

CROSS-COUNTRY DIFFERENCES IN MONETARY POLICY TRANSMISSION IN CENTRAL BANKS MODELS

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ABSTRACT

This paper examines possible explanations for observed differences in the transmission of euro area monetary policy, as described by the properties of central bank large-scale macroeconomic models. In particular it considers the extent to which these differences are due to differences in the underlying economies. It finds that, against most yardsticks, the cross-country variation in the results is found to be plausible in the sense that it broadly corresponds with other evidence or observed characteristics of the economies in question.

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Introduction

This paper examines observed differences in the transmission of euro area monetary policy in central bank models. To this end, the paper draws on the results of a carefully designed common monetary policy simulation experiment prepared within the Eurosystem's Working Group on Econometric Modelling (WGEM) and reported by van Els et al. (2003).² This experiment involved a temporary 100 basis point increase in the short term interest rate for two years, accompanied by consistent movements in long-term interest rates and the exchange rate based on the term-structure and uncovered interest parity conditions respectively.

The WGEM results provide a particularly rich data source for investigating differences in monetary policy transmission for a number of reasons. First, the design of the experiment was agreed in advance by the respective modellers and was therefore harmonised and undertaken in a consistent manner across models. Second, the results were decomposed into the main channels of monetary policy transmission. More specifically, the modellers provided quantitative estimates of the effects of monetary policy via its direct effects on consumption, investment, income wealth, the exchange rate and intra-euro area trade spillovers. This decomposition, provides an unparalleled degree of richness for the analysis of the sources of differences in monetary policy transmission.

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² Henceforth, we refer to this simulation experiment as the WGEM experiment. A more detailed set of results are included in the working paper by van Els et al (2001).

Finally, the fact that the results are drawn from the main macroeconomic models of the euro area central banks is also important. Central bank models are in many respects highly informative tools for analysing monetary policy transmission, since they incorporate the ‘local wisdom’ of the monetary policy maker on the response of the domestic economy to a policy impulse. Of course this does not mean that these models provide the best representation of monetary policy transmission that is available, although given the pre-occupation of central banks with such issues it would be reasonable to expect that they should provide a good representation of this mechanism. In any event, the mere fact that these tools are the central banks main large-scale macroeconomic models, and as such are used to help prepare projections and scenario analyses, makes them of interest. For this reason alone, it would be important to gain a greater insight into the extent to which their representation of monetary policy transmission differs across countries and whether this appears consistent with known features about the economies in question.

One issue that is important to mention is the potential role of model design in affecting these results. It is clear that the models used by the euro area central banks also differ in terms of ‘modelling philosophies’, which may be unrelated to differences in the economic structures. A detailed comparison of the design of these models is provided in the volume edited by Fagan and Morgan (2005). The extent to which model design can influence a model’s representation of monetary policy effects was investigated by Berben et al (2005). They found, for instance, that the treatment of expectations formation and wealth effects can have a major bearing on the results. In relation to the former, it is noteworthy that two of the models stand-out from the rest in their use of forward-looking expectations. The models of Finland and Belgium, incorporate a much greater degree of forward-lookingness in the determination of a wide range of macroeconomic variables than the other models, and it is important to keep this in mind when examining the results presented in this paper. As will be highlighted later, these models tend to yield results which are more often outliers from the rest.

Nevertheless, whilst acknowledging these two possible exceptions, the link between the different approaches to modelling and the workings of the respective economies is uncertain. It is likely that there are differences in expectations formation and the impact of various forms of wealth across countries which may well be related to economic structures and institutions. However, it also seems likely that not all of the differences in modelling strategies can be linked to underlying economic differences. Hence, one of the functions of this paper is to examine the extent to which the observed differences in monetary policy in these models make sense, given what we know about the respective economies.

The paper aims to answer two questions. The first is, to what extent is the transmission of monetary policy different in these models and how large are these differences? To answer this question we firstly document the size and nature of the differences in monetary policy transmission. Calculating the statistical significance of the differences is more problematic as the models have been developed independently, are not linked and there is no comprehensive set of information about the error-bounds

attached to each simulation result. Nevertheless, we also develop a metric for quantifying the size and importance of these differences.

The second question we seek to answer is, to what extent are these differences reliable or, in other words, to what extent do they make sense from an economic standpoint? Our approach to answering this question is to make a broad assessment of the relationship between the cross-country pattern of results and various statistics about economic structures, institutions and the properties of macroeconomic data. In this regard we first compare the decomposition of policy effects into channels with various statistics which might be expected to influence the size of each channel. We then compare the results with observed business cycle properties to assess the extent to which they are consistent. Finally we consider the overall results in the light of data on financial structures, labour market institutions and implied social preferences. In each case we collect the results of simple bivariate cross-sectional correlations between the results and particular economic variables. With a maximum sample size of 12, no individual result can be seen as offering a particularly robust assessment on the cross-country differences. Rather we prefer to place most emphasis on the overall pattern of the results and the extent to which there is consistency across a wide range of indicators.

1 To what extent does monetary policy transmission differ across central bank models?

The WGEM experiment documents the responses to an increase in the short-term interest rate (a monetary policy ‘shock’) using the macroeconometric models available at the 12 national central banks within the euro area. The responses have been measured at a quarterly frequency over a five years horizon. Since the differences in monetary policy transmission cannot be inferred by a single measure, we examine a number of statistics.³ In particular, we examine the impact of a monetary policy shock on GDP, private consumption, the sacrifice ratio, and the deflators of private consumption and GDP. The WGEM experiment expresses the responses of these endogenous variables (Y_t) in terms of percentage deviations from their respective baseline values (\bar{Y}_t)

$$(1) \frac{Y_t - \bar{Y}_t}{\bar{Y}_t} \cong \log Y_t - \log \bar{Y}_t \equiv y_t - \bar{y}_t.$$

³ Nevertheless, we recognise the difficulty in obtaining formal tests of cross country differences given the small number of countries in our sample. An alternative avenue is the one considered by Dedola and Lippi (2000) who study monetary policy heterogeneity both across industries and countries.

We assume that \bar{y}_t may be represented as a linear function of disturbances and (logs of the) exogenous variables⁴. Then it is possible to compute the moving average representation of both \bar{y}_t and y_t ,⁵ and isolate the effects of the monetary policy shock. For the generic l -th endogenous variable of the k -th country,

$$(2) \quad y_{l,t}^k - \bar{y}_{l,t}^k = \underbrace{\sum_i \sum_j \alpha_{l,i,j}^k \eta_{i,t-j}}_{y_t} + \sum_j \delta_{l,j}^k \varepsilon_{t-j} - \underbrace{\sum_i \sum_j \alpha_{l,i,j}^k \eta_{i,t-j}}_{\bar{y}_t}$$

where $\eta_{i,t}$ represents the generic i -th disturbance and ε_t is the monetary policy shock. The set of coefficients $\{\delta_{l,j}^k\}$ and the related country-aggregate $\{\delta_{l,j}^k\}$, which measures the response of $y_{l,t}^k$ and the euro area average $y_{l,t}$ to a discretionary change in the short-term interest rate, are determined by the structure of the euro area countries and can be used to detect whether there are differences in the way the economies work. In the WGEM experiment the interest rate was raised by one percentage point for eight periods (quarters), and returned to base afterwards. Hence, $\varepsilon_{t+j} = .01$ for $0 \leq j \leq 7$ and zero otherwise, so that the impulse response coefficients can be recovered by means of the set of deviations⁶

$$y_{t+j}^k - \bar{y}_{t+j}^k. \text{ In particular, for } 0 \leq j \leq 7, y_{t+j}^k - \bar{y}_{t+j}^k \propto \sum_{u=0}^j \delta_u^k \text{ while for } 7 < j, y_{t+j}^k - \bar{y}_{t+j}^k \propto \sum_{u=j-7}^j \delta_u^k,$$

where the proportionality factor is given by the size of the monetary policy shock.

The set of parameters $\{\delta_j^k\}$ can then be compared across countries and related to the response of the

euro area as a whole. The (scaled) *interim* variance $\tilde{\sigma}_k^2 = \frac{\sum_{i=1}^T (\delta_i^k)^2}{\sum_{i=1}^T (\delta_i^k)^2}$ can be used to gauge the relative

size of the fluctuation induced by the change in the monetary stance. The correlation coefficient

⁴ This assumption is not restrictive for behavioural and technical equations but implies that accounting identities hold only as an approximation.

⁵ Exogenous variables are not problematic in this regard: they are, by construction, not Granger-caused by the endogenous variables and may therefore be separately solved in terms of their fundamental shocks. Somewhat more problematic is the interpretation of the change in the short-term interest rate as entirely due to a discretionary policy impulse, since this abstracts from the feed-back existing between the state of the economy and the systematic component of the monetary stance. A possible way out is the recognition that the policy interest rate does not move continuously but in a piecemeal fashion, when changes in fundamentals are large enough to justify an adjustment. Accordingly, if the initial shock and the ensuing response of the economy are small, the assumption of a fixed interest rate is a viable one.

⁶ In order to reduce notation to a minimum, henceforth no index is used to distinguish variables across countries. The subscript l is therefore dropped.

$$\frac{\sum_{j=0}^T \delta_j \delta_j^k}{\sqrt{\sum_{j=0}^T (\delta_j)^2} \sqrt{\sum_{j=0}^T (\delta_j^k)^2}}$$

between the country and aggregate responses can be used to assess whether the timing, direction and size of the adjustment in each country is similar to the one displayed at the aggregate level.

Tables 1-2 report the values of the interim variance and the correlation coefficient for GDP, private consumption, the private consumption deflator and the GDP deflator. The amplitude of GDP fluctuations differs substantially across countries. For instance, in Finland it is nearly 5 times larger than in Belgium. Finland, Portugal, Greece and Italy all exhibit comparatively large output volatility and these cross-country differences appear to be statistically significant. A similar, though not identical pattern emerges from the correlation between country and aggregate movements. A low coefficient indicates that the timing of the output response in a particular country diverges from that of the euro area as a whole. Again, Finland stands out as the country whose response is furthest apart from the aggregate one, while the response for France differs little from the average response for the euro area. Overall, the correlation coefficients tend to be quite large, indicating that the differences in timing of the responses do not seem to be that marked. The response of private consumption shows a more sizeable difference across countries. The magnitude and timing of the consumption response in France is most in line with the aggregate one. The comparatively small response of consumption (in relation to the impact on output) in Belgium is indicative of a large degree of consumption smoothing. In contrast, in Portugal, Finland, Italy and Greece, movements in consumption are actually larger than the movements in GDP. Finally, the timing of the response of consumption in Finland, the Netherlands and Belgium is markedly different from the aggregate.

Turning to nominal variables, the deflationary effect of the monetary policy shock on prices appears to be more evenly distributed across the euro-area than is the case for the aggregate demand components (Table 2). Again, Finland behaves somewhat differently from the other countries. The timing and magnitude of the response of the deflators are unlike that exhibited elsewhere, being more rapid and consistently larger. With regard to the consumption deflator, Austria also deviates somewhat from the average response, as inflation barely reacts. This behaviour is noteworthy since it is not matched by a similarly asymmetric response of GDP.

Figure 1 combines the evidence concerning unemployment and price responses. In order to highlight the importance of the degree of stickiness in the goods and labour markets in determining the effects of monetary policy, the sacrifice ratio is plotted. The figures for Germany, Belgium and the Netherlands point to relatively quick adjustment in goods and labour markets, which contributes to keeping the output cost of a monetary contraction well below the area average. Also France, Ireland and Italy exhibit

a balanced response of prices and quantities to the interest rate increase, while Portugal, Austria⁷ and Greece appear to be characterised by values of the sacrifice ratio which are on average higher than those prevailing in the rest of the euro area.

To sum up, the results indicate that monetary transmission varies across these models of the countries in the euro area.⁸ In particular, there seems to be a group of countries whose economic structure is quite homogenous, but there are other countries where the transmission mechanism in these models works differently.⁹ Unlike previous studies (see previous footnote), however, the WGEM results suggest that the size of this ‘core’ is larger, now including countries such as Italy and Spain, who have not usually been considered to be part of it. The detected differences are likely to be statistically significant, at least in a few cases, and in the next section we consider whether they have any significance from an economic standpoint.

2 Are Cross-Country Differences in Monetary Policy Transmission Reliable?

2.1 Comparing the Channel Decomposition from WGEM Results with Economic Structures

We now turn to explaining the decomposition of the WGEM results into the various channels of monetary policy transmission. The approach taken is to compare the pattern of results for each channel with a number of prior judgements based on theoretical or empirical considerations. Six channels of transmission are identified. In each case we describe the channel and consider what factors may influence its magnitude as shown in Table 3. For each channel we consider the average impact on output and prices in the first two years. In principle any horizon could have been chosen, but two years reflected the timing of the change in monetary policy and represents the standard-time interval for assessing the impact of interest rate shocks. As an alternative, results have also been derived using a horizon of five years, although these are not shown. Broadly speaking, most of the following results still hold with a five-year horizon.¹⁰

The substitution-effect-in-consumption channel – the real interest rate represents the relative cost of present versus future consumption. Following a policy tightening, it becomes more rewarding to delay

⁷ The high sacrifice ratio in Austria is due to a particularly weak response of prices rather than a strong response of output.

⁸ One possible explanation for this evidence might be that the financial structure of the EMU members is still quite different and does not provide sufficient risk sharing mechanisms to households, who are therefore unable to adequately ensure against income fluctuations. Nevertheless, other recent evidence finds a weak response of consumption across euro area countries compared with the US (see Angeloni, Kashyap, Mojon and Terlizzese, 2003).

⁹ A number of other studies come to similar findings. Kouparitsas (1999), relying on VAR estimates, claims that Finland and Ireland form a sort of periphery within EMU and respond to monetary policy impulses differently from the other countries. Bean (1999) lists several studies which find asymmetries in the transmission mechanism and which, following Eichengreen and Bayoumi (1993), distinguish between a core and a periphery within the EU.

¹⁰ As discussed in Section 3, in some models additional channels are singled out: a price-monetary channel is included in the one of the Bundesbank; an expectation channel is present in the Italian model.

consumption and increase saving, which exerts a negative impulse on the current level of economic activity. The effects of this channel on output would be expected to depend on the proportion of GDP accounted by consumers' expenditure and the sensitivity of consumption to changes in interest rates. The latter may be linked to the financial strategies adopted by consumers (e.g. whether they feel the need to maintain precautionary balances) and financial conditions (e.g. whether they face credit constraints).

This channel exists in all models. In most cases consumption is directly affected by changes in the short-term interest rate, although in the case of Greece, Ireland and Portugal it is the *real* short-term rate. In Spain and the Netherlands, consumption is affected by the long-term interest rate and in the case of Germany and Luxembourg it is the *real* long-term rate. In Italy, short-term interest rates affect the consumption of durables whilst long-term rates affect the consumption of non-durables. Average output effects in the first two years are largest in Greece (-0.25%) and Portugal (-0.2%), whereas in Belgium there is a small positive output effect. Price effects are generally much smaller, with the largest effects reported in Austria and Portugal (-0.02%) with a small positive effect observed in Italy.

To examine the extent to which the importance of consumer spending matters, we compared the output effects against the share of consumers' expenditure in total GDP. This shows a clear relationship with a greater consumption share being associated with a larger substitution effect on output. As discussed, the sensitivity of consumer spending to changes in interest rates may also be expected to depend on the extent to which consumers' feel the need to make precautionary savings and the extent to which they face credit constraints. A rise in interest rates would increase the return to precautionary balances and, if it led to a worsening in economic conditions, would also be expected to increase the need for such balances, inducing additional saving and a fall in consumer spending. The need for precautionary savings may be higher for the self-employed who would be expected to enjoy less employment security than permanent employees. In addition, as the self-employed are less likely to have a regular and reliable pattern of income, they may more readily encounter credit constraints than permanent employees. A rise in interest rates may increase the number of credit-constrained consumers as collateral declines and may worsen short-term income prospects. There is a reasonably clear relationship between the self-employment share and the output effects of the substitution channel. In those countries where self-employment is more prevalent, the output effects of the substitution channel are larger in magnitude.

Similar arguments could be advanced with respect to certain labour market institutions. For instance trade unions might be expected to reduce the likelihood of employees facing significant wage cuts or facing redundancy. If people do lose their jobs, a generous unemployment benefit system would reduce the income loss from redundancy. Therefore, both institutions might be expected to be associated with a lower need for precautionary savings. As indicated in Table 3, there are some signs that the magnitude of the substitution channel is diminished in those countries where these institutions are stronger.

The cost-of-capital channel – the rise in the real interest rate is reflected in the real cost of capital. The optimal capital-output ratio falls and the pace of capital accumulation slows accordingly. A similar mechanism operates for investment in housing and for inventories accumulation. The rental cost of durable goods moves in parallel with the cost of capital and also causes a contraction in consumer spending.¹¹ The magnitude of this channel might be expected to depend on the financial structure and the conditions faced by firms. For instance, effects may be larger in countries where firms are more indebted or where they borrow on short-term interest rates. As with consumers, firms may also face credit constraints, and these may be more important for smaller firms with less easy access to capital markets. Finally, industrial structure may matter as some industries may be more affected by changes in interest rates due to either their capital requirements or the nature of the goods they produce (e.g. durables, non-durables, intermediate or investment goods).

This channel is also present in all models but there are differences in the way it is incorporated. In many cases the link between interest rates and business investment is via the capital stock. A change in interest rates affects the user costs of capital, which affects the desired capital stock and thereby investment. Because of adjustment costs, investment can only gradually bring the actual capital stock to its desired level. Italy is the country with the strongest reported cost of capital impact on output (-0.18) followed by Portugal (-0.15), with Luxembourg reporting the smallest effects. The largest impact on prices is also observed in Italy and Portugal (-0.025), with Belgium reporting a small rise in prices.

As discussed, the magnitude of the cost of capital channel might be expected to depend on the financial structure and the conditions faced by firms and the industrial structure. To consider the first of these we have examined the link between the results and the proportion of firms' financing which is short-term, the size of firms' interest payments and the proportion of small firms. No role is found for the proportion of firms using short-term-financing, but there is some relationship between the magnitude of non-financial firms' interest payments and the cost of capital channel, with greater interest payments being associated with a more influential cost of capital channel. However this relationship is largely driven by one observation (Italy).¹² A relationship is also found between the share of small firms and the output effects of the cost of capital channel. As discussed, small firms may be subject to greater capital market frictions than larger ones and more affected by the credit channel. Finally, it might be expected that the magnitude of the cost of capital channel would be affected by industrial structure. For instance, it may be the case that manufacturing, particularly of durables and investment goods, would be more significantly affected than other sectors. There appears to be some relationship with a larger manufacturing sector being associated with a larger magnitude of the cost of capital channel.

¹¹ Since most econometric models used in the experiment do not distinguish between consumption of durables and non-durables to allow comparisons, the response to the monetary policy shock of durables spending has been allocated not to the cost-of-capital channel, but to the substitution-effect channel.

¹² In fact this firms' net interest payments measure may be more directly related to the income channel than to how credit constraints affect the cost of capital channel.

It is clear that the above factors can explain only a limited amount of the cross-country variation in the cost of capital channel. It seems likely that the results are driven by country-specific factors, such as traditional patterns of behaviour in the finance industry. For example, in Germany there is a tradition of ‘relationship banking’ entailing close ties between corporations and banks, such that changes in the cost of capital have a relatively small impact. Further evidence on this is documented in Ehrmann and Worms (2001).

The income and cash-flow channel – a rise in financial yields increases the disposable income of net lenders and worsens the cash flow of net borrowers. The importance of the cash-flow channel is likely to be linked to the financial structure of the economy. It may also depend on the relative propensity of borrowers and lenders to spend. This channel exists in all models except in those for Greece and Ireland. The impact of this channel will depend on the financial position of households and firms at the time of the policy action.¹³ Portugal and Finland report negative income channel effects on output in the first two years, whilst Belgium, Spain, France and Italy report positive effects. Only in the case of Finland (negative) and Italy (positive) do these output effects translate into any noticeable price effects in the first two years.

The magnitude of the income effect may depend on the net amount of interest receipts by households and also household’s exposure to interest changes through short-term debt. It does appear to be the case that where net interest receipts are negative, the income channel exerts a negative effect on output, and where net interest receipts are positive, the output effects are also positive. In Italy, the positive contribution of the income channel reflects the fact that households are net creditors, and raise consumption in response to the increase in interest payments received on holdings of government debt. In Finland and the Netherlands, households are net debtors. Hence, the income channel tends to reinforce the drop in output in these countries. Finally, we also compared the proportion of financing that is short-term with the magnitude of the output effects from the income channel. It does appear to be the case that, where more household borrowing is short-term the income channel is more negative (for example in Portugal).

The wealth channel – a rise in the cost of borrowing reduces the discounted value of future expected payoffs of physical and financial assets. The market value of households’ net wealth adjusts to incorporate capital losses and household spending falls accordingly. The impact of the wealth channel would be expected to be affected by the magnitude of household wealth and the sensitivity of consumers’ expenditure to changes in wealth. Changes in wealth are caused by (cumulated) changes in asset holdings (M3, bonds, shares and net foreign assets) as well as by valuation effects. As to the latter, asset prices are endogenous in the models for Finland (house prices), Italy (house and bond) and the Netherlands (house, share and bond prices). In the models for Finland and the Netherlands, wealth not only affects consumption directly, but also residential investment through changes in house prices. The

¹³ The change in interest payments sums up to zero, when taking into account the rest of the world.

wealth channel is not present in the results reported for Austria, Germany, Greece, Spain, France and Portugal.

As regards the magnitude of the wealth channel, the results are rather sparse as only Italy, the Netherlands, Ireland and Finland report any noticeable wealth effects in the first two years. Wealth effects on output are negative in Italy and the Netherlands and positive in Ireland¹⁴. The results for Finland give no perceptible impact on average output in the first two years and a tiny (positive) impact on prices. To examine these wealth channel results we attempted to compare the output effects against the market capitalisation as a % of GDP. The idea here is, that countries with a more significant equity market may report more significant wealth effects. However, no clear relationship is observed which may be related to the paucity of the results.

The weakness of the wealth channel is perhaps surprising, given the increased importance of stocks and bonds in portfolios of households and firms. One reason why wealth effects may be moderate, even when explicitly accounted for in the models, relates to the fact that, by assumption, the interest rate shock is a rather short-lived so that forward looking long-term interest rates respond only partially, limiting the impact on asset prices. Nevertheless, for those countries that consider endogenous asset valuation effects, the total real effects (not only the wealth effect) of the monetary disturbance seem to be more relevant.

The exchange rate channel – in most models of exchange rate determination, a monetary policy tightening leads to an appreciation of the currency. A stronger exchange rate causes a fall in export volumes and an increase in consumer spending, induced by the positive income effect which follows an appreciation. It also yields a fall in the price level, directly since it reduces the cost of imported goods and the size of the mark-up and indirectly since it worsens the competitive position of domestic firms and hence net exports. For both the price and output effects it might be expected that the proportion of trade outside the euro area, which would thus be affected by a change in the euro exchange rate, would help to explain the pattern of results. The extent and the speed of the pass-through of changes in the exchange rate into trade and domestic prices will also be important. This will depend on the pricing strategies of importers and the extent to which they ‘price-to-market’ or passively accept exchange rate induced price changes.

This channel directly feeds into the euro-price of oil and other commodities (involving the euro-dollar exchange rate) and the foreign prices of other goods and services (involving the effective exchange rates). The change in import and competitors’ prices in euro initiates a change in domestic prices, which will spread through the price and wage system. As the results indicate, the largest price effects are recorded in Finland with an average fall of 0.4% in the first 2 years. In contrast, the smallest price

¹⁴ In the latter case this is due to the deflator attached to the wealth variable (the consumption deflator), being more affected than the nominal wealth variable and leading to a rise in *real* wealth.

effects are observed in Luxembourg with an average fall of 0.015% over this period. However, the distribution of output effects is rather different. In this case the largest output effects are recorded in Germany (-0.225%) and the smallest in Portugal (-0.02%).

A number of factors may underlie these results. Campa and Gonzalez-Minguez (2002) find that openness and sectoral composition are relevant determinants of differences in the exchange rate pass through in euro area countries. Hence, for both the price and output effects it would be expected that the proportion of trade outside the euro area, which will thus be affected by a change in the euro exchange rate, should help to explain the pattern of results, at least in the short run. However, we tested this and in neither case are the results supportive of the notion that trade patterns can explain the exchange rate channel. A number of additional factors maybe at work. In the case of the effects on domestic prices, the extent and the speed of the pass-through will also be important. This will depend on the pricing strategies of importers and the extent to which they ‘price-to-market’ or passively accept exchange rate induced price changes. For instance it might be expected that changes in the price of raw materials and fuels, which are determined on international markets, would be passed through into domestic prices. If this was the case, then a high share of such items in total imports may be reflected in a larger change in domestic prices, following the change in the exchange rate. This relationship appears to hold for the price effects of the exchange rate channel.

In relation to the output effects of the change in exchange rate it might be expected that the presence of multinational firms might lead to larger effects from the exchange rate channel as such firms may be more easily able to relocate production. To proxy this effect, we compare the relationship between the share of large firms and the output effects of the exchange rate channel. There appears to be a weak relationship, with larger firms being associated with a larger output effect from the change in the exchange rate.

The spillover channel - models were initially operated in ‘isolated’ mode without intra-euro area spillovers. Therefore, at the outset no assumptions were made about any change in foreign variables due to the simulation that might feed back into the domestic results. However, such effects were taken into account in a second round through an exchange of results between modellers whereby the results of the first run of all models in isolated mode were incorporated in each model. The variables affected were export demand and competitors’ export and import prices. It would be expected that the extent to which countries trade within the euro area would be an important factor in determining the magnitude of the spillover channel.

Finland is the country with the largest impact on prices via the spillover channel (-0.075%) whilst Germany and Ireland report minimal price effects. In terms of output, the largest effects are reported in Belgium (-0.1%) and Luxembourg (-0.08%). The magnitude of the spillover channel on prices may depend on how import price changes feed through into domestic prices. This will depend, at least in

part, on how important intra-euro area imports are in relation to GDP. We compared intra-EU-12 imports (of goods) as a % of GDP to the magnitude of the spillover effects on prices. A slight relationship is observed (whereby more intra EU-12 trade is associated with a larger price effect from the spillover channel). However, these results are greatly affected by one outlier (Finland), and if this is removed, a stronger relationship is observed. As regards the output effects, we have linked these to total intra-EU-12 trade as a proportion of GDP. Here, a clear relationship is observed, with greater intra-EU-12 trade being associated with larger spillover effects on output.

2.2 Comparing the WGEM Results with Business Cycle Properties

We now examine the extent to which the cross-country differences in the transmission results reflect differences in business cycle fluctuations among euro area countries. An important caveat to keep in mind here is that business cycle differences may be caused by many other shocks hitting the economy apart from monetary policy. For example, cyclical swings in economic activity may also result from changes in the fiscal stance, commodity prices (in particular oil), and the exchange rate. Nevertheless, business cycle differences remain potentially informative as long as the relative importance of the shocks buffeting the economy is not too different across countries. .

The cyclical behaviour of macroeconomic time series from euro area economies has been documented in the literature, see for instance, Angeloni and Dedola (1999) and Agresti and Mojon (2001). Generally speaking, although business cycles may gradually have become more synchronised across Europe, there appear to be substantial differences in terms of the volatility of these macroeconomic time series.¹⁵ This raises the possibility that these differences can be used to shed some light on the plausibility of the WGEM results. With this aim, we examine a number of ‘hypotheses’.

The first hypothesis assumes that in those countries where the volatility of private consumption is high, private consumption will react more swiftly and strongly to a change in the interest rate. As a result, the importance of the substitution in consumption channel may be enhanced in these cases. The importance of this channel (and of the other channels analysed below) is gauged with two measures. The impact of this channel on prices and output after one year (in absolute terms) describes its importance in the short run. The cumulated absolute impact on prices and output after five years is used to trace the influence of the substitution channel in the long run. In line with the hypothesis, there appears to be a significant (at 84% level) positive relationship between the volatility of private consumption and the output effects in the short-run, although such a relationship is not found in the long-run (Table 4).¹⁶ The short-run impact on prices is negligible in most countries and hence unrelated to the volatility of consumption.

¹⁵ See, for instance, Berben et al (2005).

¹⁶ Spearman’s rank order correlation coefficient is used to measure correlation between the two variables involved. P-values are obtained by linear interpolation of the exact small sample distribution.

Nevertheless, in the long-run, the impact on prices and the volatility of private consumption are significantly (at 95% level) correlated.

The second hypothesis assumes that, in those countries where the volatility of investment is higher, investment should be more responsive to changes in the interest rate, which in turn should lead the cost-of-capital channel to play a dominant role in the monetary transmission process. Generally, this hypothesis is not supported by the data. However, this is largely due to two outliers - Greece and Luxembourg - countries for which investment is rather volatile but the cost-of-capital channel is of little importance. If these two countries are dropped from the sample, then a significant relationship (at 89% level) between the volatility of investment and the short run impact on output can be obtained.

Lastly, we investigate the extent to which the impact on prices is related to the components of labour costs, in particular wages and labour productivity. The idea here is that, if wages or labour productivity are more volatile, labour costs may be potentially more responsive to changes in the monetary policy stance. More volatile labour cost components may then translate into a larger impact on prices from changes in the interest rate. Here, we only take into account the domestic channels of transmission. We can only get a significant relationship (at 92% level) between the volatility of wages and the long run impact on prices if we drop Ireland from the sample. The fact that Ireland is an outlier here can to some extent be explained by its pattern of trade. A very large proportion of output is exported and a very large proportion of consumption is met by imports. Therefore, changes in domestic unit labour costs will not affect domestic consumer prices much, but will instead impact on competitiveness. In addition, the Irish retail sector has traditionally been heavily influenced by UK retailers' pricing in sterling, so that domestic factors are also not important in affecting these prices.

2.3 Comparing the Overall WGEM Results with Economic Structures

We now assess the plausibility of cross-country differences in monetary policy transmission in the euro area by examining how they correspond with the economic structures of EMU countries. We first focus on preferences with regard to the variability of output and inflation, which translate into social insurance schemes which differ in terms of coverage and effectiveness.¹⁷ Following this we consider asymmetries potentially arising in financial markets, which affect the transmission mechanism from interest rates to aggregate demand. Finally we briefly discuss other goods and labour market factors.

While the role of financial structures and of price and wage flexibility is well understood, only a few studies have dealt with the links between social preferences and the effectiveness of monetary policy.¹⁸ One reason might be that the effects of social preferences on the economic structure are pervasive and it

¹⁷ Bean (2000) and Cecchetti (1999) include discrepancies in social preferences among the sources of asymmetries in monetary policy transmission.

¹⁸ See for instance, De Grauwe (1995) and Bean (2000).

is therefore far from clear how to derive formal tests of their relevance in shaping the transmission mechanism. As a tentative solution, we focus on the fiscal policy framework, which is one of the features which may reflect the degree of aversion to income fluctuations. As regards fiscal policy, automatic stabilisers exert a damping effect on the cycle, and may therefore reflect more reliably the extent to which society accepts slower adjustment to shocks in order to avoid large swings in output and income. Van den Noord (2000) provides estimates of the size of the automatic stabilisers, in terms of the elasticity of net lending to the output gap, for most OECD countries¹⁹. Figure 2 indicates that there is a negative relationship between the output-inflation volatility ratio and the size of the automatic stabiliser. Those countries whose budget is more responsive to changes in the output gap, i.e. more contractionary in booms and more expansionary in recessions, are thought to dislike income volatility to a greater extent. Hence, they exhibit a lower ratio of the volatility of output with respect to that of inflation. The regression coefficient is statistically significant at the 5% confidence level. Although various other factors will play a role, the evidence for this narrow measure of social preferences suggests that preferences do contribute to explaining some of the observed differences in the transmission mechanism.

We now turn to the role of the financial structure in shaping the way in which the economy responds to monetary policy impulses. Capital markets and the banking system determine the speed and the extent to which policy impulses are transmitted to longer-term interest rates, equity prices and the exchange rate. The net asset position of households, firms and the government sector then determines the impact on aggregate demand of the new combination of asset yields. The presence of imperfections in financial markets and the associated existence of a credit channel, by amplifying the response to the initial change in interest rates, provides additional leverage to the policy action.²⁰

Table 5 reports a number of statistics highlighting selected characteristics of the financial structures of the euro area countries.²¹ These variables are compared with the cost of the policy tightening as measured by the sacrifice ratio.²² The table shows the results obtained by means of univariate regressions.²³ The evidence is mixed. Market capitalisation, as a share of GDP, helps to discriminate

¹⁹ See Van den Noord (2000), Table A.1, page 19. No figures for Luxembourg are provided.

²⁰ A credit channel exists when, due to information asymmetries and moral hazard problems, banks and non-financial firms are not uniformly affected by monetary policy actions, since small units have limited access to financial markets. Macroeconometric models are not well-suited for gauging the relevance of the credit channel in monetary transmission, since usually they do not distinguish firms according to size and health.

²¹ Homogeneous data are hard to find for all countries and in most cases statistics are available only for a subset of countries.

²² As in Van Els et al. (2001), in the present study the sacrifice ratio has been computed focusing on the response of the unemployment rate and the GDP deflator in the first five years of the simulation experiment. The following additional assumptions have been used: (i) the sacrifice ratio is computed with reference to domestic channels only; (ii) the cumulated unemployment loss is computed for the first j^* years, where j^* is the year in which the unemployment rate reaches a peak; (iii) the cumulated reduction in inflation is computed for the first k^* years, where k^* is the year in which the level of the GDP deflator reaches a trough.

²³ In addition to univariate regression, the Spearman rank order correlation coefficient has also been computed and the results are available upon request from the authors. All in all, the two methods provide very similar evidence. The use of regression methods facilitates comparisons with the available literature on monetary transmission within the euro area.

between bank-oriented and market-oriented financial structures. It is expected to be higher wherever capital markets are developed and well functioning and where the cost of adjusting to a monetary policy shock is moderate. Market capitalisation is indeed low in Portugal and Austria, where the sacrifice ratio is relatively large, and high in France and the Netherlands, where the effects of the monetary shock are moderate. Germany and Finland do not fit convincingly into this story, and Greece is completely at odds with it. The size of MFI loans to firms (as a percentage of GDP), which may reflect the extent to which credit constraints bite on investment spending, does appear to have some explanatory power, especially when the share of loans which are short-term is considered.

The concentration of the banking sector provides some help in understanding the sources of asymmetries in the transmission mechanism. Focusing on concentration may be appropriate if one assumes that the larger the average size of banks, the higher their ability to attract funds from capital markets and the lower their exposition to a credit squeeze. The Herfindahl index²⁴ and the market share of the five largest banks do not contribute to explaining the size of the sacrifice ratio, while the variables related to the number of credit institutions operating in the euro-area countries do. Indeed, the smaller the average size of banks, the larger the sacrifice ratio. The variable measuring the penetration of credit institutions from countries outside the euro area has a negative sign. This would be justified if these banks were less affected by monetary policy shocks due to their ability to exploit alternative sources of funding. Looking at non-financial firms, the results tend to be less informative. The sacrifice ratio seems to be positively related to the number of firms issuing shares and inversely related to their average capitalisation, which is inconsistent with the notion that, the higher the information asymmetry, the lower the capacity of enterprises to access non-bank finance. The size of firms, as proxied by the number of employees in their payrolls, is not significant. All in all, even allowing for the uncertainty due to the noise present in the data, the differences in the financial structure do not seem able to explain all of the observed asymmetries in the transmission mechanism.

It is widely accepted that potentially important asymmetries in monetary transmission are to be found in the working of labour and goods markets. There are two aspects of the labour and goods markets that are of particular interest in understanding how costly it is to adjust to a monetary policy shock: nominal inertia and real rigidity. The higher they are, the less reactive are prices and wages to changes in the output gap and the less effective is interest rate policy. It is well known that nominal inertia - at least with respect to wages - is lower in Europe and higher in the US, while the opposite is true for real (wage) rigidities. However, it is not well documented how both of them are distributed across countries in the euro area.²⁵ Given the lack of available estimates, both kind of rigidities are measured only indirectly. It is assumed that nominal inertia and real price-wage rigidity are functions of a small number

²⁴ A measure of concentration of production in an industry, calculated as the sum of the squares of market shares for each firm.

²⁵ Layard et al. (1991) report estimates for both parameters for most of the current EMU members (9 out of 12), but the figures are by now somewhat outdated, given the extensive reforms in labour market institutions which have taken place in the last decade.

of variables which, by shaping workers' and employers' behaviour, ultimately determines the size of both parameters. Real rigidity inversely depends on the responsiveness of the price and wage mark-ups to product and labour market slackness. The former is related to market contestability and depends on the extent of state control, the incidence of regulations and the size of barriers to entrepreneurship and trade. The latter is affected by the institutional features which maintain a high degree of bargaining power for the insiders and which reduce the degree of centralisation and coordination of wage bargaining.

We addressed this issue by examining whether there was any relationship between the sacrifice ratio, assumed to measure the cost of adjusting after a monetary shock, and a number of proxies of both nominal inertia and real rigidity.²⁶ In general the results were disappointing, in the sense that no clear and convincing pattern emerged for the variables under consideration. The exceptions were the measures of the barriers to trade and investment and employment protection legislation (EPL). Both of these variables turned out to be significant and positive, implying that they were associated with a higher sacrifice ratio.

3 Conclusions

This paper has examined observed variations in the transmission of euro area monetary policy in central bank models. In particular it has aimed to answer two questions. The first is, to what extent is the transmission of monetary policy different in these models and how large are these differences? To answer this question we first documented the size and nature of the differences in monetary policy transmission and then developed a metric for quantifying the size and importance of these differences. We found that monetary transmission appears to vary across the models of countries of the euro area. In particular, there seems to be a large group of countries where the observed behaviour is relatively homogenous, but there are also other countries where the transmission mechanism in these models works differently. In comparison with previous work, however, the WGEM results suggest that the size of the more homogenous group is larger, including countries such as Italy and Spain, who have not usually been considered to be part of it. Some of the detected differences are quite marked and, in some cases, are also likely to be statistically significant.

The second question that we have sought to answer is, to what extent are these differences reliable or, to what extent do they make sense from an economic standpoint? Our approach to answering this question was to make a broad assessment of the relationship between the cross-country pattern of results and various statistics about economic structures, institutions and the properties of macroeconomic data. In this regard, financial structures and the fiscal policy framework appear to make some contribution to

²⁶ The sacrifice ratio is defined as in Van Els et al. No figure for Luxembourg is available. A full set of results are available on request from the authors.

explaining part of the heterogeneity in the responses of countries to a monetary policy shock. There also appears to be a role for the credit channel as various financial indicators show some relationship with the pattern of results. In relation to the decomposition into channels of transmission, the magnitude of most channels appeared to bear at least some relation to prior beliefs based on information about the respective economies.

With regard to business cycle properties, there appears to be some evidence that the transmission results correspond to cross-country differences in various business cycle ‘stylised facts’. In particular, a high volatility of consumption observed in the business cycle data may be indicative of a greater sensitivity of consumption to changing interest rates. This pattern was observed in the model results, where the magnitude of the substitution channel seemed to correspond to the volatility of private consumption. Overall, against most yardsticks, the cross-country variation in the model results was found to be plausible. The results broadly correspond to the differences in business cycle properties across countries and most – but not all – economic, financial and structural statistics.

References

- Agresti, A.M. and B. Mojon (2001), *Some Stylised Facts on the Euro Area Business Cycle*, ECB Working Paper No 95.
- Angeloni, I. and L. Dedola (1999), *From the ERM to the Euro: New Evidence on Economic and Policy Convergence among EU Countries*, ECB Working Paper No 4.
- Angeloni, I., A. Kashyap, B. Mojon and D. Terlizzesse (2003): "The output composition puzzle: a difference in the monetary transmission mechanism in the euro area and U.S.", forthcoming in the *Journal of Money Credit and Banking*.
- Bean, C. (1999), ‘The single monetary policy: one size fits all?’ in *EMU: Realignments In and Out of the Eurozone*, Royal Institute for International Affairs, London.
- Bean, C. (2000), ‘Monetary policy under EMU’, mimeo
- Berben, R.-P., Locarno, A, Morgan, J. and Valles, J. (2005), ‘Cross-Country Differences in Monetary Policy Transmission’, ECB Working Paper No. 400.
- Blanchard, O. (1985), ‘Debt, deficit and finite horizons’, *Journal of Political Economy* 93, 223-247.
- Brayton, F. and P. Tynsley (1995), *Polynomial Generalization of Dynamic Frictions in Structural Macro Models*, FRB Staff Working Paper.
- Campa, J.M. and J.M. Gonzalez-Minguez (2002), *Differences in Exchange Rate Pass-Through in the Euro Area*, Banco de España Working Paper No 0222.
- Cecchetti, S.G. (1999), ‘Legal structure, financial structure and the monetary policy transmission mechanism’, FRB of New York, *Economic Policy Review* 5 (2), 9-28.
- Cecchetti, S.G. and R.W. Rich (1999), ‘Structural estimates of the U.S. sacrifice ratio’, mimeo.

- Dedola, L. and F. Lippi (2000) 'The monetary Transmission Mechanism: Evidence from Industries of five OECD countries, Banca d'Italy, Termini di Discussioni, 389.
- De Grauwe, P. (1995), *The Economics of Convergence towards Monetary Union in Europe*, Centre for Economic Policy Discussion Paper No 1213, London.
- Ehrmann, M. and A. Worms (2001), *Interbank Lending and Monetary Policy Transmission: Evidence for Germany*, Bundesbank Discussion Paper 11/01.
- Eichengreen, B.J. and T. Bayoumi (1993), 'Shocking aspects of European monetary unification', in *European Monetary Unification: Theory, Practice and Analysis*, B.J. Eichengreen (ed), Cambridge, MIT Press.
- Fagan, G. & Morgan, J. (2005), *Econometric Models of the Euro-Area Central Banks*, Edward Elgar.
- Kouparitsas, M.A. (1999), "Is the EMU a viable common currency area? A VAR analysis of regional business cycles", *Economic Perspectives*, Federal Reserve Bank of Chicago.
- Layard, R., S. Nickell and R. Jackman (1991), *Unemployment. Macroeconomic Performance and the Labour Market*, Oxford, New York, Toronto and Melbourne, Oxford University Press.
- Ludwig, A. and T. Slok (2002), *The Impact of Changes in Stock Prices and House Prices on Consumption in OECD Countries*, IMF Working Paper No 02/1.
- Massaro, R. and E. Lääkäri (2002), 'The European and euro-zone financial structure', *Statistics in focus*, Theme 2, 18/2002, Eurostat.
- McAdam, P. and J. Morgan (2001), *The Monetary Transmission Mechanism at the Euro-Area Level: Issues and Results using Structural Macroeconomic Models*, ECB Working Paper No 93.
- Mihov, I. (2001), 'One monetary policy in EMU', *Economic Policy*.
- Mojon, B. and G. Peersman (2001), *A VAR Description of the Effects of Monetary Policy in the Individual Countries of the Euro Area*, ECB Working Paper No 92.
- Peersman, G. (2004), 'The Transmission of Monetary Policy in the Euro Area: Are the Effects Different across Countries?', *Oxford Bulletin of Economics and Statistics* 66, 285-308.
- Van den Noord, P. (2000), *The Size and Role of Automatic Fiscal Stabilisers in the 1990s and Beyond*, OECD Economics Department Working Papers No 230.
- Van Els, P., A. Locarno, B. Mojon & J. Morgan (2003), "New Macroeconomic Evidence on Monetary Policy Transmission in the Euro Area", *Journal of the European Economic Association*, April-May 2003 I(2-3), pp. 720-730. B Working Paper No 94.
- Van Els, P., A. Locarno, J. Morgan and J.P.Villetelle (2001), *Monetary Policy Transmission in the Euro Area: What Do Aggregate and Structural Models Tell US*, ECB Working Paper No 94.

Table 1

	Output				Consumer Spending			
	σ_i	p-value	ρ_i	p-value	σ_i	p-value	ρ_i	p-value
Belgium	0.034	0.043	0.813	0.000	0.006	0.000	-0.984	0.000
Germany	0.067	0.126	0.758	0.000	0.023	0.020	0.336	0.148
Greece	0.095	0.005	0.798	0.000	0.091	0.000	0.792	0.000
Spain	0.075	0.052	0.627	0.003	0.057	0.037	0.555	0.011
France	0.037	0.078	0.978	0.000	0.045	0.196	0.880	0.000
Ireland	0.067	0.115	0.873	0.000	0.067	0.007	0.476	0.034
Italy	0.090	0.008	0.830	0.000	0.102	0.000	0.834	0.000
Luxembourg	0.050	0.478	0.682	0.001	0.083	0.000	0.568	0.009
Netherlands	0.057	0.306	0.657	0.002	0.040	0.383	-0.080	0.738
Austria	0.057	0.313	0.701	0.001	0.048	0.147	0.735	0.000
Portugal	0.118	0.000	0.611	0.004	0.264	0.000	0.879	0.000
Finland	0.149	0.000	0.300	0.199	0.174	0.000	-0.416	0.068

Notes: The first three columns report for each country the interim (20 periods) standard deviation (σ_i) of the response of output to a monetary policy shock, the value of the F-statistic and the corresponding p-value for testing whether output variability is the same in country *i* as in the aggregate of EMU. The next three columns show the correlation coefficients between output response in country *i* and in the average of the euro-area (ρ_i), the value of the t-statistics and the corresponding p-value for testing whether the patterns of responses at the country and aggregate level are the same.^{27 28}

²⁷ The correlations reported in the tables are computed without excluding the country to which the coefficient refers from the euro area aggregate. This procedure induces an upward bias in the estimates for the larger countries. However, it could be argued that this is an appropriate measure as the monetary policy stance is based on developments at the euro area level and the cost of losing monetary independence is proportionate to the asymmetries existing between each country and the whole of the currency area. In the case of Germany, the adoption of the alternative solution of excluding the country from the area average would have generated some small differences.

²⁸ Country variances scaled by the aggregate variance have an F distribution; the correlation coefficients ρ , transformed into the quantity $\frac{\rho}{\sqrt{1-\rho^2}}\sqrt{n-2}$, are distributed as a Student-*t* random variable. The distribution

of these statistics is based on assumptions which are not likely to be satisfied in the present case. In particular, the hypothesis that both the variances and the covariances are computed on a random sample rather than on a set of estimated coefficients is unrealistic: since there is just one observation to estimate each impulse-response parameter, this is by no means an irrelevant assumption and puts inference procedures on shaky foundations. The results reported are therefore better viewed as suggesting some kind of metric which makes it possible to compare country results rather than as providing a reliable inference procedure to assess the statistical significance of the detected asymmetries.

Table 2

	Consumption Deflator				GDP Deflator			
	σ_i	p-value	ρ_i	p-value	σ_i	p-value	ρ_i	p-value
Belgium	0.029	0.021	0.829	0.000	0.022	0.001	0.881	0.000
Germany	0.057	0.185	0.956	0.000	0.065	0.107	0.913	0.000
Greece	0.071	0.037	0.855	0.000	0.067	0.084	0.708	0.000
Spain	0.091	0.003	0.822	0.000	0.095	0.003	0.940	0.000
France	0.026	0.008	0.859	0.000	0.027	0.006	0.966	0.000
Ireland	0.031	0.044	0.902	0.000	0.041	0.229	0.964	0.000
Italy	0.057	0.195	0.936	0.000	0.059	0.203	0.812	0.000
Luxembourg	0.015	0.000	0.824	0.000	0.024	0.002	0.635	0.003
Netherlands	0.048	0.455	0.935	0.000	0.075	0.034	0.774	0.000
Austria	0.031	0.036	0.293	0.210	0.016	0.000	0.701	0.001
Portugal	0.046	0.459	0.900	0.000	0.046	0.418	0.892	0.000
Finland	0.159	0.000	0.435	0.055	0.119	0.000	0.021	0.929

Notes: As in Table 1

Table 3

Channel	Factors Influencing its Magnitude (Spearman Rank Correlation Coefficient)
Substitution - Output Effects	Share of consumers' expenditure in total GDP (0.59) Self-employment share (0.61) Union density (-0.35) Unemployment benefit replacement ratio (-0.39)
Cost of Capital - Output Effects	Non-financial firm's interest payments (0.31) Share of small firms (0.39) Manufacturing share of output (0.38)
Income - Output Effects	Net interest receipts as a proportion of net income (+0.47) Proportion of household financing that is short-term (-0.49)
Exchange Rate - Price Effects - Output Effects	Share of raw materials and fuel in imports (0.10) Share of large firms (0.31)
Spillover - Price Effects - Output Effects	Intra-EU-12 imports (0.22) Intra-EU-12 total trade (0.41)

Table 4

Variable	Factors Associated with its Volatility
Consumption	Volatility of consumption and the response of output in the short-run under the substitution channel (+0.45) Volatility of consumption and the response of prices in the long-run under the substitution channel (+0.58)
Investment	Volatility of investment and the response of output in the short-run under the cost of capital channel (+0.44) Volatility of wages and the response of prices in the long-run under all domestic channels (+0.57)

Table 5 Financial Structure and Monetary Policy Transmission

	<i>slope</i>	<i>t-stat</i>	<i>p-value</i>	<i>d.o.f</i>	<i>R</i> ²
<i>Stock market capitalisation</i>	-0.003	-0.594	0.284	9	0.038
<i>MFI loans to non-financial sector (< 1 year)</i>	0.042	1.560	0.923	9	0.213
<i>Consumer credit</i>	0.040	0.593	0.716	9	0.038
<i>Total number of credit institutions</i>	0.011	1.751	0.938	7	0.305
<i>Credit institutions from non EA countries</i>	-1.669	-1.643	0.081	5	0.351
<i>Herfindahl Index</i>	1.080	0.288	0.609	6	0.014
<i>Market share of the five largest banks</i>	0.005	0.473	0.675	7	0.031
<i>Total assets of the banking sector (% GDP)</i>	-0.003	-1.212	0.128	9	0.140
<i>Number of firms issuing shares</i>	0.032	1.284	0.884	9	0.155
<i>Average capitalisation of firms issuing shares</i>	0.000	-2.639	0.013	9	0.436
<i>Firms with less than 250 employees</i>	0.011	0.540	0.699	9	0.031
<i>Firms with 250 employees or more</i>	-0.013	-0.628	0.273	9	0.042

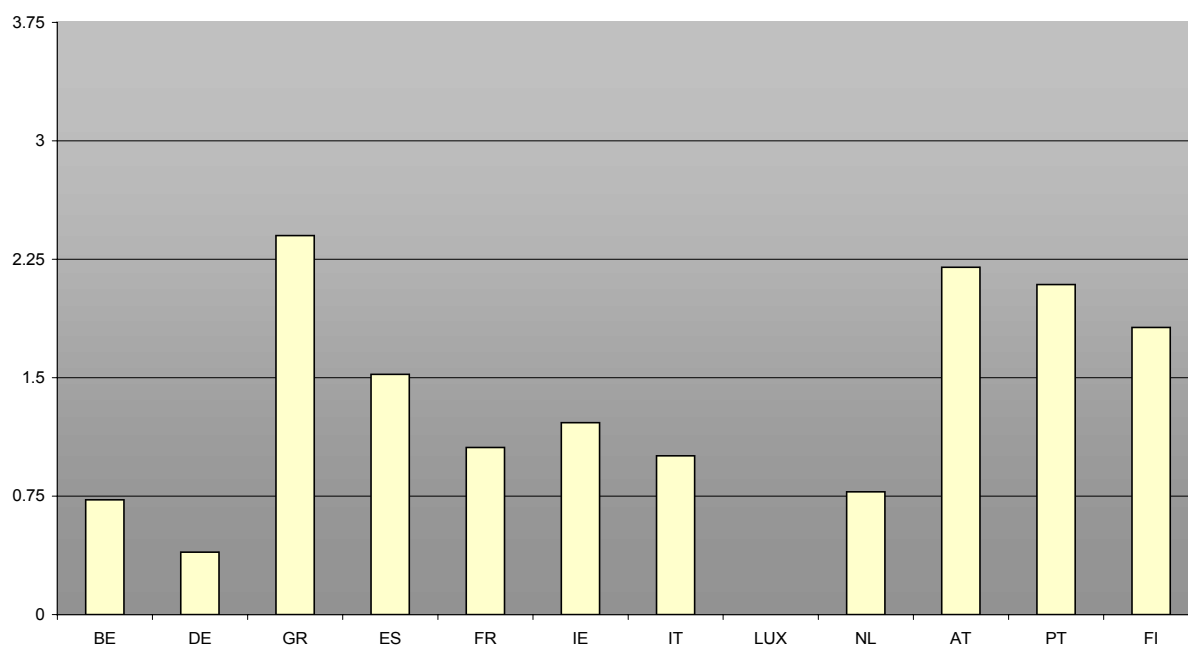
Figure 1**Sacrifice Ratios for the Euro-area countries**

Figure 2

