An accuracy assessment of FPB's medium-term projections

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Igor Lebrun, il@plan.be

Abstract – The Federal Planning Bureau has been publishing medium-term macroeconomic projections for the Belgian economy since the beginning of the eighties. In this working paper past projection errors are scrutinised to give users a broad idea of the uncertainties surrounding these projections. The analysis reveals that projections for most of the macro-economic variables show no statistically significant bias with the notable exception of the evolution of exports and labour productivity which was clearly overestimated, while labour force growth was systematically underestimated. Examination of the role played by the main exogenous variables shows the importance of potential export markets in explaining projection errors on GDP and components. However, losses in export market shares were underestimated in most economic outlooks. Concerning the labour force, the origin of the projection error changed over time: attributable almost exclusively to errors in the average participation rate at the beginning of the sample, from 1997 onwards the relative contribution of errors on working-age population increased gradually.

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1. Introduction

The Federal Planning Bureau (FPB) has been publishing medium-term macroeconomic projections for the Belgian economy since the beginning of the eighties. The tradition of producing a baseline simulation with a medium-term horizon was inherited from the (failed) indicative planning experiments in the seventies. This baseline is a no-policy-change scenario, notably with regard to fiscal and social policies, that is based upon an international environment founded on projections prepared by international institutions like the European Commission or the OECD. Scenario analysis is sometimes performed to illustrate the impact of potential risks or to analyse the effects of new economic policy measures. Since 1988, the baseline and variants are produced using the macro-econometric model HERMES (see Bossier et al., 2004), while previously the MARIBEL model was employed. The economic outlook for the Belgian economy is published each year in spring and presented to the representatives of the social partners within the Central Economic Council. These projections are updated in October by incorporating the latest short-term forecasts (elaborated for the new federal government's budget) and are used as the macroeconomic framework for the Belgian stability programme.[1]

The outlook is a very detailed macroeconomic projection that covers developments by industry, evolutions in the labour market, public finances and, in recent years, even in energy consumption and associated greenhouse gas emissions. The prime objective of these projections is not to produce the forecasts that best anticipate the most likely political decisions, but rather to provide, by extending underlying trends, a benchmark scenario pointing to possible future constraints and imbalances that may never materialise if prompt measures are taken. As such, it lends itself less to traditional accuracy evaluation than the short-term forecasts published in the economic budget, which are regularly assessed.[2] The overall coherence of the projection and the quality of the analysis offered to policy makers and to the public in general in terms of diagnosis are probably the main features for gauging its usefulness. However, in this working paper past projection errors are scrutinised to give users a broad idea of the precision of the projections and also to identify possible methodological weaknesses that should be improved.

The paper is organized as follows. In chapter 2 we discuss the methodology adopted and comment upon the comparison between projected growth rates and outcomes for a selected number of variables. The main statistical properties of the projection errors for these variables are presented in chapter 3. The possible causes behind these projection errors are examined in the following chapter. Based upon the conclusions of previous chapters concerning potential methodological weaknesses, the final chapter makes a qualitative assessment of the latest editions of the economic outlook.

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[1]   The main results of the autumn update of the economic outlook are published in the Quarterly Newsletter of the FPB.

[2]   See for instance Dobbelaere and Hertveldt (2004) and Bogaert et al. (2006).

2. Comparison between projected growth rates and outcomes

2.1. The methodology adopted

The economic outlook has been released in April since the mid-nineties with an update in October in recent years, the latter being used as the macroeconomic framework for the Belgian stability programme. Previously, a first version was published in February-March and an updated version in July. The April releases (before 1996 the July issues) were used in the following analysis as we chose to select only one projection per year in our data sample which starts with the outlook of July 1986 (covering the period 1987-1990) and ends with the April 2001 release (covering the period 2002-2006). Subsequent editions cannot be fully evaluated yet due to the lack of hard data beyond 2005. To analyse the projection errors we decided to work with growth rate averages covering the projection period. Until the 1997 release, the projection period covered four years beyond the current year; from 1998 one extra year was added. In the analysis discussed below we examine four-year geometric growth rate averages beyond the year of publication for all releases. We did not include the estimates for the current year as these short-term forecasts are produced with a different methodology using a quarterly model supplemented by business-cycle-related information.

A traditional problem faced when measuring forecasting errors is the choice of the data vintage to be defined as the outcome, as most macroeconomic data, notably national accounts, are regularly revised when new information sets become available or when methodological changes are introduced. [3] As these factors can hardly be anticipated, we chose to compare the projected growth rate for year t with the estimate available in the database of year t+2. For instance, we defined the growth rate available in spring 1992 as the outcome for the year 1990. This choice is based on the calendar of the national accounts as that data vintage will entail the first release of the national accounts for 1990 published in autumn 1991.

In the following pages, the results for the main macroeconomic variables (volumes and prices) will be analysed, as well as the assumptions regarding labour force evolutions. Fiscal variables will not be presented here, as their projection under the "no-policy-change" assumption requires a different approach for investigation.[4]

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[3] For a discussion on the topic see for instance Kranendonck and Verbruggen (2006) for the Netherlands or Döhrn (2006) for Germany.

[4] See for instance Lebrun (2006) for a tentative evaluation of FPB's budgetary projections.

2.2. GDP and components

In this section we compare average growth projections with outcomes for GDP and its components, namely private consumption, private gross fixed capital formation and external trade.[5] As shown in Figure 1 below, the volatility of GDP growth rates, although smoothed by the four-year average, is not well captured by the projections: average projected growth rates oscillate between 2.0% and 2.9% while the outcome varies between 0.9% and 3.6%. The upswing in the late eighties, following a period of low economic growth during the first half of that decade, was clearly underestimated, while high growth figures recorded during the period 1987-1990 generated hopes of sustained higher growth, which did not materialise. The period following the 1993 recession was characterised by more cautious projections which were more in line with the outcomes, whereas the prolonged downturn during the first half of this decade was missed. This analysis clearly illustrates the difficulty to separate the trend from the cycle at the end of the sample: a sustained period of economic upswing tends to make the forecaster think that this upswing is permanent, while a prolonged period of slow growth has the opposite effect. Note that over the whole sample GDP growth was overestimated on average by a bit more than 0.4 percentage points.

Figure 1 - GDP growth: projections versus outcomes
(average growth rates in %)
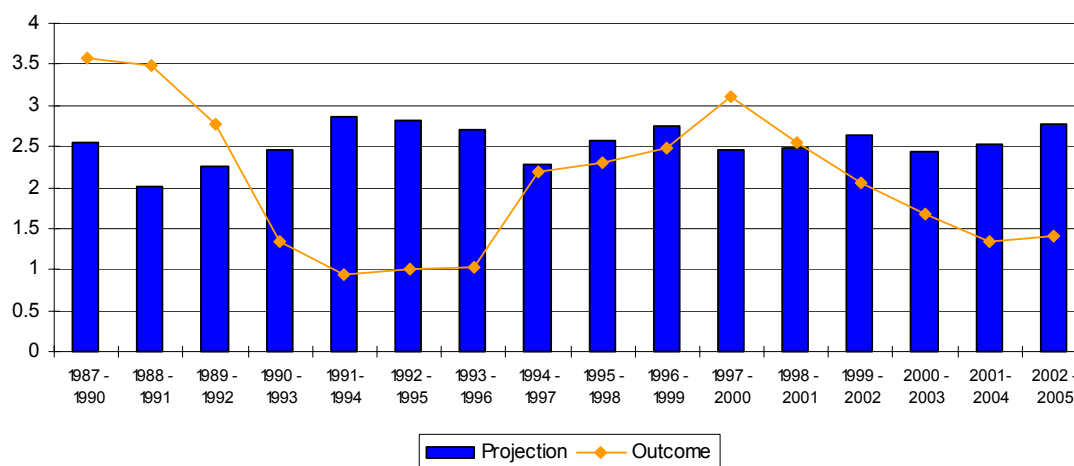
Projections for private consumption growth (Figure 2) clearly show a more cyclical pattern than projections for GDP, while the cycles in outcomes are very much alike. The upswing in the late eighties and the subsequent downturn were clearly missed whereas the following recovery was apprehended correctly till 1999. The top of the cycle in 2000 and the abrupt slowdown that followed were not anticipated. Over the whole sample though, private consumption growth was overestimated by less than 0.2 percentage points.

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[5] Public consumption and public investment are not considered here as they are treated as exogenous variables in the HERMES model.

Figure 2 -   Private consumption growth: projections versus outcomes
        (average growth rates in %)
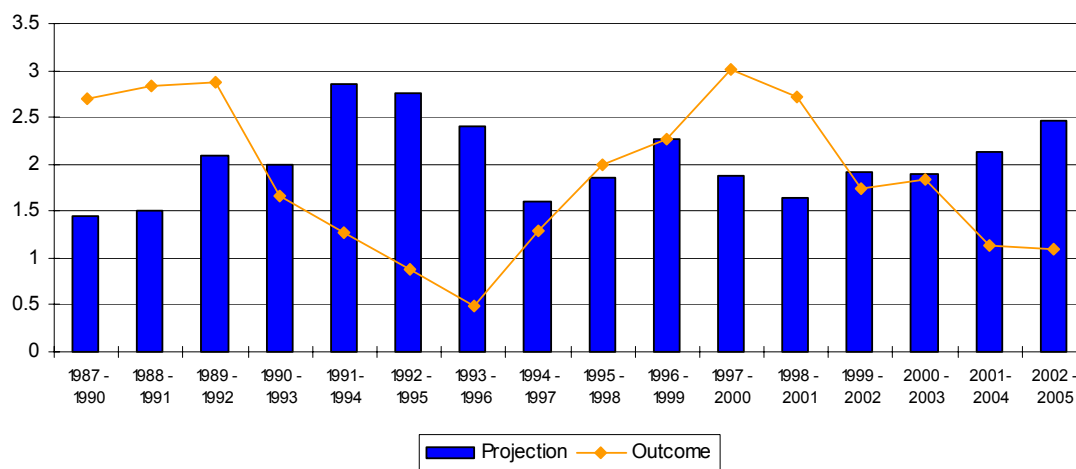
One of the explanations for the limited cyclicality in GDP growth projections as compared to outcomes can be seen in Figure 3. Indeed the huge swing in business investment during the period 1987-1993 and the slowdown at the end of the sample are not captured. Average projected growth rates vary between 3.1% and 5.3% whereas outcomes fluctuate between -2.2% and 11.7%. Over the entire period, business investment is overestimated by 1.3 percentage points. Note that if the first two economic outlooks are dropped form the sample, the overestimation jumps to 2.4 percentage points.

Figure 3 -   Business investment growth: projections versus outcomes
        (average growth rates in %)
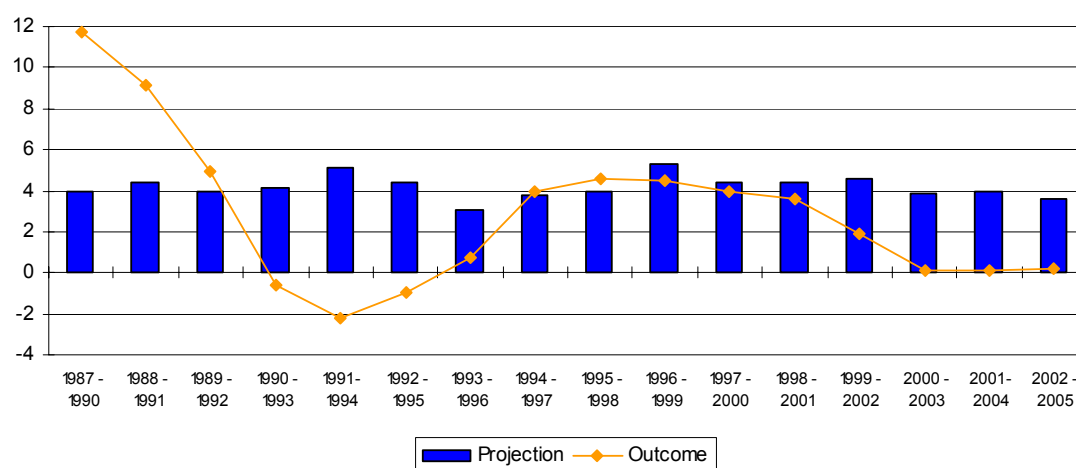
As for business investment, the boom in housing investment during the late eighties came as a complete surprise, but the subsequent slowdown was captured reasonably well by the projections, as the modest growth during the second half of the nineties. The economic outlook for 2000-2003 was clearly too bright but the two following projections were too prudent despite an overly optimistic assessment of the overall economic situation. Over the whole sample, housing investment growth was underestimated by 1.2 percentage points, but if the two first projections are skipped, the result shifts to a slight overestimation.

Figure 4 -   Housing investment growth: projections versus outcomes
(average growth rates in %)
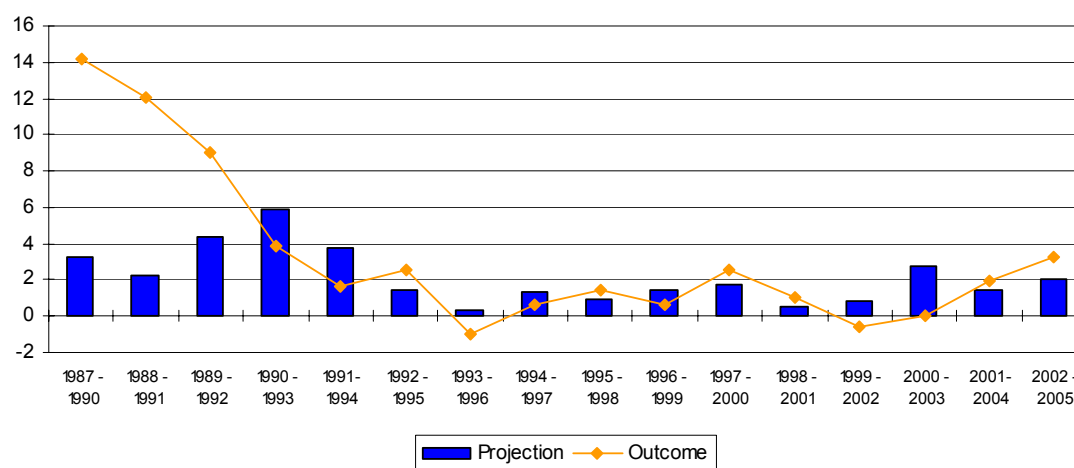
As can be seen from Figure 5, export growth was clearly overestimated on the whole sample. Underestimation of export growth only occurs in four out of sixteen economic outlooks. Especially the periods including the troughs in 1993 and 2001-2002 show large projection errors. On average export has been projected to increase by 5.5% annually, while recorded average growth rates reached only 4.3%.

Figure 5 -   Export growth: projections versus outcomes
        (average growth rates in %)
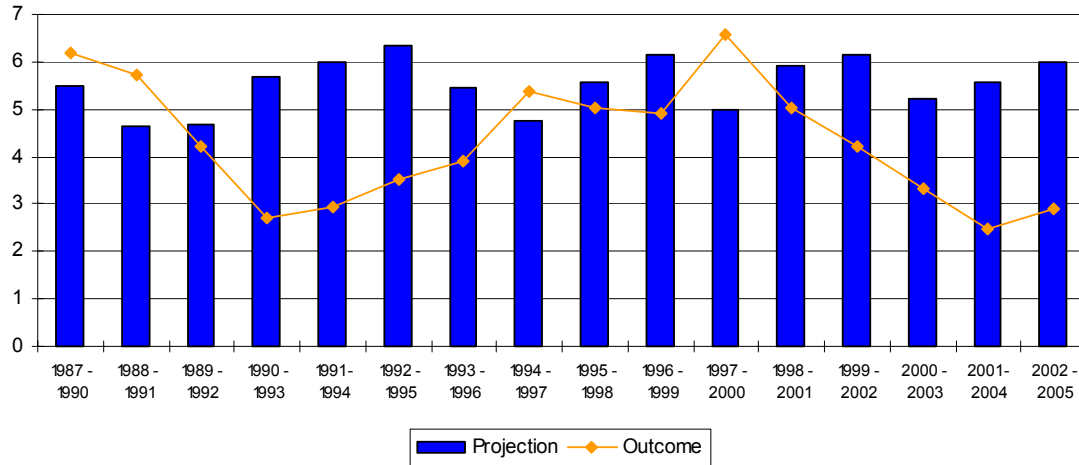
Import growth projections are clearly linked to final demand growth projections. In Figure 6 below we corrected import growth projections for growth errors on the components of final demand (taking into account the import content of each component). This rough correction generates import growth projections which are in line with the outcomes for most of the periods, only during the first three outlooks was import growth clearly overestimated. The average projection error is close to zero if these outlooks are excluded from the sample.

Figure 6 -   Import growth: projections (corrected for final demand errors) versus outcomes
        (average growth rates in %)
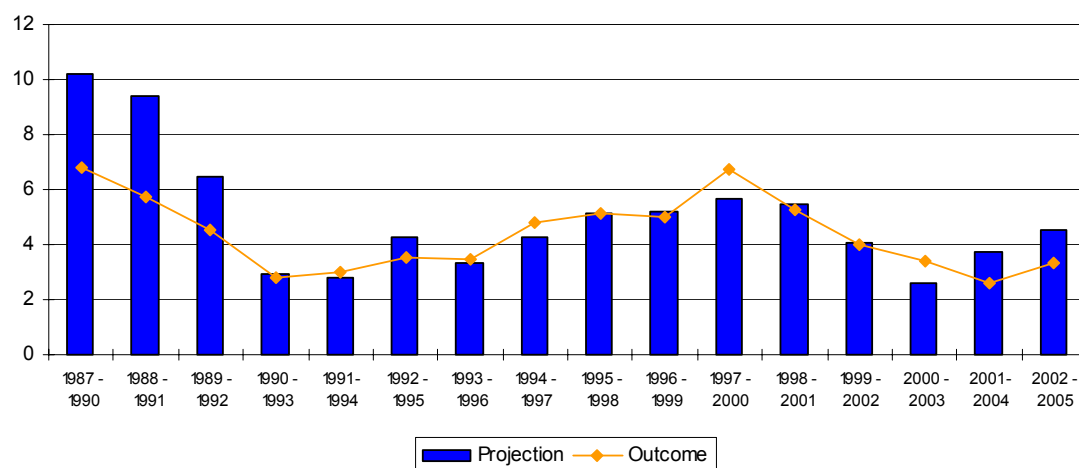
2.3. Prices

In this section we will focus on two domestic prices, namely the private consumption and the GDP deflator. Figure 7 compares the average projected growth rates for the former with outcomes. Although the overall movements in prices are captured reasonably well (acceleration in the late eighties/early nineties and deceleration afterwards) consumer price inflation was undoubtedly underestimated at the beginning of the sample, while the decrease was systematically underestimated till the beginning of the new millennium. The four last examined outlooks show an underestimation of consumer price inflation. Over the whole sample positive and negative errors cancel each other out so that the average error is very close to zero.

Figure 7 -   Private consumption deflator growth: projections versus outcomes
(average growth rates in %)
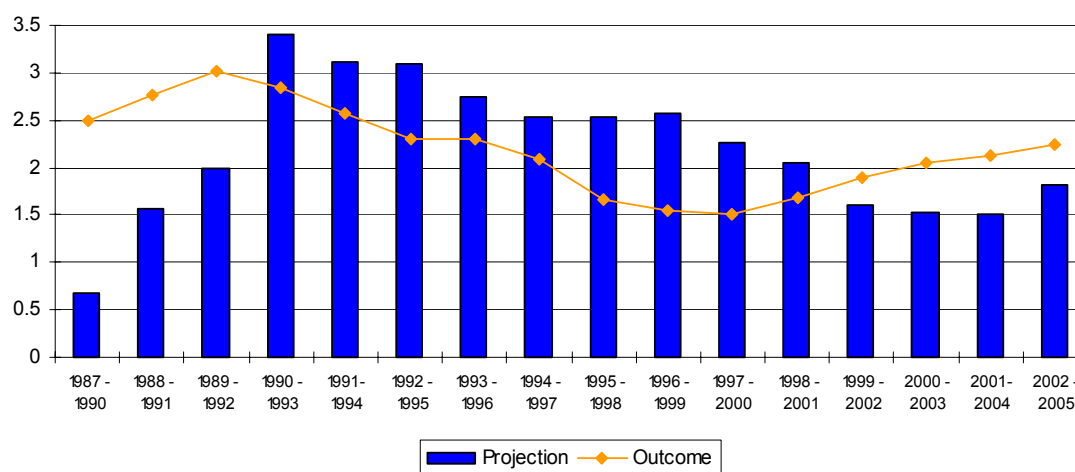
GDP deflator growth rates show the same pattern both for projections and outcomes as private consumption deflator growth rates,[6] but errors are smaller except for the first two economic outlooks of the sample. These two projections are also the cause of the slight underestimation of GDP price inflation on average over the whole sample.

Figure 8 - **GDP deflator growth: projections versus outcomes**
            (average growth rates in %)
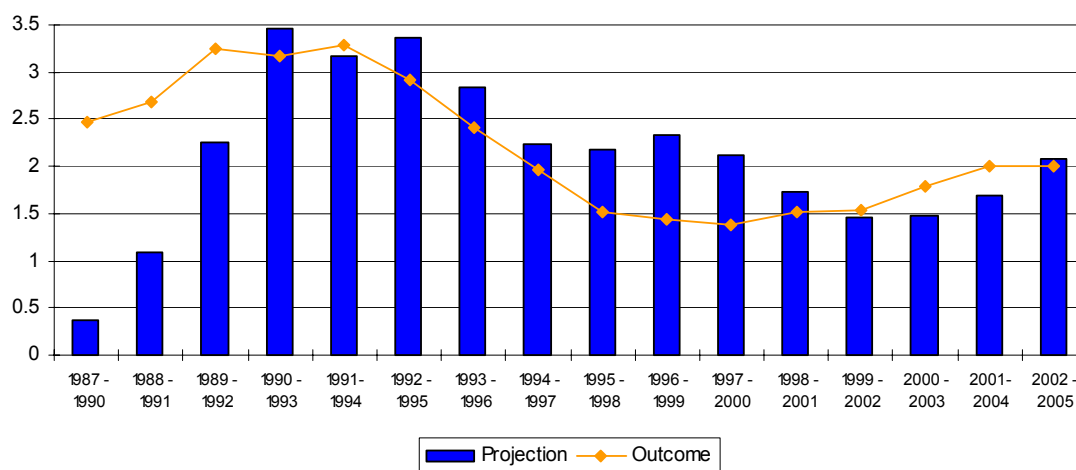
2.4. Labour force, employment and productivity

In this final section we compare projections with outcomes for labour force, employment and productivity growth. The former can be considered as an exogenous variable from the point of view of the HERMES model (as the international environment or monetary and fiscal policy). Nevertheless labour force projections result from demographic projections and assumptions regarding labour participation rates. Figure 9 reveals that labour force growth was systematically and largely underestimated although the projection error decreases significantly in the last period considered. Recorded average annual growth rates reached 0.7%, while the labour force was projected to increase by only 0.2% per year.

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6   The difference in growth rates between private consumption deflator and GDP deflator is essentially attributable to changes in import price inflation.

Figure 9 -   Labour force growth: projections versus outcomes
            (average growth rates in %)
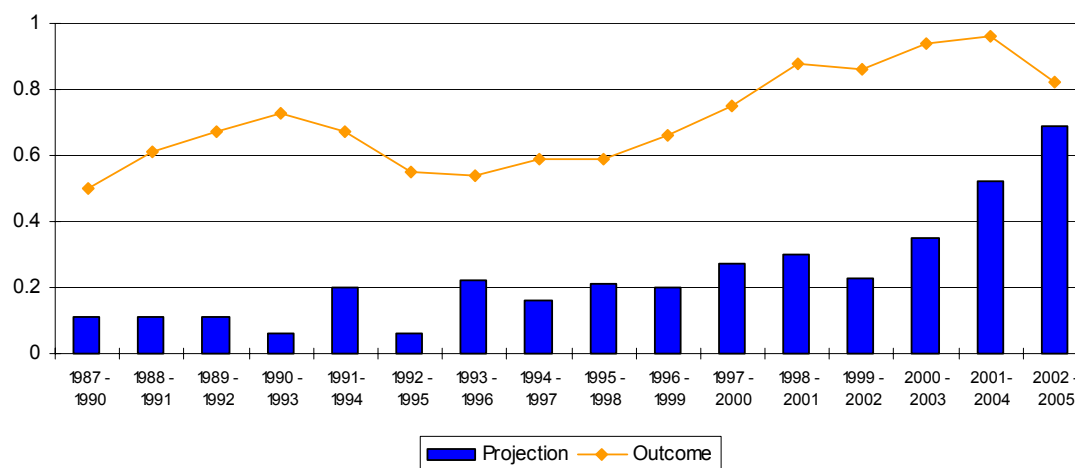
Employment growth projections were, consistent with GDP growth projections, too prudent at the end of the eighties while subsequent outlooks during the early nineties were clearly too optimistic. The upswing that followed was captured to a certain extent but the downturn at the end of the sample was missed again. Note that the full sample employment growth was projected without error on average, while GDP growth was overestimated.

Figure 10 - Employment growth: projections versus outcomes
            (average growth rates in %)
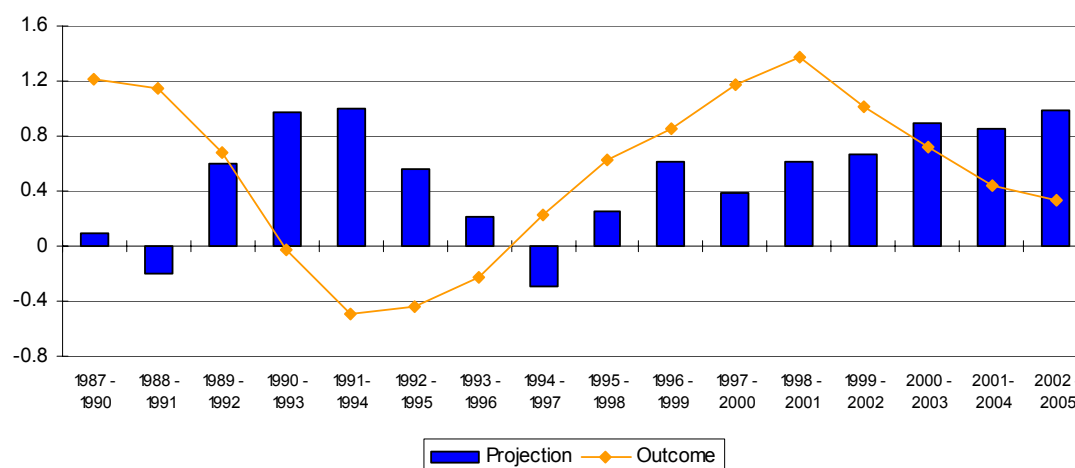
This statement implies that labour productivity growth was on average overestimated. This is evident in Figure 11: projected productivity growth exceeds the outcome in fourteen out of sixteen economic outlooks. The decreasing trend in productivity growth was not captured suffi-

ciently in the successive projections. The very volatile nature of productivity growth, as clearly visible on the figure[7], makes disentangling the cycle from the trend not an easy task in real time. On average over the whole sample productivity growth was overestimated by almost half a percentage point yearly.

Figure 11 - Productivity growth: projections versus outcomes
(average growth rates in %)

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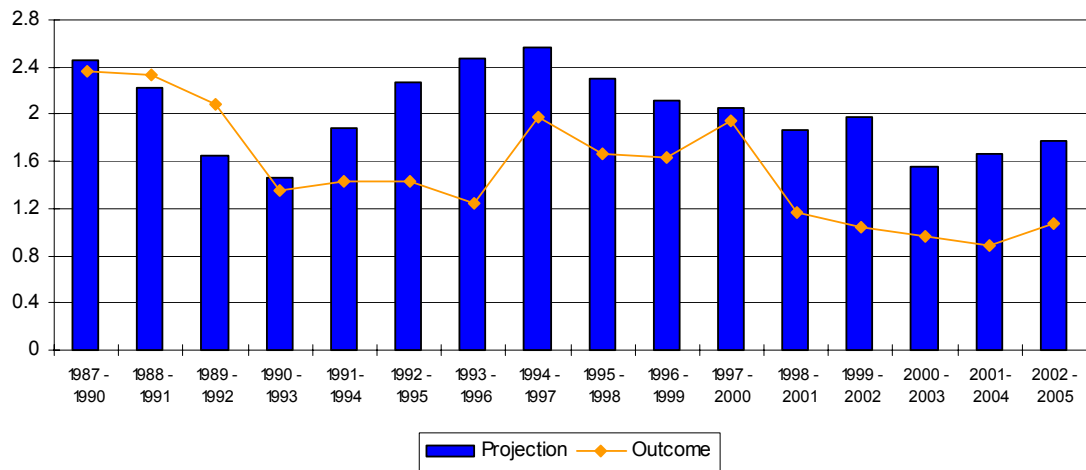
[7]   Despite the fact that the four-year moving average process is smoothing the data.

3. Statistical properties of the projection errors

After a graphical comparison of projections and outcomes, we turn to some standard summary statistics to analyse the properties of the projection errors.[8] The mean error (ME), computed as the arithmetic average of the errors, indicates by how much the projected growth rates were on average overestimated (negative sign) or underestimated (positive sign).[9] A desirable property of forecasts is unbiasedness, meaning that the mean error should be close to zero. But as a mean, it says nothing about the variance of the error. A small mean could indicate that all the errors were small but also that large negative and positive errors offset each other. The mean absolute error (MAE), computed as the arithmetic average of the absolute value of the projection errors, and the root mean square error (RMSE), computed as the square root of the arithmetic average of the square value of the projection errors, do not suffer from this ambiguity. Compared with the MAE, the RMSE gives more weight to the largest errors. A drawback of the above mentioned statistics is that they depend upon the volatility of the series considered which means that one cannot readily compare them across variables. A way to normalise them is to divide the MAE by the mean absolute deviation of the series and the RMSE by the standard deviation of the series.

Another way to evaluate the accuracy of the forecasts is to compare them with naïve forecasts[10]: the Theil coefficient is calculated as the RMSE of the reference forecasts divided by the RMSE of the naïve forecasts. A Theil coefficient below unity indicates that the projection outperforms the naïve alternative. Finally, forecasts are said to be (weakly) efficient if all the information contained in the data is used.[11] This means in statistical terms that forecasts errors should on average be zero and serially uncorrelated, otherwise the systematic relation between errors could be exploited to improve these forecasts.

The first column in Table 1 indicates, as we already noticed in the previous chapter, that except for housing investment, the growth rates of all components of GDP were on average overestimated. Yet the penultimate column shows that this optimistic bias is statistically significant at 5% level only for export growth. Inflation, as measured by private consumption and GDP deflators, was estimated without bias over the whole sample. Finally, the evolution of the labour force and labour productivity were undeniably under- and overestimated respectively.

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[8]   See Carnot et al. (2005) for a general presentation and critical discussion about the summary statistics.

[9]   The projection error is defined here as the outcome minus the projected growth rate.

[10] By naïve forecasts we refer to purely statistical techniques using lagged values of the series to construct future values of the same series.

[11] Strong efficiency requires the use of all the information currently available at the time the forecasts were made, meaning that forecasting errors cannot be explained by any variable included in the forecaster's information set, see for instance Timmerman (2006) or Hallenberg et al. (2004) for a discussion and statistical applications.

As can be seen from the second column, the absolute size of the errors is clearly larger for investment and exports than for consumption, while absolute errors on domestic prices are more limited. Note that the size of the absolute error on GDP is not higher than for first round forecasts of the economic budget[12], due to the fact that over-and underestimates offset each other somewhat over the four-year projection period. In the case of the labour force, the mean error equals the mean absolute error implying that the average growth rate was underestimated in all projections, while labour productivity growth was overestimated in fourteen out of sixteen economic outlooks. In a similar study carried out by the CPB for the Dutch economy, labour force had been underestimated eight times out of nine analysed projections over the period 1976-2002, while productivity growth had been overestimated seven times.[13] The RMSE statistic in the third column gives the same type of picture as the previous column except that now the large errors made on housing investment growth at the beginning of the sample are more penalised.

Table 1 -   Key descriptive statistics for errors on projected four-year average growth rates (1987-2005)

	ME	MAE	RMSE	RMSE/σ	Theil	No bias	No corr
Private consumption	-0.18	0.90	1.10	0.85	0.70	0.64	0.00*
Business investment	-1.33	3.11	3.91	0.71	0.55	0.28	0.00*
Housing investment	1.19	2.56	4.04	0.60	0.55	0.36	0.04*
Exports of goods and services	-1.23	1.72	1.98	0.81	0.81	0.01*	0.12
Imports of goods and services	-0.90	1.68	1.95	0.78	0.69	0.11	0.10
Gross Domestic Product	-0.46	0.92	1.10	0.78	0.65	0.18	0.00*
Private consumption deflator	0.01	0.74	0.83	1.18	0.60	0.98	0.00*
GDP deflator	0.09	0.60	0.81	1.01	0.52	0.75	0.01*
Labour force	0.47	0.47	0.49	1.92	2.10	0.00*	0.11
Employment	0.02	0.67	0.79	0.99	0.68	0.93	0.00*
Labour productivity	-0.48	0.55	0.63	0.65	0.86	0.00*	0.04*

Notes: Projection error = outcome - projection; ME is the mean error; MAE is the mean absolute error; RMSE/σ is the root mean square error divided by the standard deviation of the variable; Theil reports the RMSE of a given projection relative to the RMSE of an a naïve alternative given by the average growth of the four previous years, with a Theil statistic below unity indicating that the projection is more accurate than the naïve alternative; No bias gives the significance level of the t-statistic (with standard error robust to autocorrelation) for the hypothesis H_o: ME=0 obtained by regressing the projection error on a constant; No corr gives the significance level of the Breusch/Godfrey LM test for uncorrelated errors up to second order obtained with previous regression; * indicates a rejection of H_o at a 5% significance level.

The fourth column computes the size of the error, corrected for the volatility of the series as it is likely to make larger absolute errors on more volatile series. Taking this factor into account, the size of the error appears to be very similar among most variables, with gross fixed capital formation now in line with the other series. On the other hand, the projections for the less volatile components, such as domestic prices, are now seen as less accurate. Projections on the labour force come out again as the weakest link. The next column compares the projections errors with those obtained using a naïve method that takes the four-year average growth rate recorded the year before the projection was made. Theil statistics below unity indicate that the projections are

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[12]   See Dobbelaere and Hertveldt, op. cit.
[13]   See Kranendonck and Verbruggen, op. cit.

more accurate in all cases except for labour force projections. The last column shows that auto-correlation cannot be rejected for any of the variables in the table having no statistically significant bias.[14] In fact this is not surprising for medium-term projections for which, unlike short-term forecasting, outcomes and consequently errors are only available with a huge delay, explaining the inertia in the latter.[15]

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[14] Testing for autocorrelation for errors that exhibit a clear bias is not relevant as most of the errors tend to have the same sign.

[15] For example, the full outcome for the spring 2007 outlook will be only available in 2014. For a discussion concerning the practical difficulty of using the information on the distribution of the errors to improve the forecasts, see Döhrn, op. cit.

4. Analysing projection errors

4.1. Possible causes behind projection errors

Up to now we have compared projected average growth rates with outcomes and through a number of summary statistics examined the main characteristics of the projection errors. In this chapter we will analyse some of the causes behind these errors. They can originate from four kinds of sources. Firstly, errors can be due to the uncertainty surrounding the most recent data. As we discussed previously, recent data can be subject to important revisions and so have an influence on the quality of the forecasts. This factor is certainly very important for short-term forecasts for which starting points and carry-over effects are essential, but it is probably less critical for projections with a longer horizon.[16] Secondly, errors can be ascribed to mistakes on the exogenous variables. Exogenous variables are variables for which their future path is defined outside the core model used to produce the forecasts. The future values for these variables are themselves simply assumed, constructed with specific methods or forecasted by other institutions. Typical exogenous variables for the economic outlook are those related to the international environment, demography and economic and social policy. A third source of error is generated by the model itself. Econometric models contain stochastic coefficients and error terms which are by definition surrounded with uncertainty.[17] Coefficients may also change over time. The model may be misspecified, meaning that the functional forms of the equations or the simultaneous dynamics of the whole system do not adequately describe the functioning of the economy.[18] A last source of error is related to the so-called "add-factors" reflecting expert's opinion and amending the spontaneous solution of the model. This last aspect is certainly important for short-term forecasting, as for the economic budget, but these add-factors are used in a very parsimonious way in medium-term projections which reflect essentially the unconstrained outcome of the model.

As mentioned above, errors on medium-term projections can essentially be attributed to two factors, namely to the exogenous assumptions and to the model itself. Ideally, to disentangle the contribution of each of these factors one should rerun each projection using the historical model but replacing the original set of exogenous variables by their outcome, as defined in section 2. In a model of the size of HERMES, containing around 400 exogenous variables, and which is continuously being adapted, this represents an enormous task. Furthermore, the model versions used at the beginning of the sample were running on mainframes and are not compatible with

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[16] This is confirmed by a recent study analysing the sources of errors on Dutch forecasts/projections, see Kranendonck and Verbruggen, op. cit. Nevertheless for some variables (as gross fixed capital formation) it seems to remain a significant factor even for projections up to four years.

[17] For an evaluation of the risk related to the error terms of behavioural equations and to the model's exogenous variables using stochastic simulations see for instance Meyermans and Van Brusselen (2006).

[18] Risks relating to the possible misspecification of the model are limited by taking into consideration a number of diagnostic statistics during estimation and subsequent rigorous testing of the model.

the current PC software. This means that we will make use of a simplified methodology here, correcting projections for the main macroeconomic variables described in the previous chapters for errors on some key exogenous assumptions using *ex post* average elasticities as given by standard model simulations.

4.2. International trade

For a small, open economy as Belgium the development of potential export markets is a crucial exogenous variable for projecting GDP growth. The export market hypothesis is typically based on weighted (reflecting the geographical orientation of Belgian exports) import growth projections produced by international organisations (EC, OECD). As can be seen from Figure 12 below, foreign export market growth was clearly underestimated during the beginning of the sample and for the economic outlook 1997-2000, but unduly optimism prevailed at the beginning of both decades.

Figure 12 - Potential export markets growth rates: Projection errors
         (in percentage points)

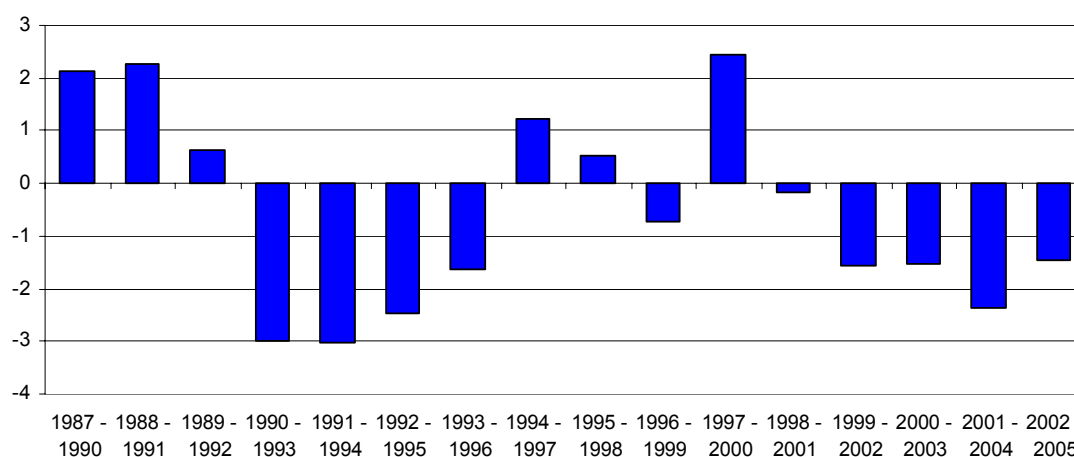Figure 13 shows the clear relationship between the errors on foreign export markets and on Belgian GDP growth. According to the regression more than 80% of the variance of the errors on the latter is explained by errors on potential export market growth and the estimate indicates that for each percentage point error on export market growth, GDP growth projection will deviate by half a percentage point from its outcome.

Figure 13 - GDP **growth and potential export markets assumptions**
(average growth rates errors in percentage points)
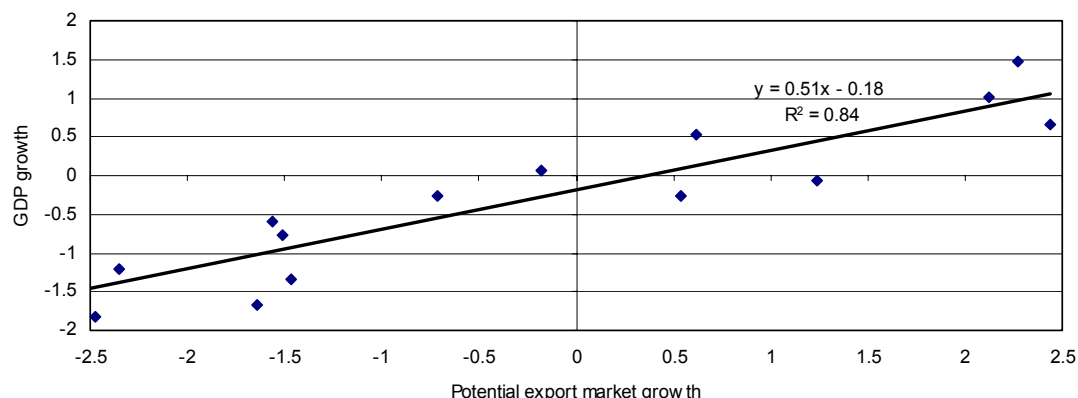
However, it is clear that the equation presented here is a reduced form estimate which captures not only the international trade surprises but also the impact of other exogenous variables of the international environment which are correlated with world trade, such as oil prices, asset prices or interest rates.[19] It may also capture the effects of fiscal policy if the latter is pro-cyclical. This explains why this effect exceeds the impact on GDP growth of a shock on world trade exclusively based on a technical simulation with the HERMES model (see Table 2 below).[20] Interestingly, this observation holds for all components of GDP except for exports. Errors on labour productivity growth are only weakly correlated with errors on potential export markets and also exhibit a smaller reduced-form elasticity.

Table 2 -   Comparison between elasticities based on a model simulation and on projection errors

	Model simulation	Projection errors
Private consumption	0.16	0.48 (R^2 = 0.61)
Business investment	0.60	1.78 (R^2 = 0.76)
Housing investment	0.04	1.43 (R^2 = 0.42)
Exports of goods and services	0.93	0.83 (R^2 = 0.94)
Imports of goods and services	0.81	0.93 (R^2 = 0.94)
Gross Domestic Product	0.37	0.51 (R^2 = 0.83)
Employment	0.22	0.39 (R^2 = 0.79)
Labour productivity	0.17	0.12 (R^2 = 0.21)

Notes: The column labelled "Model simulation" indicates the average impact over four years of a one percent increase in export markets based on a technical simulation with the 2000 version of the HERMES model (see Bossier and Vanhorebeek, 2000); the column labelled "Projection errors" gives the impact of a one percentage point error on export market growth obtained by regressing the average growth error of the variable considered on a constant and on the average export market growth error.

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[19]   For a discussion on the interaction between the errors on the different exogenous variables, see for instance Keereman (2003).

[20]   Obviously different model versions may generate slightly different elasticities, but not in such a way that conclusions drawn here would be invalidated.

To test the sole effect of the projection errors on potential export markets, we corrected projections on GDP growth and components using the elasticities based on the technical model simulation. The results are shown in Table 3. The first three columns give the ratio of respectively the mean error, the mean absolute error and the mean square error between "corrected" and "uncorrected" projection errors. These statistics indicate that the mean error on private consumption growth has been halved, while the absolute size of the error has been reduced by 20% or even 37% if large errors are more penalized. Corrections on business investment lower the average error less but significantly diminish large errors. Due to its very small elasticity vis-à-vis changes in world trade, housing investment is - not surprisingly - almost unaffected by the correction. The average projection error is almost divided by two for exports and imports and the absolute size of the error is reduced even more. For GDP as a whole the average error is lowered by 44% while the mean absolute error is reduced by more than 50%.[21] Again, large errors are removed as the value of the mean square error indicates.

Table 3 - **Key descriptive statistics for projections errors corrected for export market assumptions (1987-2005)**

	ME ratio	MAE ratio	MSE ratio	No bias	No corr
Private consumption	0.51	0.80	0.63	0.76	0.00*
Business investment	0.75	0.75	0.57	0.27	0.00*
Housing investment	1.02	0.99	0.98	0.35	0.04*
Exports of goods and services	0.59	0.42	0.18	0.00*	0.43
Imports of goods and services	0.51	0.32	0.11	0.00*	0.35
Gross Domestic Product	0.56	0.45	0.24	0.12	0.01*
Employment	6.22	0.60	0.38	0.37	0.01*
Labour productivity	0.81	0.89	0.71	0.00*	0.00*

Notes: ME ratio is computed as the mean error of "corrected" projection errors divided by the mean error of "uncorrected" projection errors; identical definition for mean absolute error (MAE) and mean square error (MSE); No bias and No corr: see notes Table 1.

Interestingly, the statistically significant bias signalled in Table 1 for exports does not disappear - export growth projections corrected for export market errors are now overestimated in all cases - and the mean error on import growth projections is now also statistically different from zero. Concerning the former, as shown in Figure 14, the losses in market shares, computed as the difference between growth of exports and of potential export markets, were undoubtedly underestimated in most economic outlooks.

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[21]   These findings are perfectly in line with the results obtained for the economic budget (see Dobbelaere and Hertveldt, 2004).

Figure 14 - Evolution of export market shares: projections versus outcomes
        (in percentage points)
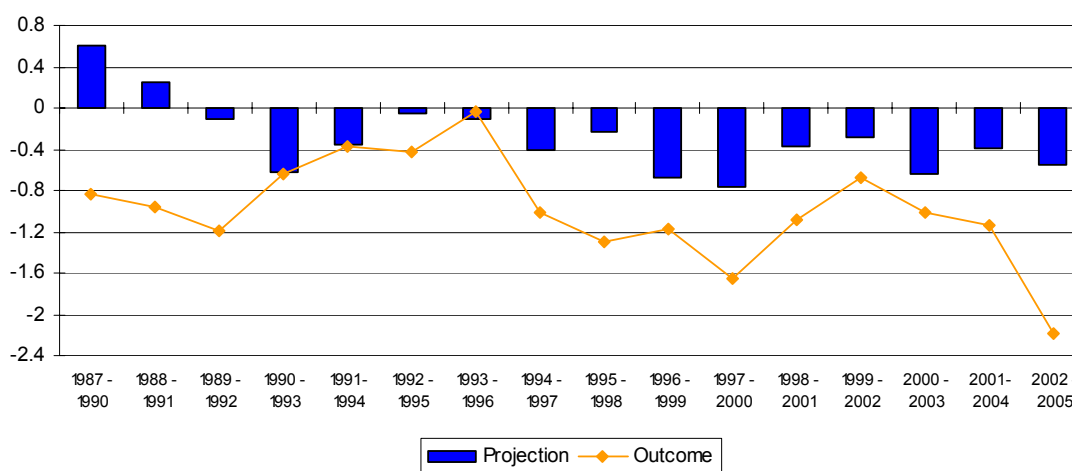
For employment, the ME ratio in Table 3 indicates that, while uncorrected errors were on average very close to zero (see Table 1), employment growth corrected for external growth errors was on average underestimated, although the bias is not statistically significant. However, the absolute size of the errors would have been significantly smaller. Note that the accuracy in labour productivity growth is only slightly improved by the correction and the optimistic bias remains. Understanding the causes behind the errors on productivity growth is far from straightforward. Broadly speaking, macroeconomic productivity growth can be explained by the evolution of technological progress, relative prices of inputs (in particular wages) determining capital deepening, working time, structural shifts within the economy and cyclical conditions. For instance, underestimating losses in export market shares may have led to an overestimation of value added in the manufacturing industry and consequently of macroeconomic productivity growth. Underestimating labour force growth, may have led to underestimate the unemployment rate and subsequently to overestimate wage growth. Analysing all these factors, as well as the impact of the no-policy-change assumption on wage evolutions and public employment, would go well beyond the scope of this paper.
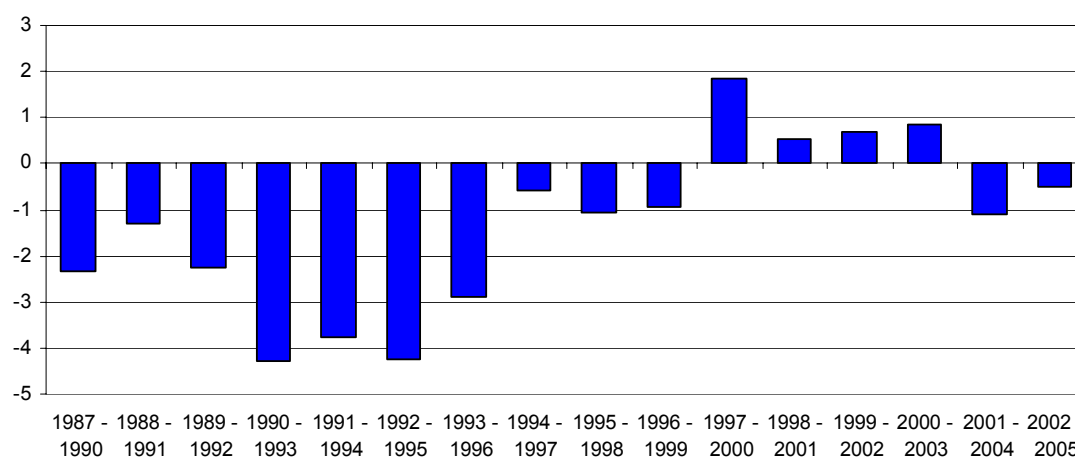
4.3. Import prices

Fluctuations in international prices (with oil prices as a special case) and in the exchange rate have a direct impact on inflation measured by the private consumption deflator and an indirect influence on the GDP deflator. In this section we will examine the impact of import prices projection errors, which are largely determined by the two exogenous variables quoted above, on domestic prices. [22] As shown in Figure 15, import price growth was strongly overestimated till

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[22]   A pricing to the market strategy by the importers would nevertheless entail some influence of domestic prices on import prices, see Hertveldt and Lebrun (2003).

the mid-nineties. This can partly be explained by the (unforeseen) appreciation of the effective exchange rate of the BEF between 1986 and 1995.

Figure 15 - Import prices growth rates: Projection errors
(in percentage points)

Interestingly there appears to be no correlation at all between the projection errors made on import prices and on consumer prices (the same holds for the GDP deflator). This observation could lead to the wrong conclusion that errors made on the internal costs and mark-ups have been the dominant factor behind the errors on domestic prices. Using a methodology similar to the one correcting GDP growth for export markets errors (results not shown here) reveals that inflation would have been underestimated and absolute errors would have been larger if future import price evolutions had been known. This implies that the absence of bias and the limited size of the mean absolute error in domestic price projections (see Table 1) is in fact the consequence of an overestimation of international prices and an underestimation of domestic costs. This clearly shows that accuracy is not a sufficient criterion to fully gauge the quality of the projections.

Figure 16 - Import and consumer prices growth: Projection errors
        (average growth rates errors in percentage points)
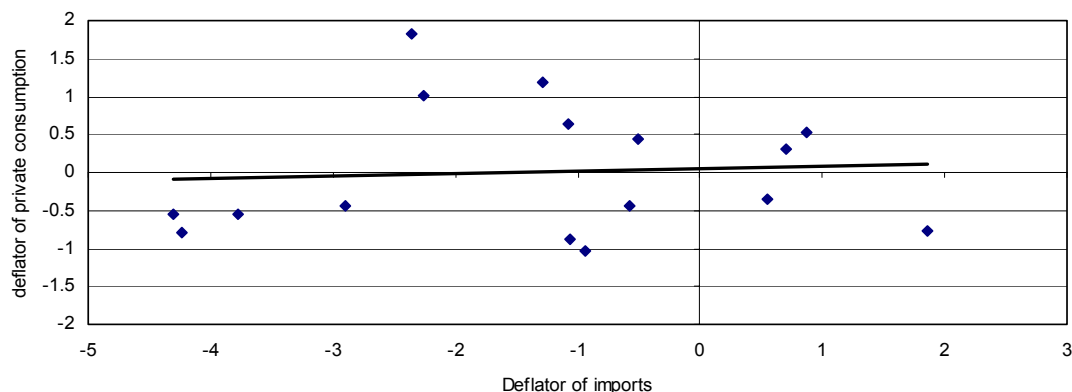
4.4. Demographic and participation rate projections

As revealed by the analysis in previous chapters, labour force growth has been underestimated in all releases of the economic outlook. Although this series is an exogenous variable for the HERMES model, its future path is in fact the combination of separate projections for population and participation rate. Figure 17 gives, since the 1993 edition[23], the respective contribution of errors on the working-age population and the average participation rate to the projection errors for labour force growth.

Figure 17 - Labour force growth rates: Contributions to projection errors
   *(in percentage points)*

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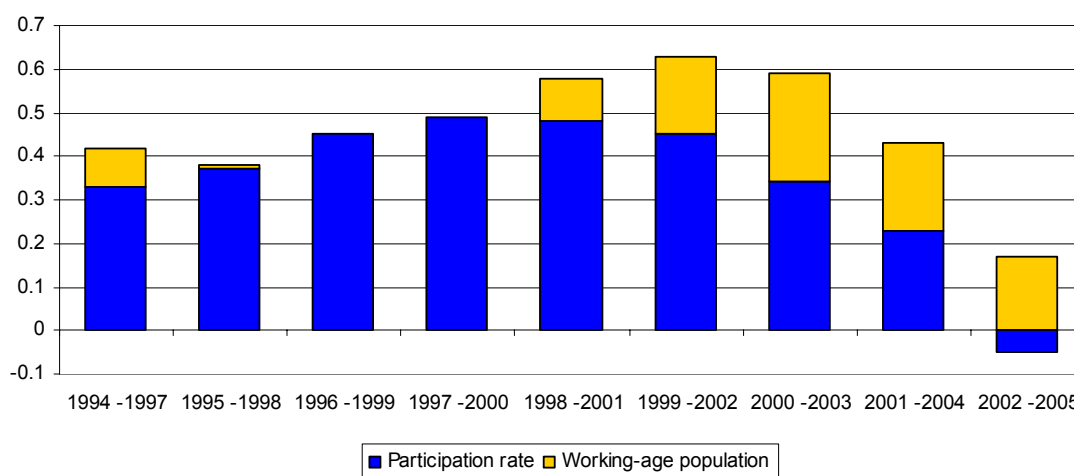
[23] Demographic projections prior to 1993 were not updated annually.

For the releases from 1994 to 1996, errors in labour force growth are almost exclusively attributable to errors in the average participation rate, while from 1997 onwards, the contribution of the latter decreased while the errors on working-age population contributed relatively more and more to the overall error. As is shown in Figure 18, the modest errors on working-age population (releases 1994-1996) correspond to an overestimation of total population growth, while since the 1997 economic outlook, total population growth (and consequently working-age population growth) has been underestimated.

Figure 18 - Total and working-age population growth rates: Projection errors
        (in percentage points)
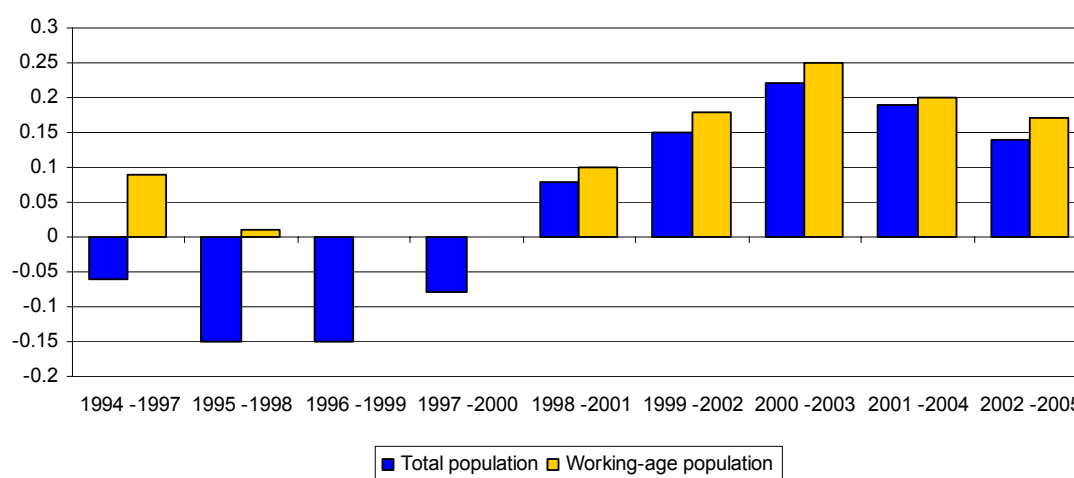

4.5. Economic and social policies

Economic and social policies do of course also have an impact on the projection errors on the macro-economic variables examined in chapter 2 and 3, but as mentioned in the introductory section of this chapter it would be an enormous task to track all the modifications, especially in the area of fiscal and social policies. Changes in monetary policy, as reflected in modifications in interest rates, would be easier to identify but applying the same methodology as for foreign trade errors might be misleading. Indeed the overall effect of changes in monetary policy is probably much larger than the only mechanical effect of variations in interest rates as would be measured with a technical simulation with the HERMES model, as co-movements are likely to occur in other exogenous variables like exchange rates and asset prices or in inflation and growth expectations.

5. Looking ahead

As mentioned in the introduction, an accuracy assessment serves two purposes, namely to evaluate the uncertainty surrounding the projection but also to help establish a research agenda for areas in which methodological developments need to be made. Although we are unable to evaluate the economic outlooks published beyond 2001 with the methodology used in the previous chapters, it is still worthwhile to have a qualitative assessment of the latest editions having in mind the main conclusions of our previous analysis. To do so we use the figures contained in the April 2007 data vintage to provide an estimate for the outcome during the periods 2003-2006 and 2004-2007.

Firstly, it is interesting to examine how GDP growth projections have evolved in recent years remembering that on average economic growth projections were too optimistic in the past. As Figure 19 reveals, GDP growth has been revised gradually downwards since the "top" attained in the 2001 issue, to reach in the 2006 edition the lowest average growth rate projected since nineteen years.[24] Note that if GDP growth estimates for the years 2006 and 2007 are confirmed, then the average GDP growth projected in the 2003 release will turn out to be close to the outcome.

Figure 19 - GDP growth: projections versus outcomes[1]
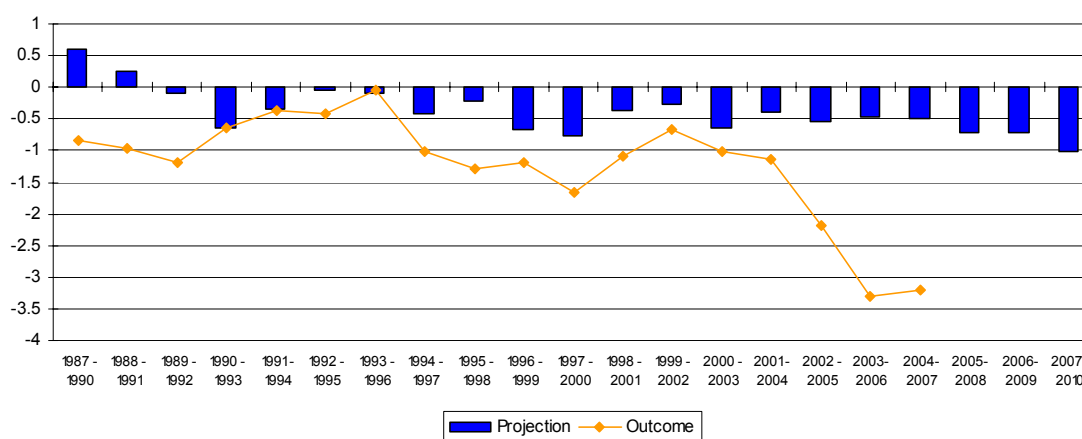   *(average growth rates in %)*
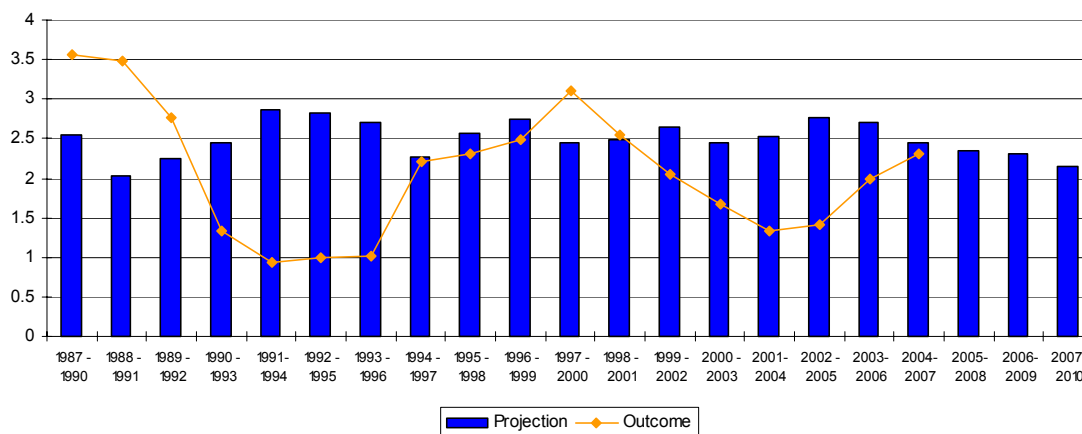
[1] The outcome for the periods 2003-2006 and 2004-2007 are based on estimates using the April 2007 data vintage.

Another important issue identified in chapter 4 concerns the evolution of export market shares defined as the difference between export growth and growth of potential export markets. According to the latest estimates (see Figure 20) market share losses have increased dramatically in recent years. Noticeably this phenomenon was not anticipated in the latest issues of the eco-

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[24]   But in fact only slightly below the average effective growth rates recorded during the overall period.

nomic outlooks. This is of course worrisome and research is ongoing at the FPB to understand its causes. Preliminary econometric evidence at an aggregate level reveals that most part of these market share losses cannot be explained by price competition effects. Data problems - especially the distinction between prices and volumes - and capacity constraints are other possible explanations that remain to be validated.

Figure 20 - Evolution of export market shares: projections versus outcomes[1]
        (in percentage points)

[1] The outcome for the periods 2003-2006 and 2004-2007 are based on estimates using the April 2007 data vintage.

Concerning productivity growth, the latest estimates tend to indicate that the very low growth rates recorded at the beginning of the decade were partly due to cyclical conditions. Following a study on the underlying causes of this decline in trend productivity growth, the latest two economic outlooks foresee very cautious average growth rates. As recent in-depth research within the EUKLEMS project indicates, the decline in trend productivity growth can essentially be attributed to a slowdown in the contribution of multi-factor productivity but also to a certain extent to structural changes within the Belgian economy. A recent revival in multi-factor productivity growth within market services might indicate that the decline has come to an end (Biatour et al, 2007).

Figure 21 - Productivity growth: projections versus outcomes[1]
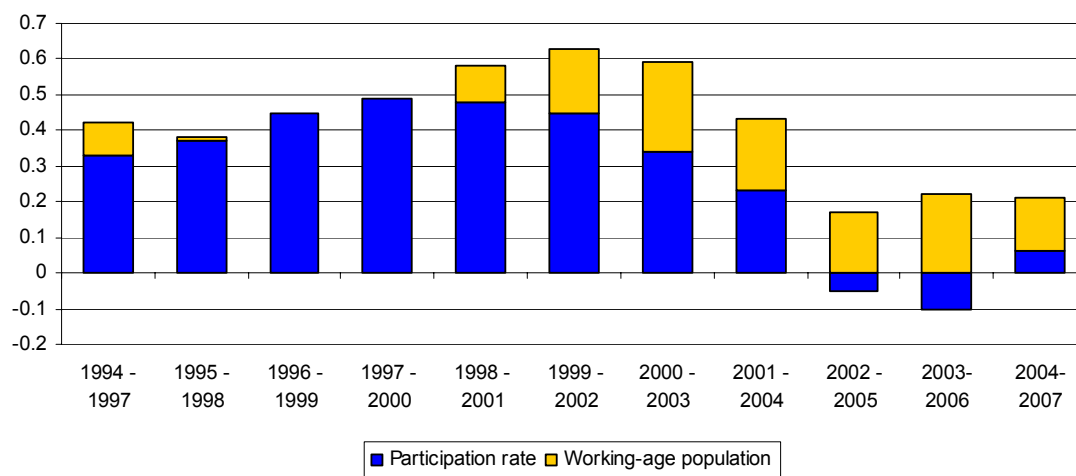 *(average growth rates in %)*
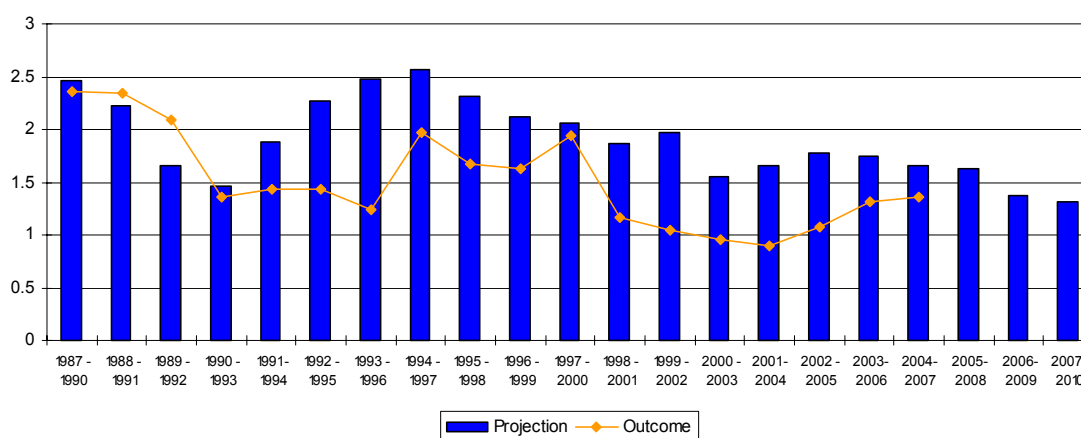
[1] The outcome for the periods 2003-2006 and 2004-2007 are based on estimates using the April 2007 data vintage.

As revealed in the previous chapter, projected average growth rates for the participation rate have been largely underestimated in the past. Aware of its past poor performance in this field, the FPB introduced a refined methodology based on the evolution of participation rates by age group and by gender. The module determines the evolution of labour supply 'bottom up' per age (five-year classes until 49, annual classes afterwards), gender and region of residence. In each of those cells, the demographic evolution is linked to a projection of the corresponding activity rate. The projection of the activity rates is based on a cohort logic, allowing the module to fully capture sociological phenomena, such as the gradual increase in female activity rates. The projection by cohort mainly extrapolates existing trends, although it also explicitly takes into account important policy measures (e.g. the gradual raising of the legal retirement age for women). Moreover, a projection of the main schemes for subsidised retirement from the labour market (early retirement, non-job-seeking older unemployed and full-time career interruption) is made simultaneously, considering both structural and cyclical influences. The improvement brought in with this new methodology is visible on Figure 22. Since the outlook 2001, participation rates are very accurately projected and do not show any systematic underestimation.

Although this new methodology has reduced the gap between the projections and the outcomes significantly, the labour force projections seem to remain too conservative. The next methodological challenge is to better understand the factors driving recent population evolutions. A working group of experts, including representatives of the FPB and Statistics Belgium, was set up last December to analyse in detail current trends and to understand the reasons behind these evolutions. Special attention will be given to the economic factors explaining immigration behaviour. New demographic projections, taking on board these analyses, are due to be finalized by 2008.

Figure 22 - Labour force growth rates: Contributions to projection errors[1]
        (in percentage points)

Legend: ■ Participation rate   ■ Working-age population

[1] The outcome for the periods 2003-2006 and 2004-2007 are based on estimates using the April 2007 data vintage.

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