

# WORKING PAPER

# 7-06

## Tools and methods used at the Federal Planning Bureau



**Federal Planning Bureau**

Economic analyses and forecasts

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## Federal Planning Bureau

The Belgian Federal Planning Bureau (FPB) is a public agency under the authority of the Prime Minister and the Minister of Economic Affairs. The FPB has a legal status that gives it an autonomy and intellectual independence within the Belgian federal public sector.

FPB's activities are primarily focused on macroeconomic forecasting, analyzing and assessing policies in economic, social and environmental fields.

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### Publications

Recent publications:

*The Economic Forecasts*

*The Economic Outlook*

*The "Short Term Update"*

Planning Papers (recent publications)

giving the results of policy analyses and assessments.

100 *De administratieve lasten in België voor het jaar 2005*

L. Janssen, Ch. Kegels, F. Verschueren - February 2006

Working Papers (recent publications)

5-06 *Linking household income to macro data to project poverty indicators*

G. Dekkers, G. De Vil, P. Willemé - July 2006

6-06 *Fiscale O&O-stimuli in België*

J. Fiers - July 2006

Citations should refer to the publication, mentioning the author(s) and the date of publication.

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## Introduction

The main task of the Federal Planning Bureau (FPB) is to produce analyses and projections in the economic, social and environmental fields that are relevant for policy making. For that purpose, the FPB has, over the course of the years, developed a number of tools and methods. These instruments take shapes of different natures: formal models articulating economic behaviour, statistical tools, bookkeeping type instruments, less formal systemic frameworks, etc. Empirical validation has always been a subject of concern (hence the special attention paid to the building of databases) and can be considered as a common feature of this heterogeneous set of instruments.

The FPB has a long tradition of building models and using them for policy analyses. The FPB's instruments have evolved significantly over time. This paper does not review the almost four decennia of experience with different tools and methods at the FPB, but gives only a brief overview of the most important instruments currently operational or under construction at the FPB. It should thus be considered as a snapshot of a constantly evolving subject.

Over the course of the years, the FPB's tools and methods have undergone a process of deepening and widening: existing instruments have been upgraded and new models have been developed in additional research areas. Imperfections of instruments that mostly come to light when using them in applications give rise to enhanced versions. New theoretical insights and advanced empirical techniques (once they seem to be well established) are taken on board. The development of new tools usually reflects new features in society, emerging policy issues or new legal missions.

At least equally important to the development of tools and methods is the proper use of them to produce analyses and projections. The FPB's experience as a 'model user' teaches first of all that instruments should be used for the purposes they are conceived for ("different models for different purposes"). To answer the question of whether a tool is suited for a given type of analysis, one should look beyond technical possibilities, and assess whether the underlying mechanisms of the tool are adequate for the issue under investigation. The FPB researchers are aware of the limitations of tools, essentially stemming from the fact that they unavoidably imply a stylisation of an increasingly complex reality. There is no single overriding model for the Belgian economy, which covers all aspects of policy-relevant issues. For that reason, the FPB often combines different tools when making analyses or projections. Models and tools start from different points of view, and have different strengths and weaknesses. In the end, the FPB summarises the outcomes of different instruments to contribute to the process of policy making.

Despite these caveats listed above, the use of more or less formalised instruments has the undeniable advantage that it increases the degree of rigour in analyses. Furthermore, reporting the characteristics of the instruments used contributes to the methodological transparency, a principle that the FPB considers of paramount importance.

In this paper, the tools and methods used at the FPB are classified in three groups: national models; international models; and other tools and methods. The listed FPB's instruments are used to produce analyses and projections in a wide range of areas: business cycle analyses and short-term forecasting, macro-sectoral analyses and medium-term outlook, long-term projections and the issue of ageing, intersectoral

relationships, international economics, labour market analyses, public finance, demographic analyses, transport economics, energy market analyses, environmental issues and sustainable development. This paper gives only a bird's-eye view of the most important tools and methods. At the end of each instrument's description, references to a short-list of technical papers, applications and to FPB contact addresses can be found.

Jan VERSCHOOTEN

FPB Vice-Commissioner

Henri BOGAERT

FPB Commissioner

# Tools and methods used at the Federal Planning Bureau

## National models

MODTRIM	<b>MOD</b> èle <b>TRIM</b> estriel: quarterly macroeconomic model
HERMES	<b>H</b> armonized <b>E</b> conometric <b>R</b> esearch for <b>M</b> odelling <b>E</b> conomic <b>S</b> ystems: medium-term macro-sectoral econometric model
LABMOD	<b>L</b> ABour Market <b>M</b> ODEl: econometric labour market model
MALTESE	<b>M</b> odel for <b>A</b> nalysis of <b>L</b> ong- <b>T</b> erm <b>E</b> volution of <b>S</b> ocial <b>E</b> xpenditure: system of interconnected models from demography to public finances
MEP	<b>M</b> icro- <b>E</b> conomic <b>P</b> ension Model: micro-simulation model for retirement behaviour
PLANET	Federal <b>P</b> LANning Bureau model analysing the interaction between the Belgian Economy and the Transport sector
PRIMES-BEL	Long-term energy outlook for Belgium

## International models

NIME	New <b>I</b> nternational <b>M</b> odel for Europe: world econometric macro-model
NEMESIS	New <b>E</b> conomic <b>M</b> odel for <b>E</b> nvironment and <b>S</b> trategies <b>I</b> mplementation for <b>S</b> ustainable <b>D</b> evelopment: macro-sectoral econometric model with economy-energy-environment interactions

## Other tools and methods

Business cycle	System of leading indicators
Labour supply	Module for medium-term labour supply outlook
Social security	Socio-demographic Models Social Protection Models
Population	Population projections
Public finance	Public finance in the national macroeconomic models
ALECA	Survey on the administrative burden
Input-Output Tables	
Satellite accounts	Transport Satellite Accounts Environmental Satellite Accounts
TransGovern	Transformation of living conditions through Governing: an integrated model for sustainable development strategy analysis and perspectives

## MODTRIM

The Federal Planning Bureau produces short-term forecasts for the Belgian economy twice a year. These forecasts are known as the Economic Budget and serve as the macroeconomic background for the preparation of the Federal Government's Revenue and Expenditure Budget. The Federal Planning Bureau has been using the annual version of the econometric model MODTRIM since 1994 as the central tool in this process. At the origin of the project and as its name indicates, this annual version was meant to be short-lived and quickly replaced by a quarterly version. Unfortunately, the lack of quarterly national accounts prevented doing so for several years. In 1998, the National Accounts Institute published official quarterly accounts for the first time and the construction of the quarterly version of the model started in Spring 2000. This provided also the occasion to reassess all behavioural equations of the annual model. The choice to develop a quarterly model was motivated by the fact that this periodicity is more suited to business cycle analysis and short-term forecasting.

The size and the aggregation level of the model were mainly determined by two factors. On the one hand, the model had to be able to forecast all the variables needed by the Government and Federal Agencies in order to allow them to prepare their budgets. On the other hand, we were constrained by the more limited availability of quarterly data compared to annual data. The structure of identities, which makes it possible to reconstruct the accounts of the institutional sectors, can therefore be considered as an aggregate version of the accounting framework of the yearly model. Overall, the model contains about 20 true behavioural equations, around 180 ad hoc equations and about the same number of identities. The outcome of the quarterly model is, like its annual predecessor, 'demand-driven' in the sense that output is essentially determined by the level of aggregate demand. World trade, international prices (including oil prices), interest rates and exchange rates remain the most important exogenous variables but equity prices now also play a role.

### *Publications:*

Hertveldt B., Lebrun I., "MODTRIM II: A quarterly model for the Belgian economy", Working Paper 6-03, May 2003.

Dobbelaere L., Hertveldt B., Hespel E., Lebrun I., "De opmaak van de economische begroting: een handleiding", "Tout savoir sur la confection du budget économique", Working Paper 17-03, October 2003.

"Budget économique/Economische Begroting", published twice a year in March and October.

### *Contact:*

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## HERMES

The HERMES model is used for medium-term forecasts and simulations of economic policy alternatives. The first version of the HERMES model was built during the period 1982-1986. The purpose of the original project was to construct an instrument for economic analysis of the economies of the Member States of the European Community. To this end, a standardised version of the HERMES model was designed and implemented in six Member States. Since then, the Belgian model has been updated and developed on a regular basis. Major improvements were made in the field of the environment and in the structure of the branches. To analyse environmental issues, the model was adapted in order to compute the evolution of greenhouse gas emissions per branch and per institutional sector. Regarding the branches, a further disaggregation of the market services was achieved in 1999 in order to better take into account the evolution of the Belgian economy. The newest HERMES version, dating from 2004, extended the number of branches again, with an additional disaggregation of the branch 'Transport and communication'. With the collaboration of the three Belgian regional administrations, the HERMREG project, aimed at developing regional modules for HERMES, started in October 2005.

The model HERMES is a medium-term demand-oriented annual model in which supply elements play an important role. The activity of the branches is determined mainly through the demand side. Production capacity is also demand-determined in the long run, although supply effects are present. The rate of production capacity utilisation affects the development of prices, investment and imports. The current version of the model contains about 4 300 equations (of which 460 are behavioural equations) and more than 670 exogenous variables. The model's size is mainly a consequence of breaking down the economy into 16 branches. The public finance block is also described in detail.

In May each year (with an update in autumn for the Belgian Stability Program) the Federal Planning Bureau delivers a medium-term macroeconomic projection for the Belgian economy using the HERMES model. The model is also extensively used to test macro and fiscal effects of policy or external shocks and provides updated and detailed projections of greenhouse gas emissions to the Belgian 'National Climate Convention'.

### **Publications:**

Bossier F., Bracke I., Stockman P., Vanhorebeek F., "A description of the HERMES II model for Belgium", Working Paper 5-00, July 2000.

Bossier F., Bracke I., Gillis S., Vanhorebeek F., "Une nouvelle version du modèle HERMES", Working Paper 5-04, February 2004.

"Perspectives économiques/Economische vooruitzichten", published annually in May.

Bassilière D., Bossier F., Bracke I., "Projections of greenhouse gas emissions by 2010 for Belgium", FPB Report, June 2005.

Planning Paper 97 (see 'labmod' for references).

Bogaert H., Bossier F., Bracke I., Dobbelaere L., "Les conséquences économiques du choc pétrolier sur l'économie belge", Working Paper 1-06, November 2005.

### **Contact:**

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## LABMOD

Recent theoretical and empirical progress in labour economics and the increasing attention paid to the supply side of labour market policies, led the Federal Planning Bureau to start building a specific model for the Belgian labour market at the start of the new millennium. Therefore LABMOD was developed to assess the short-run and long-term effects of policies that affect taxes on labour, unemployment benefits, the efficiency of matching demand and supply on the labour market, and the labour force in Belgium.

The model spells out the long-run behaviour and short-term dynamics of the market sector, without imposing any public sector budget or a balance of payments constraint. In the long run, value added and the input of (homogeneous) labour and capital are constrained by a Cobb-Douglas production function, wage contracting, a value added price mechanism driven by monopolistic competition, additional labour costs that reflect the cost of matching demand and supply on the labour market, and a mechanism that ties producer, consumer and investment prices. The short-run dynamics, however, are very much aggregate demand driven, reflecting disposable income, investment demand, world demand and international price competitiveness. The long-run equilibrium real wage responds to the tax wedge, labour market tensions, labour productivity and the replacement rate between unemployment benefits and take-home wages. There is no mechanism that keeps the steady-state unemployment rate unaffected after a shock in the labour force. Long-run equivalence is imposed on the employers' SSC rate, the personal-income tax rate and the employees' SSC rate. In the short run, however, the real wage appears to be more sensitive to the employers' SSC rate than to employee tax rates.

LABMOD has been used alone or in combination with the HERMES model to assess, for instance, the impact of the personal income tax reform in Belgium or the effects of several tax shifting schemes aiming at reducing labour costs.

### **Publications:**

Joyeux C., Hendrickx K., Masure L., Stockman P., "Een nieuw macro-econometrisch arbeidsmarktmodel: schatting, basissimulatie en arbeidsmarktbeleidssimulaties", Working Paper 13-03, August 2003.

Stockman P., "Personal income tax reform in Belgium: The short-, medium- and long-run impact on wages, employment and value added re-examined by LABMOD", Working Paper 11-04, April 2004.

Bassilière D., Bossier F., Bracke I., Lebrun I., Masure L., Stockman P., "Socialezekerheidsbijdrageverminderingen en alternatieve financiering van de sociale zekerheid: simulaties van beleidsvarianten", "Variantes de réduction des cotisations sociales et de modalités de financement alternatif", Planning Paper 97, January 2005.

### **Contact:**

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## MALTESE

Since the early eighties, the legal pension system in Belgium has been reformed on several occasions. In order to preserve the long-term financial sustainability of the public pension schemes, the government felt the need to assess these reforms in a long-term perspective. To do so, the government needed a tool to evaluate the budgetary cost of various alternative policies. The analyses were carried out by the FPB, within the scope of its legal assignment to support economic policy making. For that purpose, the FPB developed the MALTESE model. In order to assess the full impact of the different policy variations, and in particular the side effects of the reforms on other public expenditures, it appeared necessary to extend the model to all social expenditures, social security contributions, tax revenues, and debt dynamics.

MALTESE -projections have been carried out in different studies concerning the long-term projections of social and educational expenditures in Belgium (1990, 1994, 1997, 2000). These studies have been reported to the government, Parliament and social partners, published under the responsibility of the FPB and presented at international scientific workshops. The Law of September 2001 requiring a continuous reduction in the national debt and the establishment of the Ageing Fund, also provided the creation of the Committee for the Study of Ageing. This Committee has to draw up an annual report on the budgetary and social consequences of ageing. The FPB serves as the secretariat of the Committee and is also responsible for the simulations.

The functioning of the MALTESE model can be described schematically as follows. Starting from a demographic projection, the model generates the main elements determining the long-term evolution of receipts and benefits of the different social security schemes, and, finally, of the whole public finances. This is done within predefined scenarios with hypotheses concerning the macro-economic environment, labour supply behaviour and access criteria in the different social schemes, and, finally, the legislation on the calculation of the social benefits and their linking to the general welfare evolution.

As the requested policy scenarios grew more and more complex, the MALTESE model developed into a central model with several interconnected peripheral models, allowing a more detailed description of some determinants. Specifically, certain aspects of socio-economic behaviour, the calculation of the pension amount in each pension scheme, and health care expenditure are treated in separate models, each with its specific characteristics (see pages 'socio-demographic models' and 'social protection models').

The global results of the peripheral models are centralized in the 'core' MALTESE model, which completes the simulation and produces a homogeneous output. This approach allows studying the impact of both endogenous developments and policy parameters on the financial and social sustainability of the future pensions.

### **Publications:**

Hoge Raad van Financiën - Studiecommissie voor de vergrijzing / Conseil Supérieur des Finances - Comité d'Etude sur le Vieillessement – Report published annually in May.

Englert M., Fasquelle N., Festjens M-J., Lambrecht M., Saintrain M., Streel C., Weemaes S., "Verkenning van de financiële evolutie van de sociale zekerheid 2000-2050", "Perspectives financières de la sécurité sociale 2000-2050", Planning Paper 91, January 2002.

**Contact:** malt@plan.be

## MEP

The MEP model has been used since June 2005 and has no predecessors. The purpose of MEP is to provide an insight into the extent that the current public retirement schemes for private-sector wage earners might encourage older workers to voluntarily leave the labour market and enter retirement. What are the implicit and explicit financial consequences of continuing to work? And do these differ between workers of different categories, and between the two main public retirement schemes available to private sector employees in Belgium?

MEP simulates both the retirement scheme and the Conventional Early Leavers' Scheme ('Brugpensioen') as well as income tax regulations for Belgium for the years between 1996 and 2004. It aims at answering the above questions by exploiting the so-called option-value approach. The model is based on the notion of actuarial non-neutrality of a retirement scheme, by setting the gains from postponing retirement (extra salary) against the associated losses (foregone expected pension for all future years until decease) associated with a specific retirement scheme. However, unlike previous applications of this approach, this model does not take a representative sample as the point of departure, but simulates the costs and benefits from postponing retirement of four fictitious employees, who represent male and female white- and blue-collar workers.

The MEP model simulates on the level of the individual. This gives it a unique position within the Federal Planning Bureau. The advantage of MEP is that it confirms conclusions drawn by other authors (among which are Gruber and Wise, 2004), whilst in addition allowing for the separation of specific retirement schemes, and for the effect of different fiscal regimes for retired and working persons. This way, it allows the simulation of very specific aspects of pension and tax regulations which may affect an individual retirement decision.

There are no links with other instruments currently used at the FPB. A limitation of MEP is that there is no micro-macro interaction. Consequently, the macro-budgetary effects of a potential policy measure still need to be simulated by other specifically designed models such as MALTESE. Because it is able to simulate the effect of very specific tax and pension regulations on the individual level, MEP has a large potential in supporting policy makers in designing and implementing pension and fiscal policy. It aims to take up this role in the future.

***Publications:***

Dekkers G., "De Financiële Implicaties van Langer Werken: een Micro-Economisch Pensioen Model (MEP)", Working Paper 15-05, July 2005.

Dekkers, G., "The Financial Consequences of Working Longer: an Application of a Micro-Economic model of Retirement in Belgium", International Journal of Microsimulation, forthcoming.

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# PLANET

The projection model of the Belgian Federal PLANning Bureau, which models the interaction between the Belgian Economy and the Transport sector, is in the first stages of development<sup>1</sup>. The development started in 2004 and a first version of the model is expected in 2006-2007. The model will be used to produce, in particular for the Federal Ministry of Transport:

- medium- and long-term projections of annual transport demand in Belgium, both for passengers and freight transport;
- simulations of the effects of transport policy measures;
- cost-benefit analyses of transport policy measures.

The model consists of five main modules: MACRO, TRANSPORT, COST, POLICY and WELFARE. The main aim of the MACRO module is to provide macroeconomic projections at the level of the NUTS3 zones for Belgium. The HERMES model is used to provide the following inputs into the PLANET model: the value of production, import and export, employment, household income, prices and wages. The HERMES results for the value of production and employment need to be spatially disaggregated at the NUTS3 level. The level and composition of transport demand is provided by the TRANSPORT module according to a 4-step procedure: (1) the generation of trips in each NUTS3 zone, (2) the distribution of trips originating from each NUTS3 zone among the different NUTS3 zones, (3) the derivation of the mode by which the trip is made, and (4) the determination of the time at which the trip takes place. The COST module provides transport costs as well as information on the environmental and safety impacts of transport and on net government revenue obtained from transport users and producers. It also derives the marginal external costs of transport. The POLICY module summarises the policy instruments that are used in the scenario analysis. Finally, the WELFARE module computes the effects of transport policy measures on welfare.

Due to the many methodological and data challenges involved in the development of such a comprehensive model, the objective is to have a simple operational version of the model in a short period of time (2006-2007) and then to progressively improve the coverage and capabilities of the model.

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<sup>1</sup> For the development of the PLANET model, the FPB received a funding for 4 years from the Federal Ministry of Transport.

## PRIMES-BEL

In order to fulfil its mission in the framework of the implementation of the internal EU electricity and gas markets in Belgium<sup>1</sup>, the FPB elaborates and publishes a long-term energy outlook for the country every 3 years. The first publication was issued in 2001. The time horizon of the projections ranges from 20 to 30 years (see references below).

The energy outlook is based on quantitative analyses using the PRIMES energy model<sup>2</sup>. More precisely, the study combines a reference scenario describing the evolution of the Belgian energy system without any structural or policy change, with a number of alternative scenarios that are evaluated with respect to the reference scenario. The alternative scenarios focus on long-term energy and environmental challenges related to the expected sharp increase in fuel consumption in transport and the fuel and technology mix in the power generation sector in the context of the nuclear phase-out and the Kyoto commitments. Sensitivity analyses involving the prices of oil and gas are also included in the study.

The quantitative analysis involves all energy transformation and consuming sectors (e.g. power generation, industry, households, etc.) and all energy forms (coal, oil products, electricity, etc.). It provides not only information on the evolution of the energy system, but also on energy-related CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> emissions. The PRIMES model, however, does not allow assessments of the feed-back of policies and measures on the economy, which can be seen as a weakness of the approach.

The PRIMES model is not available at the FPB and the implementation work is sub-contracted to the Technical University of Athens (NTUA), the main developer of the model. The scenario definition, some data collection, the results' analysis and the report writing, however, are performed by the FPB in close collaboration with NTUA.

It is worth noting that some results of the long-term energy outlook are used in the in-house-developed HERMES model (e.g. evolution of the structure of electricity generation) and that efforts are made to reconcile the medium-term energy perspectives of HERMES with the long-term energy perspectives of PRIMES, notably in the context of climate change policy.

The long-term energy outlook of the FPB is used by the federal energy regulator, the government and the federal administration.

### **Publications:**

Courcelle C., Gusbin D., "Energievooruitzichten 2000-2020 – Verkennende scenario's voor België", "Perspectives énergétiques 2000-2020 - Scénarios exploratoires pour la Belgique", Planning Paper 88, January 2001.

Gusbin D., Hoornaert B., "Energievooruitzichten voor België tegen 2030", "Perspectives énergétiques pour la Belgique à l'horizon 2030", Planning Paper 95, January 2004.

### **Contact:**

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<sup>1</sup> Cf. the Belgian Electricity and Gas Laws implementing the EU Electricity and Gas Directives.

<sup>2</sup> The PRIMES model is a partial equilibrium model of the energy system that integrates energy demand and supply. The model exists for each EU Member State. Its development was financed by the European Commission. On a regular basis, PRIMES is used by DG TREN to provide long-term projections for the European Union. For further information, see: <http://www.e3mlab.ntua.gr/manuals/PRIMsd.pdf>.

## NIME

In the past, the Federal Planning Bureau made intensive use of the HERMES-LINK world model for its recurrent tasks, such as the medium term economic forecasts, and for its international research programmes. However, this system, composed of eight large sectoral national models and four bilateral trade flow models, had gradually become outdated and did not reflect developments in the European monetary and economic environment. Therefore, it was decided in 1999 to build a new, easier to maintain, world model called NIME that would better reflect the new European framework.

In the current version of the NIME model, the world is divided into six blocs, i.e. the euro area, the bloc consisting of the Western EU Member States that do not belong to the euro area, the New EU Member States, the United States, Japan and a bloc representing the rest of the world. All these country blocs are linked together by trade and financial flows. In all of these blocs but two, i.e. the New EU Member States and the rest of the world, we distinguish a household sector, an enterprise sector, a government sector and a monetary sector. A similar set of behavioural equations and accounting identities is specified for each sector across blocs, while the parameter values of the equations are obtained using econometric techniques applied to the aggregated, annual data of the different blocs.

The NIME model makes an analytical distinction between three time horizons. First, the short run is the period during which the plans of the different sectors are not fully realised, because of adjustment costs during the implementation of these plans. In the short run, prices adjust sluggishly and output adjusts to meet demand. Second, the medium run is the period during which the plans are realised, but might still change because the other endogenous variables have not yet fully adjusted to their steady state value. Third, the steady state is the period during which changes in nominal variables have no real effects, and during which, for example, the unemployment rate is equal to its natural rate, the expectations are fully realised, the public debt to GDP ratio and the foreign debt to GDP ratio are stabilised, and the economy is on a balanced growth path.

The model is used to make medium-term projections for the international economy, which are published twice a year in January and August, as well as to study the transmission mechanisms of economic policies and exogenous shocks.

***Publications:***

Meyermans E., Van Brusselen P., "The NIME Model: A Macroeconometric World Model", Working Paper 3-01, June 2001.

The NIME Economic Outlook for the World Economy, twice a year in January and August.

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## NEMESIS

NEMESIS is a macro-sectoral econometric model built for decision-making in the fields of energy, environment and economic policies. The model's development is co-financed by the European Commission and is carried out by a European consortium led by the 'Laboratoire ERASME (Paris)' and including the FPB as one of the contractors. The main purposes of NEMESIS are the production of macro and sectoral short and medium-term forecasts and the analysis of policy cases related to energy/environment and R&D.

NEMESIS is a large econometric model which covers the former EU15-countries plus Norway, 30 sectors and 27 consumption functions, amounting to about 70 000 equations, of which 8 000 are estimated econometrically. Each of the 16 European countries is fully modelled and is essentially linked to the others through external trade. The rest of the world, which includes 10 different geographical areas, is assumed to be exogenous. The main exogenous variables are the short- and long-term interest rates, exchange rates, activity proxies and goods prices for the rest of the world, demographic variables and the tax systems.

The following characteristics of the model are worth mentioning. The supply side incorporates some properties of the new theories of growth, i.e. the endogenisation of technical progress. In particular, endogenous R&D decisions determine a knowledge variable that, in turn, implies process and quality innovations (those being also affected by technological and knowledge spillovers). The production technology considers three variable factors (labour, energy, materials) and two quasi-fixed factors (R&D and capital). As far as external trade is concerned, it is treated as if it takes place through two channels: intra-EU and trade to the rest of the world. Data availability was an important factor in this choice – it allowed an emphasis to be put on intra-EU trade flows, which represent a large portion of the total trade in the EU. One caveat worth mentioning is that, while it is possible to identify volumes for intra- and extra-EU trade, databases do not provide this distinction for prices. The energy-environment sub-module transforms sectoral activity indicators from the 'economic' sub-model into relevant energy indexes with price effects and pollutants emissions: CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, HFC, PFC and CF<sub>6</sub>.

### ***Publications:***

Bureau fédéral du Plan, Chambre de Commerce et d'Industrie de Paris, ICCS, Laboratoire ERASME, 2002, "Detailed technical final report for the European Commission".

Brécart D., Chevallier C., Fougeyrollas A., Le Mouël P., Lemiale L., Zagamé P., "3% d'effort de R&D en Europe en 2010: Analyse des conséquences à l'aide du modèle Némésis", Study for the European Commission, Research Directorate-General, 2004.

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## System of leading indicators

As this system is used in combination with the econometric model MODTRIM to produce a complete macroeconomic forecast, we are not only interested in the overall business cycle, but also in the cyclical evolution of the different expenditure categories and sectors of the economy. While the system of leading indicators is able to give a quick diagnosis of the current state of the business cycle and the near future, it can neither rely on the same degree of coherence, nor on the theoretical and empirical basis of an econometric model. Accordingly, and given the complementarity of both instruments, the system of leading indicators is essentially used to check, component by component, the results of the Modtrim-model. If the model's result is confirmed by the leading indicator, the probability of the forecast increases. If both instruments give divergent diagnoses, the experts' views settle the matter. In fact, if the information supplied by the leading indicators is judged to be robust, the model's results can be corrected using add-factors. If, on the contrary, some divergence between the leading indicator and the reference series has been observed during the most recent period, the spontaneous model's result will be retained.

The FPB follows a similar methodology to CPB Netherlands: the leading indicator technique is applied for each private expenditure component (private consumption, business investment, housing investment and exports) and for each market sector (manufacturing industry, construction and market services). After that we construct, by calculating weighted averages of the composite indicators of the individual series, a composite indicator for the cyclical component of GDP for each approach (expenditure and production). Finally, we combine these two series to obtain a composite indicator for the overall business cycle.

The leading indicators are published in "Short Term Update", the quarterly newsletter of the FPB, under the heading 'Recent economic developments'.

### ***Publications:***

Lebrun I., "Le système d'indicateurs avancés du BFP - Un nouvel outil pour l'analyse conjoncturelle", Working Paper 2-99, June 1999.

"Short Term Update – Quarterly Newsletter of the Federal Planning Bureau", published in February, May, September and December.

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## Labour supply module

The medium-term labour supply is calculated 'off model' by means of a separate module and is entered as an exogenous variable into the medium-term model HERMES and into the short-term model MODTRIM (in the latter case, only for the year  $t+1$ ).

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. These results are also introduced as exogenous variables into the HERMES and MODTRIM models.

The results at the federal level for both labour supply and subsidized retirement from the module also serve as a starting point for the long-term socio-demographic modelling (see MALTESE and modules of social security schemes).

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## Socio-demographic Models

The evolution of the number of beneficiaries in the different social security schemes is simulated by means of specific models (briefly discussed below), distinguishing several socio-economic groups (working population, students, pensioners, disabled people, etc.), subdivided by status (wage earners, self-employed workers, civil servants). The projection of the working population is produced in the 'Labour Supply Module'.

The MALTDEMO model calculates the schooling and activity rates per gender and per age class. The model generates successive generations, maintaining the difference in labour market behaviour of one generation compared to the previous one (in the same age class, 5 years earlier in time) as that generation grows older. For the future active generations, a link is made to the schooling rate of the same generations at a young age. It also calculates the risk of inflow into the disability scheme in connection with demographic evolutions.

The HORBLOC model estimates the number of pensioners per pension scheme and per pension status in each scheme. The probability of inflow into a retirement pension (between the age of 60 and 65) – subdivided by gender, age, and pension scheme – is connected with the probability of outflow from the socio-economic groups, in such a way that the number of 59 year old people in year  $t$  (working or in an equivalent status) determines the number of pensioners at the age of 65 in year  $t+6$ . Because of this connection with the activity, the future evolution of the number of pensioners takes the increasing number of women having built up own and growing pension rights into account. This leads to an increasing split of household rate pensions into two separate retirement pensions for men and women, followed by a cumulated old age and survivor's pension for the surviving spouses. As a result, changing professional behaviour is translated into new retirement behaviour of the future generations.

This changing professional and retirement behaviour has an impact on the future pension amounts. The pension amounts in each pension scheme are computed in a separate model (see page 'social protection models').

The output of these models is used in the medium-term macro-economic projections (see page 'HERMES model') and in the long-term projections (see page 'MALTESE model').

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## Social Protection Models

Changing professional behaviour, reflected in new retirement behaviour of the future generations (see MALTDEMO and HORBLOC: page 'socio-demographic models'), has repercussions on the future pension amount. In each scheme the pension amounts are calculated in separate models, considering the ageing of the successive generations, and containing a sophisticated calculation of the pension amount of the new retirees. In each submodel, the model targets the specific calculation rules and the characteristic behaviour in each pension scheme. A mechanical approach was chosen, mimicking the actual pension calculation of type cases and allowing the study of the impact of each single policy parameter, using current rules or alternative parameters with respect to pension mass and pension amount.

The PENSION model, which generates the pension mass in the employees' scheme, pays special attention to the influence of the wage limit on the highest pensions, the increase of the lowest pensions through the attribution of a minimum right per year of career and the extension and improvement of female pension rights (despite their temporary slowdown as a result of the growth of part-time labour since the eighties).

The MOSES model, which generates the pension mass in the self-employed workers' scheme, contains an extensive modeling of the transition from fixed pensions to pensions based on earned income. As the scheme covers a very hybrid group of beneficiaries, as far as income level, length of career and mixed pension rights is concerned, the model evaluates the pension of a large number of type cases, coming from 60 different kinds of activities. Moreover, this model extensively deals with the 'minimum pension'.

Finally, the PUBLIC model evaluates the pension mass in the public sector. The specific characteristics of this scheme, namely the principle of the delayed wage (pension calculated on the basis of the salary at the end of the career, linked to the official salary rates, retirement due to physical disability) and preferential quota (granted to specific professions), play an important role in subdividing the different pension types in each public subsector (administration, education, ...).

Public expenditure for acute and long-term health care is estimated on the basis of the spending profiles per age and gender (to measure the influence of changes in the demographic structure) and of its historical trend. The latter, expressing the dynamics of supply and demand factors as well as of political objectives, is estimated as a medical consumption function, with GDP per capita as explaining variable (as a measure of the capacity to finance new technological developments in health care).

The output of these models is used in the medium-term macro-economic projections (see HERMES model) and in the long-term projections (see MALTESE model).

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## Population projections

The Belgian population projections are the result of close cooperation between Statistics Belgium, the Federal Planning Bureau and an open group of experts (demographers, geographers, sociologists, economists, health specialists and users from various government agencies).

Usually, the Belgian population projections are elaborated at the NUTS-3 geographical level (the 43 Belgian administrative districts ('arrondissements'), '44' if one includes the German-speaking community, which covers one part of a district). These 43 districts can then be grouped into 11 provinces (NUTS-2 level), 3 regions (NUTS-1 level), 3 communities and the country. These projections provide a central scenario and alternative scenarios that are obtained by a low and a high variant for each of the three basic parameters: fertility, mortality and external migrations. All three scenarios for each parameter are defined as realistic, with the central one being the most plausible.

The bulk of the work, each time a new set of reviewed population projections arrives, is to collect and analyse the past data, proceeding to suitable regroupings so as to be able to analyse the data at a very detailed level. Data are indeed available for the 2 genders, 113 ages, 43 districts and, at present, 3 groups of nationalities (Belgians, non-Belgian Europeans (EU-15) and remaining nationalities). Methods such as principal component analysis and cluster analysis, help to rank the fertility and mortality patterns of the districts.

The model is written in APL (A Programming Language), which, thanks to the use of matrices, is very efficient for analysing and forecasting data comprising several dimensions as described above.

The calculations start from an observed population on January 1st and successively inject projected mortality rates, fertility rates for women aged 15 to 49 and emigration rates from one district to the other 42 as well as to a foreign country. International immigration projections are determined on the basis of past observed levels and expected evolutions. It should be noted that all above-mentioned rates and levels are elaborated by gender, age and nationality group. Next, a probability of naturalization is applied to the foreign population living in Belgium. After some minor adaptations needed to reflect the births and deaths that may affect the immigrants for the year, the population at the end of the year is obtained. After that, a new iteration can begin, until the year 2050 in the last exercise.

The last official population projections, i.e. the "Population projections 2000-2050", were based on the available population figures on 1 January 2000. These population projections are, however, updated by the FPB on a yearly basis for its own needs, using the observed population on 1 January, without modifying the basic hypotheses.

**Publication:**

Statistics Belgium / Federal Planning Bureau, "Bevolkingsvooruitzichten 2000-2050 per arrondissement", "Perspectives de population par arrondissement 2000-2050", November 2001.

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## Public finance in the national macroeconomic models

Public finance plays an important part in the different models in use at the Federal Planning Bureau (FPB). However, its precise role is influenced by the specific features of each model. In the European System of Accounts (ESA), the public services sector is divided up into four sub-sectors: the Federal government, Social Security, the federated entities (Regions and Communities) and the local authorities (municipalities, provinces, social aid centres (CPAS/OCMW) and police districts).

In the HERMES model, which is used for medium-term projections and for simulating economic policies, each type of public revenue and expenditure is estimated in annual figures for each of the sub-sectors. The grand total of expenditure and revenues, the financing capacity, and then the debt of each sub-sector are obtained using a bottom-up approach. The aggregates for the whole sector of the public services are determined by consolidation.

Except for interest payments and unemployment benefits, for which behavioural equations are used, public expenditure depends only to a limited extent on economic factors (except inflation) and thus has a mainly exogenous character. As far as the authorities at the federal level (including Social Security) and at the federated entities' level are concerned, the estimate of expenditure and the integration of discretionary decisions is based on a detailed analysis of available annual budgets and their conversion to the ESA definitions. In the medium term, expenditure projections are the result of the translation into the national accounts of the multi-annual projections carried out by the authorities themselves, of a quantification of the planned measures, or, failing that, of hypotheses elaborated by the FPB (such as, for example, extrapolating the trend of the previous years). For the local authorities' primary expenditure, the method is different. Given the great number of actors involved, it is impossible to take the budgets as a starting point. As a consequence, behaviours observed in the past are extrapolated, while trying to fully integrate the decisions taken, among others, by authorities at other levels.

Just as for expenditure, the main non-fiscal revenues are almost entirely exogenous, and their projections reflect the decisions as closely as possible, depending on the accuracy of the information contained in budgets and official announcements. On the other hand, the evolution of fiscal and parafiscal revenues depends both on the macroeconomic context and on the measures taken. Those revenues are therefore calculated endogenously, while taking into account the specificities of the tax system (e.g. progressiveness). Where applicable, discretionary measures are incorporated in the projection on the basis of the ex ante quantification made by the government, but the ex post result takes into account the evolution of the tax bases, which are themselves computed by the model.

The MODTRIM model for short-term forecasts is based on quarterly data, which are only available for the sector of the public services as a whole, not for each sub-sector. However, as far as primary expenditure is concerned, no specific quarterly profile is projected. On the other hand, an adequate methodology has been developed to estimate fiscal revenues, which allows cyclical behaviour to be taken into account.

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## ALECA (Survey on the administrative burden)

At the request of the Council of Ministers and in collaboration with the Service for Administrative Simplification (DAV/ASA), every two years the FPB estimates of the cost of the administrative burden for companies and self-employed persons in Belgium. The estimate of the administrative burden is based on a national survey among a representative sample of companies and self-employed persons.

Up to now, three national surveys have been conducted: for the years 2000, 2002 and 2004, respectively. All surveys use the same methodology and the same (updated) sample of companies and self-employed persons. The sample of companies is subdivided into three categories in order of magnitude (small, medium-sized and large) and into two categories of activity (industry and services). The sample of self-employed persons is subdivided into four activity classes (agriculture, industry, construction and services). The survey also allows some general conclusions for the three regions to be drawn.

The survey covers three areas of legislation: environmental, employment and tax legislation. The questionnaire for each of these three areas comprises three parts. First, a quantitative section that allows a monetary estimate of the administrative burden to be provided. Secondly, a qualitative part that represents the opinion of companies and self-employed persons on the quality of regulation and of administration. Finally, a last section directly linked to the actual measures taken as part of the simplification process and to the companies' and self-employed persons' expectations in this field.

The quantitative part contains a number of questions of which the answers allow the total cost of the administrative burden to be determined. The total cost is the sum of the internal and external costs. The internal costs represent the hours spent by employees or self-employed persons on carrying out the necessary procedures, estimated using the average hourly labour costs derived from the survey. The external costs include the expenses for subcontractors needed to meet the administrative obligations.

The qualitative indicators are classified into two large categories: indicators relating to the quality of legislation and indicators relating to the quality of contact with the administration in charge of that specific legislation. The phrasing of the questions is similar for both categories: a number of propositions have to be evaluated by marking one of the following possibilities: fully agree, agree more or less, rather disagree, fully disagree or no opinion. The final section probes enterprises and self-employed persons about their knowledge and use of current simplification projects. It also inquires into their opinion on projects promoting administrative simplification.

### **Publications:**

Janssen L., Kegels Ch., Verschueren F., "De administratieve lasten in België voor het jaar 2004", "Les charges administratives en Belgique pour l'année 2004", Planning Paper 100, February 2006.

Joos A., Kegels Ch., "De administratieve lasten in België voor het jaar 2002", "Les charges administratives en Belgique pour l'année 2002", Planning Paper 94, January 2004.

De Vil G., Kegels Ch., "De administratieve lasten in België voor het jaar 2000", "Les charges administratives en Belgique pour l'année 2000", Planning Paper 92, January 2002.

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## Input-Output Tables

On the basis of the Law of December 1994, the Federal Planning Bureau is responsible, within the framework of the National Accounts Institute, for drawing up the five-yearly input-output tables (IOT). In the past, IOT were drawn up by Statistics Belgium (NIS/INS). Statistics Belgium published IOT for 1959, 1965, 1970, 1975, and 1980. Afterwards, the FPB estimated tables for 1985 and 1990, respectively published in 1998 and 1999. In February 2003 the IOT for 1995 were published, elaborated according to ESA95 rules. The most recent IOT cover the year 2000 (published in December 2004).

IOT are used as an instrument of analysis for specific sectoral studies (mostly at the request of the social partners represented in the Central Economic Council - CRB/CCE), for the study of inter-industrial relations, and for impact studies.<sup>1</sup> As the FPB finds itself at the source of IO-data, it is possible to produce analyses at a more detailed sectoral aggregation level than published.

IOT are used in interaction with the FPB macroeconomic models. For instance, impact studies are generally carried out in combination with the HERMES model to assess second-round demand effects. IOT are also entered into the production and price module of the HERMES model. The MODTRIM model uses the import content per component of the final expenditure, deduced from the IOT for imports.

Finally, we mention that, recently, the development of a Social Accounting Matrix ('labour oriented SAM') has been started. In a first stage, employment is differentiated by gender, age, statute, and education level. At the same time, a study is being carried out in order to assess the feasibility of interregional IOT (for the three Regions).

### **Publications:**

INR/FPB, ICN/BFP, "Input-Outputtabellen van België voor 2000", "Tableaux Entrées-Sorties de la Belgique pour 2000", December 2004.

L. Avonds, "Een vergelijkende analyse van de Input-Outputtabellen van 1995 en 2000", Working Paper 4-05, February 2005.

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<sup>1</sup> Examples of such applications can be found in the FPB Working Papers 12-05, 21-04, 20-03, 3-02, and 1-00.

## Satellite accounts

Currently, the FPB is working on two kinds of satellite accounts: the satellite accounts for transport and the environmental accounts.<sup>1</sup> Satellite accounts constitute a supplement and an extension of the national accounts, and are aimed at conducting policy analyses.

### Transport Satellite Accounts

Transport Satellite Accounts (SA) are currently being developed for Belgium.<sup>2</sup> They will provide a more comprehensive accounting of the transport activity in the Belgian economy. To illustrate this point, it is worth noting that the National Accounts provide no direct information about the level and incidence of ancillary transport activities carried out within producer units.

The methodology used in this project follows, to a large extent, the methodology developed and applied in France for transport SA. According to this methodology, transport activity is estimated from transport expenditure and for each mode of transport (“private” road transport, “public” road transport, railways, inland waterways and aviation). Transport expenditure is divided into two categories: current expenditure and capital expenditure, and is allocated to the different agents (households, government, etc.). Furthermore, the transport SA also include information about fiscal receipts.

The transport SA are elaborated at national level (Belgium) and for the years 1995 and 2000. In the future, most likely the frequency of transport SA will correspond to that of the national Input-Output tables.

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### Environmental Satellite Accounts

The main FPB activities with respect to environmental accounts relate to NAMEA Air, Namea Energy and EPEA.<sup>3</sup> Those operations are largely financed by Eurostat.

Apart from drawing up the environmental accounts, we also carry out research into interesting applications. Thus, the combination of the three sets of data (NAMEA Air, NAMEA Energy and EPEA) may lead to new insights, e.g. through a decomposition analysis of the air pollution. Linking environmental data to (macro)economic indicators (e.g. from the IOT) constitutes another interesting domain of analysis.

Although Eurostat only demands environmental accounts for Belgium, most data are collected at regional level, thus allowing the development of regional analyses. For instance, a number of methods for regionalizing emission projections have recently been explored.

#### **Publications:**

G. Vandille, B. Van Zeebroeck, “De Belgische Milieurekeningen”, “Les comptes environnementaux en Belgique”, Planning Paper 93, June 2003.

I. Bracke, G. Vandille, “Regionale emissievooruitzichten”, Working Paper 5-05, March 2005.

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<sup>1</sup> The FPB also takes part in the advisory committee supervising the proceedings with respect to the satellite accounts for tourism.

<sup>2</sup> For the development of transport SA, the FPB received a funding for 4 years from the Federal Ministry of Transport.

<sup>3</sup> NAMEA: National Accounting Matrix including Environmental Accounts. EPEA: Environmental Protection Expenditure Accounts.

## TransGovern

TransGovern is a comprehensive systemic model for describing and analysing how a given society develops and how public authorities can influence this development in the long term. It provides a systematic structuring of the available social, environmental, economic and political information.

TransGovern extends the use of the concepts central to the DPSIR framework (*Driving forces, Pressures, States, Impacts, Responses*), developed at the OECD. It combines those concepts with the triangular model of interactions between the three basic capitals of development (human, environmental and economical). TransGovern adds the institutional capital to these and places it at the core of an original public policy module.

TransGovern includes two main parts: living conditions and the political process. Through this process, public authorities, based on the information received on the living conditions, implement political responses aimed at orienting the transformation of living conditions.

Living conditions are described by three capitals, three driving forces and their interactions. TransGovern includes human capital (standard of living, health, knowledge and capacities), environmental capital (natural resources and biological diversity) and economic capital (physical and technological capital, net financial assets). The driving forces are human processes and economic activities that have an influence on these capitals. TransGovern identifies three sets of driving forces: demography, consumption and production patterns. The driving forces can influence each other. In addition, they exert their influence on the human, environmental and economic capitals through pressures. In TransGovern, each pressure originates from one driving force and modifies the state of one capital. Conversely, changes in the state of one capital can have impacts on the state of the other capitals. Those changes also produce feedbacks on the driving forces. The living conditions part of TransGovern is thus a complex system. Influencing this system in such a way that it generates a sustainable development of society requires an integrated approach.

The political process part of TransGovern represents the development of political responses in a four-step process: visions of the world, political agenda, institutional capital and formulation and implementation of policies. Because the scientific knowledge available to public authorities will never be sufficient to support all their responses, visions of the world and the perception of existing risks play an important role. These are subjective elements that are influenced by norms, values and political priorities. The political agenda results from the democratic debate between the various components of society. The authorities' capacity to materialise the items on the political agenda into political responses depends on the institutional capital, i.e. the state of the country's organisational, legal and social structures.

**Publication:**

Task Force Sustainable Development, "Ontwikkeling begrijpen en sturen: Federaal Rapport inzake Duurzame Ontwikkeling 2000-2004", "Comprendre et gouverner le développement: Rapport fédéral sur le développement durable 2000-2004", Federal Planning Bureau, December 2005.

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