

Basic Model Elasticities of the macroeconomic model for France of the Banque de France (FR-BDF)

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ABSTRACT

This paper presents a set of Basic Model Elasticities (BMEs) of the Banque de France's new macroeconomic model for France, FR-BDF. A detailed description of the model is provided in Lemoine et al (2019) and this "BMEs workbook" is designed as a tool for practitioners of economic policy forecasting or analysis in France. It describes the model's response to a number of shocks grouped into four families: external shocks (oil prices, world demand, competitors' prices), monetary and financial shocks (exchange rates, short-term interest rates, long-term interest rates, housing prices), public finance shocks (public consumption, public investment, social benefits, direct taxes, social contributions) and structural shocks (labor efficiency, labor force, equilibrium unemployment rate). These different BMEs also illustrate the convergence properties of the model, in particular the importance of monetary and financial channels and the link between the real and nominal spheres in the transmission and absorption of shocks.

Keywords: Semi-Structural Modelling, Macroeconomic Forecasting, Macroeconomic Policy Analysis

JEL classification: E17, E6

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This paper presents the properties of the model for France developed by the Banque de France, see Lemoine et al. (2019). The authors of this paper are therefore far from being the only contributors to the construction of these BMEs, and the other members of the team that led the project to build the model must be included: Matthieu Lemoine, Harri Turunen, Mohammed Chahad, Antoine Lepetit, Anastasia Zhutova, Pierrick Clerc and Jean-Pierre Laffargue.

Non-technical summary

This document presents a set of basic model elasticities (BMEs) of the Banque de France's new macroeconomic model for France (FR-BDF) in its version published in 2019. Readers interested in a detailed description of the model should refer to the specific working paper (Lemoine et alii 2019), while this set of BMEs is mainly intended as a stand-alone supplement for practitioners of forecasting or economic policy analysis on France.

It provides a summary description of the model's response to a number of shocks grouped into four families:

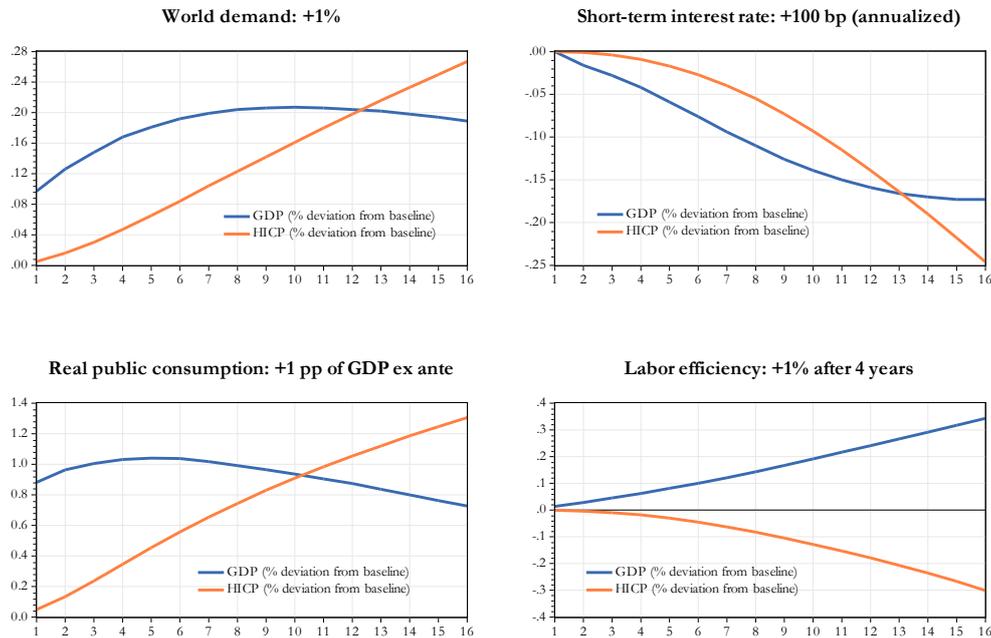
- (i) External shocks (oil price, world demand, competitors' prices) ;
- (ii) Monetary and financial shocks (exchange rates, short interest rates, long interest rates, property prices) ;
- (iii) Public finance shocks (public consumption, public investment, social benefits, direct taxes, social contributions) ;
- (iv) Structural shocks (efficiency, structural unemployment and labour force).

The BMEs presented are constructed on the basis of "pure" shocks in the VAR expectations version of the model - the one used for forecasting. These BMEs are "analytical" in the sense that they give the model's reaction to a specific shock, but are not "realistic" in the sense that, in reality, the economy is affected by a combination of shocks and the various variables concerned interact with each other. For example, in order to describe the total effect of a monetary policy decision, at least a priori one would have to associate the BMEs of short rates, long rates and exchange rates. Moreover, all the BMEs assume that only France is affected by the shock, even when this assumption is inherently unlikely.

However, by combining several BMEs the practitioner can construct these realistic and coherent scenarios, and this booklet of BMEs thus provides the basic building blocks. Finally, it should be noted that the approach here is aggregated and that other tools should be used to examine specific sectoral effects or distributive effects within households.

Reading the different BMEs provides a better understanding of the mechanisms at the heart of the FR-BDF model. A few main ideas can be retained. Monetary and financial shocks spread visibly through the economy. When other interest rates and the exchange rate are assumed to be fixed ("pure" short-rate shock hypothesis), the short rate acts in the model via the channel of expectations, in particular via expected permanent income, unemployment expectations and inflation expectations. Exogenous demand shocks diffuse through the usual channels, notably employment and agents' income. They also affect prices fairly rapidly, which, under the assumption that monetary policy does not react, triggers the main mechanism for rebalancing the economy through price competitiveness. Expectations also play a role in demand shocks, with in particular effects on anticipated unemployment, which plays a role in wages, and on expected inflation, which in particular affects household and business investment via the real cost of capital. Finally, structural shocks highlight the importance of mechanisms for rebalancing supply and demand, particularly via the nominal sphere.

Real GDP and HICP responses to four main BMEs (deviation from baseline in % points – quarters on the x-axis)



Variantes analytiques du modèle de prévision et simulation de la Banque de France pour la France (FR-BDF)

RÉSUMÉ

Ce document présente un ensemble de « variantes » du nouveau modèle macroéconomique sur la France de la Banque de France (FR-BDF) dans sa version publiée en 2019 et utilisée pour la prévision et l'analyse. La description détaillée du modèle est faite dans Lemoine et alii (2019) et ce « cahier de variantes » est surtout conçu comme un outil à destination des praticiens de la prévision ou de l'analyse de politique économique sur la France. Il fournit une description de la réaction du modèle à un certain nombre de chocs regroupés dans quatre familles : chocs externes (prix du pétrole, demande mondiale, prix des compétiteurs), chocs monétaires et financiers (taux de change, taux d'intérêt courts, taux d'intérêt longs, prix immobiliers), chocs de finances publiques (consommation publique, investissement public, prestations sociales, impôts directs, cotisations sociales) et chocs structurels (efficacité du travail, population active et taux de chômage d'équilibre). Ces différentes variantes illustrent également les propriétés de convergence du modèle, en particulier l'articulation forte entre les sphères réelles et nominales dans la transmission et l'absorption des chocs.

Mots-clés : Modélisation semi-structurelle, prévisions macroéconomiques, analyses des politiques économiques

Les Documents de travail reflètent les idées personnelles de leurs auteurs et n'expriment pas nécessairement la position de la Banque de France. Ils sont disponibles sur publications.banque-france.fr

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1. Introduction: what objective for this BMEs workbook?

This document presents a set of BMEs of the Banque de France's new macroeconomic model for France (FR-BDF), in its 2019 version ; the reader interested in a detailed description of the model should refer to the full working paper.¹

This BMEs notebook is mostly an autonomous complement to the working paper, intended for practitioners of macroeconomic forecasting and policy analysis on the French economy. It provides a summary description of the model's response to a number of shocks grouped into four families:

- (i) External shocks: oil price, world demand, competitors' price
- (ii) Monetary and financial shocks: exchange rates, short-term interest rates, long-term interest rates, house prices
- (iii) Public finance shocks: public consumption, public investment, social benefits, direct taxes, social contributions
- (iv) Structural shocks: labor efficiency, labor force and equilibrium unemployment rate

The BMEs presented are "pure" shocks and respect an "orthogonality principle": for each BME, we shock only one of the above-mentioned variables and any reactions of the other variables covered by another BME are deactivated, in order to let only the endogenous core of the model work (price, demand, labor market, etc.).

The resulting BMEs are thus "analytical" in the sense that they give the model's reaction to a specific shock, without being "realistic" in the sense that, in reality, the economy is affected by a combination of shocks and the different variables involved interact with each other. For example, to describe a full alternative scenario on the international environment, it may seem necessary to combine at least one shock on oil prices and one on global demand. Similarly, a monetary policy decision will a priori affect both short-term and long-term rates and the exchange rate.

By respecting this principle of orthogonality and assuming that the model is linear (which is a satisfying approximation most of the time), this BMEs workbook provides the bricks that any forecaster or policy analyst can combine by simple addition to construct coherent alternative scenarios. This practice is common within the Eurosystem, from which the name « Basic Model Elasticities » (BMEs) originates² and it is the same approach as the "variantes" provided by Insee and French Treasury in the Mésange working paper³.

It is also useful to give some elements of description and methodology on the construction of these BMEs:

- The FR-BDF model makes agents' expectations explicit, which can be formed either using a specific VAR model or constructed in a way that is consistent with the model. For this set of BMEs we use the version of the model with VAR-based expectations, which is used for the forecasts.

¹ Voir Lemoine et al. (2019).

² Voir ECB (2016).

³ Voir Bardaji et al. (2017).

- To construct these BMEs, we take the June 2019 forecast as a baseline and simulate counterfactual scenarios from the 1st quarter of 2018 to the 4th quarter of 2021. Shocks occur in the first quarter of the simulation and are persistent for 4 years, excepted for structural shocks which are gradual and linear over the entire horizon (4 years). The size of the shocks is fixed arbitrarily such that a simple rule of three allow calculating impacts of specific scenarios on headline macro variables.
- In addition, we provide only the reactions within this horizon of 4 years. FR-BDF is designed such hat the long-term convergence towards a balanced-growth path is well defined. However, this imposes constraints, e.g. that public debt cannot diverge in the long term thanks to the implementation of a fiscal stabilization rule or that interest rates return to predefined targets. These characteristics ensure a strong coherence of the model but they also involve mechanisms that are different from those we are trying to analyze here. This is the reason why we limit the analysis to a 4-year horizon, in which we deactivate convergence mechanisms, for example the fiscal rule. In the same vein, we assume that monetary policy will not react to the shocks considered.
- For all BMEs, we assume that the shock only affects France but not its partners, even when this assumption is unrealistic by nature (e.g. oil price BME). Taking into account spillover effects from our trade partners would modify the return to equilibrium linked to relative price mechanisms. By combining several BMEs (e.g. oil, competitor prices and world demand), the practitioner can construct these realistic scenarios.
- We use the version of the model presented in Lemoine et al. (2019) to produce the BMEs presented in the following notebook. They could be subject to revisions in the future, as the macro modelling team will update the model.
- Finally, a macroeconomic model, however detailed it may be, cannot answer all economic policy questions. We can only provide a macroeconomic and aggregate analysis here and one should mobilize other tools to examine specific sectoral or distributional effects within households.

Figure 1 shows the reaction of real GDP and Harmonized Index of Consumer Price (HICP) for four main BMEs, each one being related to a specific family. A careful analysis of the BMEs presented in this workbook allows us to understand better the mechanisms at work in FR-BDF, from which we can draw some key ideas at first glance.

Monetary and financial shocks are spreading quite widely throughout the economy. Assuming that other interest rates and the exchange rate are fixed, the short rate acts in the model only through expectations through the effects on permanent income, unemployment expectations and inflation expectations.

Exogenous demand shocks spread through the usual channels, particularly employment and agents' disposable income. They also affect inflation relatively quickly, which, under the assumption that monetary policy does not respond to shocks, triggers the main mechanism for rebalancing the economy through price competitiveness and foreign trade. A number of BMEs illustrate the

importance of the evolution of relative prices with the rest of the world for restoring the equilibrium of the model. This mechanism is essential, particularly in the absence of a monetary policy response, and the fact it happens quickly is an important feature of FR-BDF.

Anticipation mechanisms also play a role in demand shocks, with effects on expected unemployment in wages and on early inflation, which affects household and business investment via the real cost of capital.

Finally, structural shocks highlight the importance of mechanisms for rebalancing supply and demand, particularly via prices and wages.

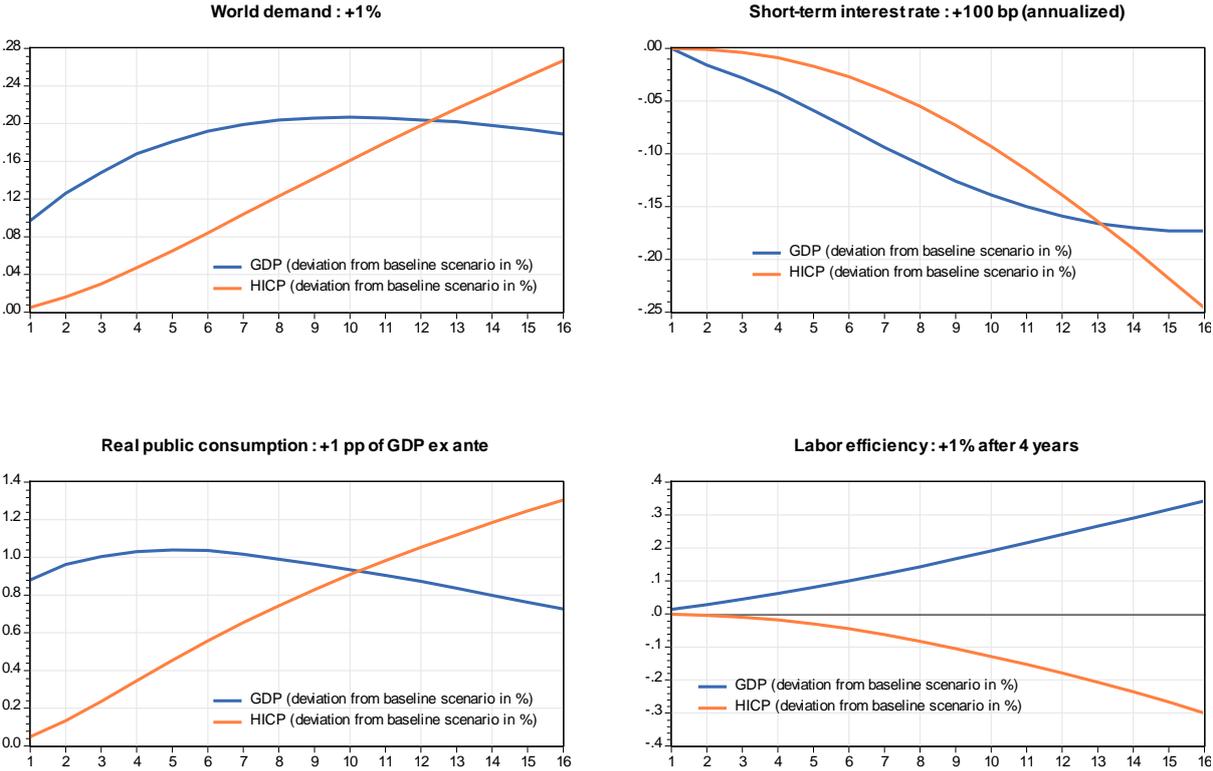


Figure 1 : Real GDP and HICP responses to four main BMEs (in percentage point, deviation from baseline scenario – quarters on the x-axis)

1. External shocks

1.1. World demand

The shock considered is a direct and sustained 1% increase in global demand for France. This external shock is a "pure" demand shock that illustrates how demand and supply adjust in the model.

French exports react instantly to the additional demand, with a high apparent elasticity (0.86 in the first year) but still lower than one. Faced with this increase in activity, firms are increasing their demand for labor and unemployment is falling. They also increase their investment spending, especially since the positive output gap (measured as the gap between effective GDP and long term GDP of the model, see Lemoine et al (2019)) pushes inflation expectations up and thus reduces the real cost of capital in the absence of monetary policy response. Finally, firms are increasing their prices, with pro-cyclical markup setting behavior. The fall in unemployment and the rise in prices support the increase in nominal wages, although real wages (deflated by consumption deflator) decrease. The counter-cyclical response of real wages comes from both nominal wage rigidity (with respect to the productivity cycle) and a direct effect of the output gap on the VA deflator of market branches, which reinforces price reactions via direct Phillips effects.

Falling unemployment and rising prices support nominal wage growth. However, real wages per capita fall because of wage indexation to consumption price inflation is significantly below the unit. With the increase in employment, the mass of real compensations still increases overall. This generates household purchasing power gains that allow households to increase their consumption and investment spending. The savings rate is also falling slightly as a result of the reduction in real interest rates. Overall, domestic demand quickly makes a significant contribution to activity (+0.08 pp after two years), with an overall investment response that is stronger than that of consumption, as expected given the volatility of these two aggregates. Finally, imports react strongly and rapidly to the increase in exports with a high import content, as well as to the increase in domestic demand.

The activation of price and wage mechanisms pushes export deflators up, which gradually affects the economy's price competitiveness. The reaction of exports thus never reaches an apparent elasticity of 1 with respect to the shock on world demand but even begins to decline after two years. Mechanisms for rebalancing through competitiveness are thus gradually being set up.

The effect of the shock on the level of GDP is greatest after 3 years and then it begins to decline. In the face of a positive output gap, inflation remains persistently high and prices continue to diverge from the central account over the next 4 years. Finally, the public deficit is permanently reduced by the increase in activity, which leads to a mechanical reduction in the ratio of public debt to GDP.

In this BME, the lack of closure with partner countries plays an important role. A demand shock from a given country would have qualitatively identical effects in all third countries, pushing demand for France even higher on the one hand and reducing price competitiveness losses on the other hand, since the partner countries would also face inflationary pressures.

Table 1: Response to a 1% increase in world demand to France

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.14	0.20	0.21	0.20
Private consumption	0.04	0.07	0.08	0.08
Public consumption	0.00	0.00	0.00	0.00
Total investment	0.08	0.19	0.23	0.22
<i>Business investment</i>	0.10	0.25	0.29	0.27
Public investment	0.00	0.00	0.00	0.01
<i>Households investment</i>	0.08	0.16	0.20	0.21
Exports	0.86	0.89	0.86	0.80
Imports	0.55	0.52	0.50	0.49
Contributions to real GDP (deviation in pp)				
Domestic demand	0.04	0.08	0.09	0.09
Net exports	0.10	0.12	0.12	0.11
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.03	0.10	0.17	0.24
HICP excluding food & energy	0.04	0.13	0.23	0.33
GDP deflator	0.03	0.10	0.18	0.26
Imports deflator	0.00	0.01	0.04	0.08
Export deflator	0.03	0.11	0.18	0.25
Labor market				
Unemployment rate (deviation in pp)	-0.03	-0.09	-0.11	-0.11
Total employment	0.04	0.09	0.12	0.12
Unit labor costs	-0.10	-0.07	0.01	0.10
<i>Compensation per employee</i>	0.00	0.04	0.10	0.17
<i>Productivity</i>	0.10	0.10	0.09	0.08
Real compensation per employee ⁴	-0.02	-0.06	-0.08	-0.07
Households revenue				
Real gross disposable income (GDI)	0.05	0.06	0.06	0.06
Households saving ratio (% of GDI, deviation in pp)	0.01	0.00	-0.01	-0.02
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.04	0.08	0.09	0.09
Public debt (% of GDP)	-0.04	-0.12	-0.21	-0.30

⁴ We use the household consumption deflator.

1.2. Competitors' prices

The shock considered is a sustained 1% increase in the price of foreign competitors both for exports and imports. This is an external demand shock based on price competitiveness and not on volumes. This shock does not originate from a depreciation of the nominal exchange rate; it is therefore a shock on competitors' prices in foreign currency.

French exports and imports increased directly by 0.23 pp and 0.12 pp in the first year, as a result of gains in export competitiveness and the fall in import prices. GDP increased by 0.05 pp in the first year, with a contribution of around 0.04 pp from net foreign trade.

Domestic demand gradually accelerates over the first two years, with employment growth leading to household consumption and investment via households' disposable income. Business investment is also increasing because of the increase in market VA. It is also supported by the decline in the real cost of capital (in the absence of a monetary policy response) because of higher expected inflation.

In the labor market, the reduction in both contemporary and expected unemployment rate is pushing nominal wages up (+0.02% after two years) while real wages are falling (-0.05% after two years). Like the mechanism described in the world demand BME, the countercyclical response of real wages slows the growth of household purchasing power. The increase in real household GDI therefore comes mainly from employment growth.

The effect on GDP is maximum after 3 years, with about +0.2%, while prices continue to rise in years 3 and 4, reflecting the unemployment gap which continues to widen to -0.11 pp after 4 years. The gap between activity and employment results from employment inertia, which continues to increase despite the stabilization of the shock's effects on activity.

Price increases gradually reduce initial competitiveness gains, which stabilizes the response of external demand to competitors' price shocks. Export deflator has an apparent elasticity of 0.17 after 1 year, which reflects the import content of exports: in the first year, the increase in the price of imports reached +0.28% and is almost half-transmitted to the export price.

Public finances are improving with a 0.08 percentage point increase in the budget balance and a reduction in the public debt ratio of -0.21 percentage points of GDP after 4 years, *via* the mechanical effect of economic activity and automatic stabilizers.

Table 2: Response to an increase by 1% of foreign competitors' prices of exports and imports

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.05	0.15	0.19	0.19
Private consumption	0.01	0.04	0.06	0.07
Public consumption	0.00	0.00	0.00	0.00
Total investment	0.02	0.11	0.18	0.20
<i>Business investment</i>	0.02	0.14	0.23	0.25
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	0.02	0.10	0.16	0.19
Exports	0.23	0.58	0.69	0.68
Imports	0.12	0.27	0.31	0.32
Contributions to real GDP (deviation in pp)				
Domestic demand	0.01	0.05	0.08	0.08
Net exports	0.04	0.10	0.12	0.12
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.01	0.07	0.15	0.24
HICP excluding food & energy	0.01	0.09	0.21	0.33
GDP deflator	0.01	0.06	0.14	0.22
Imports deflator	0.28	0.37	0.41	0.45
Export deflator	0.17	0.32	0.43	0.53
Labor market				
Unemployment rate (deviation in pp)	-0.01	-0.05	-0.09	-0.11
Total employment	0.01	0.05	0.10	0.11
Unit labor costs	-0.04	-0.08	-0.03	0.05
<i>Compensation per employee</i>	0.00	0.02	0.06	0.13
<i>Productivity</i>	0.04	0.09	0.09	0.08
Real compensation per employee	-0.01	-0.05	-0.09	-0.11
Households revenue				
Real gross disposable income (GDI)	0.01	0.04	0.04	0.03
Households saving ratio (% of GDI, deviation in pp)	0.00	-0.01	-0.02	-0.03
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.01	0.05	0.07	0.08
Public debt (% of GDP)	-0.01	-0.06	-0.13	-0.21

1.3. Oil prices

The shock considered is a sustainable 10% increase in the price of oil in euros, starting from an initial price of 55 euros per barrel of Brent. Due to the weak substitutability of energy consumption, there are nonlinearities in the transmission of shocks on crude oil prices to final prices for consumers.⁵ We therefore recommend using this BME as a 5.5 euros increase in the price of a barrel and, for example, multiplying it by 10/5.5 to obtain the BME of a 10 euros shock.

The rise in oil prices almost immediately affects import deflators and the final price of energy for households. The indirect transmission through the production process is also significant. After one year, the total HICP increased by 0.24 pp, including a contribution of around 0.1 pp of the HICP excluding energy and food, which itself increased by 0.15 pp. The transmission to export prices is also important. Finally, GDP deflator is almost unchanged after one year.

The purchasing power levy resulting from the shock gradually affects household consumption, which falls by -0.04 pp after one year, as well as their investment. Nevertheless, households initially absorb a significant part of the shock in their savings rate, which falls by -0.12 pp in the first year, because of the consumption smoothing effect induced by the permanent income.

In addition, rising export prices degrade price competitiveness and reduce exports. One must keep in mind that the shock here is *asymmetrical* in the sense that it affects France but not its partner countries. A realistic BME of a global oil price shock would obviously combine this shock with an identical shock among partners, which would a priori reduce price competitiveness losses.

Declining demand reduces GDP and in turn reduces employment and business investment. Nominal wages increase slightly through indexation mechanisms, but decline in real terms due to the effect on wages of the anticipated increase in the unemployment rate.

The deterioration in the domestic macroeconomic environment weighs on prices, which after their peak in the first year start decreasing in the second year, whether we consider HICP, GDP deflator or export deflator. This price feedback mechanism makes it possible to stabilize gradually economic activity.

Finally, the shock deteriorates public debt and deficit because of automatic stabilizers.

⁵ The elasticities we present depend on the share of energy imports in households' consumption, which itself depend on the level of oil price.

Table 3: Response to + 10% increase of oil prices in euros, from the level of 55 euros per barrel

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.04	-0.14	-0.19	-0.21
Private consumption	-0.04	-0.11	-0.16	-0.19
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.01	-0.09	-0.18	-0.24
<i>Business investment</i>	-0.01	-0.15	-0.28	-0.36
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	-0.01	-0.01	-0.03	-0.07
Exports	-0.07	-0.21	-0.26	-0.26
Imports	-0.01	-0.04	-0.09	-0.11
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.02	-0.08	-0.12	-0.15
Net exports	-0.02	-0.06	-0.07	-0.06
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.24	0.22	0.17	0.11
HICP excluding food & energy	0.15	0.13	0.05	-0.03
GDP deflator	0.03	0.02	-0.02	-0.07
Imports deflator	0.60	0.66	0.65	0.63
Export deflator	0.28	0.27	0.23	0.18
Labor market				
Unemployment rate (deviation in pp)	0.01	0.04	0.08	0.11
Total employment	-0.01	-0.04	-0.09	-0.11
Unit labor costs	0.07	0.14	0.14	0.09
<i>Compensation per employee</i>	0.03	0.05	0.04	-0.01
<i>Productivity</i>	-0.03	-0.09	-0.10	-0.10
Real compensation per employee	-0.21	-0.17	-0.12	-0.12
Households revenue				
Real gross disposable income (GDI)	-0.18	-0.21	-0.21	-0.21
Households saving ratio (% of GDI, deviation in pp)	-0.12	-0.08	-0.04	-0.02
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.05	-0.08	-0.10	-0.12
Public debt (% of GDP)	0.05	0.13	0.23	0.35

2. Monetary and financial shocks

2.1. Short-term interest rates

The shock studied here is a sustained increase in the short-term interest rate (3-month Euribor) of 100 bp annualized. According to the orthogonality principle, we assume that the shock on short-term rates does not transmit to the long-term sovereign rate or to household and corporate borrowing rates. This BME illustrates the importance of expectations in FR-BDF insofar as the short rate then affects the economy only through this channel, notably *via* the expected permanent income, the expected unemployment gap and expected inflation.

Household consumption and investment are declining. Households expect their permanent disposable income to fall and they also face a higher real cost of housing credit, due to lower expected inflation. On the firms side, the real cost of capital increases because of lower expected inflation and investment falls sharply from the second year onwards. The decline in activity is leading to a reduction in French import demand.

Prices are falling overall with a direct effect of the deterioration in activity but also two channels linked to expectations. On the one hand, the decline in expected inflation immediately affects actual inflation. On the other hand, the expectation of long-term unemployment above its long-term level pushes nominal and real wages down. The slowdown in prices mechanically leads to gains in price competitiveness and an increase in exports after the second year, which stabilizes the recessive effect of the rise in the short rate. The disinflationary effect of the rate increase extends over the entire horizon with an effect of -0.21% after 4 years on the HICP.

Foreign trade is the main stabilization mechanism in the medium term: thanks to price competitiveness gains, exports are increasing. However, this is insufficient to offset the recessive effect of the rate increase on all components of domestic demand, with particularly marked effects on household and business investment via anticipated inflation as well as the effects of activity (for firms) and permanent income (for households).

Without the effect of the short rate shock on the long-term rates that determine the interest paid by the public sector in FR-BDF, public finances deteriorate only through the effect of the automatic stabilizers and under the assumption of no reaction from fiscal policy. The budget balance deteriorates by -0.13 percentage point of GDP and the public debt increases by 0.29 percentage point of GDP over the next 4 years.

Table 4 : Response to a +100 bp increase in short-term interest rates

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.02	-0.09	-0.14	-0.17
Private consumption	-0.05	-0.11	-0.17	-0.22
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.06	-0.36	-0.66	-0.84
<i>Business investment</i>	-0.06	-0.40	-0.72	-0.89
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	-0.08	-0.47	-0.92	-1.23
Exports	0.00	0.01	0.05	0.12
Imports	-0.05	-0.17	-0.27	-0.31
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.04	-0.15	-0.25	-0.32
Net exports	0.02	0.06	0.10	0.15
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.00	-0.04	-0.11	-0.21
HICP excluding food & energy	-0.01	-0.05	-0.15	-0.28
GDP deflator	-0.01	-0.04	-0.12	-0.22
Imports deflator	0.00	0.00	-0.02	-0.05
Export deflator	-0.01	-0.04	-0.12	-0.22
Labor market				
Unemployment rate (deviation in pp)	0.01	0.06	0.12	0.14
Total employment	-0.01	-0.07	-0.12	-0.15
Unit labor costs	0.00	-0.04	-0.12	-0.24
<i>Compensation per employee</i>	-0.01	-0.05	-0.14	-0.26
<i>Productivity</i>	-0.01	-0.02	-0.02	-0.02
Real compensation per employee	0.00	-0.02	-0.03	-0.05
Households revenue				
Real gross disposable income (GDI)	-0.01	-0.05	-0.08	-0.09
Households saving ratio (% of GDI, deviation in pp)	0.03	0.06	0.08	0.10
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.01	-0.06	-0.10	-0.13
Public debt (% of GDP)	0.01	0.07	0.16	0.29

2.2. Long-term interest rate (term-premium)

We now consider a sustained shock of +100 bp on the nominal long-term interest rate (10-year rate on the OAT) via the term premium and without a shock on the short-term rate. This shock will be transmitted to the economy via its effect on all bank rates, on corporate bond rates and on the real cost of capital. Unlike a short-term interest rate shock, the long-term rate has no *direct* effect on expectations because it does not enter the satellite Vector Autoregressive (VAR) model used to construct them. However, it indirectly affects expectations through the output gap and inflation.

In the short term, the increase in long-term rates leads to a decline in GDP of -0.04%. Household consumption contracts quite significantly (-0.09% in the first year) due to an upward effect of the long-term bank rate shock on the equilibrium savings rate. Household investment is also declining, but moderately in the short term (-0.02%). Business investment is contracting more sharply (-0.10%).

The effects of the rise in long-term rates on business and household investment become more apparent from the second year onwards, reaching -1.41% and -1.84% respectively in the fourth year. The two components of private investment then explain most of the contraction in GDP. It is important to note here that expectations have dampening effects in the short term: the elasticity of the business investment target to the capital cost shock would be about -3.5%, while that of the household investment target would be -2.5%, impacts that are stronger than observed in this BME. Indeed, under VAR expectations, agents expect the shock to be temporary and do not fully adjust their factor demand to the long term target.

Household consumption recovers from the second year onwards and almost returns to the level of the baseline scenario in the 4th year (-0.01%). Household purchasing power is benefiting from lower prices, nominal wage inertia and the increase in net financial income in line with the rise in long-term rates. However, the increase in consumption is limited by the increase in the long-term savings rate.

Compared to the short-term rate BME, the effect on unemployment is almost half as small (-0.08% compared to 0.14% for the short-term rate BME in the 4th year), which explains in particular why the effect on nominal wages and prices is more limited in the case of the long-term rate shock. This difference is mainly due to the structure of expectations and the absence of a direct effect of the long-term rate on them.

Public finances deteriorate significantly more than in the short rate BME, mainly due to the increase in the debt burden, which contributes to the widening of the public deficit (-0.2 pp of GDP) and increases the dynamics of public debt (0.48 pp of GDP).

Table 5: Response to a +100 bp increase in long-term interest rates

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.04	-0.10	-0.16	-0.19
Private consumption	-0.09	-0.12	-0.08	-0.01
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.07	-0.50	-0.98	-1.30
<i>Business investment</i>	-0.10	-0.67	-1.16	-1.41
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	-0.02	-0.35	-1.13	-1.84
Exports	0.00	0.01	0.04	0.09
Imports	-0.08	-0.21	-0.29	-0.29
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.06	-0.18	-0.27	-0.32
Net exports	0.03	0.07	0.11	0.13
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.01	-0.03	-0.08	-0.13
HICP excluding food & energy	-0.01	-0.05	-0.11	-0.18
GDP deflator	-0.01	-0.04	-0.09	-0.14
Imports deflator	0.00	0.00	-0.02	-0.04
Export deflator	-0.01	-0.04	-0.09	-0.14
Labor market				
Unemployment rate (deviation in pp)	0.01	0.03	0.06	0.08
Total employment	-0.01	-0.03	-0.07	-0.08
Unit labor costs	0.03	0.06	0.06	0.02
<i>Compensation per employee</i>	0.00	-0.01	-0.04	-0.08
<i>Productivity</i>	-0.03	-0.07	-0.10	-0.10
Real compensation per employee	0.00	0.02	0.05	0.06
Households revenue				
Real gross disposable income (GDI)	0.05	0.17	0.30	0.43
Households saving ratio (% of GDI, deviation in pp)	0.11	0.24	0.32	0.37
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.03	-0.09	-0.16	-0.20
Public debt (% of GDP)	0.03	0.12	0.28	0.48

2.3. Nominal effective exchange rate (exclud. Dollar)

The shock considered is a sustained appreciation of the nominal effective exchange rate of the euro of +10% excluding the dollar (studied separately, see below). This shock will affect the economy through the prices of foreign export and import competitors, considering that the share of trade in dollars is reduced to that of trade with the United States. Thus, this BME affects about 45% of our exports. It does not affect our partner countries in the euro zone.

Nominal exchange rate appreciation led to a loss of competitiveness of French exports, which contracted by -0.97% in the first year. Imports are also falling sharply (-0.52%) due to the high import content of exports. However, the negative impact on imports is dampened by price competitiveness gains made by foreign competitors, which reduce the price of French imports and promote their penetration into the French economy. The transmission at export prices is also significant but slightly reduced compared to imports.

The effects on foreign trade gradually transmit to the other components of demand: household consumption falls by -0.18% after 2 years and -0.26% after 4 years and total investment falls by -0.45% after 2 years and -0.79% after 4 years. The decline in expected inflation and the increase in the real cost of capital are combined with the overall decline in activity to explain the decline in investment.

Prices fall quite sharply, respectively by -0.85% for GDP deflator and -0.92% for consumer prices at 4 years. In addition to the effects of the fall in import prices, two domestic channels can explain the fall in prices. On the one hand, higher expected unemployment weights on wages and the price-wage loop (via the market value-added price equation). On the other hand, the generalized effect of the output gap in the model, through expectations and in the short term of certain equations, in particular that of the value-added price.

The decline in nominal wages is significantly lower than that of consumer prices (-0.50% in 4 years compared to -0.92%). Real wages increase by +0.43% over the next 4 years and partially offset the effects of rising unemployment on real household GDI.

The fall in prices will partly restore the price competitiveness of exports, which has deteriorated due to the appreciation of the effective exchange rate. Exports stabilize over the next 3 years and beyond 4 years, the balance would be restored by wage and price adjustments that would allow French exports to regain market share.

Finally, public finances are deteriorating under the effect of automatic stabilizers. The budget balance widened by -0.32 percentage points of GDP and the public debt increased by 0.86 percentage points of GDP after 4 years.

Table 6: Response to a 10% appreciation of nominal exchange rate (exclud. Dollar)

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.18	-0.58	-0.76	-0.77
Private consumption	-0.05	-0.18	-0.25	-0.26
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.07	-0.45	-0.73	-0.79
<i>Business investment</i>	-0.08	-0.58	-0.93	-0.99
<i>Public investment</i>	0.00	0.00	0.00	-0.02
<i>Households investment</i>	-0.09	-0.40	-0.64	-0.72
Exports	-0.97	-2.49	-2.95	-2.93
Imports	-0.52	-1.25	-1.47	-1.51
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.05	-0.20	-0.30	-0.32
Net exports	-0.14	-0.39	-0.47	-0.46
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.04	-0.25	-0.58	-0.92
HICP excluding food & energy	-0.05	-0.35	-0.80	-1.25
GDP deflator	-0.03	-0.22	-0.53	-0.85
Imports deflator	-1.00	-1.31	-1.44	-1.59
Export deflator	-0.64	-1.21	-1.68	-2.08
Labor market				
Unemployment rate (deviation in pp)	0.04	0.20	0.37	0.43
Total employment	-0.04	-0.21	-0.39	-0.45
Unit labor costs	0.14	0.30	0.13	-0.21
<i>Compensation per employee</i>	0.00	-0.06	-0.23	-0.50
<i>Productivity</i>	-0.14	-0.37	-0.37	-0.32
Real compensation per employee	0.03	0.19	0.35	0.43
Households revenue				
Real gross disposable income (GDI)	-0.06	-0.16	-0.17	-0.13
Households saving ratio (% of GDI, deviation in pp)	-0.01	0.02	0.07	0.11
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.05	-0.20	-0.29	-0.32
Public debt (% of GDP)	0.05	0.25	0.53	0.86

2.4. Dollar/Euro exchange rate

The shock considered is a 10% appreciation of the euro against the dollar. Only price competitiveness with the United States is affected. Specifically, we do not take into account that, at least in the short run, the currency or exports of a number of other countries are, in one way or another, linked to the dollar. In contrast, in consistency with the orthogonality principle, we suppose that oil prices are fixed in dollars, and the euro/dollar shock affects the price of energy imports in euros. Finally, the shock only affects France and not its partner countries, including the euro zone.

This shock combines channels described in two previous BMEs. On the one hand, we observe mechanisms linked to an unfavorable exchange rate shock, here against the United States. On the other hand, we observe a downward shock on the price of oil in euros, assuming that it is fixed on world markets in dollars. These two shocks have a downward impact on inflation but they have an opposite effect on activity: the loss of price competitiveness is unfavorable but the fall in the price of oil in euros is favorable.

In the end, the impact of this BME on activity and the unemployment rate is quite low over the entire horizon. Initially slightly negative, the effects become a little positive after 4 years.

The price level is falling significantly over the entire horizon. The impact of the fall in the price of oil in euros is cumulative with the fall in the price of imports excluding energy. Through indexation mechanisms, lower inflation transmits to wages even if real wages increase significantly. The fall in the nominal cost of labor has a downward impact on the price of GDP.

With regard to the components of demand, on the one hand, exports are falling significantly, affected by the losses in price competitiveness, even if they are somewhat cushioned by the spread in final prices of the fall in oil prices. On the other hand, lower energy prices generate significant purchasing power gains for households, which they gradually consume. Despite gains in purchasing power, household investment is declining as real interest rates rise.

The shock is slightly positive on the public deficit and therefore the public debt, which mainly reflects composition effects in the tax bases.

Table 7: Response to a 10% appreciation of Euro against Dollar

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.01	0.00	0.02	0.04
Private consumption	0.02	0.05	0.08	0.11
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.01	-0.01	0.02	0.07
<i>Business investment</i>	-0.01	0.01	0.07	0.14
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	-0.01	-0.07	-0.09	-0.07
Exports	-0.14	-0.32	-0.36	-0.34
Imports	-0.09	-0.23	-0.24	-0.23
Contributions to real GDP (deviation in pp)				
Domestic demand	0.01	0.03	0.05	0.07
Net exports	-0.01	-0.03	-0.03	-0.03
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.19	-0.22	-0.24	-0.25
HICP excluding food & energy	-0.13	-0.17	-0.20	-0.22
GDP deflator	-0.03	-0.05	-0.08	-0.10
Imports deflator	-0.66	-0.78	-0.80	-0.81
Export deflator	-0.35	-0.48	-0.54	-0.58
Labor market				
Unemployment rate (deviation in pp)	0.00	0.01	0.00	-0.01
Total employment	0.00	-0.01	0.00	0.01
Unit labor costs	-0.02	-0.06	-0.10	-0.12
<i>Compensation per employee</i>	-0.02	-0.05	-0.08	-0.09
<i>Productivity</i>	0.00	0.01	0.02	0.03
Real compensation per employee	0.17	0.17	0.16	0.17
Households revenue				
Real gross disposable income (GDI)	0.13	0.14	0.14	0.15
Households saving ratio (% of GDI, deviation in pp)	0.09	0.07	0.05	0.04
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.03	0.03	0.03	0.04
Public debt (% of GDP)	-0.03	-0.06	-0.08	-0.12

2.5. House prices

The shock considered is an immediate and sustained increase in house prices of 10%. This shock initially affects the economy through two channels: on the one hand, household investment, which reacts through an arbitrage mechanism between purchases in old and new construction; on the other hand, rents and therefore HICP inflation are supposed to react to the increase in house prices, under the assumption that the increase in house prices comes from an increase in expected rents that do materialize afterwards. On the other hand, the model does not include household wealth effects, which are generally estimated to be low at the macroeconomic level in France.

The effects of the shock on GDP gradually reflect in household investment, which is increasing towards a long-run elasticity of 0.5 to the shock on house prices. The increase in activity then passes on to business investment and household consumption.

Inflation is driven upwards by the opening of the output gap and the positive effect of the fall in the unemployment rate on wages. Despite slight losses in households purchasing power in the first two years, consumption remained stable and even increased slightly as a result of higher inflation expectations and a lower expected real rate, which explains the fall in the savings rate. On the other hand, losses in price competitiveness are holding back exports, with an increase of 0.1% in the price of exports after 4 years, while imports increase with domestic demand.

The effects on the budget balance are limited and very slightly positive, via the automatic stabilizers. Public debt is slightly reduced by -0.1 percentage point of GDP after 4 years.

Table 8: Response to an increase of house prices by 10%

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0,00	0,03	0,10	0,14
Private consumption	0,00	0,00	0,02	0,04
Public consumption	0,00	0,00	0,00	0,00
Total investment	0,01	0,25	0,60	0,87
<i>Business investment</i>	0,00	0,03	0,10	0,17
<i>Public investment</i>	0,00	0,00	0,00	0,00
<i>Households investment</i>	0,05	1,01	2,36	3,35
Exports	-0,01	-0,02	-0,03	-0,06
Imports	0,00	0,06	0,14	0,18
Contributions to real GDP (deviation in pp)				
Domestic demand	0,00	0,06	0,15	0,23
Net exports	0,00	-0,03	-0,06	-0,08
Changes in inventories	0,00	0,00	0,00	0,00
Prices				
HICP	0,05	0,05	0,07	0,11
HICP excluding food & energy	0,07	0,07	0,09	0,15
GDP deflator	0,03	0,03	0,06	0,11
Imports deflator	0,00	0,01	0,02	0,03
Export deflator	0,03	0,03	0,05	0,10
Labor market				
Unemployment rate (deviation in pp)	0,00	-0,01	-0,03	-0,06
Total employment	0,00	0,01	0,03	0,07
Unit labor costs	0,01	-0,01	-0,04	-0,03
<i>Compensation per employee</i>	0,01	0,01	0,02	0,05
<i>Productivity</i>	0,00	0,02	0,06	0,08
Real compensation per employee	-0,04	-0,04	-0,04	-0,06
Households revenue				
Real gross disposable income (GDI)	-0,03	-0,01	0,01	0,02
Households saving ratio (% of GDI, deviation in pp)	-0,02	-0,01	-0,01	-0,01
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0,01	0,01	0,04	0,06
Public debt (% of GDP)	0,01	-0,01	-0,04	-0,10

3. Public finance shocks

3.1. Public consumption (exclud. public compensations)

The shock considered is an ex ante increase of +1 pp of GDP over 4 years in general government consumption (in volume). We neutralize price effects by assuming public sector wages are equal to baseline. Monetary policy does not react to the shock and there is therefore no negative effect via interest rates or the nominal exchange rate; on the other hand, the real effective exchange rate will adjust to the effects of the demand shock on prices.

In the first year, GDP increased by almost 1 pp and the effect is maximal after 2 years: we have a multiplier of 1.02 after 2 years. Usually, the shock has a direct impact on activity (via the resources-uses balance) and indirectly via multiplier effects on consumption (+0.30%) in the first year, household investment (+0.57%) and business investment (+0.7%). The strong increase of imports dampens the effect on the shock on economic activity.

Employment increases significantly with activity (+0.25% in the 1st and +0.52% in the 2nd year) and the fall in unemployment and expectations on unemployment lead to a gradual increase in nominal wages via the Phillips curve. This will push prices up from the second year onwards via the factor price frontier.

Prices increase from the first year by about +0.2%. Because of the demand shock, the output gap widens and firms raise their prices by increasing their margins. The increase in VA price is passed on to consumer and export prices. Finally, the increase in nominal wages and unit labor costs reinforce price effects.

Households are enjoying significant gains in purchasing power despite rising prices and the negative reaction of real wages to the demand shock. The household savings rate increases slightly in the short term due to the inertia of permanent income, but then tends to fall as a result of the decline in the expected real long-term rate. This effect would disappear if monetary policy responded to the increased activity. The effect on household and business investment is significant, both through the effect of expected inflation on the real cost of capital and through the direct effect of activity and income.

Finally, exports are gradually deteriorating with the loss of price competitiveness. The balance between supply and demand is thus restored through the appreciation of the real exchange rate and the reaction of foreign trade.

Public finances are deteriorating because of the fiscal stimulus, which is entirely financed by net borrowing. Public debt increases by 2 percentage points of GDP over the next 4 years, while the deficit widens by -0.5 percentage points of GDP after 4 years.

Table 8: Response to an ex ante increase of 1pp of GDP in public consumption (exclud. public compensation)

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.97	1.02	0.92	0.78
Private consumption	0.30	0.36	0.37	0.35
Public consumption	4.23	4.19	4.16	4.13
Total investment	0.57	1.07	1.03	0.87
<i>Business investment</i>	<i>0.70</i>	<i>1.38</i>	<i>1.30</i>	<i>1.07</i>
<i>Public investment</i>	<i>0.00</i>	<i>0.01</i>	<i>0.01</i>	<i>0.02</i>
<i>Households investment</i>	<i>0.57</i>	<i>0.92</i>	<i>0.98</i>	<i>0.88</i>
Exports	-0.04	-0.27	-0.63	-0.99
Imports	0.94	0.98	0.89	0.78
Contributions to real GDP (deviation in pp)				
Domestic demand	1.30	1.44	1.43	1.38
Net exports	-0.32	-0.41	-0.50	-0.58
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.19	0.60	0.94	1.21
HICP excluding food & energy	0.27	0.83	1.28	1.62
GDP deflator	0.22	0.65	1.01	1.29
Imports deflator	0.01	0.10	0.26	0.44
Export deflator	0.23	0.66	0.98	1.21
Labor market				
Unemployment rate (deviation in pp)	-0.24	-0.49	-0.54	-0.44
Total employment	0.25	0.52	0.56	0.46
Unit labor costs	-0.67	-0.25	0.23	0.63
<i>Compensation per employee</i>	<i>0.04</i>	<i>0.24</i>	<i>0.57</i>	<i>0.92</i>
<i>Productivity</i>	<i>0.72</i>	<i>0.50</i>	<i>0.36</i>	<i>0.32</i>
Real compensation per employee	-0.16	-0.37	-0.38	-0.30
Households revenue				
Real gross disposable income (GDI)	0.33	0.29	0.25	0.20
Households saving ratio (% of GDI, deviation in pp)	0.03	-0.06	-0.10	-0.13
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.63	-0.50	-0.47	-0.49
Public debt (% of GDP)	0.63	1.13	1.60	2.09

3.2. Public compensation

The shock considered is a sustained ex ante increase of 1 percentage point of GDP in public wages, i.e. an increase in public consumption in value terms through its deflator component and at constant productivity and employment in the public sector.

GDP increases by 0.10% in the first year, reaching a maximum effect of 0.43% after 4 years. Compared to the shock in public consumption in volume terms, the effects on activity are significantly smaller and are only gradually transmitted to the economy. Indeed, the increase in public wages does not directly affect demand in volume, compared to a real public consumption shock. It affects nominal variables and in particular household disposable income, which increases by 1.54% in the first year, reaching a maximum of +1.69% after 4 years.

As a result, the shock transmits indirectly and gradually, through income and expected permanent income and the response of households' consumption and investment. Then, the effect spreads to the other components of aggregate demand. In response to the severe income shock, the household savings rate increased by 1 percentage point of GDP in the first year before falling to +0.4 percentage point of GDP above the central scenario after 4 years.

Household consumption and investment increase by 1.21% and 0.97% respectively after 4 years. Business investment grew more moderately by 0.52% after 4 years, mainly because of the increase in activity and the fall in the real cost of capital via anticipated inflation. Exports fell by -0.23% with the loss of price competitiveness while imports rose by 0.74% because of domestic demand.

Consumer prices will gradually increase (0.36% after 4 years), under the dual effect of the increase in employment (via the Phillips curve of wages) and activity (via the effect of the output gap on the VA price).

The discrepancy between the GDP deflator and consumer prices is due to the specific nature of the shock studied: the increase in public wages is transmitted in full to the public sector value added deflator, which explains the strong increase in the GDP deflator. Real per capita wages in the economy as a whole rose very strongly by 2.80% after 1 year before falling to 2.68% after 4 years, because of rising inflation. It is worth noting here that the increase in public wages has no direct effect on market sector wages, but only indirectly through the effect on the unemployment gap.

The 1 percentage point increase in ex ante public wage growth worsened the fiscal balance by -0.52 percentage points of GDP in the first year. In addition to the macroeconomic closing effects, the significant difference of 1 percentage point of GDP to the ex ante shock is also because distributed wages are immediately taxed. The effect on public balance is further reduced by the effect of the automatic stabilizers. Public debt increased by 1.7 percentage points of GDP after 4 years.

Table 9: Response to an ex ante increase of 1 pp of GDP in public compensation

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.10	0.25	0.37	0.43
Private consumption	0.29	0.70	1.00	1.21
Public consumption	0.00	0.01	0.02	0.04
Total investment	0.04	0.22	0.43	0.55
<i>Business investment</i>	<i>0.03</i>	<i>0.22</i>	<i>0.43</i>	<i>0.52</i>
<i>Public investment</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.01</i>
<i>Households investment</i>	<i>0.07</i>	<i>0.36</i>	<i>0.69</i>	<i>0.97</i>
Exports	0.00	-0.03	-0.11	-0.23
Imports	0.20	0.47	0.65	0.74
Contributions to real GDP (deviation in pp)				
Domestic demand	0.17	0.41	0.61	0.75
Net exports	-0.07	-0.16	-0.24	-0.31
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.01	0.09	0.21	0.36
HICP excluding food & energy	0.02	0.12	0.29	0.49
GDP deflator	2.02	2.11	2.23	2.40
Imports deflator	0.00	0.01	0.04	0.10
Export deflator	0.02	0.10	0.23	0.38
Labor market				
Unemployment rate (deviation in pp)	-0.01	-0.08	-0.16	-0.21
Total employment	0.02	0.08	0.16	0.22
Unit labor costs	2.77	2.76	2.79	2.89
<i>Compensation per employee</i>	<i>2.81</i>	<i>2.89</i>	<i>2.95</i>	<i>3.05</i>
<i>Productivity</i>	<i>0.08</i>	<i>0.17</i>	<i>0.21</i>	<i>0.22</i>
Real compensation per employee	2.80	2.80	2.73	2.68
Households revenue				
Real gross disposable income (GDI)	1.54	1.61	1.66	1.69
Households saving ratio (% of GDI, deviation in pp)	1.06	0.77	0.55	0.40
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.52	-0.44	-0.40	-0.36
Public debt (% of GDP)	0.52	0.95	1.35	1.72

3.3. Public investment

The shock studied is a sustained ex ante increase of 1 percentage point of GDP in real public investment. It is a pure public demand shock: FR-BDF does not include channels to assess the potential effects of public investment on the supply side of the economy: for example on labor productivity, private investment or via the stock of public capital. Once again, monetary policy is not responding to the shock.

GDP increased by 0.74% in the first year. However, this important effect is 0.2 pp lower than that of the public consumption BME, which is a shock of equal size ex ante and directly affecting demand for goods and services. This difference is due to the reaction of imports with an import content of investment higher than that of public consumption. The contribution of the other components of domestic demand is also lower due to general equilibrium effects.

GDP would increase by 0.85% in the second year, before falling to 0.72% after 4 years. The analysis of contributions to growth shows that this "hump-shaped" profile comes from the reaction of domestic demand, which reaches its maximal effect in the second year (through multiplier effects). On the other hand, exports are gradually deteriorating with the loss of price competitiveness.

Employment gradually adjusts to the demand shock and has a hump-shaped profile similar to the GDP response, increasing by 0.18% in the first year to reach a maximum of +0.46% after 3 years, before starting to decline after 4 years.

Consumer prices increased by 0.14% in the first year due to the Phillips effects of the model. On the one hand, the positive output gap pushes prices up directly (via the VA price), and on the other hand the current unemployment gap is negative (-0.17 pp in the first year) and gradually pushes nominal wages up (via the expected unemployment gap) from the second year onwards (+0.23% after 2 years and +0.97% after 4 years). The rise in domestic prices gradually spreads to exports and imports' deflators and worsens the price competitiveness of French exporters.

The impact of the shock on public finances is more negative than in the BME of public consumption, due to the lower effects on activity, with an increase in the public debt ratio of around 2.5 pp of GDP and a widening of the deficit of around -0.6 pp of GDP in the fourth year.

However, taking into account the supply effects of a public investment shock in this BME could significantly change the results, in particular through effects on long-run GDP and output gap.

Table 10: Response to an ex ante increase of 1 pp of GDP in public investment

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.74	0.85	0.81	0.72
Private consumption	0.23	0.30	0.34	0.35
Public consumption	0.00	0.00	0.00	0.00
Total investment	4.77	5.12	5.10	4.98
<i>Business investment</i>	<i>0.51</i>	<i>1.09</i>	<i>1.08</i>	<i>0.92</i>
<i>Public investment</i>	<i>29.43</i>	<i>28.81</i>	<i>28.74</i>	<i>29.00</i>
<i>Households investment</i>	<i>0.43</i>	<i>0.74</i>	<i>0.83</i>	<i>0.78</i>
Exports	-0.03	-0.21	-0.50	-0.80
Imports	1.45	1.33	1.23	1.13
Contributions to real GDP (deviation in pp)				
Domestic demand	1.23	1.37	1.39	1.38
Net exports	-0.48	-0.50	-0.57	-0.65
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.14	0.47	0.76	1.01
HICP excluding food & energy	0.20	0.65	1.04	1.34
GDP deflator	0.17	0.54	0.88	1.18
Imports deflator	-0.01	0.07	0.20	0.35
Export deflator	0.17	0.51	0.80	1.01
Labor market				
Unemployment rate (deviation in pp)	-0.17	-0.39	-0.44	-0.38
Total employment	0.18	0.40	0.46	0.40
Unit labor costs	-0.52	-0.20	0.25	0.67
<i>Compensation per employee</i>	<i>0.03</i>	<i>0.23</i>	<i>0.58</i>	<i>0.97</i>
<i>Productivity</i>	<i>0.56</i>	<i>0.45</i>	<i>0.34</i>	<i>0.32</i>
Real compensation per employee	-0.11	-0.24	-0.19	-0.05
Households revenue				
Real gross disposable income (GDI)	0.25	0.26	0.28	0.29
Households saving ratio (% of GDI, deviation in pp)	0.02	-0.03	-0.05	-0.05
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.71	-0.60	-0.59	-0.61
Public debt (% of GDP)	0.71	1.31	1.89	2.51

3.4. Social benefits

In this BME, we simulate a sustained ex ante increase of 1 percentage point of GDP in social benefits excluding unemployment benefits. In contrast, unemployment benefits are endogenous to the unemployment rate and thus react endogenously to the shock. The shock directly affects household disposable income and transmits to the economy via expected permanent income; in this sense, it is a pure demand shock (especially in the absence of an active tax rule to stabilize debt) and the model does not include any effects on labor supply.

The transmission of the shock is thus quite similar to that of the BME of public wages, with the exception of the indexation of certain incomes to the price of GDP. The effects on GDP are limited in the first year but then increase in magnitude (+0.09% in one year, +0.43% in 4 years).

The main transmission channel is household spending. They benefit from an increase in their effective purchasing power and they anticipate an increase in their permanent income following the increase in real gross disposable income (GDI). However, the shock is somewhat mitigated by real wage inertia, which decreases countercyclically due to wage rigidities.

Households react to the increase in permanent income and gradually increase their consumption of goods and services. However, the increase in consumption is less rapid than the increase in real GDI, and the savings rate increases in the short term by almost 1 pp of GDP, before gradually returning to the baseline scenario. Household investment is a little more inertial and grows more gradually than consumption after the shock.

The rise in domestic demand leads to a direct increase in imports, while the rise in prices will gradually worsen the price competitiveness of exporting firms and reduce French exports.

GDP and consumer prices increase with positive effects on activity and employment (Phillips effects). On the one hand, firms increase their markup over prices due to the effect of the output gap on the VA price in the short term. On the other hand, nominal wages gradually increase from the second year onwards and push up VA price. The price increase transmits then to the export deflator and drives the adjustment mechanism through foreign trade and export price competitiveness.

On the public finance side, the social benefit shock is more negative in terms of the evolution of the budget balance and public debt than previous public expenditure shocks (consumption in volume, wages and investment in volume). The government balance widens by -0.82 percentage points of GDP in the first year before falling to -0.62 percentage points as a result of the automatic stabilizers. Public debt is expected to increase by 2.86 percentage points of GDP after 4 years.

Table 11: Response to an ex ante increase of 1 pp of GDP in social benefits (exclud. unemployment benefits)

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.09	0.26	0.37	0.43
Private consumption	0.27	0.66	0.94	1.12
Public consumption	0.00	0.00	0.00	0.00
Total investment	0.05	0.23	0.42	0.54
<i>Business investment</i>	<i>0.05</i>	<i>0.24</i>	<i>0.43</i>	<i>0.53</i>
<i>Public investment</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.01</i>
<i>Households investment</i>	<i>0.07</i>	<i>0.34</i>	<i>0.66</i>	<i>0.91</i>
Exports	0.00	-0.03	-0.11	-0.23
Imports	0.19	0.45	0.61	0.68
Contributions to real GDP (deviation in pp)				
Domestic demand	0.16	0.42	0.61	0.74
Net exports	-0.06	-0.16	-0.24	-0.31
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.01	0.09	0.21	0.35
HICP excluding food & energy	0.02	0.12	0.29	0.48
GDP deflator	0.02	0.09	0.23	0.38
Imports deflator	0.00	0.01	0.04	0.10
Export deflator	0.02	0.10	0.23	0.37
Labor market				
Unemployment rate (deviation in pp)	-0.02	-0.08	-0.16	-0.21
Total employment	0.02	0.09	0.17	0.22
Unit labor costs	-0.07	-0.14	-0.11	0.00
<i>Compensation per employee</i>	<i>0.00</i>	<i>0.03</i>	<i>0.09</i>	<i>0.21</i>
<i>Productivity</i>	<i>0.07</i>	<i>0.17</i>	<i>0.20</i>	<i>0.21</i>
Real compensation per employee	-0.01	-0.06	-0.12	-0.15
Households revenue				
Real gross disposable income (GDI)	1.44	1.49	1.50	1.49
Households saving ratio (% of GDI, deviation in pp)	0.99	0.69	0.48	0.31
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.82	-0.75	-0.68	-0.62
Public debt (% of GDP)	0.82	1.56	2.24	2.86

3.5. Direct taxes

The shock considered is a permanent ex ante increase of 1 pp of GDP in direct taxes paid by all agents: households (about 80% of the total), SNF-SF firms (about 20% of the total) and the rest of the world (1% of the total). The additional revenue is entirely allocated to reducing the general government deficit.

Regarding private agents, two mechanisms are essentially at work. For households, the tax increase reduces their purchasing power and therefore gradually reduces their consumption and investment. On the other hand, labor supply is not affected by the increase in taxes. For firms, the increase in corporate taxes does not directly affect their investment or employment decisions.

In line with the previous description, the BME is therefore essentially a levy on the purchasing power of households, which is 1.31 pp lower in the first year. Their consumption and investment decline accordingly, even if the shock, which is significant and sudden, is initially largely dampened by the sharp decline in the household savings rate.

However, the decline in activity remained moderate in the first year (-0.09 pp). It increases over time as the household savings rate approaches its initial level and as the shock is increasingly passed on to household spending.

The reduction in activity leads to a reduction in employment, business investment and prices, with a total effect on household purchasing power that increases over time.

On the other hand, lower export prices generate price competitiveness gains that support exports, a stabilization mechanism that somewhat dampens the decline in domestic demand.

The impact on the government budget balance is close to +1 pp of GDP in the first year but is reduced in subsequent years as the deterioration in the macroeconomic environment weighs on government revenues and expenditure related to unemployment. The net effect on the deficit after 4 years is thus only 0.83 pp. However, the public debt significantly decreases by -3.58 pp after 4 years.

Table 12: Response to an ex ante increase of 1 pp of GDP in direct taxes

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.09	-0.23	-0.34	-0.40
Private consumption	-0.25	-0.61	-0.86	-1.04
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.04	-0.21	-0.38	-0.50
<i>Business investment</i>	-0.04	-0.22	-0.40	-0.49
<i>Public investment</i>	0.00	0.00	0.00	-0.01
<i>Households investment</i>	-0.06	-0.31	-0.60	-0.84
Exports	0.00	0.03	0.10	0.21
Imports	-0.18	-0.41	-0.56	-0.64
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.15	-0.38	-0.57	-0.69
Net exports	0.06	0.14	0.22	0.29
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.01	-0.08	-0.19	-0.33
HICP excluding food & energy	-0.02	-0.11	-0.26	-0.44
GDP deflator	-0.01	-0.09	-0.21	-0.35
Imports deflator	0.00	-0.01	-0.04	-0.09
Export deflator	-0.02	-0.09	-0.21	-0.34
Labor market				
Unemployment rate (deviation in pp)	0.02	0.08	0.15	0.19
Total employment	-0.02	-0.08	-0.15	-0.20
Unit labor costs	0.07	0.13	0.10	0.00
<i>Compensation per employee</i>	0.00	-0.02	-0.09	-0.19
<i>Productivity</i>	-0.07	-0.15	-0.19	-0.20
Real compensation per employee	0.01	0.06	0.11	0.14
Households revenue				
Real gross disposable income (GDI)	-1.31	-1.36	-1.40	-1.42
Households saving ratio (% of GDI, deviation in pp)	-0.93	-0.65	-0.46	-0.33
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.97	0.91	0.87	0.83
Public debt (% of GDP)	-0.97	-1.89	-2.75	-3.58

3.6. VAT

The shock considered is a permanent shock on the VAT rate increasing ex ante government revenues by 1 percentage point of GDP. The shock affects households' consumption and investment expenditures and the investment expenditure of firms subject to VAT.

On impact, the shock causes a sharp rise in consumer prices and investment deflators. The GDP deflator, which includes VAT, is also increasing significantly. The rise in consumer prices immediately reduces household purchasing power, despite the increase in nominal wages, which only partially compensates for the rise in consumer prices.

The increase in wages in turn leads to an increase in production costs and the price of VA increases in turn, in a second phase, and is transmitted to all the deflators of the model, in particular the price of exports, reducing the price competitiveness of French exports.

GDP contracts by 0.39 pp over the next 4 years. In the first year, household consumption contributes most strongly to the reduction in activity, with a decline of -0.14 pp. The decline in output is amplified by the decline in private investment, from the second year onwards, because of the slowdown in activity (for business investment) and the decline in permanent income (for household investment). Exports are declining, but at a slower pace than imports, and thus contributing positively to GDP growth, mitigating the decline in domestic demand.

Employment is contracting and the unemployment rate is rising by 0.18 pp over the next 4 years. The unemployment gap would then weigh on nominal wage growth, which stabilizes 4 years after the shock. In the long term, the economy would stabilize through the decline in nominal wages, which would restore price competitiveness and boost French exports.

On the public finance side, the increase in VAT very significantly improves the budget balance, which increased by 0.95 GDP points in the first year, before deteriorating slightly after 4 years, to +0.84 GDP points. The public debt decreases by -3.6 pp of GDP.

Table 13: Response to an ex ante increase in VAT by 1 pp of GDP

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.05	-0.17	-0.29	-0.39
Private consumption	-0.14	-0.35	-0.50	-0.62
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.05	-0.28	-0.52	-0.69
<i>Business investment</i>	-0.07	-0.34	-0.61	-0.77
<i>Public investment</i>	0.00	0.00	0.00	0.00
<i>Households investment</i>	-0.04	-0.30	-0.64	-0.94
Exports	0.00	-0.02	-0.05	-0.09
Imports	-0.11	-0.28	-0.38	-0.43
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.09	-0.26	-0.41	-0.52
Net exports	0.04	0.09	0.11	0.12
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	1.09	1.13	1.16	1.18
HICP excluding food & energy	1.55	1.61	1.65	1.67
GDP deflator	1.12	1.15	1.19	1.21
Imports deflator	0.00	0.01	0.02	0.04
Export deflator	0.01	0.05	0.09	0.10
Labor market				
Unemployment rate (deviation in pp)	0.01	0.06	0.12	0.18
Total employment	-0.01	-0.06	-0.13	-0.18
Unit labor costs	0.19	0.35	0.50	0.52
<i>Compensation per employee</i>	0.14	0.24	0.33	0.31
<i>Productivity</i>	-0.04	-0.11	-0.16	-0.21
Real compensation per employee	-0.94	-0.89	-0.83	-0.87
Households revenue				
Real gross disposable income (GDI)	-0.75	-0.76	-0.76	-0.81
Households saving ratio (% of GDI, deviation in pp)	-0.53	-0.35	-0.23	-0.16
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.95	0.92	0.88	0.84
Public debt (% of GDP)	-0.95	-1.87	-2.75	-3.59

3.7. Employees' social contributions

The shock considered is a permanent and ex ante increase of 1 pp GDP in social contributions paid by employees.

In the model's Phillips curve, wages formation is based on changes in gross wages that depend on inflation, productivity trends and unemployment expectations. Households therefore do not have the capacity to negotiate a gross wage increase to compensate for the increase in their contributions, and the shock therefore acts here exactly like a direct tax increase. However, compared to the BME of direct taxes presented above, the shock is greater in the disposable income of households because they are the only ones to bear the 1 percentage point increase in GDP, whereas it was previously divided between households and businesses.

The BME is therefore a levy on the purchasing power of households. This is 1.45 pp lower in the first year. Their consumption and investment fall accordingly, even if the shock is initially largely absorbed in the household savings rate, which falls sharply in the first year (-1.03 pp).

However, the decline in activity remained moderate in the first year (-0.10 pp). It increases over time as the household savings rate approaches its initial level and as the shock is increasingly passed on to household spending.

In addition, the reduction in activity leads to a reduction in employment, business investment and prices, with an overall effect on household purchasing power that increases over time.

On the other hand, lower export prices generate price competitiveness gains that support exports, which somewhat dampens the decline in domestic demand.

From the first year onwards, the impact on the government deficit is less than 1 percentage point of GDP and is further reduced in subsequent years as the deterioration in the macroeconomic environment weighs on government revenues and unemployment related expenditure. The net effect on the deficit after 4 years is thus only 0.67 pp. However, the public debt is falling sharply, by almost 3 points after 4 years.

Table 14: Response to an ex ante increase of 1 pp of GDP in employees' social contributions

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.10	-0.26	-0.38	-0.45
Private consumption	-0.28	-0.67	-0.96	-1.16
Public consumption	0.00	0.00	0.00	0.00
Total investment	-0.05	-0.23	-0.43	-0.56
<i>Business investment</i>	-0.05	-0.25	-0.44	-0.55
<i>Public investment</i>	0.00	0.00	0.00	-0.01
<i>Households investment</i>	-0.07	-0.35	-0.67	-0.93
Exports	0.00	0.03	0.11	0.24
Imports	-0.19	-0.46	-0.62	-0.71
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.16	-0.42	-0.63	-0.77
Net exports	0.06	0.16	0.24	0.32
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.01	-0.09	-0.21	-0.36
HICP excluding food & energy	-0.02	-0.12	-0.29	-0.49
GDP deflator	-0.02	-0.10	-0.23	-0.39
Imports deflator	0.00	-0.01	-0.04	-0.10
Export deflator	-0.02	-0.10	-0.23	-0.38
Labor market				
Unemployment rate (deviation in pp)	0.02	0.09	0.16	0.22
Total employment	-0.02	-0.09	-0.17	-0.23
Unit labor costs	0.07	0.14	0.11	0.00
<i>Compensation per employee</i>	0.00	-0.03	-0.09	-0.21
<i>Productivity</i>	-0.08	-0.17	-0.21	-0.22
Real compensation per employee	0.01	0.06	0.12	0.15
Households revenue				
Real gross disposable income (GDI)	-1.45	-1.52	-1.57	-1.59
Households saving ratio (% of GDI, deviation in pp)	-1.03	-0.73	-0.52	-0.37
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.82	0.76	0.71	0.67
Public debt (% of GDP)	-0.82	-1.58	-2.29	-2.96

3.8. Employers' social contributions

The shock considered is a permanent and ex ante increase in employers' social contributions of 1 percentage point of GDP. It is mainly transmitted through two channels. On the one hand, labor costs are rising sharply, which affects labor demand and employment. On the other hand, the increase in labor costs affects GDP deflator via the Factor Price Frontier of market branches.

The increase in GDP deflator, the central deflator for the formation of all prices, induces that of the deflators of the components of demand. This price surge has several consequences. On the supply side, it limits the increase in real wages, which, from the second year onwards, is significantly lower than that of nominal wages. This in turn contributes to limiting the extent of the employment adjustment, even if it remains significant after 4 years.

The adjustment of employment to the labor cost shock is also dampened by the role of expectations. Here again, the long-term elasticity of the target for salaried employment in the market sector to the shock of employer social contributions would be close to -1.5%.

On the demand side, the increase in domestic and export prices worsens price competitiveness and weighs on exports, which are falling significantly. Rising inflation also contributes to further deterioration in household purchasing power, particularly in view of the only partial indexation of wages to prices. This decline in purchasing power is partly offset by a fall in the savings rate, but household consumption is nevertheless falling significantly.

Again, the ex-post effect on the government deficit is close but less than 1 percentage point of GDP, then it remains positive but is reduced in subsequent years due to the deterioration in the macroeconomic situation.

Table 15: Response to an ex ante increase of 1 pp of GDP in employers' social contributions

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	-0.04	-0.25	-0.57	-0.84
Private consumption	-0.07	-0.25	-0.52	-0.77
Public consumption	0.00	0.00	0.01	0.01
Total investment	-0.01	-0.05	-0.24	-0.51
<i>Business investment</i>	-0.01	-0.03	-0.18	-0.41
<i>Public investment</i>	0.00	0.01	0.01	0.03
<i>Households investment</i>	-0.02	-0.16	-0.53	-1.09
Exports	-0.03	-0.36	-0.88	-1.28
Imports	-0.04	-0.05	-0.12	-0.30
Contributions to real GDP (deviation in pp)				
Domestic demand	-0.04	-0.15	-0.34	-0.54
Net exports	0.00	-0.10	-0.24	-0.31
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	0.20	0.87	1.28	1.39
HICP excluding food & energy	0.29	1.21	1.74	1.83
GDP deflator	0.24	0.94	1.36	1.45
Imports deflator	0.01	0.13	0.36	0.58
Export deflator	0.25	0.96	1.33	1.35
Labor market				
Unemployment rate (deviation in pp)	0.02	0.12	0.27	0.42
Total employment	-0.03	-0.13	-0.28	-0.43
Unit labor costs	1.94	2.20	2.48	2.59
<i>Compensation per employee</i>	1.89	2.05	2.16	2.15
<i>Productivity</i>	-0.01	-0.12	-0.29	-0.40
Real compensation per employee	1.69	1.17	0.86	0.74
Households revenue				
Real gross disposable income (GDI)	-0.41	-0.70	-0.97	-1.15
Households saving ratio (% of GDI, deviation in pp)	-0.29	-0.38	-0.39	-0.33
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.92	0.84	0.71	0.60
Public debt (% of GDP)	-0.92	-1.76	-2.47	-3.07

4. Structural shocks

4.1. Labor efficiency

The shock studied is a permanent 1% increase in trend labor efficiency that corresponds to a similar increase in labor productivity over the medium term. The shock is gradually transmitted to the economy to reach +1% within 4 years, or +0.06% per quarter.

First, the shock is transmitted by firm labor demand and the price of VA, both of which depend directly on trend efficiency. The shock also affects nominal wages, which are indexed to the productivity trend. Finally, the shock spreads to the entire model through expectations via the output gap, which depends on long-term GDP and therefore on trend labor efficiency. In the first year, long-term GDP grows by 0.09 pp and the output gap widens by -0.05 pp, taking into account an effective GDP growth of 0.04 pp.

The demand for labor by firms is decreasing, taking into account productivity gains, and employment is reduced by a maximum of 0.27 pp after 4 years. However, the shock is neutral on long-term employment for an unchanged equilibrium unemployment rate.

The fall in GDP and consumer prices is directly due to the increase in labor efficiency via the fall in the price of VA, which is then transmitted to all demand deflators. The efficiency shock induces in particular gains in competitiveness, with the fall in export prices by -0.27 pp at 4 years. The price of imports decreases, partially following the price of VA. The latter effect reflects the behaviour of importers, who are reducing their margins to limit their loss of market share.

Despite the decline in employment, households expect a sustainable increase in their permanent income in real terms. Two effects are cumulative here, with on the one hand the direct increase in long-term GDP that affects permanent household income and on the other hand the increase in household purchasing power through lower consumer prices. Thus, household consumption and investment are much more dynamic than real GDI, which is increasing less rapidly than expected permanent income and explains the decline in the short-term savings rate. Business investment is growing much less. The decline in expected inflation increases the real cost of capital and offsets the effects of short-term demand.

Price competitiveness gains lead to a gradual increase in exports while imports increase initially, as a result of rising domestic demand, before gradually decreasing, taking into account the price competitiveness gains of domestic goods in relation to foreign goods (and despite the fall in import prices).

Finally, the effect on public finances is positive but limited with a decline in the deficit of around 0.04 GDP points per year, i.e. a cumulative decline in public debt of around 0.17 GDP points. The effect of automatic stabilizers is limited by the increase in unemployment, which increases unemployment insurance expenditure.

Table 16: Response to a permanent increase of +1% in labor efficiency after 4 years

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0,04	0,11	0,20	0,30
Private consumption	0,07	0,17	0,28	0,38
Public consumption	0,00	0,00	0,00	0,00
Total investment	0,07	0,17	0,22	0,23
<i>Business investment</i>	0,01	0,03	0,05	0,07
<i>Public investment</i>	0,00	0,00	0,00	-0,01
<i>Households investment</i>	0,29	0,67	0,83	0,83
Exports	0,00	0,02	0,07	0,16
Imports	0,05	0,08	0,07	0,02
Contributions to real GDP (deviation in pp)				
Domestic demand	0,05	0,13	0,21	0,27
Net exports	-0,02	-0,02	0,00	0,04
Changes in inventories	0,00	0,00	0,00	0,00
Prices				
HICP	-0,01	-0,06	-0,14	-0,25
HICP excluding food & energy	-0,01	-0,08	-0,20	-0,34
GDP deflator	-0,03	-0,11	-0,22	-0,37
Imports deflator	0,00	-0,01	-0,03	-0,07
Export deflator	-0,01	-0,06	-0,15	-0,27
Labor market				
Unemployment rate (deviation in pp)	0,04	0,10	0,12	0,25
Total employment	-0,04	-0,10	-0,12	-0,27
Unit labor costs	0,03	0,03	0,04	-0,11
<i>Compensation per employee</i>	0,11	0,24	0,37	0,46
<i>Productivity</i>	0,08	0,21	0,33	0,57
Real compensation per employee	0,11	0,29	0,51	0,72
Households revenue				
Real gross disposable income (GDI)	0,04	0,12	0,22	0,30
Households saving ratio (% of GDI, deviation in pp)	-0,02	-0,05	-0,05	-0,07
Public finances (deviation in pp)				
Budget balance (% of GDP)	0,01	0,03	0,07	0,06
Public debt (% of GDP)	-0,01	-0,04	-0,11	-0,17

4.2. Labor force

The shock in question consists of a gradual and sustainable increase in the working population of 1% over the next 4 years (+0.06% per quarter). This is an exogenous labor supply shock.

At the time of the shock, employment can be considered fixed and the number of unemployed and the effective unemployment rate therefore increase sharply. On the other hand, since long-term structural unemployment is assumed to remain unchanged, the increase in long-term employment is therefore also 1% and long-term growth immediately increases by 0.09 pp, which widens the output gap by around -0.05 pp for a GDP growth of 0.04 pp.

The shock diffusion mechanism then involves closing the output gap and returning the unemployment rate to its equilibrium rate. This is usually done by adjusting wages and prices. The negative output gap weighs on inflation, while falling unemployment and worsening unemployment expectations weigh on nominal and real wages.

On the demand side, the increase in production immediately increases household disposable income mass and purchasing power of GDI (but not per capita), if only because the additional unemployed receive unemployment benefits. In a similar way to the efficiency shock, permanent household income, linked to long-term GDP, also increases, which pushes households to increase consumption and investment in the short term beyond the increase in effective income alone, with a slight decline in their savings rate over the first two years. The slight increase in business investment is again due to the rise in the real cost of capital.

The alternative also assumes that public employment does not keep pace with labor force growth. Finally, exports are gradually benefiting from lower prices and foreign trade is making a major contribution to GDP growth and convergence towards the new long-term growth path.

The overall increase in demand gradually increases the demand for labor and gradually reduces the increase in the active population. Over the next 4 years, convergence has not yet been achieved, as the unemployment rate remains significantly above its initial level.

The government deficit is initially widened by the increase in spending related to the increase in unemployment insurance spending. It is gradually declining as the economy converges towards its higher long-term level. In total, public debt increased by 0.16 percentage point of GDP after 4 years.

Table 17: Response to a permanent increase of +1% in labor force after 4 years

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.04	0.11	0.21	0.32
Private consumption	0.07	0.16	0.26	0.33
Public consumption	0.00	0.00	0.00	0.00
Total investment	0.08	0.20	0.25	0.26
<i>Business investment</i>	0.02	0.07	0.11	0.13
<i>Public investment</i>	0.00	0.00	0.00	-0.01
<i>Households investment</i>	0.29	0.66	0.81	0.79
Exports	0.00	0.02	0.08	0.21
Imports	0.06	0.08	0.05	-0.03
Contributions to real GDP (deviation in pp)				
Domestic demand	0.06	0.13	0.20	0.24
Net exports	-0.02	-0.02	0.01	0.08
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.01	-0.06	-0.18	-0.36
HICP excluding food & energy	-0.01	-0.09	-0.25	-0.50
GDP deflator	-0.01	-0.07	-0.19	-0.39
Imports deflator	0.00	-0.01	-0.03	-0.09
Export deflator	-0.01	-0.07	-0.20	-0.39
Labor market				
Unemployment rate (deviation in pp)	0.14	0.35	0.49	0.73
Total employment	0.01	0.04	0.15	0.14
Unit labor costs	-0.04	-0.15	-0.28	-0.64
<i>Compensation per employee</i>	-0.01	-0.07	-0.22	-0.46
<i>Productivity</i>	0.03	0.07	0.06	0.18
Real compensation per employee	0.00	-0.01	-0.04	-0.10
Households revenue				
Real gross disposable income (GDI)	0.05	0.13	0.22	0.28
Households saving ratio (% of GDI, deviation in pp)	-0.02	-0.03	-0.03	-0.05
Public finances (deviation in pp)				
Budget balance (% of GDP)	-0.02	-0.03	-0.03	-0.08
Public debt (% of GDP)	0.02	0.05	0.08	0.16

4.3. Equilibrium unemployment rate (NAIRU)

The shock considered is a permanent decrease in the equilibrium unemployment rate of 1 pp over a 4-year horizon (-0.06 pp per quarter). Similar to the labor force shock, it is an exogenous labor supply shock.

In the first year, the shock mechanically increases the unemployment gap, compared to the new equilibrium unemployment rate, and the GDP gap widens by 0.06 pp. Long-term GDP increased by 0.1 pp for a GDP growth of 0.04 pp.

The transmission mechanisms are identical to the labor force shock. The positive unemployment gap leads to a decline in nominal wages in the short term via the Phillips curve. However, real wages per capita increase weakly in the short term due to the autonomous reaction of the VA price to the negative output gap, which reflects a pro-cyclical behavior of setting the firms' markup. But by the second year, the Phillips effect on the VA price is dominated by the decline in nominal wages and real wages are falling. The fall in labor costs then boosted demand for labor and employment increased moderately.

On the demand side, consumption increases with expected permanent income, which is growing faster than actual household GDI, taking into account long-term GDP growth. However, the unemployment gap remains wider in this BME for a longer period and explains why household consumption is less dynamic.

In the long run, employment would fully adjust to the equilibrium unemployment rate shock. The decline in wages and prices would continue, creating competitive gains for exporting firms in the French economy. But like the labor force shock, employment dynamics are particularly slow and the shock is only absorbed beyond the simulation horizon.

The budget balance improves very marginally through the effect of automatic stabilizers and by the decline in unemployment and unemployment benefits. Public debt is thus reduced by almost 0.1 percentage points of GDP over the next four years.

Table 18: Response to a permanent decrease of -1pp in the equilibrium unemployment rate after 4 years

Deviation in % from baseline scenario	Year 1	Year 2	Year 3	Year 4
Real activity				
Real GDP	0.04	0.11	0.19	0.29
Private consumption	0.07	0.14	0.20	0.23
Public consumption	0.00	0.00	0.00	0.00
Total investment	0.08	0.19	0.23	0.21
<i>Business investment</i>	<i>0.02</i>	<i>0.06</i>	<i>0.08</i>	<i>0.08</i>
<i>Public investment</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>-0.01</i>
<i>Households investment</i>	<i>0.29</i>	<i>0.65</i>	<i>0.78</i>	<i>0.72</i>
Exports	0.00	0.02	0.10	0.25
Imports	0.05	0.06	0.00	-0.11
Contributions to real GDP (deviation in pp)				
Domestic demand	0.05	0.12	0.16	0.18
Net exports	-0.02	-0.01	0.03	0.12
Changes in inventories	0.00	0.00	0.00	0.00
Prices				
HICP	-0.01	-0.07	-0.21	-0.43
HICP excluding food & energy	-0.02	-0.10	-0.29	-0.58
GDP deflator	-0.01	-0.08	-0.23	-0.46
Imports deflator	0.00	-0.01	-0.04	-0.10
Export deflator	-0.01	-0.08	-0.23	-0.46
Labor market				
Unemployment rate (deviation in pp)	0.01	-0.01	-0.09	-0.07
Total employment	-0.01	0.01	0.09	0.07
Unit labor costs	-0.06	-0.18	-0.35	-0.76
<i>Compensation per employee</i>	<i>-0.01</i>	<i>-0.08</i>	<i>-0.26</i>	<i>-0.54</i>
<i>Productivity</i>	<i>0.05</i>	<i>0.10</i>	<i>0.10</i>	<i>0.22</i>
Real compensation per employee	0.00	-0.01	-0.05	-0.11
Households revenue				
Real gross disposable income (GDI)	0.01	0.03	0.06	0.07
Households saving ratio (% of GDI, deviation in pp)	-0.05	-0.09	-0.12	-0.14
Public finances (deviation in pp)				
Budget balance (% of GDP)	0.01	0.02	0.04	0.02
Public debt (% of GDP)	-0.01	-0.03	-0.07	-0.09

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