The 35 hour week and the EMU: How should Euro-policy makers react to large asymmetric shocks?

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1. Introduction

On January 1st, 2000 the freshly born European Monetary Union will face a large asymmetric supply shock: the introduction of the 35-hour work week in France. This represents more than a 10 % reduction in working time, and no reduction in nominal wages is going to take place. The move represents a considerable increase in labor costs; when similar measures were under taken under Mitterand in 1982, they triggered sharp balance of payments crises and the subsequent devaluation of the franc eventually o®set the adverse e®ects on the price level. A similar devaluation also had eventually o®-set the large wage hikes of the May 1968 Grenelle agreement. Now the rules of the games are pretty di®erent. Monetary union precludes devaluation. Nor can ¯scal policy be used to o®set any adverse e®ects of the 35-hour week on aggregate demand, because of the Stability Pact. The loss of competitiveness of the French economy, and the resulting employment losses, will alter the support for monetary union in France from both workers and businessmen. The incentives for the French government to exert pressure on the ECB to losen the monetary stance will be stronger. At the same time, part of the in°ationary pressure of the 35-hour week will be felt elsewhere in the union, as French imported goods are more expensive and the demand for home goods is larger. The ECB will be be torn between bowing to French pressure or on the contrary ¯ghting incipient in°ation by tightening the monetary grip. Each option has large political costs.

This paper analyzes the basic macroeconomics of working time reduction in a monetary union. We ¯nd that working time reduction will increase in°ation throughout the union, more so in France than in the rest. We ¯nd a contractionary impact on output in France while output tends to rise in the rest. That is, it is an adverse aggregate supply shock in France but a favourable aggregate demand shock in the rest of the Union. However, an endogenous, tough anti-in°ationary reaction of the ECB may actually lead to a de°ationary contraction in the rest of the union, because of the ECB'a attempt to ¯ght the in°ationary spurt in France and its inability to a®ect aggregate demand di®erentially across countries.

The model brings the more general question of whether the European Central Bank should set its policy only in terms of Euro-wide aggregates or whether it should take into account how disturbances are distributed across countries. The answer depends on (i) whether the ECB aggregates individual countries preferences in proportion to their economic weight, (ii) whether these preferences di®er across countries, (iii) whether the slope of the output/in°ation trade-o® di®ers across countries.

We ¯nd that in the benchmark case where preferences are identical, quadratic and aggregated according to economic weight, the ECB should not look at the distribution. However, when one deviates from that benchmark, the ECB is likely to react di®erently to an asymmetric shock compared to a symmetric shock of identical aggregate impact on the Euro zone.

The main conclusion of the paper is that the 35-hour week in France and possibly Italy is going to put EMU at a very serious test. Previous research has shown that asymmetric shocks were not that important in Europe, which was good news for the stability of the future European Monetary Union. These good news was reinforced by the fact that asymmetric monetary shocks were due to disappear by de¯nition and that asymmetric ¯scal shocks would be reduced by ¯scal policy coordination and the Stability Pact.[1] However, this ignores the fact that European countries have di®erent labour market institutions, di®erent views on how the unemployment problem should be solved, and di®erent political constraints on their labor market policies. These asymmetries in supply will be harmful for the stability of the union because they will generate large

[1] However, the stability pact does not precude wide divergence in ¯scal policies when some countries adjust de¯cits downwards.

2. Basic model

2.1. Small open economy

The aggregate supply curve is given by:

$$y - h = \lambda p$$

, where y is output, p the price level, and h working hours.

The IS/LM block consists of the two following equations:

$$m - p = y - \gamma i$$

$$y = f - \alpha i + \phi(e - p)$$

, where m is nominal money, i the nominal interest rate, f an index of fiscal policy, and e the nominal interest rate. Finally, the interest parity condition is:

$$i = i^{*} = 0$$

The solution to that model is, under flexible exchange rates:

$$\begin{aligned}
y &= \frac{\lambda m + h}{1 + \lambda} \\
p &= \frac{m - h}{1 + \lambda} \\
e - p &= \frac{\lambda m + h}{\phi(1 + \lambda)} - \frac{f}{\phi} \\
e &= \frac{h(1 - \phi)}{\phi(1 + \lambda)} + \frac{m(\lambda + \phi)}{\phi(1 + \lambda)} - \frac{f}{\phi}
\end{aligned}$$

The fiscal and monetary variables have the usual textbook effect. A reduction in working hours depresses output and increases the price level. The real exchange rate appreciates as net exports must fall to accomodate the decrease in productive capacity. The nominal exchange rate may either appreciate or depreciate, depending on the value of ϕ; that is the degree of openness of the economy. In a very open economy the loss of competitiveness triggers a large decline in aggregate demand, which tends to lower nominal interest rates, thus leading to an incipient capital outflow and an exchange depreciation. In a relatively closed economy the dominant effect is the contraction in real balances implied by the inflationary burst, so that interest rates tend to go up and the nominal exchange rate appreciates. Hence the above equations tell us that for $\phi > 1$ the nominal exchange rate depreciates while it appreciates for $\phi < 1$.

Under fixed exchange rates at $e = 0$, the solution is

$$y = \frac{\phi h + \lambda f}{\phi + \lambda}$$

$$p = \frac{f - h}{\phi + \lambda}$$

A shorter workweek has similar effects but the magnitude is different as well as the parameters involved. The effects are now chiefly driven by the loss of competitiveness.

It is possible to compare the effects of the reduction in the workweek under the two regimes. We get, assuming $f = m = 0$:

$$\begin{aligned} y_{flex} - y_{fix} &= \frac{\lambda(1-\phi)h}{(1+\lambda)(\phi+\lambda)} \\ p_{flex} - p_{fix} &= \frac{(1-\phi)h}{(1+\lambda)(\phi+\lambda)} \end{aligned}$$

Therefore, if $\phi > 1$, working time reduction is more contractionary, but less inflationary, under fixed exchange rates than under flexible exchange rates.

2.2. Monetary union

We now modify the model to analyze what is going on when one country within a monetary union reduces working time. We assume the monetary union consists of two countries, denoted by $i = 1, 2$. Country 1 carries a weight ρ while country 2's weight is $1 - \rho$. Unionwide aggregates will be denoted with a bar, while country-specific aggregates are denoted with the corresponding country's subscript. Differences between country 1 and country 2 are denoted with a Δ. Thus for any variable x we have $\bar{x} = \rho x_1 + (1 - \rho)x_2$ and $\Delta x = x_1 - x_2$. Variables have to be understood in per capita, or per units of GDP, terms.

The model is now as follows

$$
\begin{aligned}
m_i - p_i &= y_i - \gamma i \\
y_i - h_i &= \lambda p_i \\
y_i &= f_i - \alpha i + \theta(e - p_i) + k_i(p_{3-i} - p_i) \\
i &= i^* = 0
\end{aligned}
$$

The IS curve is now modified as follows: we distinguish between net exports to the country in the union, captured by the last term, and net exports to the rest of the world, captured by the third term. We assume $k_1 = \phi/\rho$ and $k_2 = \phi/(1 - \rho)$. This ensures that in volume terms net exports from 1 to 2 are equal to minus net exports from 2 to 1.

It should be noted that we are assuming that the two economies have an identical behaviour: all the fundamental parameters such as the slope of the aggregate supply curve are the same across the two countries. This is an assumption one would want to relax; the two countries may have two different values of λ, either because price-fixing mechanisms differ or because the Phillips curve is not linear and they are at different positions in their business cycle.

A clean way to solve for the monetary union's solution is to note that the monetary union, as a whole, behaves like the flexible exchange rate economy, while the difference between the two countries behaves as a fixed exchange rate economy. Thus we get

$$\bar{y} = \frac{\lambda \bar{m} + \bar{h}}{1 + \lambda}$$

$$\bar{p} = \frac{\bar{m} - \bar{h}}{1 + \lambda}$$

$$e = \frac{\bar{h}(1 - \theta)}{\theta(1 + \lambda)} + \frac{\bar{m}(\lambda + \theta)}{\theta(1 + \lambda)} - \frac{f}{\theta}$$

The impact of working time reduction on the exchange rate is now determined by the union's openness, rather than the country's one. There is appreciation in response to working time reduction if and only if $\theta < 1$. Furthermore:

$$\Delta y = \frac{\Delta f \, \lambda \rho (1 - \rho)}{\phi + (\lambda + \theta) \rho (1 - \rho)} + \frac{\Delta h \, (\phi + \theta \rho (1 - \rho))}{\phi + (\lambda + \theta) \rho (1 - \rho)}$$

$$\Delta p = \frac{(\Delta f - \Delta h)\rho(1-\rho)}{\phi + (\lambda + \theta)\rho(1-\rho)}$$

The above equations allow to compute the response of output and the price level in each country to working hours, fiscal policy, and the union-wide money stock. This response is summarized by the following equations:

$$\begin{aligned} y_1 &= a_0 \bar{m} + a_1 f_1 + a_2 f_2 + a_3 h_1 + a_4 h_2 \\ y_2 &= b_0 \bar{m} + b_1 f_1 + b_2 f_2 + b_3 h_1 + b_4 h_2 \end{aligned}$$

, with

$$\begin{aligned}
a_0 &= b_0 = \frac{\lambda}{1+\lambda} \\
a_1 &= -a_2 = \frac{\lambda\rho(1-\rho)^2}{[\phi + (\lambda+\theta)\rho(1-\rho)]} > 0 \\
b_2 &= -b_1 = \frac{\lambda\rho^2(1-\rho)}{[\phi + (\lambda+\theta)\rho(1-\rho)]} \\
a_3 &= \frac{\rho}{1+\lambda} + \frac{(1-\rho)(\phi + \theta\rho(1-\rho))}{[\phi + (\lambda+\theta)\rho(1-\rho)]} > 0 \\
a_4 &= \frac{1-\rho}{1+\lambda} - \frac{(1-\rho)(\phi + \theta\rho(1-\rho))}{[\phi + (\lambda+\theta)\rho(1-\rho)]} \gtrless 0 \\
b_4 &= \frac{1-\rho}{1+\lambda} + \frac{\rho(\phi + \theta\rho(1-\rho))}{[\phi + (\lambda+\theta)\rho(1-\rho)]} > 0 \\
b_3 &= \frac{\rho}{1+\lambda} - \frac{\rho(\phi + \theta\rho(1-\rho))}{[\phi + (\lambda+\theta)\rho(1-\rho)]} \gtrless 0
\end{aligned}$$

Working time reduction in country 1 reduces output in country 1 but may either increase or reduce it in country 2. Country 2 benefits from the loss of competitiveness of country 1 but it may lose from the appreciation of the monetary union's currency, whenever it takes place. Note that $a_4 > 0$ if and only if $\theta < 1 - \phi/(\rho(1-\rho))$: It is necessary that the union's exchange rate appreciates by enough for country 2's output to fall.

As for prices, we get:

$$\begin{aligned} p_1 &= c_0 \bar{m} + c_1 f_1 + c_2 f_2 + c_3 h_1 + c_4 h_2 \\ p_2 &= d_0 \bar{m} + d_1 f_1 + d_2 f_2 + d_3 h_1 + d_4 h_2 \end{aligned}$$

with

$$
\begin{aligned}
c_0 &= d_0 = \frac{1}{1+\lambda} \\
c_1 &= -c_2 = \frac{\rho(1-\rho)^2}{\phi + (\lambda+\theta)\rho(1-\rho)} \\
d_2 &= -d_1 = \frac{\rho^2(1-\rho)}{\phi + (\lambda+\theta)\rho(1-\rho)} \\
c_3 &= -\frac{\rho}{1+\lambda} - \frac{\rho(1-\rho)^2}{\phi + (\lambda+\theta)\rho(1-\rho)} \\
c_4 &= -\frac{1-\rho}{1+\lambda} + \frac{\rho(1-\rho)^2}{\phi + (\lambda+\theta)\rho(1-\rho)} \\
d_4 &= -\frac{1-\rho}{1+\lambda} - \frac{\rho^2(1-\rho)}{\phi + (\lambda+\theta)\rho(1-\rho)} \\
d_3 &= -\frac{\rho}{1+\lambda} + \frac{\rho^2(1-\rho)}{\phi + (\lambda+\theta)\rho(1-\rho)}
\end{aligned}
$$

Working time reduction is unambiguously inflationary in the country where it takes place. In the other country it is inflationary if and only if output rises there. The inflationary impact is always lower in the other country than in the country where it originally takes place.

It is useful to put some numbers in the above formulae. In particular, the parameter λ can be varied to control for the time span of the effect. In the short run prices don't move much so we expect λ to be large; in the long run prices adjust fully which corresponds to the $\lambda = 0$ case.

The first scenario we consider is a union which is pretty integrated ($\phi = 1.5$) but has little exchanges with the rest of the world ($\theta = 0.5$). The following table describes the response of the union to a reduction in working time by 10 % in half of the union. That may happen if working time is reduced in France and Italy, and maybe Spain too.

	Short Run ($\lambda = 10$)	Medium run ($\lambda = 2$)	Long run ($\lambda = 0$)
y_1	-2.4	-5.5	-10.0
y_2	+1.5	+2.1	0.0
p_1	+0.75	+2.2	+5.7
p_2	+0.15	+1.0	+4.2
e	-0.4	-1.7	-5.0

Table 1: $\rho = 0.5; \phi = 1.5; \theta = 0.5$

The initial impact is a substantial slump in country 1 and a boom in country 2. Inflation increases by a little less than 1 %in country 1 while it barely increases in country 2. The exchange rate slightly appreciates. In the medium run inflation is higher and country one further sinks into recession, while country 2 fully benefits from its gain of competitiveness with respect to country 1. Finally, in the long-run the price increase in country 2 is almost as high as in country 1, which, along with the exchange rate appreciation, implies a large loss of competitiveness vis-à-vis the rest of the world.

What happens if the reform only takes place in France? To analyze this we rerun that scenario with $\rho = 0.25.$ The results are described in the next table.

	Short Run ($\lambda = 10$)	Medium run ($\lambda = 2$)	Long run ($\lambda = 0$)
y_1	-3.6	-6.9	-10.0
y_2	+0.9	+1.2	0.0
p_1	+0.6	+1.5	+3.4
p_2	+0.09	+0.6	+2.2
e	-0.2	-0.8	-2.5

Table 2: $\rho = 0.25; \phi = 1.5; \theta = 0.5$

We see that the shock, not suprisingly, exerts lower spillovers over the rest of the union. The impact on output and the price level in the rest of the union are lower, and so is the nominal appreciation. The union amortizes inflation in France, which is lower than if working time reduction had also taken place in Italy, but makes it more contractionary. Thus, lowering ρ makes the impact of the reform in France closer from the fixed-exchange rate small open economy, and more remote from the flexible-exchange rate small open economy.

Let us now consider the case of an economy which is also very much integrated in the world economy. That scenario is described in the next table. We assume $\rho = 0.5$ and $\theta = \phi = 1.5.$

	Short Run ($\lambda = 10$)	Medium run ($\lambda = 2$)	Long run ($\lambda = 0$)
y_1	-2.5	-5.6	-10.0
y_2	+1.7	+2.3	0.0
p_1	+0.75	+2.2	+5.7
p_2	+0.17	+1.1	+4.3
e	0.15	+0.5	+1.7

Table 3

Relative to table 1, we see that the union's depreciation mostly helps country 2, and does little to offset the output loss in country 1. It is because it now loses competitiveness on two fronts, rather than one: because the country is more open to the outside of the union as well it is more harmed by its adverse price shock despite the mitigating e®ect of the Union's nominal depreciation.

Last, we consider the case where µ = Á = 0:5; that is little integration of the union in the world economy and little integration within the union.

	Short Run (¸ = 10)	Medium run (¸ = 2)	Long run (¸ = 0)
y_1	-1.4	-4.4	-10.0
y_2	+0.5	+1.1	0.0
p_1	+0.8	+2.7	+7.0
p_2	+0.05	+0.5	+3.0
e	-0.4	-1.7	-5.0

Table 4

The evolution of the union's exchange rate is unchanged. The lower vulnerability of country 1 to competitiveness reduces the contractionary impact of working time reduction. The lower trade links between the two countries reduce the spillovers on country 2, both in terms of output and in°ation. By contrast, in°ation increases more in country 1 than under the integrated scenario.

3. The European Central Bank's dilemma

We now turn to the following question: how would and should the European Central bank react to the reform? An adverse supply shock is alays a dilemma since the central bank is faced between a further reduction in output or a further increase in in°ation. Here, the additional question is: should the central bank, when designing its response, take into account the fact that the shock is not symmetric and a®ects one part of the union disproportionately, or should it react only on the basis of union-wide aggregates, as for a symmetric shocks with the same aggregate consequences?

3.1. The benchmark: same preferences and weights proportional to economic size

We start with a case that should be taken as a benchmark, namely the case where the two countries have the same preferences over the output in°ation trade-o® and where their weight in decision making is proportional to economic size. Each of these assumptions is controversial; the ECB's status is on the one-man, one-vote basis, with 6 council members + 11 governors of the national central banks. And one may well argue that Italy cares less about inflation than Germany. However, this is a very useful benchmark to be analyzed.

We assume that the two countries have the same preferences with respect to output and inflation. The loss function in country i is:

$$L_i = (p_i - p^*)^2 + \mu(y_i - y^*)^2$$

Note that there is no exchange rate objective in the loss function. While this is standard, it could be introduced to take account of any "global role in the world monetary system" of the ECB. We assume the central bank is utilitarian: it minimizes a weighted average of the two loss functions, with weights precisely equal to the size of the economy. Therefore, the central bank's loss function is

$$\bar{L} = \rho L_1 + (1 - \rho)L_2 \tag{3.1}$$

The first-order condition is:

$$\rho(p_1 - p^*)\frac{dp_1}{d\bar{m}} + \mu\rho(y_1 - y^*)\frac{dy_1}{d\bar{m}} + (1-\rho)(p_2 - p^*)\frac{dp_2}{d\bar{m}} + \mu(1-\rho)(y_2 - y^*)\frac{dy_2}{d\bar{m}} = 0 \tag{3.2}$$

Noting that (because of identical λs across the two countries) $a_0 = b_0$ and $c_0 = d_0$ we find that the monetary policy rule of the ECB is

$$(\bar{p} - p^*)c_0 + \mu(\bar{y} - y^*)a_0 = 0$$

The ECB should only react to union-wide averages and ignore the distribution of disturbances across its member countries. Its dilemma comes from the fact that it faces an adverse supply shoc that increases prices while reducing output, but the fact that supply shock is asymmetric should not be taken into account in designing its response. The reaction function is, assuming $p^* = y^* = 0$:

$$\bar{m} = \frac{1 - \mu\lambda}{1 + \mu\lambda^2}\bar{h}$$

This leads us to distinguish between a "hard central bank" ($\mu < 1/\lambda$) and a "soft central bank" ($\mu > 1/\lambda$): The hard central bank reacts to the adverse supply shock with a monetary contraction, the soft one with a monetary expansion. For $\mu\lambda = 1$ the central bank is "neutral" and does not react. This corresponds to the numerical examples of the previous section. However, to the extent that λ captures the time horizon, a central bank with well defined preferences will never be neutral for all values of λ:

The following tables give us the evolution of the two economies for $\mu = 0$ and $\mu = 0.5$:

	Short Run ($\lambda = 10$)	Medium run ($\lambda = 2$)	Long run ($\lambda = 0$)
y_1	-7.0	-8.8	-10.0
y_2	-3.0	-1.1	0.0
p_1	+0.3	+0.6	+0.7
p_2	-0.3	-0.6	-0.7
e	-10	-10	-10

Table 5: $\rho = 0.5; \phi = 1.5; \theta = 0.5; \mu = 0$

The pure inflation fighter ($\mu = 0$) does not accept any deviation of the union's aggregate price level from its target value of zero. Interestingly, this implies that it will engineer a recession in both countries, contrary to the passive case where country 1 was going down and country 2 was booming. Note also that the price level dispersion does not depend on the monetary policy reaction (since the ¢ ¡ economy behaves as a fixed exchange rate economy), and that the pure inflation fighter's policy is best summarized as an exchange rate target aiming at a 10 % nominal (and real) appreciation in response to the shock.

The next table describes the economy's reaction for $\mu = 0.3$: This means soft behaviour at $\lambda = 10$ but hard behaviour at $\lambda = 2$ and $\lambda = 0$

	Short Run ($\lambda = 10$)	Medium run ($\lambda = 2$)	Long run ($\lambda = 0$)
y_1	-2.1	-6.1	-10.0
y_2	+1.8	+1.5	0.0
p_1	+0.75	+1.9	+0.7
p_2	+0.15	+0.7	-0.7
e	+0.16	-3.1	-10.0

Table 6: $\rho = 0.5; \phi = 1.5; \theta = 0.5; \mu = 0.3$

In the "long-run" scenario the central bank achieves the same outcome as the pure inflation fighter since the output-inflation trade-off cannot be exploited. In the short-run the central bank is soft and the contraction is less deep in country 1 but there is more of an expansion in country 2. The union-wide exchange rate mildly depreciates instead of appreciating. In the medium run the comparison with the passive monetary policy is inverted since at $\lambda = 2$ the central bank is hard.

3.2. Non proportional weights in decision making

We now analyze what is taking place if the weights in the ECB's loss function are not proportional to economic size. More specifically we assume that this weight is $\hat\rho \neq \rho$. If $\hat\rho > \rho$ we will say there is a "French bias"; in the opposite case we will say there is a "German bias". Let a hat denote a variable aggregated with the political weight $\hat\rho$. Then for any variable x we have

$$\hat{x} = \bar{x} + (\hat\rho - \rho)\,\Delta x$$

In such a case the ECB's optimal rule not only depends on the aggregate but also on the difference between the two countries. We get the following rule:

$$(\hat{p} - p^*)c_0 + \mu(\hat{y} - y^*)a_0 = 0$$

$$\bar{m} = \frac{\bar{h}(1 - \lambda\mu)}{1 + \lambda^2\mu} - \frac{1 + \lambda}{1 + \lambda^2\mu}(\hat\rho - \rho)\,\Delta h\,\frac{\mu\lambda(\phi + \theta\rho(1 - \rho)) - \rho(1 - \rho)}{\phi + (\lambda + \theta)\rho(1 - \rho)}$$

The response to symmetric shocks ($\Delta h = 0$) is the same as the unbiased central bank. The following table illustrates the implication of the above formula. For various values of μ, we report the response of an unbiased central bank and the response of an ECB wth a 10 % "German" bias ($\hat\rho = \rho - 0.1$)

μ	$\bar{m}_{\text{unbiased}}$	$\bar{m}_{\text{biased}}$
0	-5.0	-4.62
0.1	-2.86	-2.93
0.2	-1.67	-1.98
0.3	-0.9	-1.3
0.4	-0.38	-0.9
0.5	0	-0.6
∞	1.0	+0.15

Table 7: $\rho = 0.5$; $\phi = 1.5$; $\theta = 0.5$; $\hat\rho = 0.4$

It is interesting to note that the pro-german ECB will not necessarily react more strongly to the French adverse supply shock than an unbiased ECB. If it is very averse to inflation it will react less strongly since inflation is mostly concentrated in France. The more the central bank cares about output, the more the german-biased ECB will contract the money supply relative to its unbiased counterpart. This is because France has an output contraction but Germany has an expansion. It should be noted that in the above example a pure pro-german central bank would contract its money supply by 3.2 % regardless of its preferences. This allows to entirely offset the expansionary consequences of the French adverse supply shock both on output and inflation, thus "insulating" Germany from the French shock.

3.3. Different preferences over the output-inflation trade-off

What happens, next, when the ECB is aggregating different preferences across the two countries? Assume to simplify it is unbiased, so that it maximizes (3.1). Clearly, if countries only differ in their target values of inflation and output, the above analysis is basically unmodified. One has to replace the union-wide output and inflation targets with the weighted average of the two countries' corresponding targets.

The problem is more interesting when countries differ in the weight they put on output. Let therefore μ_i be country i's weight on output in its loss function. Then assuming again target values equal to zero we get the following first order condition for the central bank's optimal reaction:

$$\bar{\mu}c_0 + (\bar{\mu}\bar{y} + \rho(1-\rho)\Delta\mu\Delta y)\, a_0 = 0$$

, where we have used our usual notational conventions. The monetary rule then becomes:

$$\bar{m} = \frac{\bar{h}(1-\lambda\bar{\mu})}{1+\lambda^2\bar{\mu}} - \frac{\lambda(1+\lambda)\rho(1-\rho)}{1+\lambda^2\bar{\mu}}\Delta\mu\Delta h\frac{\phi+\theta\rho(1-\rho)}{\phi+(\lambda+\theta)\rho(1-\rho)}$$

The bias is contractionary when $\Delta\mu$ and Δh have the same sign. That is, if working time reduction takes place in the country that cares least about output, then the central bank must hit harder than for a symmetric supply shock with the same aggregate impact over the union. If one speculates that France care more about output than Germany, then the preceding formula tells us that the ECB's reaction should be more accomodative than for a symmetric shock.

3.4. Different output-inflation trade-offs

The last source of asymmetry concerns differences in the parameter λ; that is in the slope of the Phillips curve. Such differences may come from genuine differences in price-setting mechanisms, although we know from Lucas (1972) that these are partly due to differences in the monetary policy regime that will go away with EMU. They may also come from the combination of non-linearities in the Phillips curve and the fact that the two countries are at different positions in their business cycles so that the slope is locally larger in one country compared to the other.

The main difference is that there is now a corrective term in the union-wide Phillips curve which may be written as:

$$\bar{y} - \bar{h} = \frac{\mu}{\lambda}\bar{p} + \rho(1-\rho)\Delta\lambda\Delta p$$

While the Phillips curve describing the difference between the two countries becomes:

$$\Delta y - \Delta h = \frac{\mu}{\lambda}\Delta p - \bar{p}\Delta\lambda + \Delta\lambda\Delta p$$

The dichotomy between union-wide aggregates and differences is no longer valid. In reduced form monetary policy will affect differences while fiscal policy will affect union-wide aggregates. The aggregate economy is no longer a pure flexible exchange rate economy, and the difference economy is no longer a pure fixed exchange rate one. The solution of the model is now given by (assuming $f_- = 0$)

$$\bar{y} = \frac{\frac{\mu}{\lambda}\bar{m} + \bar{h} + \rho(1-\rho)\Delta\lambda\Delta p}{1 + \frac{\mu}{\lambda}}$$

$$\bar{p} = \frac{\bar{m} - \bar{h} - \rho(1-\rho)\Delta\lambda\Delta p}{1 + \frac{\mu}{\lambda}}$$

$$\Delta p = \frac{-(\bar{m} - \bar{h})\Delta\lambda - (1 + \frac{\mu}{\lambda})\Delta h}{Z}$$

$$\Delta y = \frac{((\bar{m} - \bar{h})\Delta\lambda + (1 + \frac{\mu}{\lambda})\Delta h)(\theta + \frac{\phi}{\rho(1-\rho)})}{Z}$$

, with

$$Z = (1 + \frac{\mu}{\lambda})(\theta + \frac{\phi}{\rho(1-\rho)}) + (1 - 2\rho)(1 + \frac{\mu}{\lambda})\Delta\lambda + (1 + \frac{\mu}{\lambda})\frac{\mu}{\lambda} - \rho(1-\rho)\Delta\lambda^2 > 0$$

These formulas allow to compute the impact of monetary policy on prices and output in each country:

$$\frac{dp_1}{d\bar{m}} = \left(\frac{1}{1 + \frac{\mu}{\lambda}} + \frac{\rho(1-\rho)\Delta\lambda^2}{Z(1 + \frac{\mu}{\lambda})}\right) - \frac{1-\rho}{Z}\Delta\lambda$$

$$\frac{dp_2}{d\bar m} = \left(\frac{1}{1+\frac{\mu}{\lambda}} + \frac{\rho(1-\rho)\Delta\lambda^2}{Z(1+\frac{\mu}{\lambda})}\right) + \frac{\rho}{Z}\Delta\lambda$$

The inflationary impact of money now differs across the two countries and is higher in the country with the lowest value of λ. Furthermore, one has

$$\frac{d\bar p}{d\bar m} = \frac{1}{1+\frac{\mu}{\lambda}} + \frac{\rho(1-\rho)\Delta\lambda^2}{Z(1+\frac{\mu}{\lambda})} = c_0' > c_0$$

The difference between the two countries increases the aggregate inflationary impact of money growth relative to the case of two identical countries with the average response of output to prices. As for output, we get

$$\frac{dy_1}{d\bar m} = \frac{\frac{\mu}{\lambda}}{1+\frac{\mu}{\lambda}} - \frac{\rho(1-\rho)\Delta\lambda^2}{(1+\frac{\mu}{\lambda})Z} + (1-\rho)\frac{\Delta\lambda}{Z}$$

$$\frac{dy_2}{d\bar m} = \frac{\frac{\mu}{\lambda}}{1+\frac{\mu}{\lambda}} - \frac{\rho(1-\rho)\Delta\lambda^2}{(1+\frac{\mu}{\lambda})Z} - \rho\frac{\Delta\lambda}{Z} \tag{3.3}$$

and

$$\frac{d\bar y}{d\bar m} = \frac{\frac{\mu}{\lambda}}{1+\frac{\mu}{\lambda}} - \frac{\rho(1-\rho)\Delta\lambda^2}{(1+\lambda)Z} = a_0' < a_0$$

Money growth is less effective at raising aggregate output, the larger the difference between the two countries. Furthermore, output increases more in the country with the higher λ.

Using (3.2) we now get the first order condition of the ECB:

$$c_0'\bar p + \mu a_0'\bar y + \rho(1-\rho)\frac{\Delta\lambda}{Z}(\mu\Delta y - \Delta p) = 0$$

This yields the following money supply rule:

$$\bar m = k_0\bar h + k_1\Delta h$$

with

$$k_0 = \frac{\left(1+\frac{\rho(1-\rho)\Delta\lambda^2}{Z}\right)\left(1-\mu\frac{\mu}{\lambda}\right) + (1+\mu)\frac{\rho(1-\rho)\Delta\lambda^2}{Z}\left(1+\frac{\rho(1-\rho)\Delta\lambda^2+(1+\frac{\mu}{\lambda})^2}{Z}\right)}{\left(1+\frac{\rho(1-\rho)\Delta\lambda^2}{Z}\right)^2 + \mu\left(\frac{\mu}{\lambda} - \frac{\rho(1-\rho)\Delta\lambda^2}{Z}\right)^2 + (1+\mu)(1+\frac{\mu}{\lambda})^2\frac{\rho(1-\rho)\Delta\lambda^2}{Z^2}}$$

$$k_1 = -\Delta\lambda \frac{\rho(1-\rho)(1+\frac{1}{\lambda})}{Z} \frac{1 - \frac{1}{\lambda}\mu + (1+\mu)\frac{\rho(1-\rho)\Delta\lambda^2}{Z} + \frac{(1+\frac{1}{\lambda})^2}{Z}\left(1+\mu\left(\theta + \frac{\phi}{\rho(1-\rho)}\right)\right)}{\left(1 + \frac{\rho(1-\rho)\Delta\lambda^2}{Z}\right)^2 + \mu\left(\frac{1}{\lambda} - \frac{\rho(1-\rho)\Delta\lambda^2}{Z}\right)^2 + (1+\mu)(1+\frac{1}{\lambda})^2\frac{\rho(1-\rho)\Delta\lambda^2}{Z^2}}$$

These formula are not obvious to interpret, in part because behaviour in response to a symmetric shock is affected by the difference between the two countrie's price response. However, we can see that for μ not too large the sign of k_1 is the opposite of the sign of $\Delta\lambda$: This means that if France reduces working time ($\Delta h < 0$) and has a steeper phillips curve (i;e; more inflation for a given output rise, $\Delta\lambda < 0$); then the monetary response should be more contractionary than for a symmetric shock. By contrast, if the output-inflation trade-off is more favourable in France, then it should be less contractionary than for a symmetric shock.

The following table compares the impact of a 10 % reduction in working time in country 1 with that of a 5 % reduction in the whole union for $\rho = 0.5$ and under various hypothesis for differences in the slope of the Phillips curve.

	Asymmetric: $h_1 = -0.1$; $h_2 = 0$	Symmetric $h_1 = -0.05$; $h_2 = -0.05$
$\Delta\lambda = 0$	$p_1 = 2.25$; $p_2 = 1.07$; $\bar{p} = 1.67$	$p_1 = p_2 = \bar{p} = 1.67$
	$y_1 = -5.5$; $y_2 = 2.0$; $\bar{y} = -1.67$	$y_1 = y_2 = \bar{y} = -1.67$
$\Delta\lambda = 1$	$p_1 = 2.07$; $p_2 = 1.08$; $\bar{p} = 1.58$	$p_1 = 1.58$; $p_2 = 1.78$; $\bar{p} = 1.68$
	$y_1 = -4.8$; $y_2 = 1.63$; $\bar{y} = -1.58$	$y_1 = -1.04$; $y_2 = -2.32$; $\bar{y} = -1.68$
$\Delta\lambda = -1$	$p_1 = 2.47$; $p_2 = 1.09$; $\bar{p} = 1.78$	$p_1 = 1.78$; $p_2 = 1.58$; $\bar{p} = 1.68$
	$y_1 = -6.3$; $y_2 = 2.7$; $\bar{y} = -1.78$	$y_1 = -2.32$; $y_2 = -1.04$; $\bar{y} = -1.68$

Table 8: $\frac{1}{\lambda} = 2$; $\rho = 0.5$; $\theta = 0.5$; $\phi = 1.5$

The bottomline is that the more the shock is concentrated in the more inflationary country (the one with the lower λ); the more its effects are amplified, both on each country and on the union's aggregate. Note that the symmetric shocks affects countries differently so that there is no true "symmetric shock" here.

The next table describes the monetary reaction depending on asymmetries between the two countries and on whether the shocknis symmetric or asymmetric. The central bank must be harder (softer) relative to both the case with no differences in the Phillips curve and the case of a symmetric shock if the adverse shock takes place in the more (less) inflationary country. In the symmetric case the central bank must be harder than in the absence of country-specific differences in the slope of the Phillips curve, with the exception of the pure inflation fighter.

μ	$\Delta\lambda = 0$	$\Delta\lambda = 1$		$\Delta\lambda = -1$	
		Sym.	Asym.	Sym.	Asym.
0	-5.0	-5.0	-4.6	-5.0	-5.3
0.2	-1.67	-1.71	-1.48	-1.71	-1.9
0.5	0.0	-0.03	0.1	-0.03	-0.18
1	1.0	0.98	1.1	0.98	0.9

Table 9: response of $\hat{m}$ to working time reduction; $\frac{\mu}{\lambda} = 2$; $\rho = 0.5$; $\theta = 0.5$; $\phi = 1.5$.

4. Governments and fiscal policy

So far wehave neglected the role of fiscal policy. What happens if governments can use fiscal policy to react to the shocks? And should that affect the central bank's behaviour?

The crucial aspect of fiscal policy is that it does not affect the Union's aggregates. Consequently a central bank that maximizes (3.1) should not pay attention to it. However, we are going to argue that this conclusion is misguided. There is an inherent instability in the fical policy game played by the two countries and monetary policy can be used to reduce such instability.

The instability comes from the fact that it is only the difference between the two levels of the fiscal stance that enters each country's output and price level. That is, $a_1 + a_2 = b_1 + b_2 = c_1 + c_2 = d_1 + d_2 = 0.$ When each country determines its optimal deficit level, it targets a value for $f_1 - f_2.$ This means that in general the fiscal strategies of the two countries will not be compatible. If a country aims at a target value of $f_1 - f_2$ greater than the other, it will be tempted to increase f_1; but the other's response will be to increase f_2; and so on... until deficits become unsustainable. In other words, there is no equilibrium.

Can the central bank cure that instability problem? Yes. How? By simply pursuing the optimal monetary policy derived in the previous section. Then the two countries will necessarily want to set the same value for $f_1 - f_2.$ This is because the ECB sets money so as to satisfy a weighted average of each country's first order condition expressed in terms of its preferred point (p_i, y_i) on its own output-inflation trade-off. But then if one first-order condition is satisfied, so must the other in order for the weighted average to be satisfied. Thus if the Central Bank behaves optimally the instability problem disappears. The central bank does neither have to look at country-specific aggregates nor to be concerned about fiscal policy. It is true that the level of the fiscal stance remains undetermined but equilibrium exists. There are two objectives: each country's loss function, and two instruments: euro-monetary policy and ¯scal divergence between the two countries.

However, such stability is fragile. In particular, it disappears if the ECB does not have the same preferences as national governments. This is quite a relevant case since it is generally argued that in order to reduce the time-consistency problem governments should appoint central bankers more in°ation-averse than themselves. But then monetary policy no longer solves the instability problem. Instability may also be restored by mistakes in monetary policy and imperfect information of the ECB about national preferences.

One way to avoid such harmful competition in ¯scal policy is to set up some "stability pact" that prevents countries from running excessive budget stance. However, such a pact should go both ways: it should prohibit excess surpluses as well as excess de¯cits. This prevents equilibrium from disappearing, although this outcome is not very satisfactory because the unconstrained country gets its preferred de¯cit level but not the constrained one.