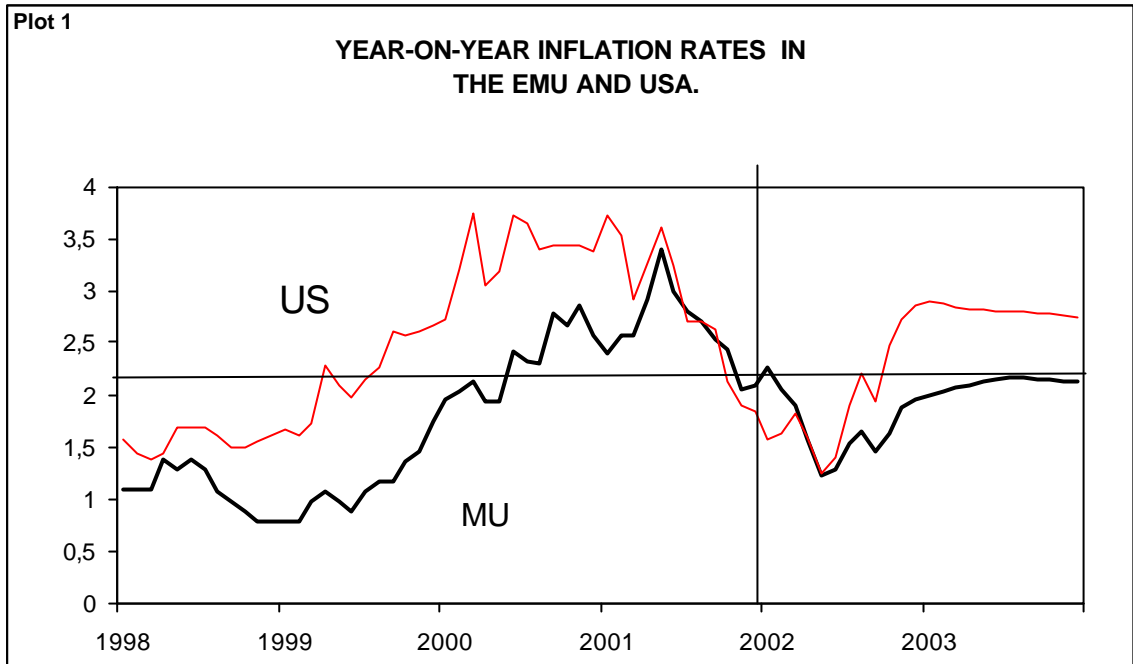
Looking at the core inflation for goods a complete different story is found. In the euro zone this inflation rate has jumped from an annual average rate of 0.7% in 1999 to a year-on-year rate of 1.6% in December 2001. The corresponding rates in US have been 0.7% and a negative one of 0.3%, with a positive average rate of 0.3% in 2001 (see plot 4). This means that the competitive advantage obtained in the euro zone from the depreciation has been undermined by the adverse inflation differential in the sector most widely open to international trade.

Therefore the increase in the inflation rates in the euro zone has been pushed by the core inflation and in particular by the inflation in the good markets generating an important adverse inflation differential in the last prices with respect US, see table 2.

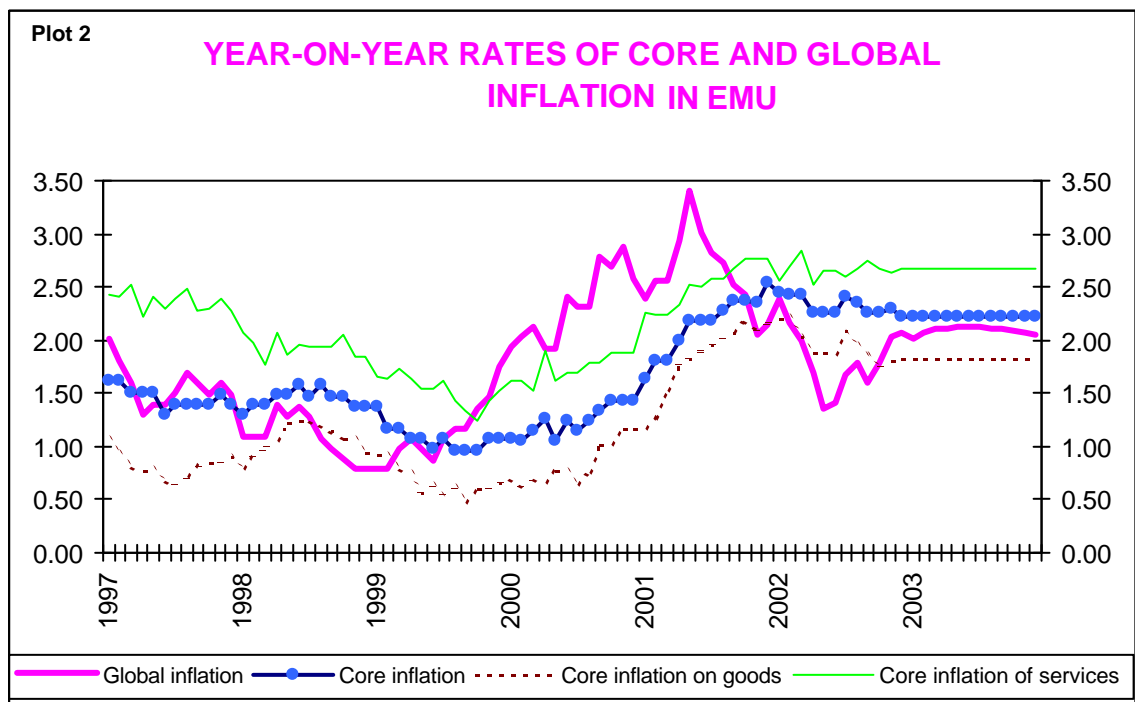
The perspective for 2002 and 2003 (see table 1) are that core inflation decreases by a few tenths of percentage point. The forecasted values for the annual average rates in 2002 and 2003 are 2.3 and 2.2.% respectively. This

minor reduction in the core inflation rate will come from prices on processed food and services, since core inflation in commodities excluding food will increase till an average value of 1.8% in 2002-03.

For global inflation the expectation for the average annual rate is of a reduction in 2002 to a value of 1.8% from the 2.6% observed en 2001, to increase again to level of 2.1% in 2003. Therefore, in contrast with the relatively stable evolution forecasted for core inflation the behavior of global inflation will be quite oscillating, increasing from 2.1% in December 2001 to 2.4% in January 2002 to decrease to values around 1.3% in May-June and to jump again to 2.1% at end of the year, maintaining this level around 2003. Plots 5, 6a and 6b show different path forecasts for global, core and residual inflation at different points in time. Plot 7 and table 3 show the one-period ahead forecasting errors and some summary statistics.



Source: Eurostat, BLS, and IFL. Date: 24<sup>th</sup> January, 2002



Source: Eurostat & IFL Date: 24<sup>th</sup> January 2001



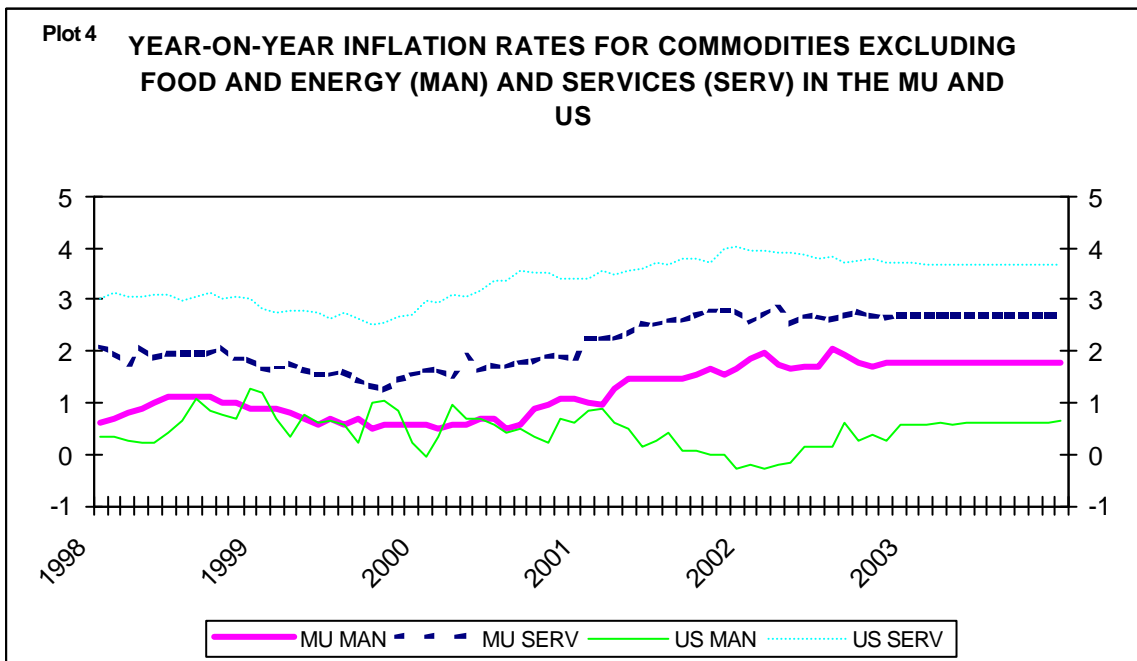
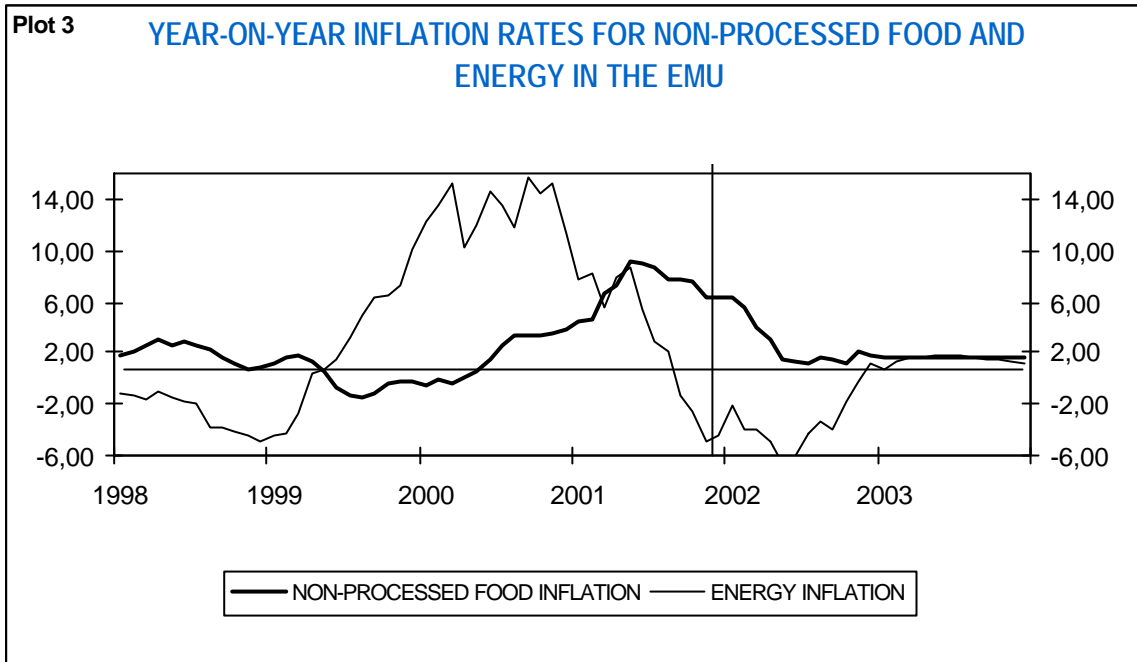


Table 1

AVERAGE ANNUAL INFLATION RATES IN THE EURO - ZONE						
	1998	1999	2000	2001	Forecasts	
					2002	2003
<b>17.462%</b> <b>Residual Inflation</b>	-0.3	1.2	7.6	4.8	<b>-0.6</b>	<b>1.5</b>
7.981% Non-Processed Food	2.0	0.0	1.7	7.2	2.6	1.6
9.481% Energy	-2.6	2.4	13.3	2.8	-3.4	1.4
<b>82.538%</b> <b>Core Inflation</b>	1.5	1.1	1.2	2.1	<b>2.3</b>	<b>2.2</b>
12.309% Processed Food	1.4	0.9	1.1	2.9	2.4	2.0
32.102% Non-Energy Commodities	0.9	0.7	0.7	1.4	1.8	1.8
38.127% Non-Energy Services	1.9	1.5	1.7	2.5	2.7	2.7
<b>100%</b> <b>HICP Inflation</b>	1.1	1.1	2.3	2.6	<b>1.8</b>	<b>2.1</b>

Source: EUROSTAT & INSTITUTO FLORES DE LEMUS, Carlos III University / Date: 24th January, 2002

### TERMINOLOGY USED:

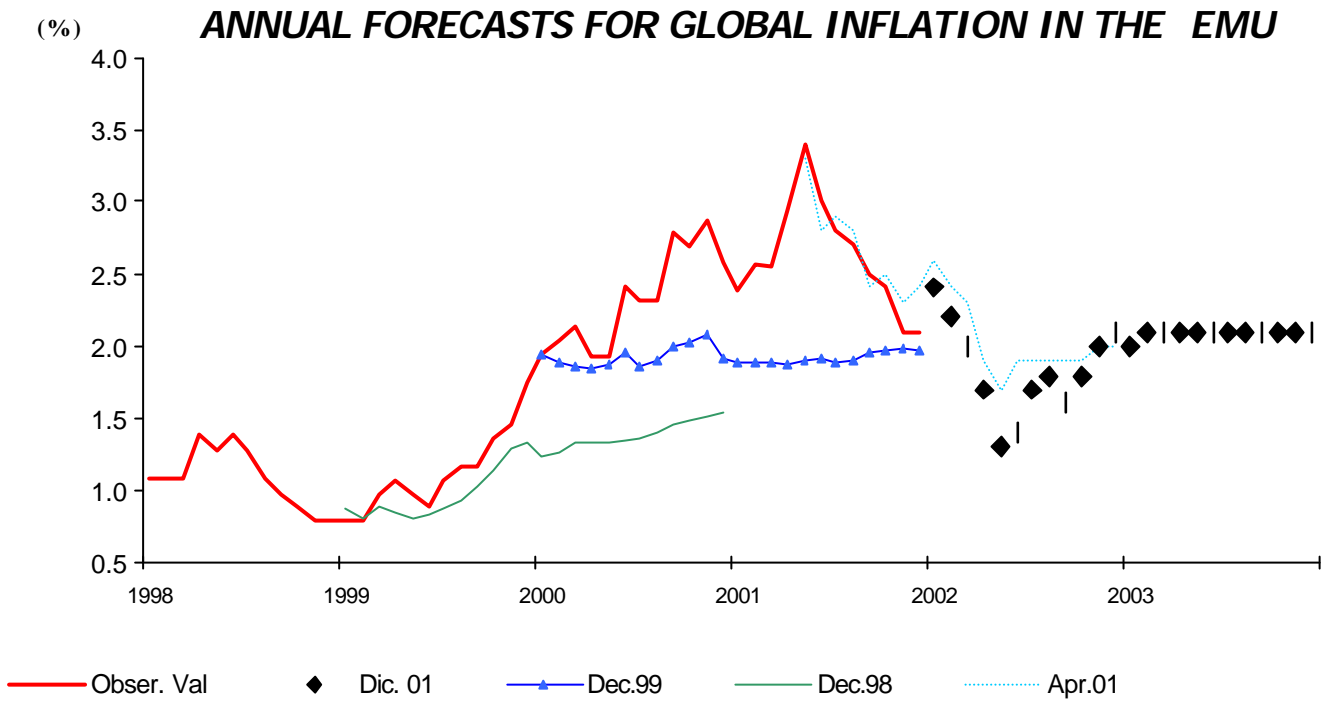
In inflation analysis it is advisable to break down a consumer price index for a country or an economic area in price indexes corresponding to homogenous markets. An initial basic breakdown used in this report is 1) Non-processed Food price index (ANE) 2) Energy price index (ENE), 3) Processed Food (AE), 4) Other commodities (MAN) and 5) Services (SERV). The first two are more volatile than the others, and in Espasa et al. (1987) a **core inflation** measure exclusively based on the latter ones was proposed.

Table 2

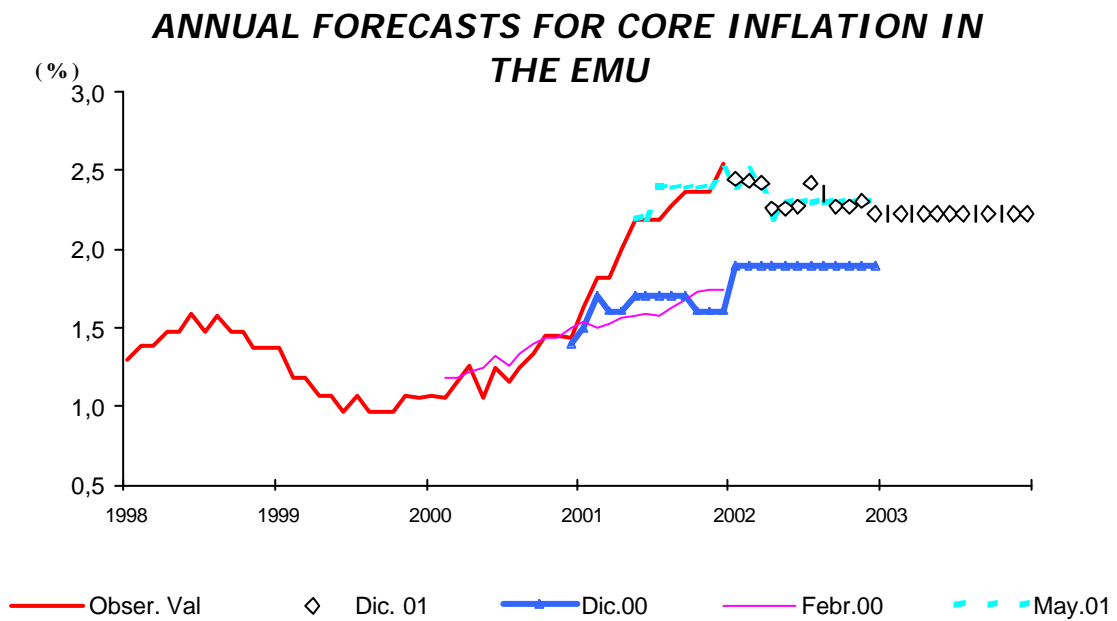
**COMPARATIVE SUMMARY OF THE INFLATION FORECASTS IN THE  
EURO-ZONE AND USA.**

INFLATION FORECASTS IN THE MU AND USA (1998-2003)						
	1998	1999	2000	2001	Forecasts	
					2002	2003
<b>GLOBAL INFLATION</b>						
Euro-zone.	1.1	1.1	2.3	2.6	<b>1.8</b>	<b>2.1</b>
USA.	1.6	2.2	3.4	2.8	<b>1.7</b>	<b>2.9</b>
<b>CORE INFLATION</b>						
Services and Non-energy industrial goods excluding food.						
Euro-zone	1.5	1.1	1.2	2.1	<b>2.3</b>	<b>2.2</b>
USA.	2.3	2.1	2.4	2.7	<b>2.8</b>	<b>2.8</b>
<b>DIFFERENT COMPONENTS OF CORE INFLATION</b>						
(1) Services						
Euro-zone	1.9	1.5	1.7	2.5	<b>2.7</b>	<b>2.7</b>
USA.	3.1	2.7	3.3	3.7	<b>3.8</b>	<b>3.7</b>
(2) Non-energy industrial goods excluding food.						
Euro-zone	0.9	0.7	0.7	1.4	<b>1.8</b>	<b>1.8</b>
USA.	0.6	0.7	0.5	0.3	<b>0.1</b>	<b>0.6</b>
<b>INFLATION IN EXCLUDED COMPONENTS FROM CORE INFLATION</b>						
(1) Food.						
Euro-zone	1.6	0.6	1.3	4.6	<b>2.4</b>	<b>1.8</b>
USA.	2.2	2.1	2.3	3.1	<b>2.4</b>	<b>2.7</b>
(2) Energy						
Euro-zone	-2.6	2.4	13.3	2.8	<b>-3.4</b>	<b>1.4</b>
USA.	-7.8	3.6	16.9	3.8	<b>-10.3</b>	<b>3.8</b>

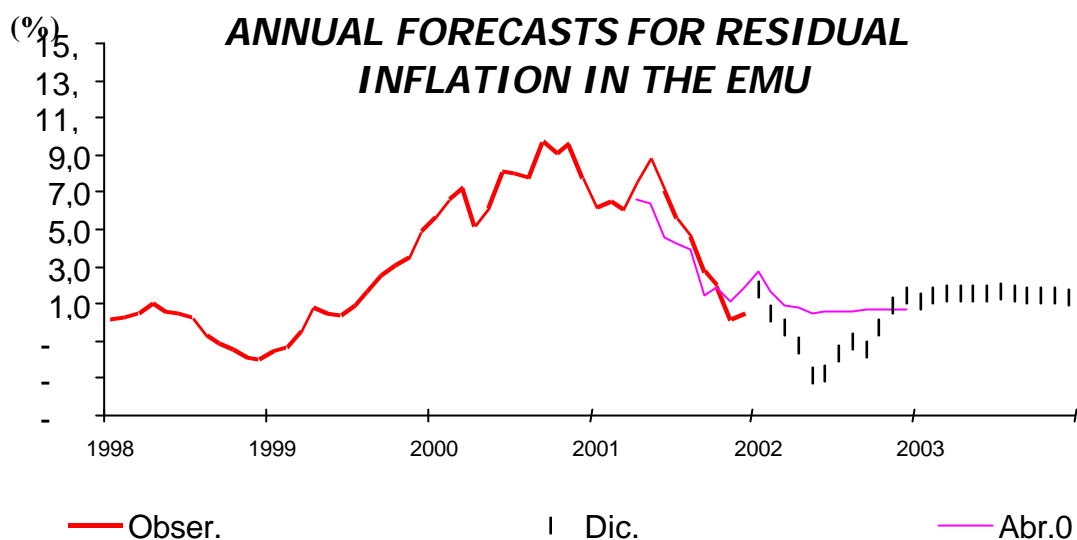
Source : Eurostat, BLS & IFL Carlos III University. Date: 24th January , 2002



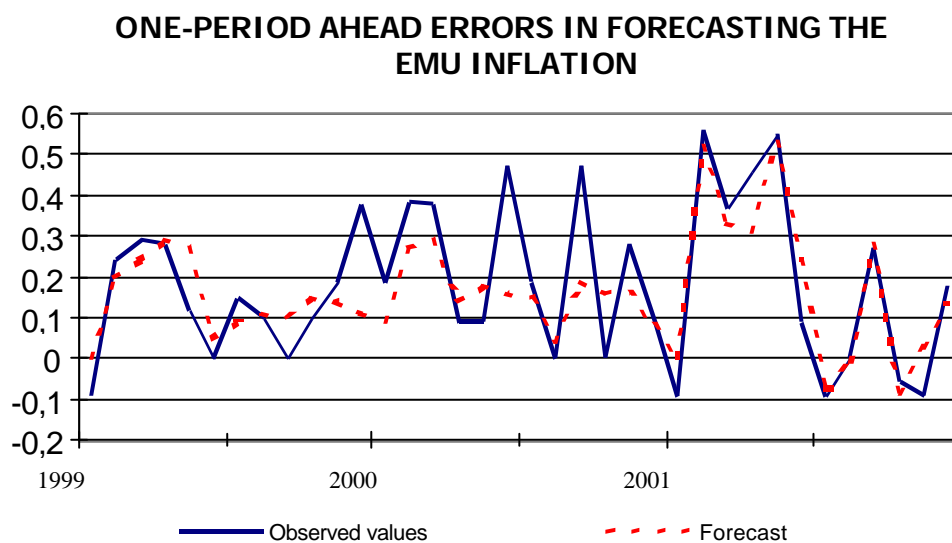
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Source: I. FLORES DE LEMUS  
Date: 22/01/02



Source: INE & I. FLORES DE LEMUS.  
Date: 22th, January 2002.

Table 3

ONE-PERIOD-AHEAD ERRORS IN FORECASTING EMU INFLATION				
	1999	2000	2001	Total
<i>Mean Error</i>	0,00	-0,06	0,01	-0,02
<i>Mean Absolute Error</i>	0,08	0,12	0,06	0,08
<i>Standar deviation (DT)</i>	0,11	0,14	0,08	0,11
<i>Percent Error</i>				
> 1 DT	16	25	33	25
> 2DT	8	8	0	5
> 3DT	0	0	0	0

Source: INE & I.FLORES DE LEMUS.

Date: 22th, January 2002.

The plots above indicate that a good part of the increase in global inflation along 1999, which was due almost exclusively to energy prices, was forecasted, but the increments of the last months of this year were not captured by the model.

In increment in core inflation in 2000 was also capture by the model quite well in advance. Based on February 2000 the model forecasts a continuous increasing path during 2000-2001 for core inflation, but the observed path for 2001 was much more pronounced, due to the behaviour of all prices contributing to core inflation: processed-food, other goods and services. Nevertheless from May 2001 the model forecasted the remaining part of the core increasing path and at the same time that was pointing out a turning point for very early 2002, which implied just a minor decrease in the core inflation.

The path of global inflation was not well forecasted during 2000 and first quarter of 2001. But the in April 2001 the model forecasted very well the peak observed in May and the subsequent pronounced decrease. We can conclude that the unexpected behaviour of energy prices during 2000 was responsible for the forecasting error in the path of global inflation during this year and the unpredicted behaviour of core inflation during the first four months of 2001 was responsible for the errors in forecasting global inflation during this period. From April 2001 the forecasting behaviour of the model has been quite good.

## I.2 Some Policy Considerations

The forecasts for 2002 and 2003 imply that the inflation target established by the ECB will only be attained during the period March to November 2002. And this would be so due to two main factors. One is the favorable behavior of non-processed food prices for which the year-on-year rate of growth will decrease from values over 9% in the middle months of 2001 to values around 1.5% since May 2002 onwards. The other force pushing down global inflation in most part of 2002 would be the price of energy. In it the average annual rate of growth will decrease to a negative value of 3.4% in 2002 from a positive value 2.7% in 2001. Therefore, the fulfillment of inflation target in most of the months in 2002 is exclusively due to the behavior of the most volatile prices in the economy, non-processed food and energy, which in the HICP weight around 17.5%. Core inflation has not been below 2% since April 2001 and is not expected to be during 2002 and 2003. Therefore the fulfillment of the inflation target is not very firm. In fact, in December 2002 it is expected that energy prices recover again positive year-on-year rates of growth which will be maintained during 2003 around a mean of 1.4%, and this will push global inflation at 2.1%, very close to the core inflation rate.

These results show that the 2% inflation target is not consolidated at medium term. This opens the question if this target should be taken seriously. As far as it has been adopted in such terms by the ECB, which is a very young institution which needs to get the credibility of economy agents, there is no much room for no much time in a flexible interpretation of the inflation target and the target once has been defined must be taken seriously.

Nevertheless, the goodness of an inflation target is possibly the same or even higher when the target is defined, explicit or implicitly, by an interval. In this sense, it is practically equal to have in 2003 an inflation in the euro zone just below 2% than just above it, as forecasted. The big difference relies on the question of how it could affect to the credibility of the ECB. The definition of the inflation target gets more relevance if we consider that HICP most probably measures inflation with a positive bias due to quality improvements not only in commodities but also in many services. If this is the case, it seems convenient that once the inflation target will be achieved in the next few months, the ECB reconsiders a new definition of the inflation target which contemplates an interval value.

In measuring inflation the HICP has an important inconvenient because it does not include properly the cost of using the own house. Therefore in following the evolution of prices in the euro-zone economy an index of construction prices is required. Those prices have been increasing recently faster than the HICP and this explains why many people-specially young people-experience that inflation from HICP must be downwards biased as a general measure of inflation. It seems advisable that Eurostat starts to take steps to provide reliable information on construction price indexes. The problem is complex because the quality of the construction affects in a great deal to prices.

By countries the inflation situation is as follows. In the average annual rate the inflation target in 2001 was not achieved by anyone except France (1.8%). Other six countries, Germany (2.4%), Austria (2.3%), Belgium (2.4%), Finland (2.7%), Italy (2.7%) and Luxembourg (2.4%) registered inflation rates below 3% and the remaining five, Spain, The Netherlands, Ireland, Portugal and Greece had inflation rates between 3.7 and 5.1%.

Therefore, the lack of success in attaining the inflation target was general by sectors through the whole euro zone: processed goods and services excluding energy - on which core inflation is calculated -, non-processed food and energy, and quite general through countries. The expectations are that in most of the months of 2002 the target will be attained due to the behavior of non-processed food and energy prices, but from December 2002 the year-on-year inflation rate will be around 2.1%, due to the stable behavior expected for core inflation with an annual rate around 2.3 - 2.2%. By countries it is expected that in the annual averages corresponding to 2002 and 2003 the target would be fulfilled in seven countries, Germany, Austria, Belgium, France, Finland, Italy and Luxembourg, which weight around 79% of the total in the euro zone inflation. For four of the other five, which are the ones experiencing more inflation at present, the expectations are in general, that they will registered in 2002 and 2003 average annual rates below the corresponding ones observed in 2001 but still above 3%.

These results seem to point out that before Maastricht a convergence process on inflation took place, but once the Monetary Union has been operating the convergency could be in the price levels. For the same goods and services this is the result which could be expected, but in most of the countries with higher inflation, Spain, Ireland, Portugal and Greece, the quality of goods and services could be different from the other countries of the Union. Then the convergency in prices would be worrying unless a parallel convergency process on quality will also taking place. Statistics about quality and consumers' satisfaction in goods and services seem necessary in order to evaluate the impact of quality improvements in the possible bias in measuring inflation and in the process of price convergency through the Monetary Union.

A disaggregated analysis of inflation, as the one we do in this paper, provides good accuracy in forecasting, as it has been discussed above, gives hints for pointing out the main factors causing inflation and provides a detailed evolution of inflation through the different markets which is useful for policy considerations. The above disaggregated analysis shows that the increase in inflation during 2000 in the EMU was mainly due to imported inflation, but non-monetary domestic factors were responsible for the increase in 2001. Therefore the fight against inflation should be directed through those factors. Thus the single market for goods and services is a potential factor pushing for higher rates of economic growth and it also constitutes an structural change which helps to keep inflation low as it has been the case during the last three years. Nevertheless, a single market will be deficient if a single financial services market is not operating. Measures to accelerate the introduction of single financial services market will help to reduce inflation.

In prices of manufactured goods the Monetary Union is experiencing an adverse and consolidated inflation differential with respect USA. This differential



has been increasing through 2001, once that the euro had already been depreciated with respect its initial value in 1999. In order to reduce and eventually to eliminate this differential a higher rate of technology incorporation is required in Europe. Measures promoting this technology incorporation at the firm level will reduce inflation and induce greater economic growth.

Also public investment on more efficient infrastructure will reduce the cost of running the economy and will push growth. A reallocation of the European budget drastically reducing subsidies, which only add income to some economic agents, and increasing subsidies for public infrastructure projects seem a right measure to adopt.

Measures to promote more adaptable labour markets based on agreements between unions and employers association will also promote growth and reduce inflation.

## II. UNIVARIATE DISAGGREGATED FORECASTS FOR GDP IN THE EURO - ZONE

The behaviour of the GDP for the euro-zone during the last ten years has been remarkably stable as it can be seen in plot 8 which shows (a) the logarithmic transformation of the GDP and the corresponding (b) quarterly and (c) annual differences. In plot (a) we can appreciate a downward permanent movement in the level of GDP in the first quarter of 1993 of around 2-3% and a transitory one of a lower magnitude in the first quarter of 1997. The firmly stable evolution of GDP is better seen in plot (b), where seasonal oscillations seem quite fixed, mainly if we apply adequate corrections for the dates just mentioned.

This visual appreciation is confirmed estimating an ARIMA model for GDP. The model contains a positive unit root, but a second one and three possible seasonal unit roots are rejected. This model has a residual standard deviation is 0.36% which is lower than the historic standard deviation for GDP in US. This model also shows that transitory or permanent corrections in the level of magnitudes between 0.9% and 2.3% are relatively frequent: three ( in the first quarter of 1992,1993 and 1997) in 43 observations. At least in part, and specially for the transitory corrections of 1992 and 1997, these changes in level can be due to the procedure employed to aggregate the corresponding national GDP`s. In any case the data shows that the relatively stable evolution is interrupted by extraordinary shocks around 7% of the times. In one case the shock (negative) was permanent and took place during 1993 recession. All this means that standard models will not be able to forecast the extraordinary moments of GDP and unfortunate they are more like to appear around turning points in the rate of growth.

The univariate forecasts of GDP turns to be quite accurate historically with errors with an standard deviation of 0.4%. But they do not give information about how the different demand components are responsible for the aggregate values. It is convenient then to forecast GDP from forecasts of its components. For this purpose we breakdown GDP in final consumption, gross investment, imports and exports. If we were to work with single univariate equation models for each component, an important piece of information about the interrelations between these components could be lost. On the other hand, working with a vector model it turns to be quite difficult to get an specification which beats the univariate forecast accuracy of the GDP model. The question could rely on the fact that the cross-dynamics between components could be quite complex to be detected with a relatively short sample.

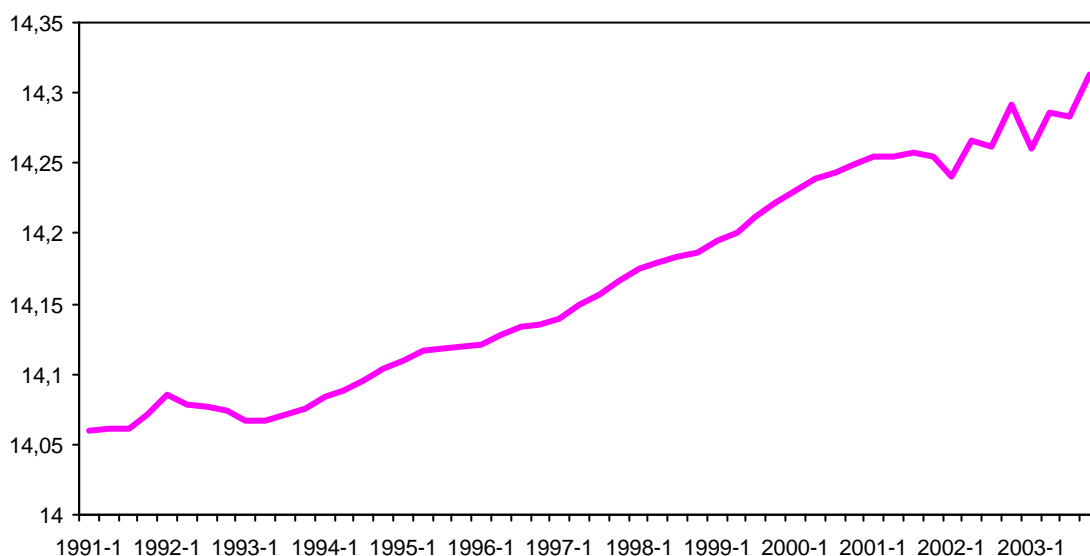
An intermediate alternative to the two options mentioned above is to use single equation models for each component but adding in each one the expected value of GDP estimated from its univariate model. Proceeding in this way the accuracy in forecasting GDP is the same than with univariate forecasts. In table 4 and plots 8(c) and 8(d) we have the GDP forecasts for 2002 and 2003.

It can be seen in the table that the year-on-year rate growth of the GDP will continue decreasing in the first two quarters of 2002 with values around 1%. But looking at the quarter-on-quarter rate of growth corrected from seasonal oscillations the quarter with minimum growth was 2001 (III), even when the recovery becomes firm is only from the third quarter of 2002. In this quarter all the components are recovered, consumption, gross investment and net exports but with moderate rates of growth: 2% consumption and just 1.1% in gross investment.

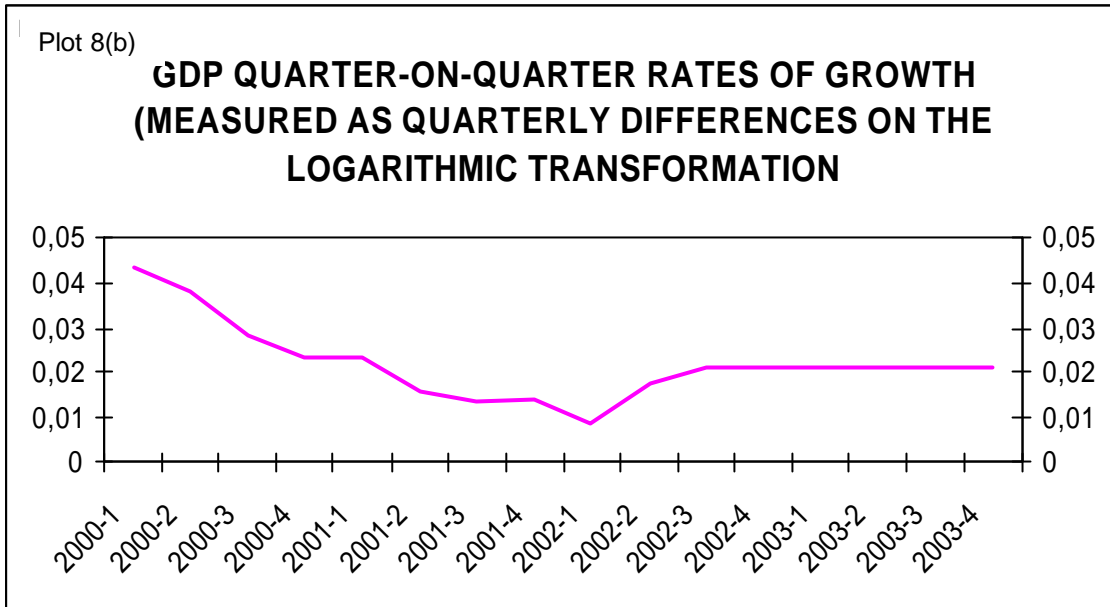
Table 5 contains a summary of macroeconomic forecast and plot 8(e) shows the year-on-year rate of growth of GDP, Domestic Demand and Net Exports.

Plot 8(a)

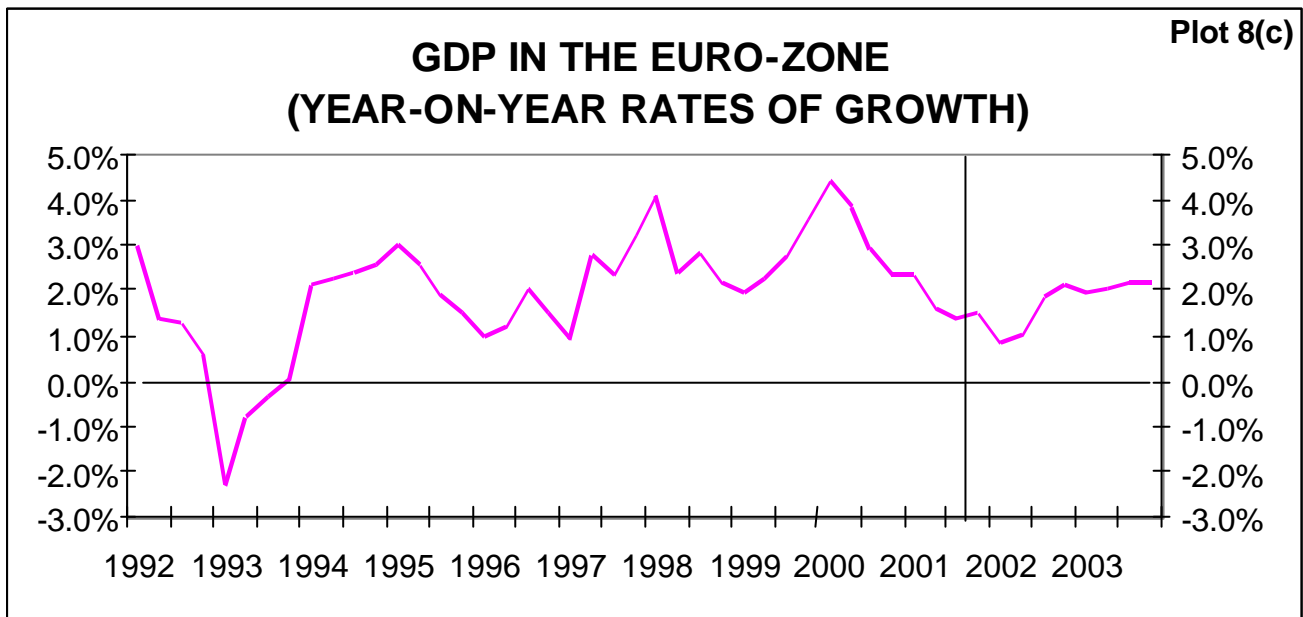
**GDP EURO-ZONE  
(Logarithmic Transformation)**



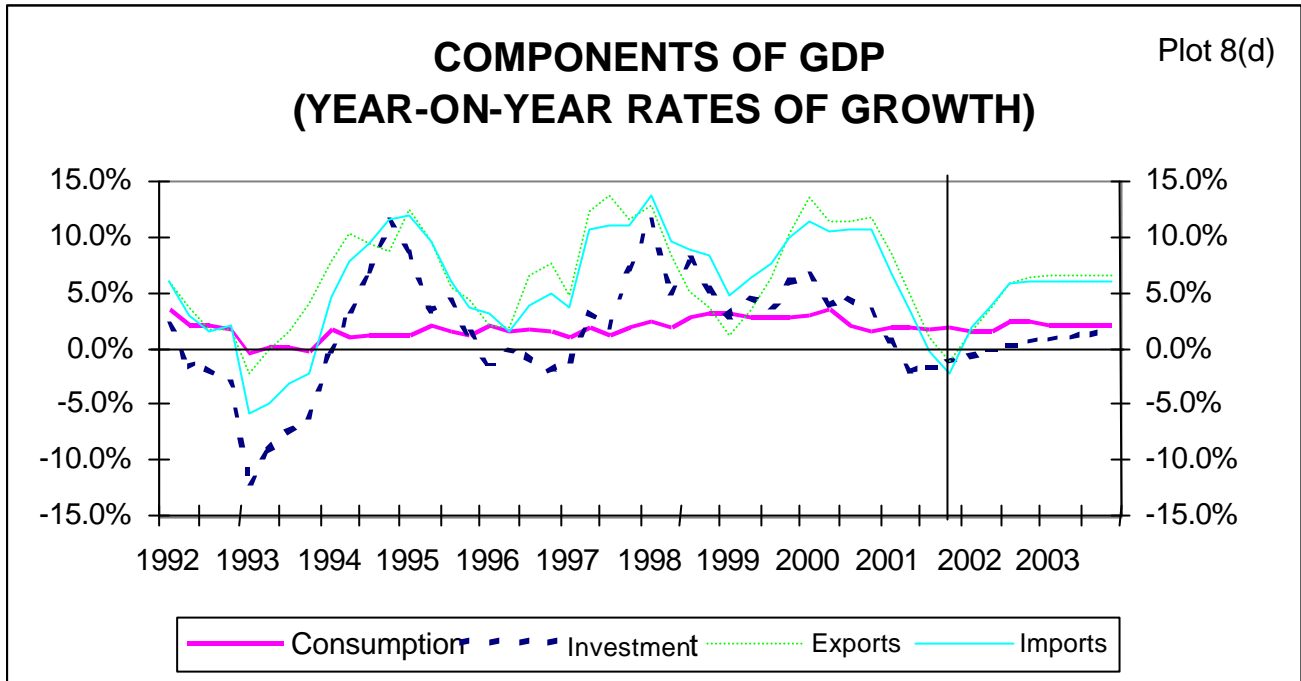
Source: Eurostat and Instituto Flores de Lemus./Date: April, 4 2001



Source: Eurostat and Instituto Flores de Lemus.  
Date: April, 4 2002



Source: Eurostat & IFL Carlos III University



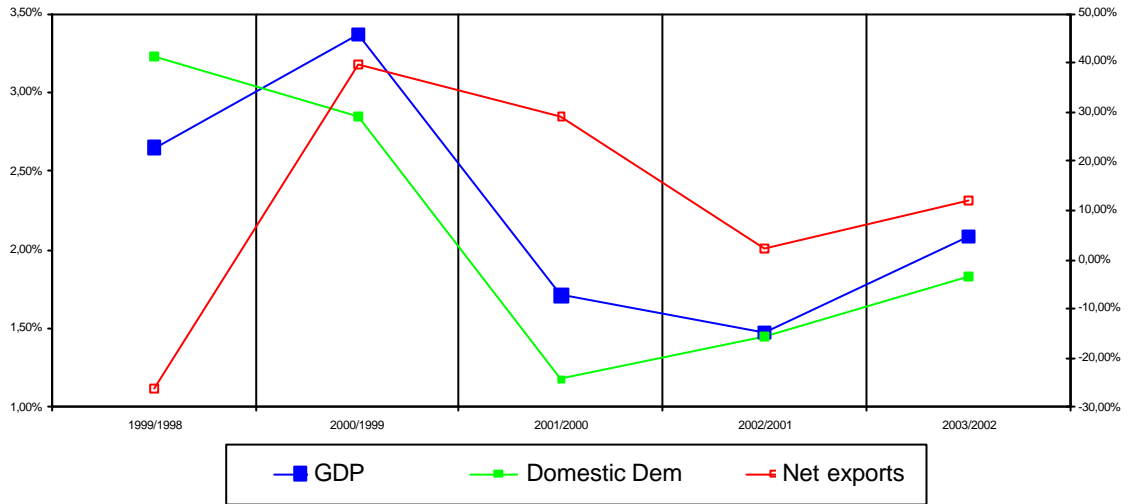
Source: Eurostat & IFL Carlos III University  
 Date: Febraury 21 th, 2002

Table 5

## MACROECONOMIC TABLE OF EURO-ZONE

	Annual Averages Rate of Growths			
			Forecasts	
	2000	2001	2002	2003
<b>GDP pm</b>	3.37	1.7	1.5	2.1
<b>Demand</b>				
Final Consumption	2.36	1.9	1.9	2.0
Gross Investment	4.34	-1.2	-0.1	1.1
Domestic Demand	2.80	1.2	1.4	1.8
Exports of Goods and Services	12.20	3.1	4.3	6.4
Imports of Goods and Services	10.91	1.7	4.4	6.0
Net Exports	42.56	29.0	2.5	11.9
<b>Supply (basic prices)</b>				
Gross Value Added Agriculture	-0.09	0.4	1.6	1.7
Gross Value Added Industry	4.44	1.5	1.1	1.6
Gross Value Added Construction	1.50	-1.5	-0.1	0.4
Gross Value Added Services	3.61	2.4	2.1	2.5
<b>Prices</b>				
CPI harmonized, annual average	2.33	2.6	1.8	2.1
CPI harmonized, Dec./Dec.	2.58	2.1	2.1	2.1
<b>Others Economic Indicators</b>				
Production Index of Industry (excluding construction)	5.3	-0.3	-1.6	1.8

**AVERAGE ANNUAL RATE OF GROWTH OF  
EMU GDP**



Rates of growth for GDP and domestic demand follow the scale on the left and the rates of growth for net exports the scale on the right.

### **III. MODELLING AND FORECASTING EMU INDUSTRIAL PRODUCTION INDEX (Forecasts from December 2001)**

#### **3.1 Main Results**

The Industrial production index (IPI) in the euro-zone can be analyzed disaggregating it by production sectors according to the destination of the goods produced, see plot 9A. This approach is useful because the production in these sectors are not fully cointegrated in trend nor in seasonality and with the disaggregated data we have very relevant information to capture the different common factors leading the trend of the aggregate and the different common factors leading the seasonality.

Since 1995 the IPI in the euro-zone has shows two business cycles, see plot 9B. In the last one the turning point at the peak took place in the year-on-year rate of growth in January 2001. According to our forecast the turning point at the bottom has taken place in January 2002. During this recession period the year-on-year rate of growth has decrease from a positive value of 7.8% in December 2000 to or negative value of 6.0% in December 2001. This means that, even with the mentioned forecast, this recession has been harder than the previous one, where the negative rate just arrived to some tenths of percentage point.

The perspectives of the recession has been deteriorating each time that a new data appeared. This was not due only to new data but also to important downwards revisions of previous data. Plot 9C shows two forecasts made with information till July and Decembe2001, respectively. It can be seem that with information till July the forecasts pointed to positive year-on-year rates from March 2002. Updating the forecasts with the information available at present - data till December 2001 - positive rates are not obtained till October this 2002. This worsening of expectations can also be observed from the publication Consensus Forecasts. In its January 2002 issue the expectation for 2002 for the German industrial production index was of a negative annual rate of 0.8% in contrast with a positive value of 1.6% three months before.

Our updated forecasts indicate that recovery which would have started in January 2002 will continue till getting a 1.8% year-on-year rate of growth around April 2003. This implies average annual rates of growth of minus 1.6% and 1.8% for 2002 and 2003, respectively, see table 6.



Table 6

<b>AVERAGE ANNUAL RATES GROWTH OF GDP AND INDUSTRIAL PRODUCTION (EXCLUDING CONSTRUCTION) IN EMU</b>					
	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>
GDP	2.6	3.3	1.7	1.5	2.1
IPI	1.8	5.3	-0.3	-1.6	1.8

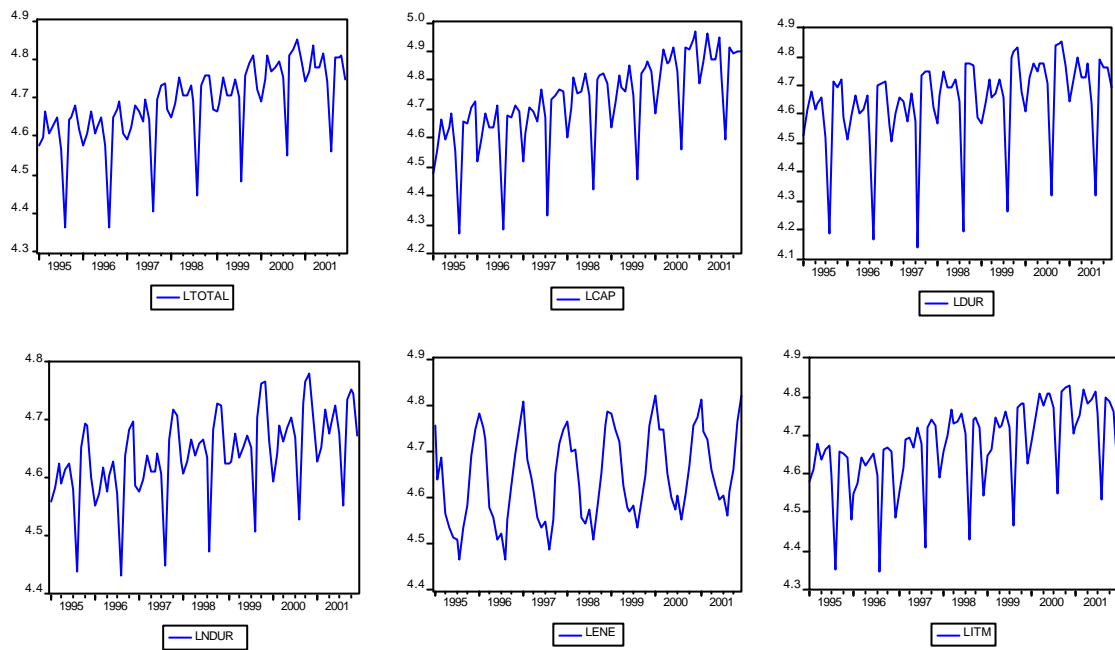
### **3.2 Industrial Production data**

Industrial Production Index for the Monetary Union is a monthly indicator provided by Eurostat and aggregated from the different country members data with a Laspeyres scheme.

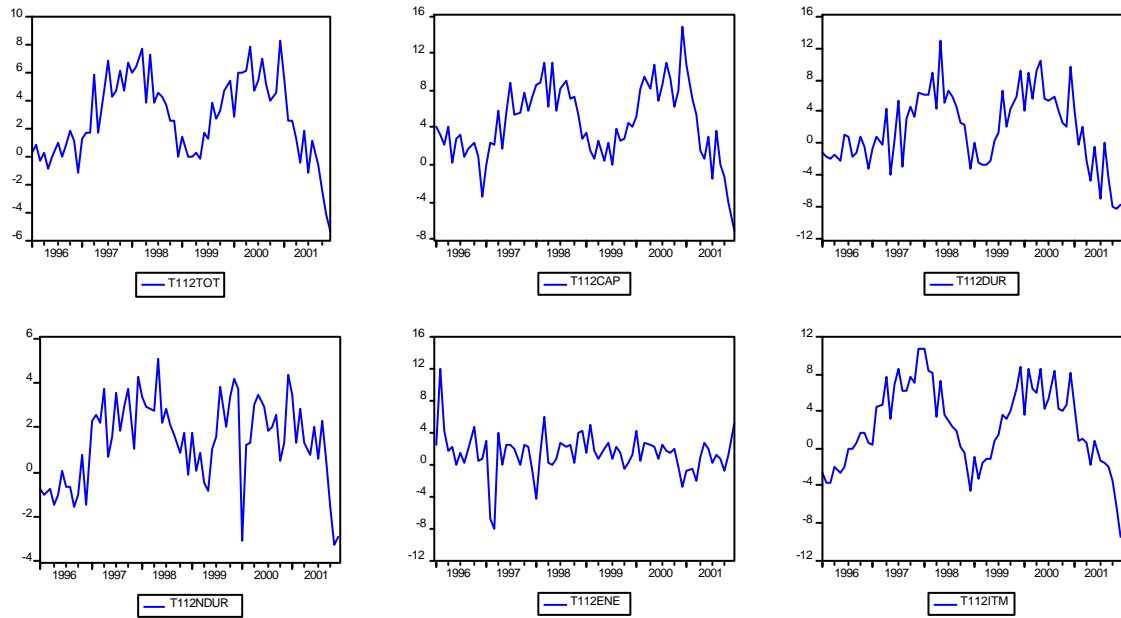
In this paper we consider Total Industry excluding construction (MUIPI) and the components: non-energy intermediate goods (ITM), capital goods (CAP), durable consumer goods (DUR), non durable consumer goods (NDUR), and energy goods (ENE). Data are available since January 1985 for MUIPI and since January 1995 for the components.

Plot 9A and 9B show the evolution of the indexes in logs and the annual rates for the different components of EMU Industrial Production Indexes.

Plot 9A: Logs of the different components of EMU IPI.



Plot 9B: Year-on-year of growth (monthly data) for the different components of EMU IPI.



## Vector Analysis Of EMU / IPI Components

Several alternatives to forecast MU IPI have been attempted: univariate ARIMA modelling for the total excluding construction, univariate ARIMA model for the different components, Vector autoregression with US Industrial Production Index, leading indicator models and vector autoregression amongst the main components attending the destination of the goods. Models were estimated from 1995:01 to 1999:12 and evaluated in forecasting performance since then until July 2001. Best forecasting results were achieved by a vector autoregression model amongst the components.

The variables have been considered in logs and energy was excluded from the vector analysis. A VAR model of order 2 for the rest of the four components appears to be enough to capture correlation between the variables. Centred seasonal dummies have also been included to assess for seasonality and there are no cointegration relationships. Table 7 shows misspecification residual tests for this model estimated from 1995:01 to 1999:12.

**Table 7.** Misspecification residual tests for a VAR(2) model in first differences for LCAP, LITM, LDUR and LNDUR.

Multivariate tests		Statistic			
Akaike		-21.72			
<b>Portmanteau</b>	<b>Lag</b>				
	4	35.49			
	5	49.31			
	6	60.11			
	7	87.85			
	12	168.33			
<b>LM</b>	<b>Lag</b>				
	1	15.73			
	12	19.21			
<b>Univariate tests</b>		<b>e<sub>LCAP</sub></b>	<b>e<sub>LDUR</sub></b>	<b>e<sub>LNDUR</sub></b>	<b>e<sub>LITM</sub></b>
<b>Q(12)</b>		5.29	13.64	11.39	16.34
<b>Q(24)</b>		17.09	27.88	21.45	38.58
<b>ARCH</b>		0.003	0.099	0.51	0.77
<b>Jarque-Bera</b>		1.02	3.61	1.87	0.14
<b>S<sub>e</sub></b>		1.83%	2.21%	0.89%	1.37%

The energy component was modelled as an AR(2) in first differences and includes seasonal dummies. Table 2 shows misspecification tests for residuals of the energy model.

**Table 8.** Misspecification residual tests for univariate model for Energy MU/ IPI

Univariate tests	e <sub>LENE</sub>
<b>Q(12)</b>	9.45
<b>Q(24)</b>	21.83
<b>ARCH</b>	0.12
<b>Jarque-Bera</b>	3.17
<b>S<sub>e</sub></b>	2.00%

We have checked the forecast performance for the sample 2000:01 to 2001:07. We have performed forecasts 1 to 12 periods ahead and computed forecast errors. Table 3 shows mean and root mean squared errors (RMSE).

Table 9. Forecast evaluation.

	Periods ahead	1	3	6	12
CAP	Mean error	<b>0.08</b>	<b>0.13</b>	<b>0.13</b>	<b>1.05</b>
	RMSE %	<b>1.73</b>	<b>2.82</b>	<b>3.60</b>	<b>4.29</b>
ITM	Mean error	<b>-0.16</b>	<b>-0.30</b>	<b>-0.52</b>	<b>-0.38</b>
	RMSE %	<b>1.71</b>	<b>2.28</b>	<b>3.24</b>	<b>2.94</b>
DUR	Mean error	<b>-0.20</b>	<b>-0.27</b>	<b>-0.58</b>	<b>-0.60</b>
	RMSE %	<b>2.11</b>	<b>2.71</b>	<b>3.40</b>	<b>3.89</b>
NDUR	Mean error	<b>-0.06</b>	<b>0.20</b>	<b>0.28</b>	<b>0.53</b>
	RMSE %	<b>1.31</b>	<b>1.25</b>	<b>1.58</b>	<b>1.43</b>
ENE	Mean error	<b>0.43</b>	<b>0.57</b>	<b>0.40</b>	<b>0.18</b>
	RMSE %	<b>1.48</b>	<b>2.17</b>	<b>2.65</b>	<b>1.76</b>

### 3.3 FORECASTS FOR 2001 AND 2002

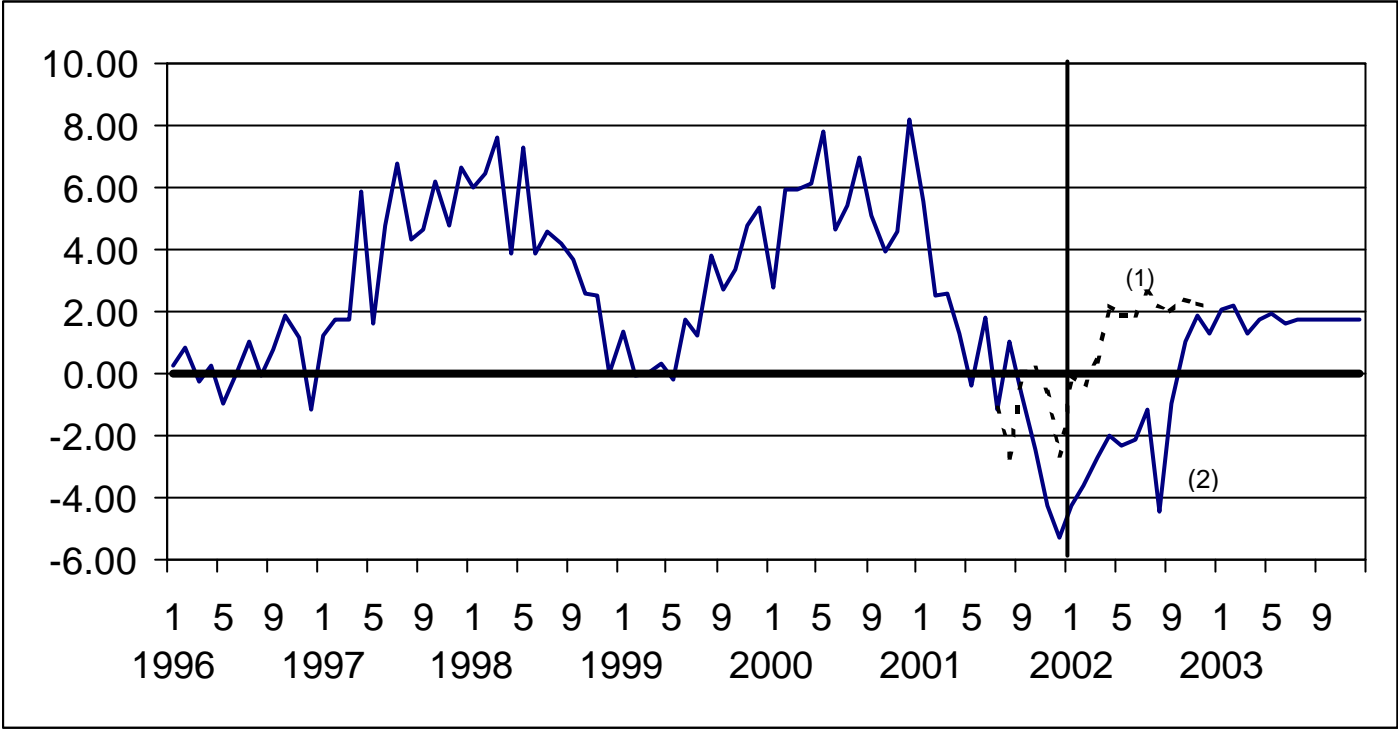
Table 10 and plot 9 show the forecasts for the industrial production index and its components.

Table 10. MU/IPI components and aggregate annual rates forecasts.

Year	Month	CAPITAL	DURABLE	INTERMEDIA	NON-DURAB	ENERGY	TOTAL
2000	1	5.19	4.04	3.66	-3.04	4.27	2.80
	2	8.22	8.84	8.45	1.22	0.34	5.98
	3	9.57	5.72	6.47	1.29	2.78	5.95
	4	8.23	9.17	5.96	3.02	2.48	6.14
	5	10.72	10.37	8.58	3.50	2.31	7.82
	6	6.85	5.60	4.25	2.94	0.75	4.66
	7	8.68	5.43	5.31	1.86	2.39	5.42
	8	10.92	5.98	8.43	2.05	1.81	6.99
	9	9.21	4.06	4.26	2.58	1.41	5.13
	10	6.19	2.63	4.14	0.48	2.03	3.97
	11	7.89	2.09	4.79	1.33	-0.32	4.57
	12	14.89	9.64	8.15	4.34	-2.73	8.22
2001	1	10.64	4.09	4.48	3.46	-0.79	5.56
	2	7.12	-0.14	0.71	1.28	-0.65	2.56
	3	5.44	2.02	0.98	2.81	-2.15	2.60
	4	1.54	-2.03	0.52	1.34	1.03	1.32
	5	0.71	-4.62	-1.82	0.81	2.63	-0.38
	6	3.10	-0.40	0.92	2.04	2.04	1.80
	7	-1.42	-6.89	-1.28	0.59	0.20	-1.14
	8	3.60	0.12	-1.55	2.33	1.10	1.06
	9	0.01	-4.44	-1.94	0.51	0.80	-0.61
	10	-1.33	-7.89	-3.47	-1.59	-0.90	-2.46
	11	-4.04	-8.13	-6.30	-3.27	1.20	-4.24
	12	-7.19	-7.66	-9.50	-2.93	5.20	-5.30
2002	1	<b>-7.84</b>	<b>-6.24</b>	<b>-5.36</b>	<b>-0.10</b>	<b>0.94</b>	<b>-4.22</b>
	2	<b>-7.32</b>	<b>-4.20</b>	<b>-4.00</b>	<b>-0.15</b>	<b>0.53</b>	<b>-3.62</b>
	3	<b>-5.09</b>	<b>-2.68</b>	<b>-3.06</b>	<b>-1.25</b>	<b>1.98</b>	<b>-2.69</b>
	4	<b>-2.54</b>	<b>-2.41</b>	<b>-2.33</b>	<b>-1.10</b>	<b>-0.47</b>	<b>-1.96</b>
	5	<b>-2.70</b>	<b>-2.25</b>	<b>-2.43</b>	<b>-1.11</b>	<b>-2.79</b>	<b>-2.29</b>
	6	<b>-2.13</b>	<b>-2.13</b>	<b>-2.35</b>	<b>-1.73</b>	<b>-1.65</b>	<b>-2.11</b>
	7	<b>-0.33</b>	<b>0.71</b>	<b>-2.05</b>	<b>-0.91</b>	<b>-0.65</b>	<b>-1.18</b>
	8	<b>-7.08</b>	<b>-5.64</b>	<b>-4.15</b>	<b>-3.03</b>	<b>-2.27</b>	<b>-4.43</b>
	9	<b>-1.74</b>	<b>0.95</b>	<b>-0.80</b>	<b>-0.75</b>	<b>-0.53</b>	<b>-0.93</b>
	10	<b>0.51</b>	<b>3.95</b>	<b>0.31</b>	<b>1.77</b>	<b>2.71</b>	<b>1.03</b>
	11	<b>2.33</b>	<b>4.28</b>	<b>1.65</b>	<b>2.35</b>	<b>0.51</b>	<b>1.91</b>
	12	<b>2.23</b>	<b>-1.08</b>	<b>2.07</b>	<b>0.44</b>	<b>-1.13</b>	<b>1.26</b>
2003	1	<b>3.87</b>	<b>2.35</b>	<b>1.88</b>	<b>1.30</b>	<b>0.76</b>	<b>2.09</b>
	2	<b>4.50</b>	<b>1.77</b>	<b>1.78</b>	<b>1.21</b>	<b>0.87</b>	<b>2.21</b>
	3	<b>2.68</b>	<b>0.06</b>	<b>1.16</b>	<b>0.80</b>	<b>-0.23</b>	<b>1.27</b>
	4	<b>3.52</b>	<b>1.29</b>	<b>1.50</b>	<b>1.10</b>	<b>0.18</b>	<b>1.77</b>
	5	<b>3.72</b>	<b>1.44</b>	<b>1.69</b>	<b>1.20</b>	<b>0.61</b>	<b>1.98</b>
	6	<b>3.24</b>	<b>0.72</b>	<b>1.40</b>	<b>0.96</b>	<b>0.20</b>	<b>1.65</b>
	7	<b>3.48</b>	<b>1.18</b>	<b>1.53</b>	<b>1.07</b>	<b>0.14</b>	<b>1.76</b>
	8	<b>3.54</b>	<b>1.16</b>	<b>1.55</b>	<b>1.11</b>	<b>0.39</b>	<b>1.76</b>
	9	<b>3.39</b>	<b>0.98</b>	<b>1.49</b>	<b>1.04</b>	<b>0.32</b>	<b>1.74</b>
	10	<b>3.46</b>	<b>1.10</b>	<b>1.52</b>	<b>1.06</b>	<b>0.21</b>	<b>1.75</b>
	11	<b>3.48</b>	<b>1.11</b>	<b>1.53</b>	<b>1.08</b>	<b>0.29</b>	<b>1.77</b>
	12	<b>3.43</b>	<b>1.05</b>	<b>1.51</b>	<b>1.06</b>	<b>0.32</b>	<b>1.77</b>
<b>Average 1998</b>		7.52	5.09	3.60	2.34	1.61	4.07
<b>Average 1999</b>		2.37	1.48	1.59	1.76	1.55	1.80
<b>Average 2000</b>		8.87	6.02	5.95	1.79	1.41	5.34
<b>Average 2001</b>		1.20	-3.25	-1.54	0.52	0.78	-0.31
<b>Average 2002</b>		<b>-2.51</b>	<b>-1.22</b>	<b>-1.87</b>	<b>-0.42</b>	<b>-0.17</b>	<b>-1.55</b>
<b>Average 2003</b>		<b>3.51</b>	<b>1.16</b>	<b>1.54</b>	<b>1.08</b>	<b>0.34</b>	<b>1.79</b>

\* Bold figures are forecasts.

Plot9(c). Annual rates for MU IPI.



- (1) Forecasts made with information till July 2001.
- (2) Forecasts made with information till December 2001.

