Danmarks Statistik
MODELGRUPPEN

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Experiment with wage relation in ADAM

Resumé:

The paper examines the macroeconomic effects of a permanent increase in the wage relation's constant. This permanent upward shift of the Phillips curve increases the long-term unemployment. It deteriorates public finances, and it changes the composition of demand.

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Key words: wage relation, supply shock, simulation

1. Introduction

The paper concerns a simple supply shock to the model. Using the new Gekko software, an ADAM-experiment is made in order to see the impact of a 0.5% permanent lift of the wage relation on a number of key variables: wages, unemployment rate, real wages, production, consumption and exports. In general, the composition of production and of domestic consumption changes when the Phillips curve is shifted. It is of interest to see how the economy stabilizes itself to the new equilibrium, where the growth rate in macro-variables corresponds to baseline growth. It is also of interest to see the implications for fiscal sustainability and debt servicing. Finally, we also try a temporary shock to the wage relation and compare the results to the permanent shock. The following section 2 concerns the permanent shock and is divided into sub sections, section 3 deals with the temporary shock and 4 concludes.

2. Permanent shock to the wage relation

2.1 Implementation of shock and interaction of main variables

The wage equation in ADAM notation is given below.

```
Dlog(lna) = 0.32045*ddloglna +0.30000*Dlog(pcpn **.5*pyfbx **.5)
                -0.25918*Dif(bul) + 0,02075 * d8587
              -0.55000*((-1)-bulw(-1)) +glna $
```

lna average hourly wage in manufacturing
pyfbx gross value added deflator, urban industries (2000=1)
pcpn net price of private consumption
d8587 dummy,-0.5 in 1985, -0.5 in 1986 and 1 in 1987
bul actual unemployment rate
bulw structural unemployment rate

The term glna equals the OLS error term in the estimation period. In ADAM, this equation is normalized on the wage level, lna, and a couple of adjustment terms and a dummy for exogenizing the wage are added. We have:

```
lna = ((exp(log(lna(-1))+0.32045*ddloglna+
      0.30000*(log(pcpn**0.5*pyfbx**0.5)
   -log(pcpn(-  1)**0.5  *pyfbx(-1)**0.5))-0.25918*((bul)-(bul(-1)))
  +0.02075*D8587-0.55000*( bul(-1)-bulw(-1))+glna))*(1.0+jrlna))*(1.0-
  dlna)+dlna*zlna$
```

We are not interested in exogenising the wage, so the 'exogenizing' dummy dlna is zero. We can shock wage through the Jrlna adjustment term that is suited for relative shocks. If the adjustment term jrlna is zero throughout the baseline, we change it to 0.005. This will change the factor 1+jrlna by 0.5 per cent and corresponds closely to adding 0.005 to glna in the first equation, which determines the log-change of lna. Thus, we add to the constant term of the equation and lift the wage relation by 0.005 without affecting the slope of the wage relation. This is equivalent to a shift of the Phillips curve to the right.

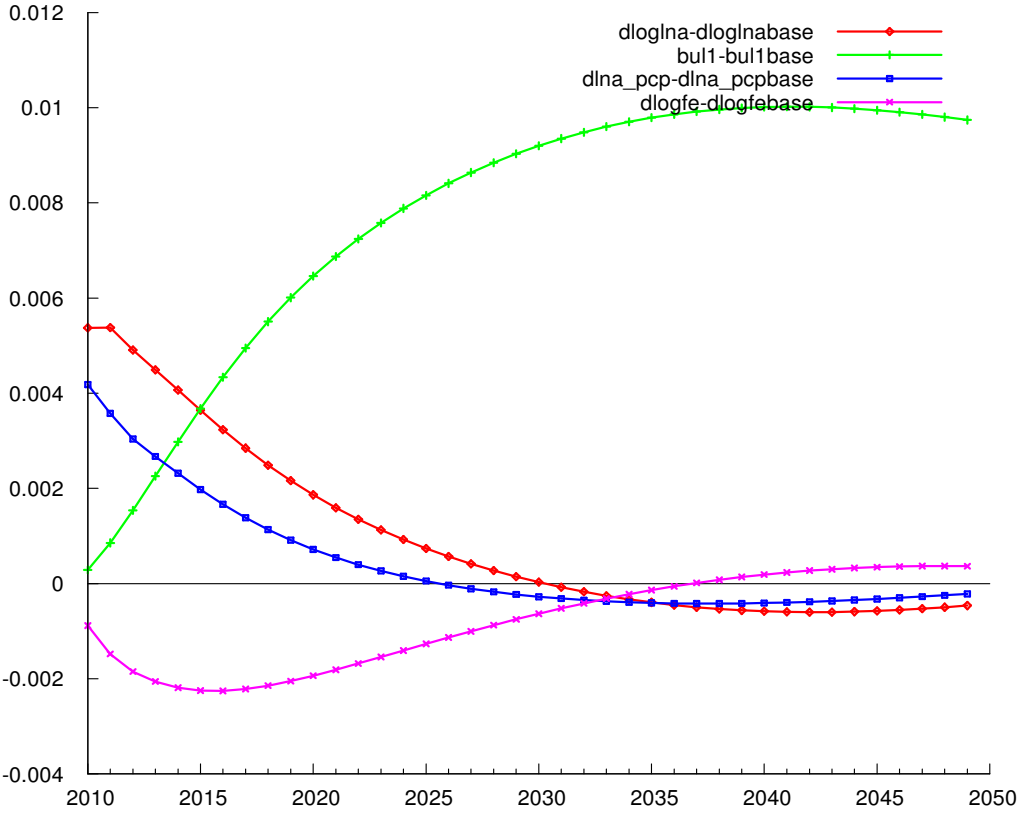
Like in the ADAM course, we use a baseline scenario that starts in 2010 and ends 40 years later in 2049.

In the following sub sections, we explain some main findings of the experiment.

2.2 Effects on unemployment rate, wages, consumption and market share

Figure 1 shows the effect of the shock on the unemployment rate and on nominal and real wage growth. Effects are measured as the difference between the chosen variable before and after the shock. The variable of interest may be a transformation of ADAM variables like the real wage growth, dlog(lna/pcp). In year 1 (2010), the unemployment rate is only 0.03% higher than the baseline unemployment rate. However, the deviation of the unemployment rate from its baseline increases over time, and, as one would expect, the shift of the Phillips curve increases the unemployment rate in the long term.

Figure 1: Effects on wage growth, unemployment and export, wage equation constant + 0.5%



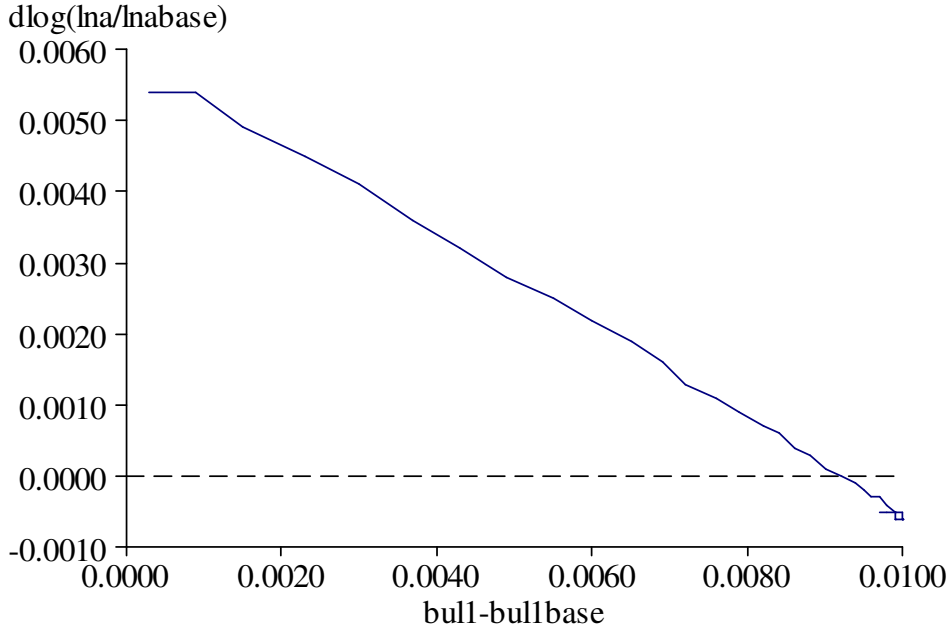
Higher unemployment entails a permanently lower production, which on the demand side corresponds to the lower competiveness and lower export that accompanies our negative supply shock. For prices and volumes in general, the permanent effect is a permanent level change relative to the baseline. Thus, in the new scenario the variable grows in parallel to its baseline scenario, and the effect on the growth rates of wages and prices and e.g. exports will be zero in the long run cf. figure 1 with 40 years on the x-axis.

Figure 2 illustrates Phillips-curve trade-off between the wage inflation and unemployment rate. The curve is made by plotting the effect on the unemployment rate against the effect on the wage change. Before the shock, the observation point is (0,0). In the first year, the annual wage growth rises by close to 0.5 per cent and there is only a marginal change in unemployment. Thus, the observation jumps for the initial locus to a point close to (0,0.05). This is not the new equilibrium in ADAM. The higher wage increase deteriorates the competitiveness of Danish production year by year, so exports fall and unemployment will grow year by year and pull down the rate of wage growth until it equals the wage growth of the baseline, which corresponds to a steady state where domestic and foreign prices grow pari passu. The new equilibrium is thus found on the x-axis to the right of the original baseline equilibrium in (0,0). As figure 1 suggested, the discrepancy of the wage growth before and after the shock will vanish over time, and become exactly zero in the long term.

The higher wage raises producer prices due to the increase in production cost, and this makes consumer prices higher. The price increase enters the wage relation, so there is some wage-price interaction behind the resulting wage increase. However, coefficient for the inflation term is only 0.3, and the main impact on the resulting wage increase comes from the impact on the rate of unemployment.

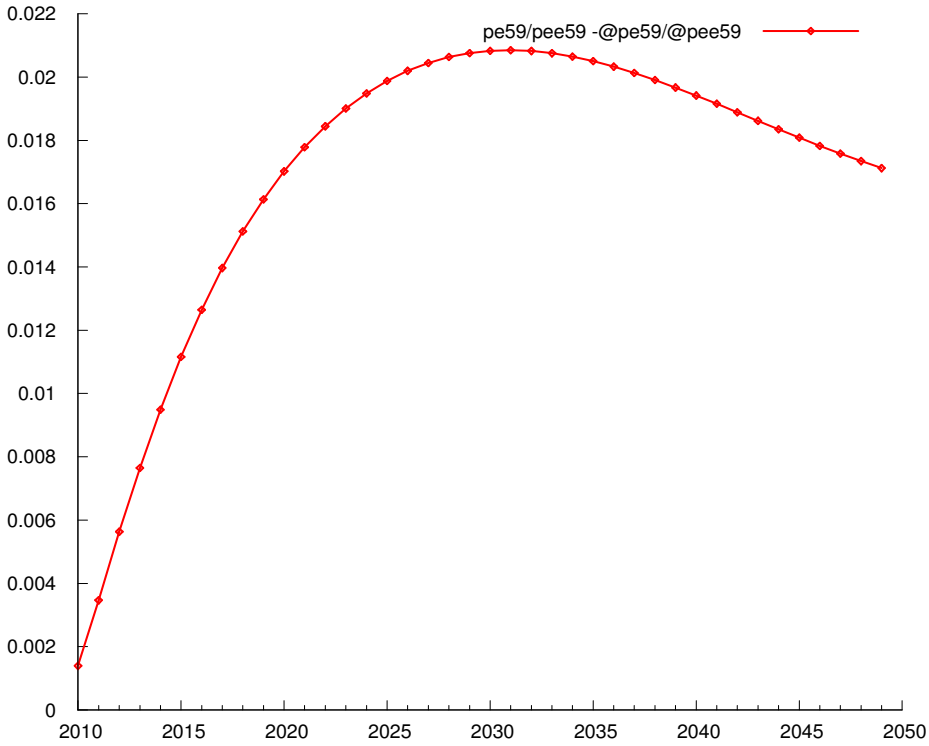
The mentioned impact on price growth makes the effect on real wage growth lower than the effect on nominal wage growth, which was shown in figure 1.

Figure 2: Effect on wage growth plotted against effect on unemployment rate (Phillips curve revealed)



The main mechanism behind the higher unemployment rate is the deterioration in competiveness, which can be exemplified by the increase in the relative price of manufacturing exports, which comprises SITC 5 to 9. The export price rises relative to the competitor price for a number of years, and the effect on the relative price levels off and becomes permanent in long run cf. figure 3.

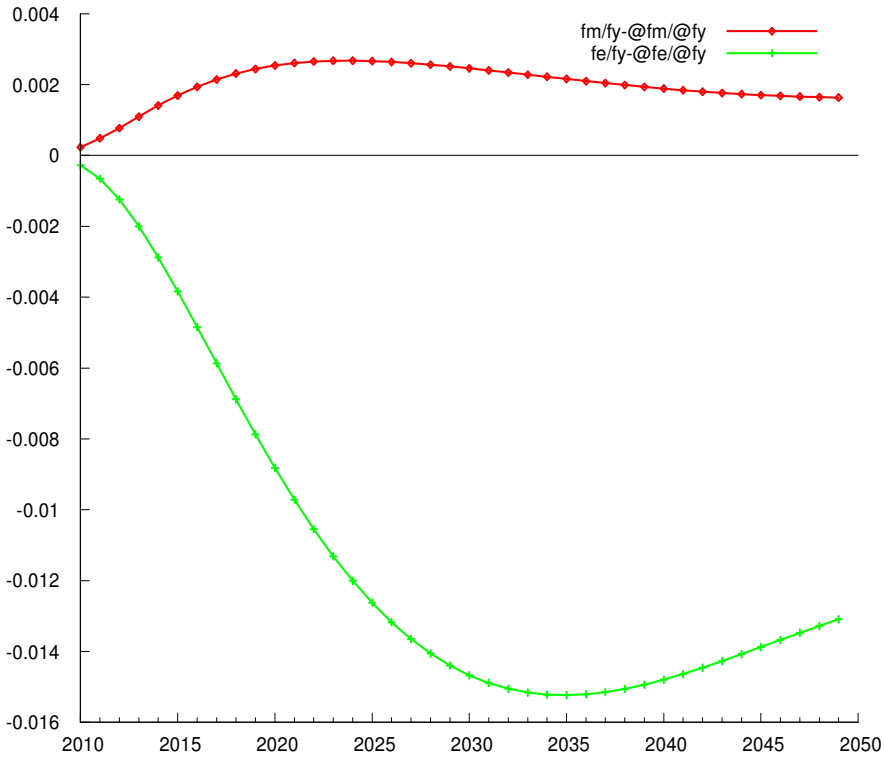
Figure 3: Effect on ratio of export price over competitor price



When the Danish export price rises relative to the price of foreign competitors, the market share will fall price. In the long term, the relative export price is constant and the negative effect on exports will also be constant in the long term. The rise in the cost and price of domestically produced goods will also impact imports and increase the import content in goods and services.

Thus, the lower competitiveness makes export lower and import higher relative to GDP cf. figure 4, which indicates that this is a permanent impact and that the impact on import is smaller in percentage terms than the impact on export.

Figure 4 Exports and import relative to GDP



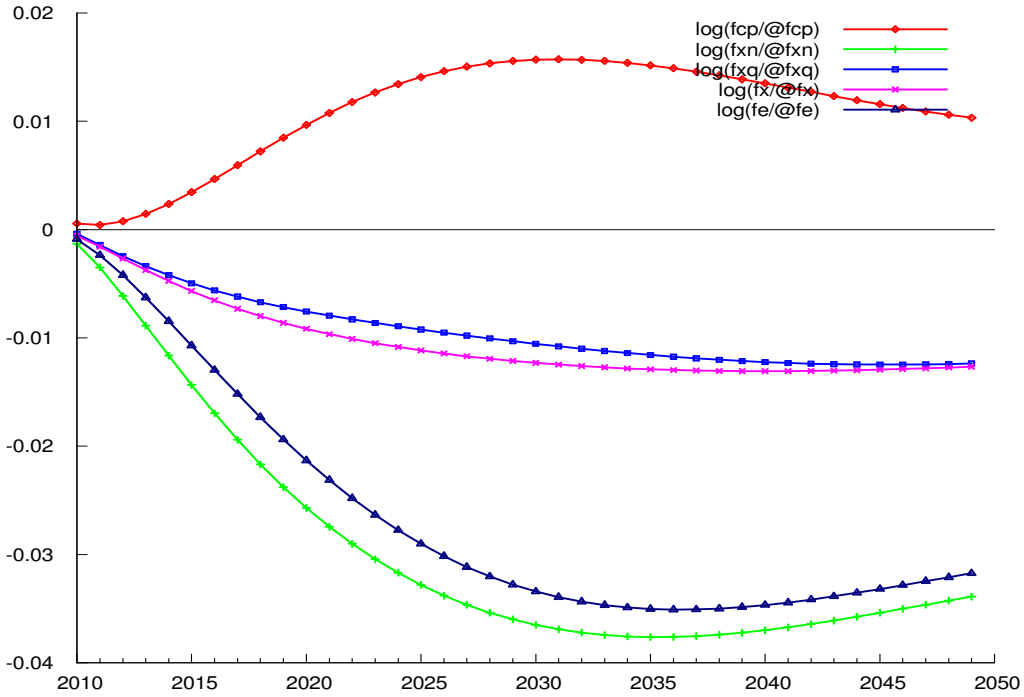
2.3 Effects on consumption and production

The impact on compe3tiveness and foreign trade is crucial for the end result, but the supply shock also changes private consumption because it changes the real income of households. Import prices remain unchanged, so the higher domestic wage and price level entails a higher real income and a higher consumption and this will dominate the income loss from higher unemployment and lower production cf. figure 5 that shows the impact on private consumption, fcp. Note that the higher consumption increases the necessary crowding out of Danish market shares and exports and makes the composition of total demand change even more.

Total production, fx, will become lower in the long term, and figure 5 also indicates that the production of manufactures, fxn, will fall more in percentage terms than the private production of services, fxq. This reflects that the export share is higher in the manufacturing than in the service industry. The latter has a higher share of consumption goods.

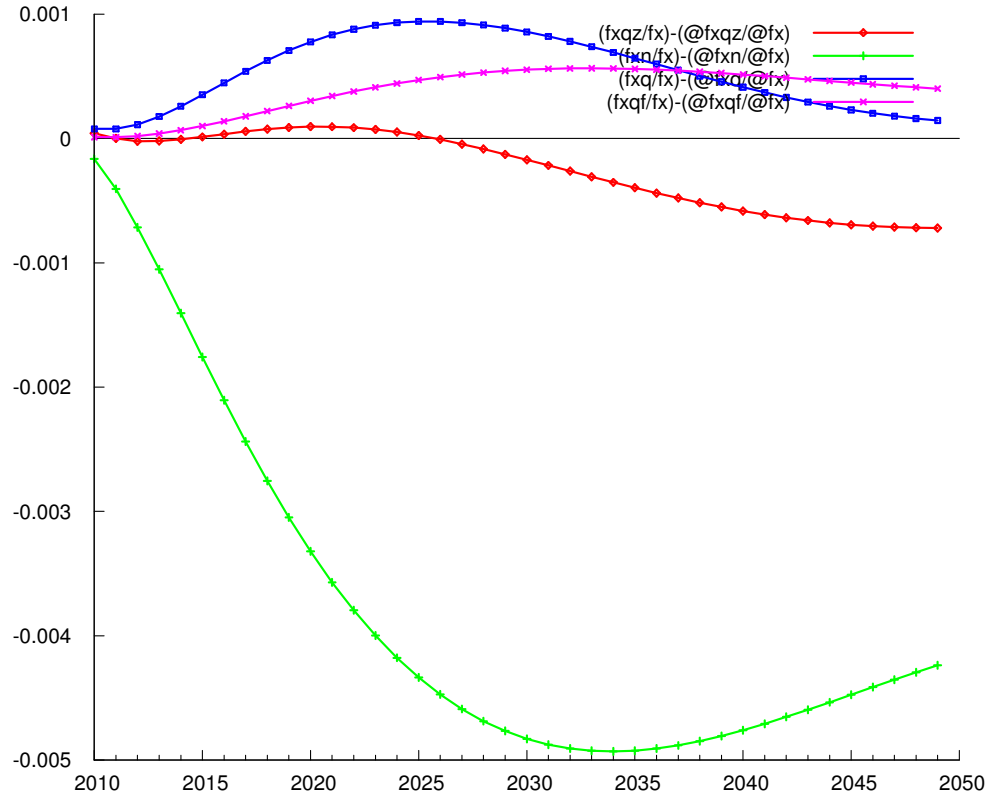
It can be added that the negative impact on production is moderated by a rise in labour productivity. The higher wage increases the relative price of labor and labor is to some extent substituted for capital. Thus, the production becomes more capital intensive, and the output per employed will increase. The positive productivity effect cannot prevent the production fall, but the production fall is moderated.

Figure 5: Effects on consumption and production



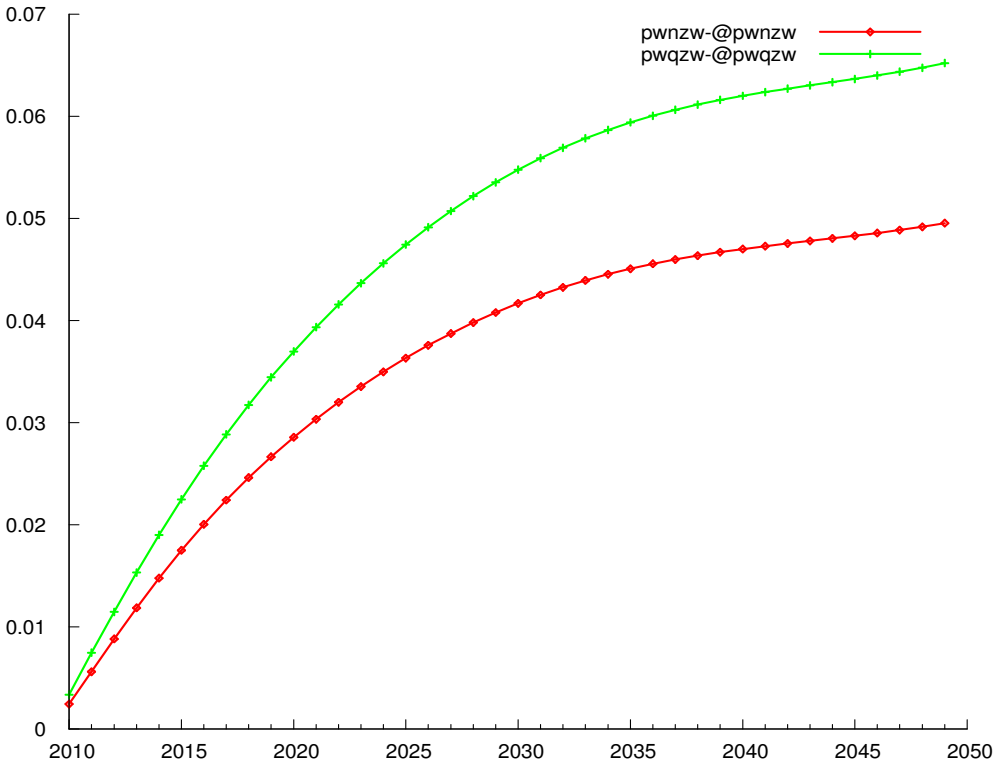
Due to the different production effect in different industries, the composition of output changes as indicated in figure 6. The share of the public service industry (not shown) rises when total production falls, and figure 6 indicates a rise in the share of private service production, fxq, which includes financial service production, fxqf.

Figure 6: Manufacturing and service output relative to total output



As wage rises, so will the production costs but the cost rise in a specific industry will depend on the labor intensity. The private service industry, qz, is more labor intense than manufacturing, nz, and the unit production cost is more affected for the service sector cf. figure 7.

Figure 7: Unit cost for manufacturing and private service sector



The impact on production costs affects the markup in the short run for price-setting industries. In these industries, the output price will rise in the long run and reflect a constant markup on the new costs. For industries with exogenous prices, Heckscher-Ohlin industries, the earnings capacity will be reduced permanently.

2.5. Effects on public debt

Public consumption rises as a share of GDP cf. figure8, which mainly reflects that public employment remains unchanged, while total employment falls.

Public consumption and public expenditures in general, not least unemployment benefits, will also increase relative to public revenues when the economy shrinks in real terms. Consequently, the public budget balance deteriorates and public debt rises as a share of GDP cf. figure 8, where public debt is represented by public sector net assets, Wn_o with a negative sign. The effect on public debt accumulates over time, and the accumulating interest expenses will also make the negative public budget effect accumulate.

The negative supply shock makes public finances unsustainable because there is no fiscal reaction function to stabilize public debt.

Figure 8: Public consumption as share of GDP

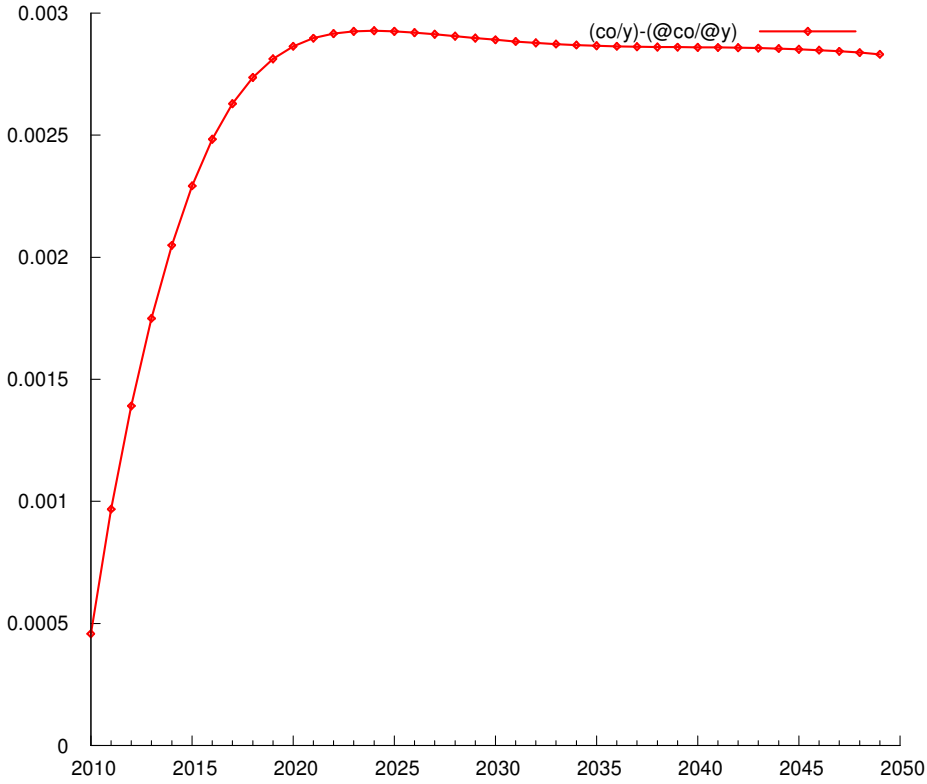
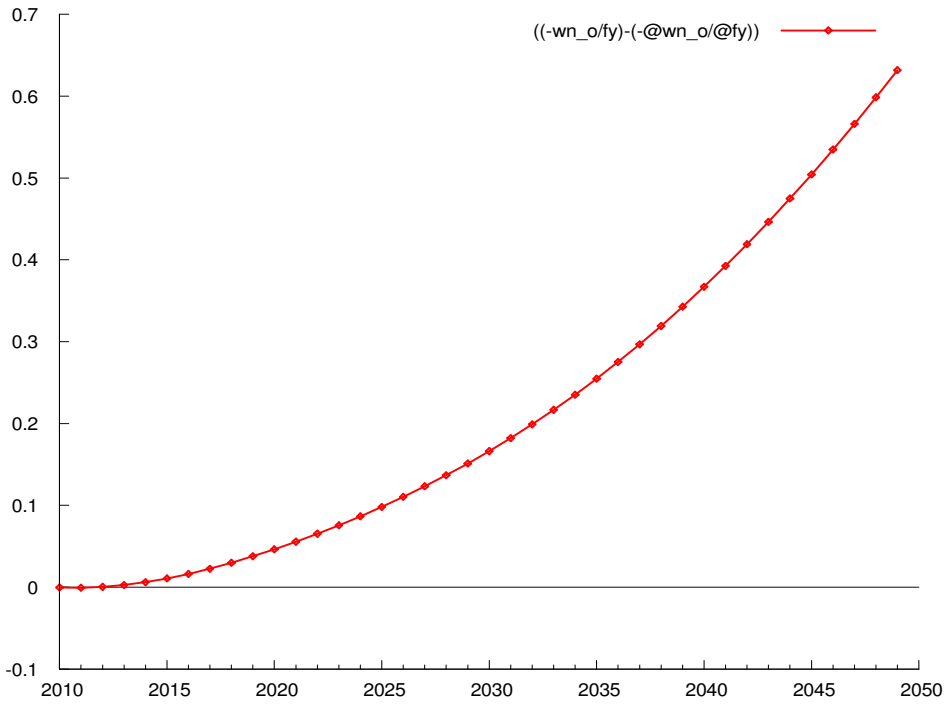


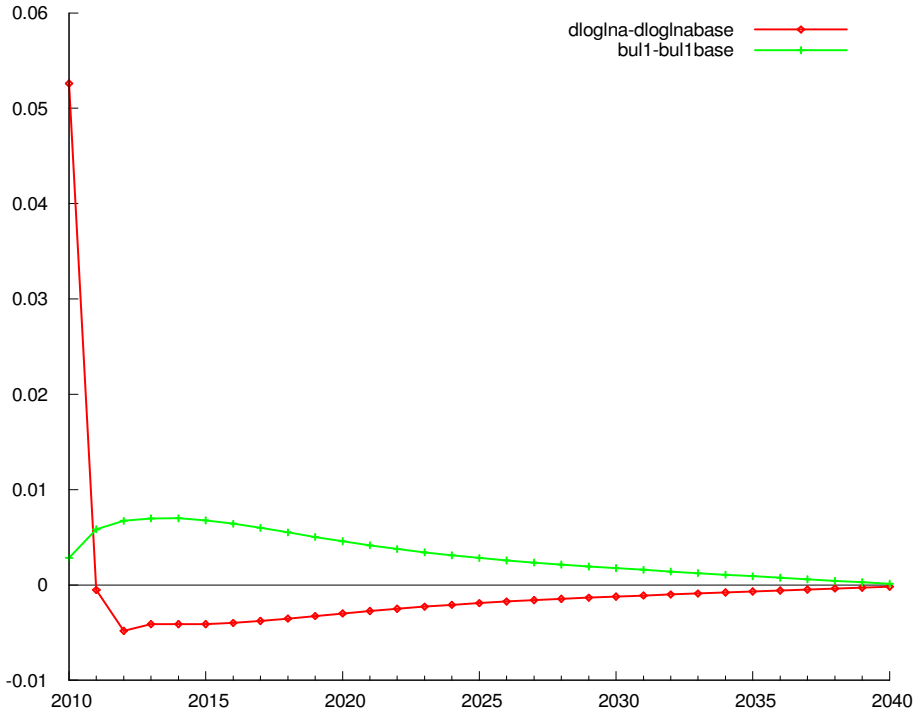
Figure 9: Public debt as share of GDP



3. **Temporary shock to the wage relation**

If we shock the adjust term by 5 per cent but only in the first year, we get the same kind of first year impact, only 10 times larger, but in the following years wage growth becomes smaller than in the baseline while the effect on the wage level is crowded out. The crowding out is driven by the initial 5.26 per cent increase in the wage level is crowded out via lower exports. In the long run the wage level, exports and unemployment will return to baseline cf. figure 10.

Figure 12: Effect on wage growth dlog(lna) and unemployment rate bul, temporary 5% shock to the wage relation's constant



4**. Conclusion**

The experiment illustrates that a negative supply shock to the wage formation increases long-term unemployment, decreases production and deteriorates public finances. Private consumption increases due to the higher real wage, but the basis for private plus public consumption is reduced, and the effect on private consumption turns negative, if fiscal policy is made sustainable by higher taxes.