CHAPTER 10.

EVALUATIONS OF FISCAL POLICIES WITH A DYNAMIC GENERAL EQUILIBRIUM MODEL OF THE FRENCH ECONOMY

The model developed by Maylis Coupet et Jean-Paul Renne will be used to evaluate the effects of several tax increases.

1. Calibration of the model

Some parameters are calibrated. For instance, the growth rates (starting by Γ) in the steady state of the consumption price, the domestic production and foreign production prices, the efficiency of labour and the population, are set to their observed average value on the past. Other parameters are given values, which are usually found in the literature, for instance the household discount rate β or the depreciation rate of capital δ. There is nothing new, which was not explained before in the course.

Other parameters are estimated by a Bayesian method. Bayesian estimation can be interpreted as a mix of a calibration and an estimation by the maximum likelihood. The estimated parameters are not numbers, which would differ from their true values by an error term, as in classical econometrics. The estimated parameters are random variables. So, before simulating the model we need to draw the values of the parameters from their probability distribution. The code of the program of the model continues with

```
tirage_parametres;
```

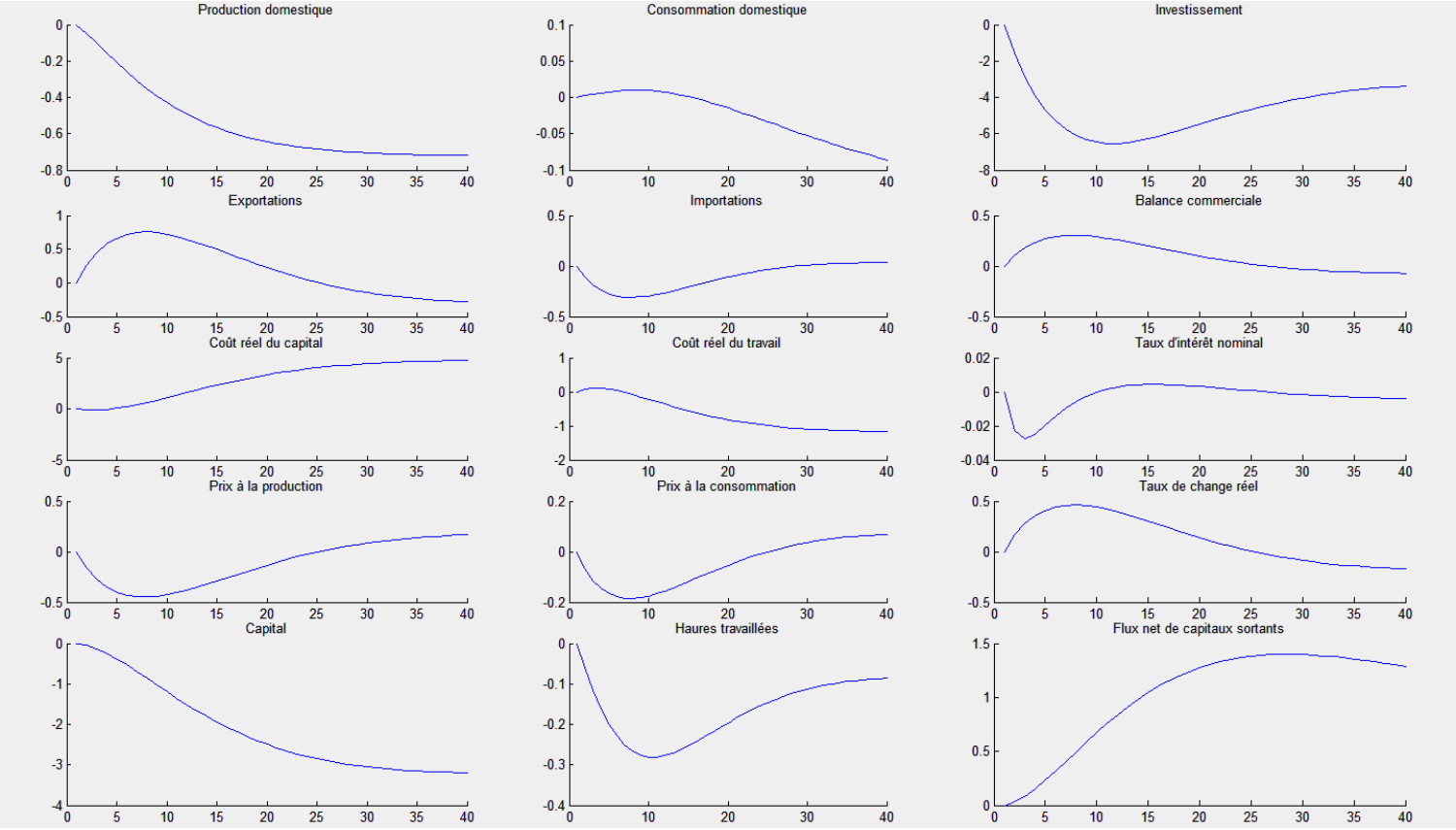
This command calls a Matlab subprogram, which computes a draw.

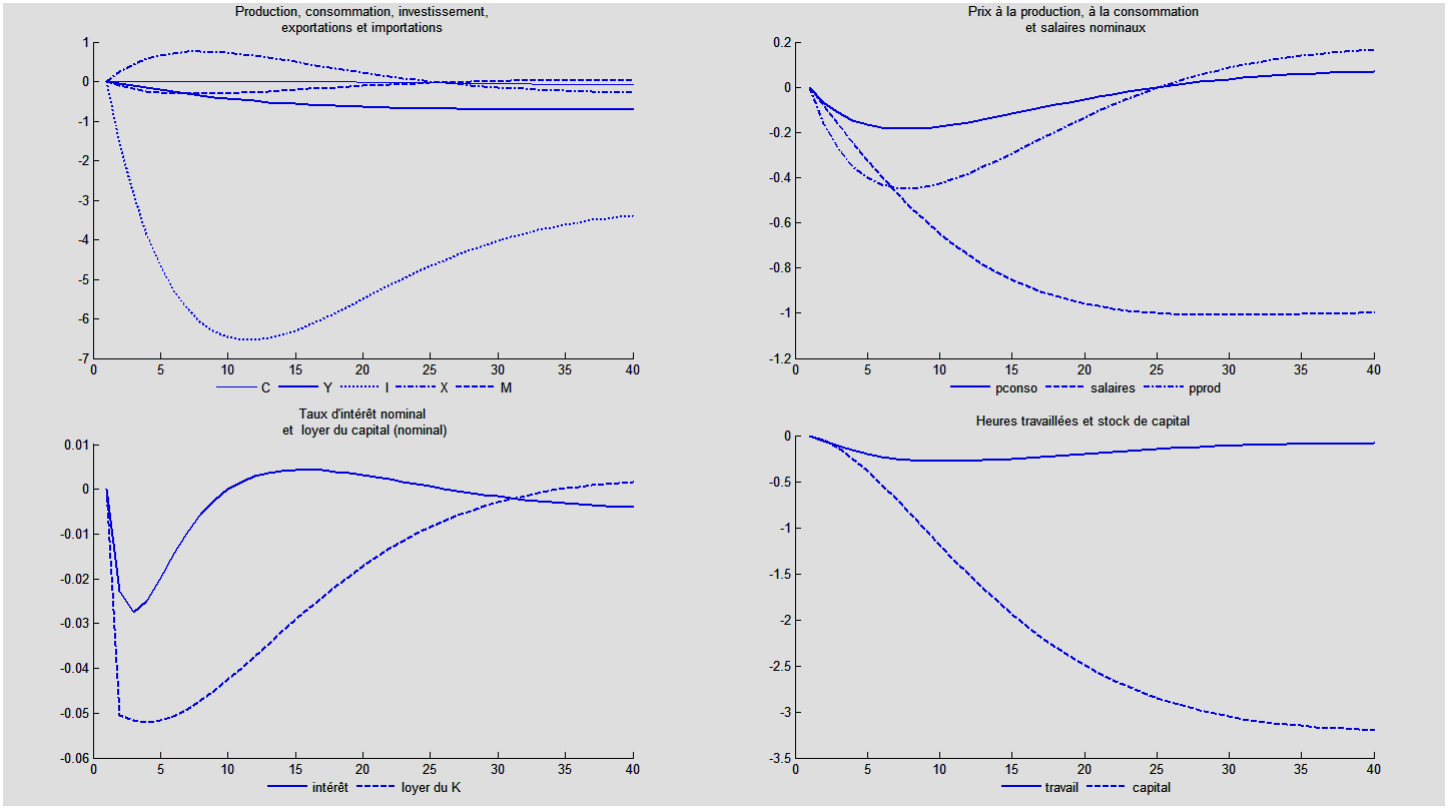
The results of the simulation depend on the draw. We can type on the command line of MATLAB

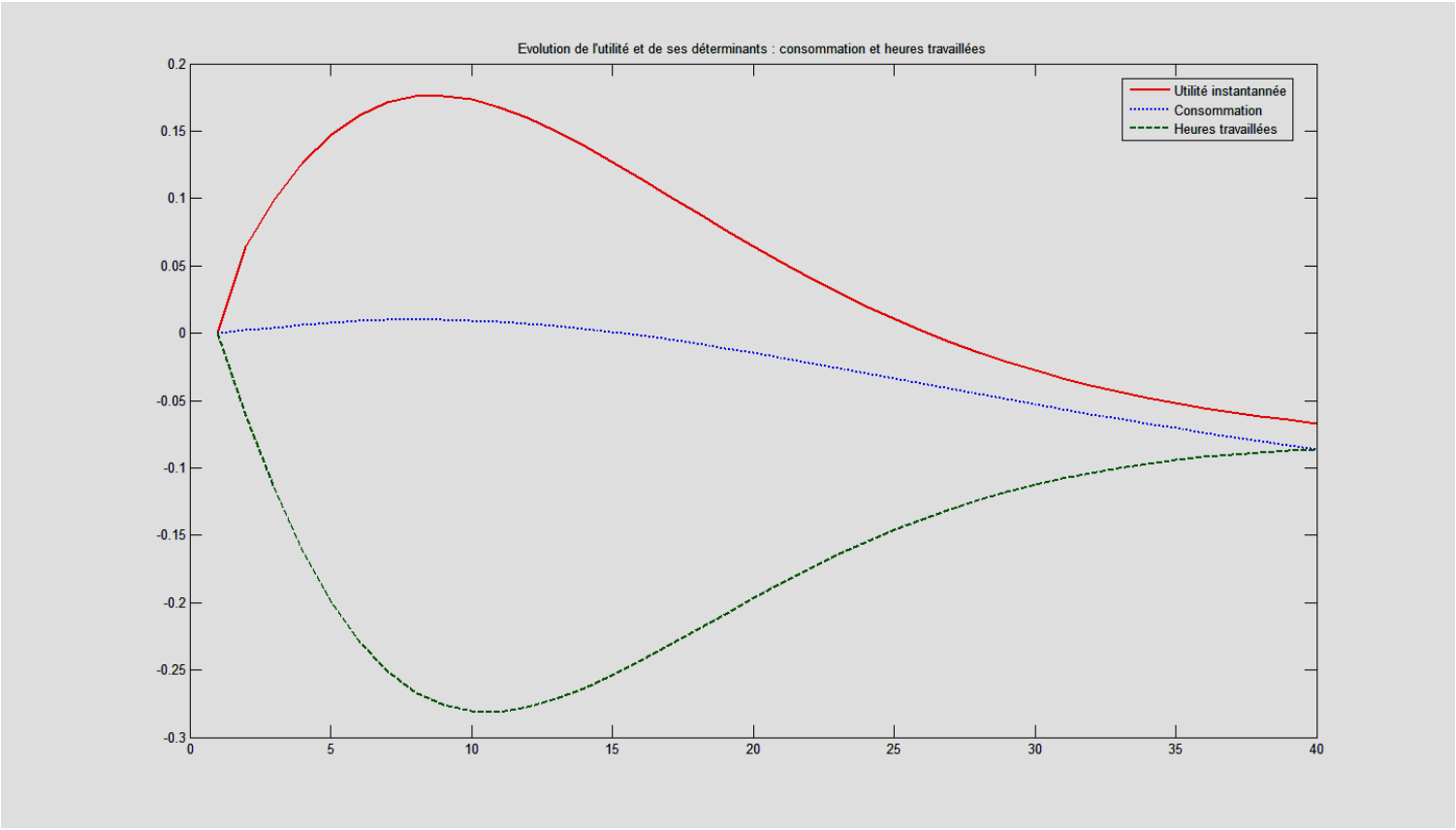
```
dynare modele_a_simuler.mod
```

and we run a simulation. However, this program is naked. The results are not even saved (although they are in the RAM of the computer until the next simulation). No graph command is included in *modele_a_simuler.mod*

It is more comfortable to run the Matlab program *simulation.m*, which calls modele_*a_simuler.mod*, saves the results in *result_dyn.mat* file, then draws three beautiful graphs of the results of the simulation. These graphs are, for an increase in the taxation rate of capital.



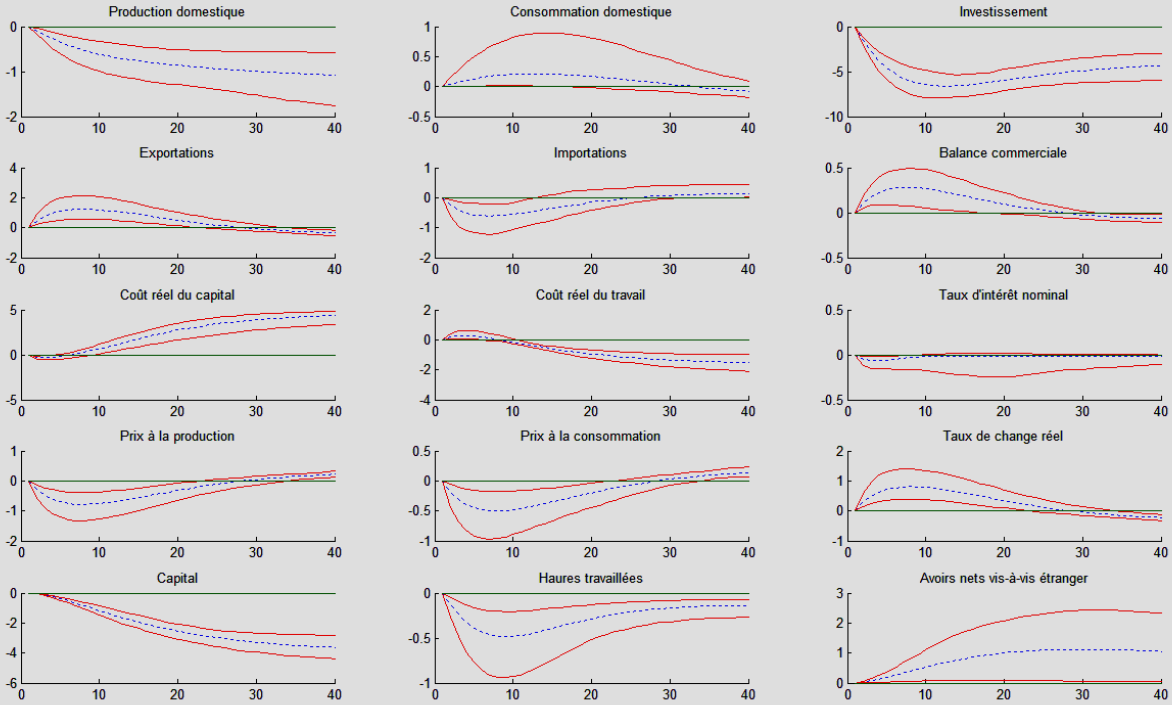




You also get a table giving the results of the simulation.

An interesting result is the change in the intertemporal utility of households.

However, the previous results depend on a specific draw of the parameters. We can also make a large number of draws, for instance 300, then simulate the model for each of these draws and finally compute the average of all these simulations. To do that, we use the Matlab program *simul_prelevts.m*. This series of simulations takes a lot of time (the whole night). The next graph represents the average of the 300 simulations and a confidence interval



2. The long run effects of three tax increases

The model is simulated first in a steady state where all taxes are set to zero. We have the following code in the program.

```
initval;

tcotsoce_aux    = 0.0;
tcotsocs_aux    = 0.0;
tkm_aux         = 0.0;
ttva_aux        = 0.0;
tob_star_aux    = 0.0;
tob_aux         = 0.0;
tp_aux          = 0.0;
trem_aux        = 0.0;
tke_aux         = 0.0;
end;

steady;
```

Then, we compute the effects of an increase in a tax rate by an *exante* amount equal to 1% of GDP (its value in the initial steady state). The three investigated taxes are social compensations (a labour tax), the VAT (a consumption but also an investment tax) and a tax on capital.

To compute the effects of an increase in the social compensation tax we write in the program the following lines, after *endvalues*

```
tcotsoce0 = 0.01*100/65;
ttva0 = 0;
trem0 = 0;
trem0 = 0;
tke0 = 0;
```

For the effects of an increase in the VAT rate we write

```
tcotsoce0 = 0;
ttva0 = 0.85*0.01*100/81;
trem0 = 0;
trem0 = 0.15*0.01*100/19;
tke0 = 0.;
```

For the effects of an increase in the taxation of capital rate we write

```
tcotsoce0 = 0;
ttva0 = 0;
trem0 = 0;
trem0 = 0;
tke0 = 0.01*100/21;
```

Finally, we get the results

	Cotisations sociales			TVA			taxe sur le capital		
	1 an	2 ans	Long terme	1 an	2 ans	Long terme	1 an	2 ans	Long terme
Production	-0,5	-0,5	-0,1	-0,1	-0,2	-0,3	-0,4	-0,6	-1,1
Consommation	-0,1	-0,1	-0,1	-0,0	-0,0	-0,1	0,1	0,1	-0,3
Emploi* (en milliers)	-100	-90	-23	-22	-27	-19	-61	-71	-19
Investissement	-0,9	-1,0	-0,1	-1,0	-1,3	-0,7	-5,1	-6,4	-3,8
Exportations	-0,5	-0,4	-0,1	0,1	0,1	-0,1	1,1	1,1	-0,4
Importations	0,2	0,1	-0,0	-0,1	-0,1	-0,0	-0,5	-0,5	-0,1
Balance commerciale**	-0,1	-0,1	-0,0	0,0	0,0	-0,0	0,3	0,3	-0,0
Salaire réel	-0,9	-1,2	-1,5	-1,0	-1,1	-1,3	-0,1	-0,4	-1,5
Coût réel du travail	0,5	0,2	-0,0	0,1	0,0	-0,3	0,1	-0,2	-1,6
Coût réel du capital	-0,7	-0,5	0,0	-0,1	0,0	0,8	-0,0	0,7	4,8
Taux de change réel	-0,3	-0,3	-0,1	0,1	0,1	-0,1	0,7	0,7	-0,2
Prix à la consommation	0,2	0,2	0,0	0,9	0,9	1,0	-0,4	-0,4	0,1

The values in the table represent relative differences in per cent from the reference (initial) steady state. For instance, we can see that the increase in social security compensation decreases output by 0.5% after one year, but only by 0.1% in the long run. It destroys 100,000 jobs in the short run and 23,000 in the long run.

Now, I will give an economic interpretation of these results in the long run.

2.1. Supply effect

Production uses two factors, capital and labour.

As in the Ramsey model, the return on capital, *net of taxes* is equal to the household discount rate $1/\beta - 1$ (remember that in page 11 of chapter 7 we had the equation $ax\alpha k^{\alpha-1} = 1 + \alpha - (1-\delta)$; the $1+\beta$ of chapter 7 has the same meaning as the $1/\beta$ of chapters 8 and 9). The rate wage rate is a decreasing function of employment: when it decreases, people decide to work less.

The cost of capital for firms is the *before-tax* return on capital. The cost of labour for firms is equal to the real wage rate, plus taxes on labour.

The dual representation of a production function is the factor-price frontier, which establishes a decreasing relationship between the *before-tax* cost of capital and the (*tax-included*) cost of labour.

An increase in the social compensation rate has no effect on the cost of capital. So, the tax-included cost of labour does not change. Thus, the (after-tax) wage rate decreases. Because of that the supply of labour that is employment decreases.
As the cost of both production factors have not changed, firms keep the same ratio between capital and labour. So, capital decreases in the same proportion as labour. Output follows this movement.

An increase in the taxation rate of capital increases the cost of capital for firms. So, the cost of labour decreases, according to the factor-price frontier. Thus, we have two effects.

- First, the production becomes more labour intensive.
- Secondly, employment decreases.

Finally, the stock of capital decreases by a higher proportion than employment. The percentage decrease in output is between the decrease in labour and the decrease in capital.

We can see on the table that an increase in the taxation of capital has much more depressive effects in the long run than an increase in the taxation of labour (the relative changes in investment and capital are equal in the long run).

An increase in the VAT rate can be decomposed into

1) A small increase in the taxation of capital;

2) A higher increase in the taxation of consumption, which decreases the purchasing power of wages, and so is equivalent to a higher taxation of labour.

The table shows that the effects of an increase in the VAT rate are intermediary between those of an increase in the social compensation rate, and an increase in the capital taxation rate. However, they are nearer to the effects of the former than of the latter increase.

2.2. Price effects

A decrease in the *real cost of labour* for firms can be obtained by a decrease in the nominal wage rate or an increase in domestic *production price*.

1. The supply of labour by households depends on *the real wage rate* that is the nominal wage rate divided by the *consumption price*.
   The consumption price is an average of the domestic production price and of the foreign production price. As the latter price does not move (don't forget that the rest of the world and France use the same currency), the consumption price increases by less than the domestic production price.
   Thus a decrease in the real cost of labour, which would be obtained by an increase in the domestic production price would have a less depressive effect on employment and output that if it is obtained by a decrease in the nominal wage rate.

2. However, if French firms increase their production price, they will become less competitive than foreign firms on the French and foreign markets. Thus, France will export less and import more.

3. The *before-tax* interest rate in France is equal to the foreign interest rate, which is exogenous, plus the risk premium. The *after-tax* interest rate is equal to the household discount rate and constant. Thus, *if the taxation of capital (interest (income) is kept unchanged,* the *before-tax* interest rate does not move either and neither the risk premium.
   The risk premium is a function of France indebtedness. So, France indebtedness and consequently the France balance of payments remain the same.

The decrease in the real cost of labour should improve the competitiveness of France if it is obtained by a decrease in the nominal cost of labour. It should deteriorate it if it is obtained by an increase in the domestic production price. In the first case the balance of payments deteriorates, in the second case it improves. Thus, the allocation of the decrease in the real cost of labour between a decrease in the nominal wage rate and an increase in the domestic production price is such that the balance of payments does not change.

The table shows that the increase in the consumption price is very small in comparison to the decrease in the real wage rate, except of course in the case of an increase in the VAT rate, which directly increases the consumption price.

3. The short run effects of three tax increases

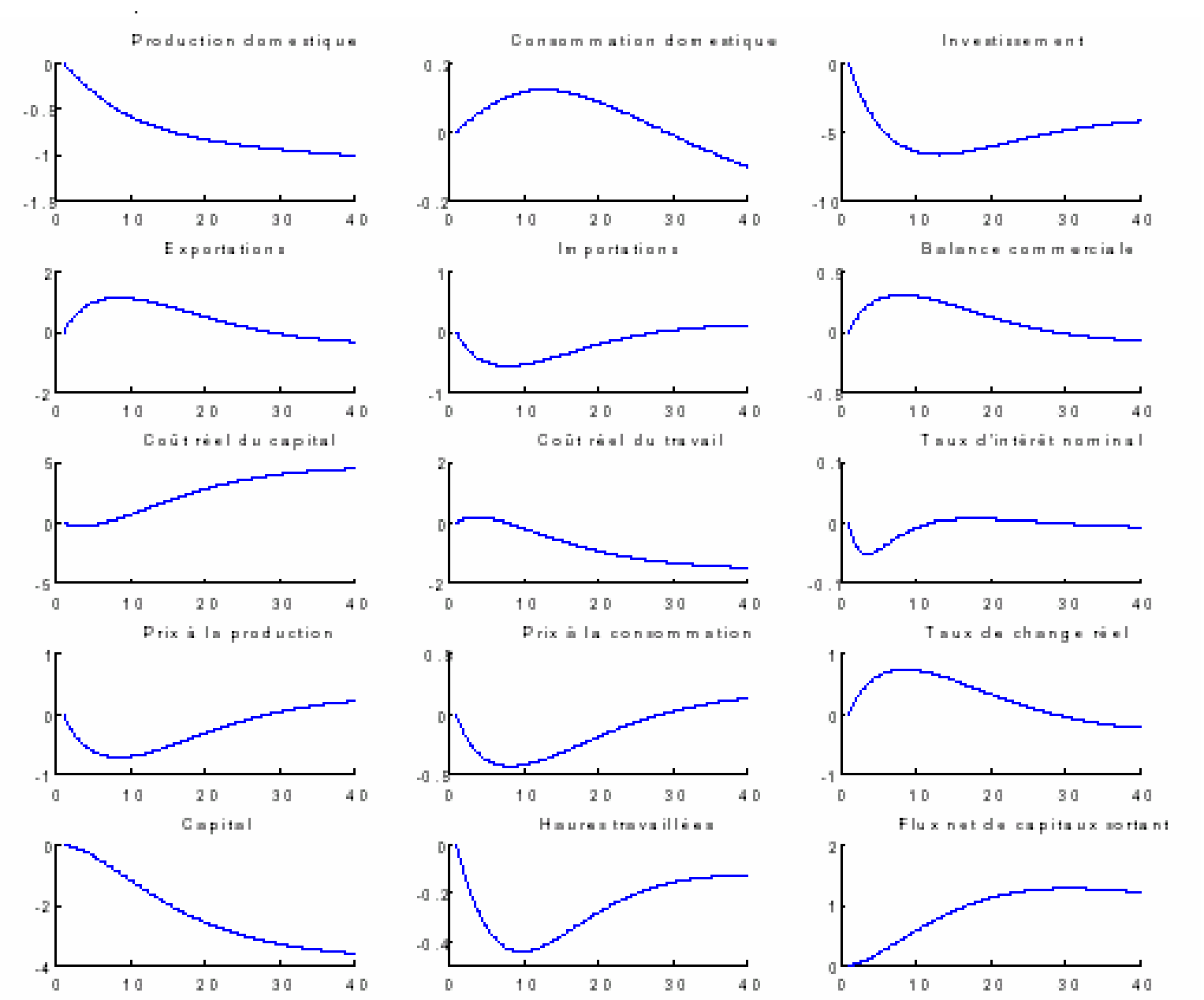
The model is very neo-classical and similar to the Ramsey's model in the long run. In the short term the model has a wide number of real and nominal rigidities.

- *Real rigidities*: adjustment of investment, employment
- *Nominal rigidities*: nominal wages, process, interest rate

For instance, let us assume that nominal wages are totally rigid and cannot move. Let us also assume that this is the only rigidity in the model. Then an increase in the social compensation rate will lead firms to decrease the (after-tax) real wage rate of households by increasing the domestic price.
If we assume instead that domestic prices are totally rigid and cannot move, but that the wage rate is flexible, an increase in the social compensation rate will lead firms to decrease the (after-tax) real wage rate of households by decreasing the nominal wage.
This example shows that the results are very sensitive to the relative strengths of the rigidities in the model. Thus, their interpretation is complex.

The following graph shows the effect of an increase in the taxation rate of capital. We can see that the decrease of capital takes time. As employment is more flexible than capital, we have an overshooting in the decrease in employment.

I do not dare telling more. The comments made in the papers on the graphs are more imaginative and creative than precise and rigorous. I find the graphs credible, but I would not be surprised if a few of them were very different.



The effects of the social VAT, will be investigated by a few students.