The role of financial markets' openness in the transmission of shocks in Europe[1]

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Abstract: In this paper we report the results of a series of internal and external shocks on the Euro Area, using the National Institute's Global Econometric Model, NiGEM. The differences in impacts across countries are discussed, stressing the role of openness to the rest of the world, the nature of investment finance, the importance of wealth in different economies, and the impact of liquidity constrained consumers on the transmission mechanism. The link between financial market integration and channels of policy transmission is closely studied.

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Introduction

Shocks to equity markets appear to have a significant impact on the economy. These effects may come through their impact on the level of wealth and hence on consumption, and they may also come through their effects on investment. Barrell and Davis (2005) suggest that the investment channel in Europe is weak, but that the effects through consumption may be noticeable. In the first section of this paper we discuss the relationships between consumption, income and net financial wealth in the Euro Area countries. We then take these equations and embed them in our Global model NiGEM, which is discussed in section 2 of the paper where we report key differences in country models that influence the response to different shocks. Section 3 looks at the impacts of fiscal shocks, and section 4 looks at the impact of equity price changes on the European economies using this model. In both sections we attempt to relate the patterns we observe to differences in equity markets and in particular to the openness of equity markets, as this helps export shocks but also increases vulnerability to foreign shocks. Section 5 concludes.

We report results for fiscal shocks and equity price shocks because they allow us to stress the differences between single country shocks and regional or global shocks. We choose a fiscal shock because its dimensions are well known, and it illustrates the roles of wealth and of equity markets in absorbing and dispersing a variety of demand shocks. The differences in impacts across Euro Area countries are discussed, stressing the role of openness to the rest of the world, the importance of wealth in different economies, and the impact of liquidity constrained consumers on the transmission mechanism. The link between financial market integration and channels of policy transmission is closely studied. We compare the impact of single country fiscal shocks, where government spending is increased in one country at a time, to results for a Euro Area-wide rise in government spending. This illustrates the role of openness and integration on spillovers from external shocks. We then discuss the impact of an equity market shock in the Euro Area, discussing the transmission of equity prices to GDP. We compare results of single country shocks to a global shock. This illustrates that the impact of equity markets on GDP is significantly greater when the shock is more widely spread, and therefore that contagion will magnify the response to an equity price shock.

1. Consumer Behaviour

The life cycle hypothesis of consumption and saving forms the baseline for a great deal of empirically usable work on consumption, suggesting as it does that consumers

accumulate assets during working life so as to live on the surplus during retirement. Accordingly, planned consumption is a function of total wealth, based on human wealth (earnings) and non-human wealth (financial and tangible assets), as in the version of the Life-Cycle Hypothesis derived in Deaton (1992). In this model, planned consumption (C_t^*) is a function of total wealth. Total wealth is the sum of human wealth (H_t) and non-human wealth (W_{t-1}). Planned consumption can accordingly be expressed as a function of H_t and W_{t-1}

$$C_t^* = m\left(H_t + W_{t-1}\right) \tag{1}$$

where *m* is the Marginal Propensity to Consume (MPC) out of total resources on average across the population. Unobservable human wealth can be proxied by some function k of current labour income (i.e. $H_t = kY_t$).

The coefficient on human wealth (i.e. income) will be boosted when there are liquidity constraints on the availability of credit, since it implies that current consumption is closely tied to receipts of current income. Ultimately, with strong liquidity constraints (no liquid wealth and no borrowing facilities) the equation would reduce to the naïve Keynesian equation with income only. More realistically, the ability to consume out of wealth, and in particular illiquid wealth, is enhanced when there are no liquidity constraints, and such wealth can be used to enhance consumption smoothing over time – either directly via decumulation or as security for borrowing. Hence we should expect that the dynamics of adjustment and the long run equilibrium in consumption equations will be influenced by the existence of liquidity constraints.

An indicator of the incidence of liquidity constraints can be constructed from the relative size of both the short and long run coefficients on income and those on financial and non-financial wealth terms in the consumption function. When there are no credit constraints, as in a liberalised financial system, the impact of current income in the short run should be low, since consumers can borrow to cover shortfalls in income. Correspondingly, the short run impact of wealth will be high, since it can be either directly decumulated or used as collateral for borrowing. On the other hand, we might expect to see a relatively larger role for recent changes in income in systems with more liquidity constrained consumers, whilst financial and especially non-financial wealth may have more influence when liquidity constraints are lower. Consequently, to the extent that wealth and income channels are affected, the multiplier effect associated with external shocks and economic

policy will be influenced by the proportion of those facing liquidity constraints, as is examined and discussed in the transmission of fiscal policy in Al-Eyd and Barrell (2005).

Following equation (1), if we assume that planned consumption does not always equal actual consumption and that human wealth can be proxied by some function *k* of current labour income we can derive the following relationship for actual consumption.

$$C_t = mkY_t + mW_{t-1} + \varepsilon_t \tag{2}$$

However, this approximation of consumption behaviour has problems in describing consumption, income and wealth relationships, especially in growing economies. As suggested by Campbell and Deaton (1989), real income in levels is unlikely to be difference stationary. In particular, the first difference of the level of income does not display constant variance; earlier increases in the level of income, in any reasonable sample of data, are likely to be substantially less than increases later in the sample.

This non-constant variance would mean any long-run relationship for consumption would be potentially spurious, given that not all of our variables are difference stationary, and a short run error correction model (ECM) for consumption would have non-stationary dynamics. Campbell and Deaton (1989) argue that most logarithmic specifications fit the data much better than the linear relationship between, for example, the ratio of consumption to income and the ratio of wealth to income. We adopt a logarithmic approximation for equation (2) to ensure that income, in natural logs, is difference stationary and hence that our long-run relationship can be non-spurious.

$$\ln C_t = c_0 + \alpha \ln Y_t + \beta \ln W_{t-1} + \xi_t \tag{3}$$

In the presence of non-stationary data, we avoid using a static regression approach by utilising a dynamic error correction model as does much of the recent literature. Recent studies such as Davis and Palumbo (2001) and Lettau and Ludvigson (2004) use the ARDL (autoregressive distributed lag) approach to estimation, with an error correction specification derived from (3), having terms in consumption, real personal disposable income and real net wealth, and short run dynamics. They include housing wealth data for the US, whilst this is not available for most countries in our sample. Instead we include as a proxy in the dynamics the change in the log of real house prices (RPH). Our econometric approach hence involves the following consumption specification:

$$\begin{aligned}\Delta \ln C_t = {} & \alpha_0 + \lambda\left[\ln C_{t-1} - \beta_1 \ln Y_{t-1} - (1-\beta_1)\ln W_{t-1}\right] + \gamma_{1i}\Delta \ln W_{t-i} \\ & + \gamma_{2i}\Delta \ln Y_{t-i} + \gamma_{3i}\Delta \ln RPH_{t-i}\end{aligned} \tag{4}$$

In order to test formally the validity of the long run cointegrating relationship between consumption, income and wealth, we run a series of regressions based on equation (3) and conduct standard ADF tests on the residuals. Table 1 details the results for three regressions, where the first represents equation (3), the second imposes homogeneity across coefficients ($\alpha+\beta=1$) and the third repeats equation (3) with the addition of a single step-dummy based on known structural reforms in the Euro Area.[3]

Table 1: Long run cointegrating relations ADF tests

	BG	**IT**	**FN**	**FR**	**GE**	**GR**
Sample	74Q1-04Q4	74Q1-04Q4	79Q1-04Q4	74Q1-04Q4	74Q1-04Q4	74Q1-04Q4
E	-2.108	-3.433	-3.074	-2.291	-2.536	-4.398
E*	-2.109	-3.168	-3.016	-1.520	-2.254	-2.118
E**	-2.652	-3.926	-2.994	-2.297	-3.477	-5.485

	NL	**OE**	**PT**	**IR**	**SP**
Sample	74Q1-04Q4	74Q1-04Q4	74Q1-04Q4	77Q2-04Q4	82Q1-04Q4
E	-2.103	-2.081	-2.636	-3.992	-4.588
E*	-2.496	-1.289	-2.126	-4.062	-4.122
E**	-4.151	-1.982	-4.373	-3.519	-3.429

Fourth order ADF test statistics reported
Residuals E reported from the following cointegrating regressions, where "delta" is a step dummy and critical values are from MacKinnon (1991):

1. lnC = a + b*lnRPDI + c*lnRNW + E — 5% critical value = -3.74
2. lnC = a + b*lnRPDI + (1-b)* lnRNW + E* — 5% critical value = -3.33
3. lnC = a + b*lnRPDI + c*lnRNW + delta + E** — 5% critical value = -4.10

Overall, the test statistics do not reveal strong cointegrating relations. However, it is instructive to note that reform-based step equations show significant improvements in the test statistics when there is little difference between the first two equations. This clearly holds for Germany, Greece, the Netherlands, and Portugal, with positive, but slighter improvements for Belgium and Italy. Indeed, the sample lengths employed are speckled with various reforms which can give rise to structural shifts, and this introduce a unit root in a series when, in fact, it would otherwise be found to be stationary (see Perron (1989)). Therefore, without taking account of every potential break in the data, it would be difficult to conclude that these relations fail to cointegrate. Another measure for assessing the cointegrating relation is advocated by Banerjee et al. (1993), who suggest that in a full error correction model, finding an ECM term (λ in equation (4)) with a t-statistic greater than 3 (in absolute value) provides strong evidence of a cointegrating relation. In

[3] Perron-step dummys are: BG, 1997 pensions reform; FN, 1991 employment reform; FR, 2000 employment reforms; IT, 1995 pensions reforms; UK, 1996 non employment benefits reforms; and SP, 1997 pensions reforms.

view of the results in Table 1 we examine this evidence in the full set of consumption estimates, to which we now turn.

In each case we started with a general model in the form of equation (4) and eliminated sequentially those variables that were not significant. Our results are consistent with those of Lettau and Ludwigson (2004), although as we noted we use a different definition of wealth, as there are no housing wealth data available for most countries in our sample. Hence, we use a different definition of income, as the absence of housing wealth suggests that we should use an income variable that includes income from housing. Lettau and Ludwigson (2004) argue that when wealth changes one must distinguish between the signal about longer run prospects one reads from the change and the noise related to temporary fluctuations in market values. We denote the structural component of wealth as W* and the transitory component as (W-W*). We would expect that the propensity to consume out of transitory wealth would be much lower than out of permanent wealth (i.e. $v_1 >> v_2$ below). A rise in equity or bond prices may reflect changes in long term interest rates or market perceptions of the future value of the equity stock that do not impact on the income flow from the asset, which we would denote r*W*. If wealth is held only for the income flow, then it would be wise to use this flow in our relationship rather than the stock of wealth. We may write this as:

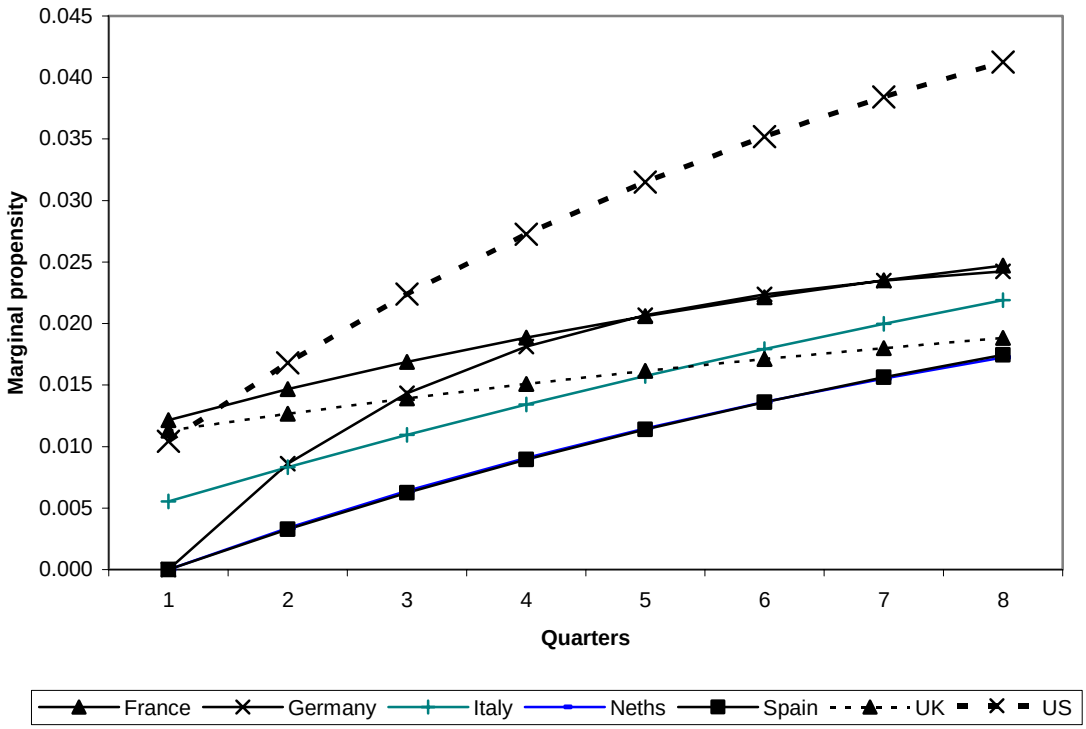
$$C_t^* = m\left(kY_t + W_{t-1}\right) = m(kY_t + k_1 r^*_t W^*_{t-1} + v_1 W^*_{t-1} + v_2 (W_{t-1} - W^*_{t-1})) \qquad (5)$$

If $k=k_1$ then we should use total income instead of labour income in our regressions in order to avoid polluting (and perhaps exaggerating) our estimates of the effects of wealth. However, it is possible that wealth is held for precautionary reasons, as Carroll (2001) stresses, and not only for its income flow or its ability to shift consumption over time. Hence we should include both the income flow and the level of wealth, but also distinguish in our analysis between transitory and permanent changes in wealth.

We estimate error correction equations below, and we can interpret the long run error correction as embedding the permanent components of income and wealth, using the log approximation favoured by Lettau and Ludwigsen and others. We report our results in Table 2 below. The impact coefficients of a change in wealth and a change in income can be interpreted as the impacts of a change in transitory wealth and of transitory income. We would expect the effects of transitory income to be high only in countries where there are noticeable liquidity constraints, as Barrell, Davis and Pomerantz (2004) suggest. Impact effects from income are present in all countries except Spain, and they are large in Germany and also in Greece and Finland. We would expect the ability for consumers to

extract a signal from a change in their financial wealth to be greater in countries where more of equity based wealth was held directly by individuals, as is suggested in Barrell and Davis (2005). Impact effects from changes in wealth are present in Finland, France, Ireland and Italy but in all cases the impacts are small at around 0.02. The longer run impacts are still small, but they vary in size between 0.03 to 0.05 in Austria and Germany, to larger than that in Italy, and they are generally around 0.1. Chart 1 plots the marginal propensity to consume out of wealth from these equations using the 2004 ratio of consumption to net financial wealth and compares it to the MPC for the UK and the US[4]. If a rise in wealth is sustained, then consumption rises over time through the lagged term in the error correction mechanism. But initially the rise is less than 0.02 per cent of the rise in wealth, and for a number of countries there is no response from consumption in the first period. These low MPC from wealth numbers suggest that we should generally observe rather low impacts from changes in equity prices on consumption, but that the impact should be related to the ratio of the value of domestic equities held by domestic residents as a proportion of their total net wealth.

Chart 1: Time profile of the marginal propensity to consume out of wealth



[4] The MPC = dC/dNW=dlogC/dlogNW*C/NW and hence we need to know the average propensity to consume out of wealth, or the consumption wealth ratio, as well as the elasticity of consumption with respect to wealth.

Table 2: Single Equation Consumption Estimates

	BG	FN	FR	GE	GR	IR	IT	NL	OE	PT	SP
Sample	74Q1-04Q4	79Q3-04Q4	81Q2-04Q4	74Q1-04Q4	78Q2-04Q4	77Q3-04Q4	74Q1-04Q4	74Q1-04Q4	80Q1-04Q4	80Q4-04Q4	80Q1-04Q4
Constant	-0.012 (1.4)	-0.001 (0.6)	-0.016 (3.0)	-0.06 (4.4)	-0.005 (1.6)	-0.018 (3.2)	-0.03 (3.5)	-0.021 (2.3)	-0.007 (1.1)	-0.055 (6.25)	-0.008 (3.1)
ECM	-0.047 (2.1)	-0.074 (2.2)	-0.115 (4.2)	-0.334 (5.3)	-0.038 (3.4)	-0.094 (3.5)	-0.06 (5.2)	-0.107 (4.0)	-0.0612 (2.0)	-0.107 (3.6)	-0.093 (3.3)
LRPDI(-1)	0.94 (19.1)	0.92 (40.4)	0.92 (37.3)	0.95 (74.2)	0.89 (30.6)	0.89 (28.01)	0.79 (27.9)	0.88 (24.6)	0.968 (20.04)	0.909 (20.9)	0.93 (37.0)
LRNW(-1)	0.06	0.08	0.08	0.05	0.11	0.11	0.21	0.12	0.032	0.0911	0.07
D ln RPDI	0.17 (2.0)	0.44 (5.7)	0.34 (2.6)	0.741 (13.3)	0.48 (7.8)	0.28 (4.7)	0.13 (2.0)	0.10 (2.0)	0.226 (3..9)	0.080 (2.1)	
D ln RNW		0.017 (1.8)					0.022 (1.8)				
D ln RNW(-1)			0.028 (2.4)			0.026 (2.5)					
D ln RPH	0.06 (1.7)	0.15 (7.3)		0.157 (2.6)				0.084 (2.8)		0.253 (5.6)	0.071 (2.9)
Intercept dummy			92Q1	90Q1			80Q1	80Q1			90Q1
Single-point dummies			96Q1				78Q2 80Q1 92Q3- -93Q2 97Q2	74Q1 77Q3 78Q4 82Q1 84Q1			
SE	0.005	0.005	0.005	0.006	0.007	0.005	0.005	0.008	0.012	0.005	0.005
LM(4)	5.4	7.0	7.2	6.8	4.9	4.9	9.1	2.6	12.9	5.4	2.1

Note: Wealth data are not available after 1997 for Ireland and Greece, but we estimate the level of financial wealth based on published data for all components.

We also include dynamic terms in house prices in these equations for all countries where they are significant. Appendix Table A1 reports preliminary equations that include dynamic terms in the log of house prices and real net financial wealth in all countries. Only those that are significant at the 10% level have been retained in Table 2. House price effects are significant in Belgium, Finland, Germany, Netherlands, Portugal and Spain. The appendix table also includes equations for the US and UK produced on a similar basis, but using housing wealth rather than house prices. In both cases the dynamic effects of housing wealth make a significant contribution. In general house price effects are significantly larger than equity price effects in the short run, reflecting the greater ease with which consumers can observe, evaluate and borrow against their housing wealth. House price effects are generally more visible in countries with more liberalised financial markets, although interestingly they are present in Germany and absent in France in our results.

2. Overview of NiGEM

NiGEM is an estimated model, which uses a 'New-Keynesian' framework in that agents are presumed to be forward-looking but nominal rigidities slow the process of adjustment to external events. All countries in the OECD[5], including those in transition, are modelled separately. In addition, we have separate models of China, Russia, Hong Kong, Taiwan, Brazil, Estonia, Latvia, Lithuania and Slovenia. The rest of the world is modelled through regional blocks: Latin America, Africa, East Asia, Developing Europe, Opec and a Miscellaneous group mainly in West Asia. All models contain the determinants of domestic demand, export and import volumes, prices, current accounts and net assets. Economies are linked through the effects of trade and competitiveness and are fully simultaneous. There are also links between countries in their financial markets as the model describes the structure and composition of wealth, emphasizing the role and origin of foreign assets and liabilities as well as the distinction between equity, bond and bank based assets, all of which are covered.

Models of the G7, EU-15, Poland, Hungary and the Czech Republic are more detailed than the other country and regional models. The core of each of these country models consists of a production function determining output in the long term; a wage-price block; a description of the government sector; consumption, personal income and wealth; international trade; and financial markets.

[5] With the exceptions of Iceland, Luxembourg and Turkey.

The NiGEM model allows forward-looking expectations in the wage and price system, interest rates and exchange rates and equity prices. A solution method is, therefore, needed that allows us to solve for their current and future values. We use the Extended Path Method of Fair and Taylor to obtain values for the future and current expectations and iterate along solution paths. Expectations are repeatedly recalculated until convergence is achieved. The model is solved far enough into the future so that the results are not affected by the terminal date, and terminal conditions are standard.

In order for the model to be theoretically coherent, there must not be any financial 'black holes' to absorb imbalances. Every export must be matched by an import, all liabilities must be matched by assets, all inward income flows from assets matched by outflows on liabilities and current accounts must add up across the world (to the normal degree of discrepancy). The model should be approaching an asset equilibrium by the terminal date. This in turn requires that the stock of government debt does not explode, necessitating a solvency constraint.

The structure of the trade block ensures overall global consistency of trade volumes by imposing that the growth of import volumes is equal to the growth of export volumes at the global level. Trade volumes and prices are linked by Armington matrices, based on 2000 trade patterns. The export demand variable is constructed as a weighted average of other countries' imports, which ensures approximate balance, and any discrepancy is allocated to exports in proportion to the country's share of world trade. Import prices depend on a weighted average of global export prices, and this ensures that the ratio of the value of exports to the value of imports remains at around its historical level. World flows of property income balance because all assets are matched by liabilities, revaluations of liabilities match those of assets and income flows match payments. Given all these elements balance, the model allocates net transfers from the OECD proportionately to the non-OECD blocks of Africa, Latin America, East Asia, Developing Europe and China, with East Asia and China taking residual flows.

NiGEM is used for both forecasting purposes and simulation studies. It is used to produce the Institute's quarterly forecast published in the *National Institute Economic Review*, and by a group of 50 model subscribers, mainly in the policy community. Usage both in the Institute and outside it is divided about equally between forecast related tasks and policy analysis. For a macroeconometric model to be useful for policy analyses, particular attention must be paid to its long-term equilibrium properties. At the same time, we need to ensure that short-term dynamic properties and underlying estimated properties are

consistent with data and well-determined. As far as possible the same theoretical structure has been adopted for each of the major industrial countries, except where clear institutional or other factors prevent this. As a result, variations in the properties of each country model reflect genuine differences in data ratios and estimated parameters, rather than different theoretical approaches. The behavioural equations have been mostly estimated individually, although key equations have been estimated in a panel framework.

Production and price setting

The major country models rely on an underlying constant-returns-to-scale CES production function with labour-augmenting technical progress. This constitutes the theoretical background for the specifications of the factor demand equations, forms the basis for unit total costs and provides a measure of capacity utilization, which then feeds into the price system.

Demand for labour and capital is determined by profit maximasation of firms, implying that the long-run labour-output ratio depends on real wage costs and technical progress, while the long-run capital output ratio depends on the real user cost of capital. The user cost of capital is influenced by the forward-looking real long-run interest rate, as well as by corporate taxes and depreciation. The user cost of capital variable is calculated from data for the past, but individual firms take account of risk on their investments when undertaking projects. The risk premium can be varied in scenarios and forecasts. Business investment is determined through the identity relationship of investment, depreciation and the capital stock. Housing investment depends on real disposable income and real interest rates.

Prices are determined as a constant mark-up over marginal costs in the long term. Our core price equations relate the producer price to the unit total cost function implied by our production function. Import prices also feed into producer prices, while consumer prices are determined by producer prices, import prices and unit labour costs. The price equations are all statically homogenous, and in most cases exhibit dynamic homogeneity as well. Capacity utilisation is determined by the production function in simulation mode, and if output is above capacity producer prices rise more rapidly.

Labour market

We assume that employers have a right to manage, and hence the bargain in the labour market is over the real wage. Real wages, therefore, depend on the level of trend labour productivity as well as the rate of unemployment. We assume that labour markets

embody rational expectations and that wage bargainers use model consistent expectations. The equations are estimated within a stylized version of the bargaining framework of Layard *et al* (1991). The dynamics of the wage market depend upon the error correction term in the equation and on the split between lagged inflation and forward inflation as well as on the impact of unemployment on the wage bargain.

There is no explicit equation for sustainable employment in the model, but as the wage and price system is complete the model delivers equilibrium levels of employment and unemployment. An estimate of the NAIRU can be obtained by substituting the mark-up adjusted unit total cost equation into the wage equation and solving for the unemployment rate [6]. The labour supply is determined by demographics and an exogenous participation rate.

Consumption, personal income and wealth

Consumption decisions are presumed to depend on real disposable income and real wealth in the long run, and follow the pattern discussed in the previous section. Total wealth is composed of both financial wealth and tangible (housing) wealth where the latter data is available. Financial wealth depends on foreign and domestic equity and bond prices and on the accumulation of assets. In all cases there is an estimate of the decomposition of assets into domestic and foreign equities and bonds.

Where housing wealth is absent house prices play a separate role. The dynamics of adjustment to the long run, which are central to a forecast, are data based, and differ between countries to take account of differences in the relative importance of types of wealth and of liquidity constraints. Personal incomes are also forecast in each country building up from components. Employment income comes from the labour market models. Taxes and transfers come from the public sector models. Rents, dividends and interest incomes are flows on the accumulated stocks of assets.

The evolution of gross financial assets and liabilities follows common modeling practice such as adopted by Masson *et al* (1990) and we assume that the personal sector has ultimate ownership of all domestically held financial assets. Each country on the model has a stock of foreign assets and a stock of liabilities. These are linked to the stock of domestic financial assets and the stock of domestic private sector and public sector liabilities. A proportion of government debt is owned abroad, as are proportions of the national stock of equities and the stock of banking assets. Some national financial wealth

[6] The labour market in NiGEM is discussed in more detail in Barrell, Becker and Gottschalk (2003)

is held in foreign equities and bonds as well as banks. Income flows from asset stocks are allocated in relation to ownership, and hence net property income from abroad depends on income receipts and payments on bonds, equity holdings and bank assets. The wealth and accumulation system allows for flows of saving onto wealth and for revaluations of existing stocks of assets in line with their prices. When foreign equity and bond prices change, domestically held assets change in value.

External trade

International linkages come from patterns of trade, the influence of trade prices on domestic price, the impacts of exchange rates and patterns of asset holding and associated income flows. The volumes of exports and imports of goods and services are determined by foreign or domestic demand, respectively, and by competitiveness as measured by relative prices or relative costs. It is assumed that exporters compete against others who export to the same market as well as domestic producers via relative prices; and demand is given by a share of imports in the markets to which the country has previously exported. Imports depend upon import prices relative to domestic prices and on domestic total final expenditure with the same long run elasticity in all countries. As exports depend on imports, they will rise together in the model.

Financial markets

We assume that exchange rates are forward looking, and 'jump' when there is news. The size of the jump depends on the expected future path of interest rates, and these, in turn, are determined by policy rules adopted by monetary authorities[7]. It is assumed that the monetary authorities adopt simple targeting rules that stabilise the price level or the inflation rate in the long term. Forward looking exchange rates have to look one period forward along the arbitrage relation involving domestic and foreign short term interest rates, with expected exchange rates next period being solved for in the same way to produce a forward recursion. We assume that bond and equity markets are also forward looking, and long-term interest rates are a forward convolution of expected short-term interest rates. Forward looking equity prices are determined by the discounted present value of expected profits. The discount factor is made up of the nominal interest rate and the risk premium on equity holding decisions.

[7] See Barrell and Dury (2000) for a discussion of monetary and fiscal policy rules in NiGEM.

Public sector

Each country has a set of equations for the public sector. Both direct and indirect taxes depend upon their respective tax bases and on the tax rate. Government spending on current goods and services and investment spending depend in part on current plans, and by default rise with trend output. Transfer payments depend upon unemployment and the dependency ratio as well as on policy. Government interest payments are determined by a perpetual inventory model based on the flow deficit and the stock of debt, with the appropriate structure of short and long-term interest payments on the debt stock.

Budget deficits are kept within bounds in the longer term, and income taxes rise to do this. This simple feedback rule is important in ensuring the long run stability of the model. Without a solvency rule (or a no Ponzi games assumption) there is no necessary solution to a forward-looking model.

Key structures

A New-Keynesian model allows exogenous nominal shocks to have real impacts in the short to medium term, as rigidities slow the process of adjustment to external events. However, these are crowded out in the long term, and the economy reverts to equilibrium. An exogenous rise in demand is eventually offset by the negative impact of temporarily higher inflation, due to higher wage costs as the labour market becomes tighter and the direct effect of higher capacity utilization on price. The temporary rise in inflation dampens consumption growth and net exports, and the economy reverts to equilibrium. Certain shocks will change the long-run equilibrium of the economy, such as a change in population projections or labour market reforms that shift the equilibrium unemployment rate, and the model allows the economy to move gradually towards this new equilibrium.

The speed of adjustment reflects estimated parameters that capture differences in flexibility across economies, as well as on assumptions made about monetary and fiscal policy. Table 3 reports key ratios for the Euro Area economies, and these help explain some of the differences in behaviour exhibited by the different country models. Stock market capitalization as a share of personal sector financial wealth captures the sensitivity of consumption to equity prices. All else being equal, we would expect to see a greater response to consumption in the Finland and Spain following an equity price shock than we would in Austria or Italy. The stock of personal sector financial liabilities relative to income partly captures the sensitivity of consumers to interest rates. We would therefore expect an interest rate rise to have a bigger impact on consumers in the Netherlands than

in Greece. The short-term impact of a rise in real personal disposable income on consumption is a measure of liquidity constraints on consumers. These parameters are reported as the coefficient on the change in the log of real personal disposable income in Table 2 above. This is somewhat higher in Germany than in other Euro Area economies, suggesting a stronger initial response of consumption to shifts in income.

Table 3: Key data ratios

	Stock market capitalization/ Personal sector net financial wealth (2004)	Personal sector financial liabilities/ Disposable income (2004)	Share of domestic stock market capitalization held abroad[8] (2004)	Openness: Total Trade/ GDP (2004)	Euro Area trade/ Total trade (2000)	Import Penetration: Imports/ Total final expenditure (2004)
Belgium	0.29[a]	0.67[a]	0.19[a]	1.75	0.59	0.46
Finland	1.43	0.81	0.61	0.78	0.34	0.26
France	0.54	0.81	0.43	0.57	0.51	0.22
Germany	0.34	1.07	0.39	0.76	0.45	0.26
Greece	0.28[b]	0.18[b]	0.30[b]	0.56	0.42	0.25
Ireland	0.47[b]	0.53[b]	2.62[b]	1.55	0.30	0.41
Italy	0.20	0.53	0.12	0.57	0.47	0.22
Netherlands	0.72[c]	2.05	0.54[c]	1.41	0.50	0.40
Austria	0.26	0.78[a]	0.67	1.02	0.56	0.33
Portugal	0.39[c]	1.32[a]	0.31[c]	0.76	0.66	0.30
Spain	0.81	1.09	0.34[a]	0.65	0.55	0.26

[a] 2003; [b] 1996;[c] 2001

Source: NiGEM database, NiGEM model, Eurostat, IMF International Financial Statistics

The share of the domestic stock market capitalization held abroad illustrates the extent to which the benefits of domestic equity price developments are likely to leak abroad. The higher this ratio, the smaller we would expect the impact of a unilateral equity price rise to be on domestic GDP. All else being equal, we would therefore expect to see a bigger impact from an equity price rise in Italy or Belgium than we would in Finland or Austria, where over 60 per cent of equities are held abroad.

Trade relative to GDP is a measure of the openness of an economy. The more open the economy, the more sensitive it is to external shocks, while the less sensitive it is to domestic shocks. The Netherlands, Ireland and Belgium are very open economies, while the France, Italy and Greece are less sensitive to external developments. The share of trade conducted within the Euro Area reflects the extent to which trade is protected

[8] The figures for Ireland are difficult to interpret, reflecting differences in the International Investment Position data reported by the IMF and stock market capitalization data reported by Eurostat.

against exchange rate developments. Finland and Ireland are more exposed to exchange rate developments than other Euro Area countries, while Portugal is relatively insensitive to the exchange rate. Imports relative to total final expenditure capture import penetration. This indicates the extent to which a rise in domestic demand will be offset by import leakages. There is a greater offsetting impact in Belgium, Ireland and the Netherlands, while there is less import penetration in France and Italy.

Of course properties of single equations and key ratios cannot in themselves explain the adjustment path of individual country models following a shock. All equations must be taken together to determine the speed and magnitude of adjustment following a shock. In the next section we compare the results of model simulations across countries to determine the aggregate impact of the factors mentioned above and other key parameters in each country model.

3. Fiscal Expansion

Tables 4-5 report the results of a series of shocks to government spending. We examine the impact of an expansionary fiscal policy in each of the Euro Area countries and in the UK, Sweden, Denmark, Poland, Hungary and the Czech Republic. These results are compared to a simulation where all Euro Area economies raise government spending at the same time. In each of the simulations we raise government consumption expenditure by 1 per cent of GDP for 2 years. In order to allow the shock to have an impact, we hold short term interest rates fixed for 2 years, so that the expansion is not immediately offset by a monetary tightening. After 2 years, we allow monetary policy to be determined by our standard feedback rule, which targets inflation and a nominal aggregate. We also impose a solvency constraint on the government that operates only after the two year shock has been removed, so that tax rates adjust to bring the government budget balance back to base.

Although fiscal and monetary responses do not take place immediately, the model is forward looking, so equity, bond and exchange rate markets all react to expected developments. There will be a monetary response after two years that depends upon the extent to which the shock concerned leaves output and inflation above base from year three onwards. If interest rates are increased on average from year three, then the long rate will increase in the first year of the shock and bond prices will fall. Moreover, since equity prices are the discounted present value of future profits, an increase in activity will raise profits and hence share prices may rise in the short term. But this is offset by the negative impact of higher long rates, and in the second year of the shock equity prices in

the Euro Area tend to fall. The exchange rate will appreciate immediately in anticipation of expected future rises in interest rates. All three of these financial market developments will help crowd out the impact of the increase in spending.

Table 4: Single country government consumption shocks - Real GDP multipliers*
(per cent difference from base)

	2005	2006	2007
Belgium	0.164	0.299	0.257
Finland	0.426	0.615	0.299
France	0.593	0.650	0.150
Germany	0.532	0.597	0.142
Greece	0.532	0.580	0.156
Ireland	0.255	0.302	0.085
Italy	0.512	0.703	0.273
Netherlands	0.406	0.422	0.027
Austria	0.525	0.622	0.174
Portugal	0.469	0.543	0.131
Spain	0.382	0.612	0.359
Czech Republic	0.313	0.343	0.364
Denmark	0.578	0.704	0.609
Hungary	0.506	0.445	0.363
Poland	0.821	0.849	0.913
Sweden	0.386	0.538	0.277
UK	0.616	0.696	0.056

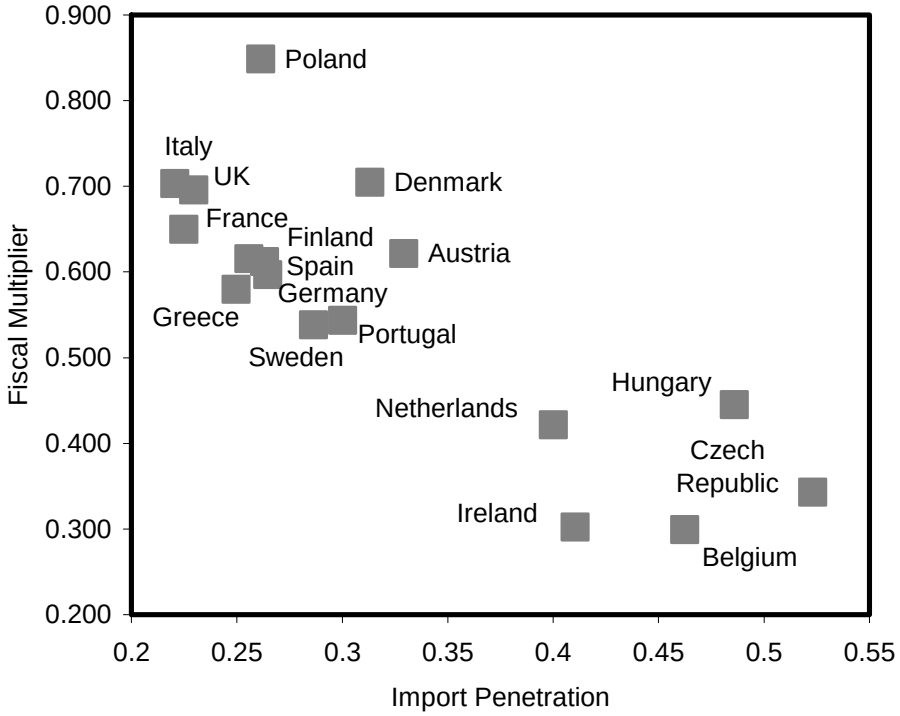
* All government consumption equations are shocked by 1% of real GDP for 2 years with interest rate effects and government solvency rules exogenous during the shock period.

The initial impact on GDP peaks after 2 years in most countries; however, in the single country shocks, the peak impact is in the first year for Hungary and the third year for the Czech Republic and Poland, while in the global shock, the peak impact is in the first year for both Ireland and Hungary. As unemployment falls below its equilibrium level and capacity utilization increases, wages start increasing and inflation picks up. The peak in inflation typically lags behind the peak in the output response, due to a gradual adjustment process reflecting economic rigidities. After two years, monetary policy becomes endogenous, and we see a rise in the interest rate. Of course, in the single country shocks the interest rate response is small, especially for the smaller Euro Area countries such as Finland, Greece, Ireland and Portugal, as the small rise in inflation exhibited by these countries has little impact on the ECB target for the Euro Area as a whole. The exchange rate is forward looking, so it strengthens in the first quarter of the simulation in anticipation of the interest rate rise. Export prices rise relative to import prices, and there is a deterioration in net trade, partially offsetting the increase in output given by higher spending. In the long-run, GDP, unemployment and inflation return to their baseline values, so there is complete crowding out of private sector expenditure by

public expenditure if the increase is permanent and financed by taxes. The long-run equilibrium is reached within about 10 years.

The fiscal multipliers are highly correlated with the *import penetration ratios* reported in Table 3. Chart 2 plots fiscal multipliers two years after the single country shocks against this measure of import penetration. As import penetration rises, the fiscal multiplier falls, as a greater share of the rise in government spending is offset by import leakages. This is seen clearly for the very open economies of the Czech Republic, Belgium, Hungary and Ireland. Fiscal multipliers are larger in Italy, the UK, France and Poland, where import penetration is relatively low.

Chart 2: Fiscal multipliers and import penetration



Multipliers are weakly negatively correlated with the *proportion of investment in GDP*, but the correlation of -0.13 with the second year multiplier suggests that this form of crowding out is noticeably less important than that from direct leakages into imports, evidenced by a correlation of -0.93 with the *import penetration ratios* illustrated above.[9] This finding, however, is largely a reflection of the design of the experiment, as temporary single country shocks in members of a larger monetary union do not elicit

[9] See Appendix Tables A.2 to A.6 for full set of correlations listed by simulation type.

much response from real long term interest rates and hence investment. If the increase in spending were permanent, then we would see more impact on real long rates and more crowding out through the investment channel.

Given the weak nature of Euro Area wealth effects in consumption and the relatively modest fall in equity prices induced in the second year of this shock, the fiscal multipliers do not exhibit a strong correlation with equity market indicators. Nonetheless, these results illustrate how differences in the structure of financial markets in the Euro Area economies affect their response to domestic demand shocks. The more financially open the economy (as measured by the *ratio of foreign liabilities to GDP*) the lower is the multiplier, with negative correlations above -0.66 in the first year and -0.82 in the second year for each of these measures. This is much as we would expect given the results in Barrell and Gottschalk (2004), which suggest that increasing openness has reduced the volatility of cycles in the major economies. Financial openness acts as an automatic stabilizer in the same way as import leakages - the greater the stock of foreign liabilities, the more assets and income flows leak abroad when the economy expands. The *liquidity constraint parameter* is positively related to the fiscal multipliers in the first year of the shock, with a correlation of 0.35. Liquidity constrained consumers clearly adjust consumption patterns to a greater degree in response to a temporary rise in income. In the third year of the shock we see a negative correlation with the *liquidity constraint parameters*, with a correlation of -0.18, as unconstrained consumers exhibit a more gradual and sustained rise in consumption.

A fiscal expansion in one country also raises output in the rest of the world. The expanding country demands more imports, thus raising exports from the rest of the world. The expanding country also loses competitiveness as prices rise, and so loses some export market share to the advantage of the rest of the world. The Euro Area economies, therefore, exhibit a stronger response to an Area-wide fiscal expansion relative to a unilateral expansion. The major impact of this comes through trade, but some will come through cross holdings of equities and other financial assets. The correlation of the multipliers in response to an Area-wide shock with our financial openness measure (the *ratio of foreign liabilities to GDP*) is somewhat lower in this more general shock, but still indicates a close relationship, with a correlation of -0.58 in the second year. Generally, the greater the *share of financial wealth held in equities* the smaller the multiplier, with a correlation of -0.59 in the first year. This reflects crowding out from generally lower equity prices. The equity price response is more significant in response to an Area-wide shock, as the impact on Euro Area interest rates is more pronounced.

Table 5: Euro Area government consumption shock - Real GDP multipliers*
(per cent difference from base)

	2005	2006	2007
Belgium	0.294	0.541	0.462
Finland	0.560	0.798	0.357
France	0.766	0.800	0.107
Germany	0.687	0.771	0.157
Greece	0.656	0.694	0.133
Ireland	0.563	0.532	-0.010
Italy	0.674	0.908	0.308
Netherlands	0.871	0.913	0.014
Austria	0.901	1.003	0.148
Portugal	0.711	0.779	0.070
Spain	0.510	0.773	0.364
Czech Republic	0.302	0.465	0.234
Denmark	0.539	0.576	0.072
Hungary	0.751	0.674	-0.173
Poland	0.256	0.385	0.182
Sweden	0.217	0.229	0.001
UK	0.153	0.189	0.047
Euro Area Interest Rate (absolute diff. from base)	--	--	0.307

* All Euro Area government consumption equations are shocked by 1% of real GDP for 2 years with the Euro Area interest rate and government solvency rules exogenous during the shock period.

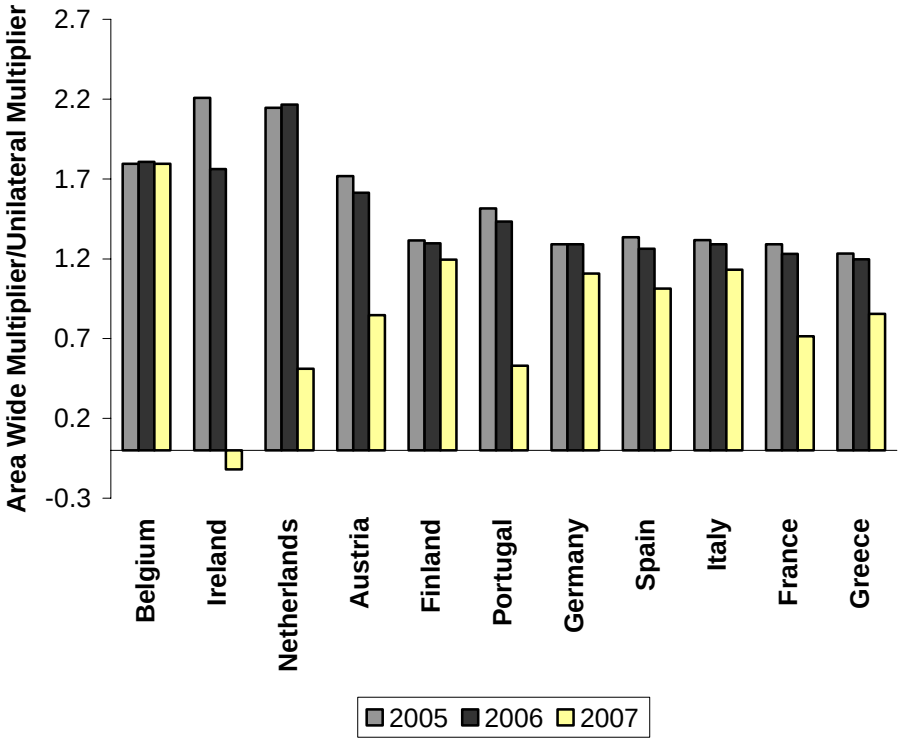
Chart 3 illustrates the size of the multiplier in each country in response to a Euro Area-wide fiscal expansion relative to a unilateral fiscal expansion for the first three years of the shocks. This can be thought of as a measure of spillovers from the rest of the Euro Area, where a figure greater than 1 indicates that the multiplier is larger in response to the Area-wide shock. Without exception, this is the case in the first two years of the shock in all Euro Area countries. However, we get very different responses in the third year of the shock, when monetary policy becomes endogenous. This reflects the significantly stronger interest rate response when all countries expand at the same time, and different sensitivities of the Euro Area economies to interest rates. Following a multi-lateral fiscal expansion, Euro Area interest rates rise by 0.307 percentage points in year 3. This compares to a rise of 0.004 to 0.11 in each of the unilateral shocks, with the size of the interest rate shift closely mirroring the relative sizes of the Euro Area economies.

In the first two years of the shock, the Euro Area-wide multipliers relative to the unilateral multipliers are highly correlated with the openness of the economy, measured as *total trade relative to GDP,* with a correlation coefficient of 0.89. The more open economies benefit more from spillovers in the form of stronger export demand from the

other expanding Euro Area countries. Those that conduct a higher *share of trade within the Euro Area* begin to reap additional benefits in the second and third years of the shock. In addition to the greater increase in demand for their exports, exchange rate shifts have less impact on their competitiveness as compared to those with low trade intensity within the Euro Area.

Chart 3: Area-wide multiplier relative to unilateral multiplier

Countries ordered from most open



The Euro Area shock has a more significant negative impact on financial wealth than the unilateral shocks, as higher long rates reduce both bond prices and equity prices. This leads to some crowding out of positive demand spillovers. The larger the *short-run impact of wealth on consumption*, the lower the spillovers in response to an Area-wide shock, with a negative correlation of -0.20 in the second year, rising to -0.33 in the third year. As we would expect from the marginal propensities to consume out of wealth illustrated in Chart 1, the relationship between spillovers and wealth strengthens gradually over time as transitory shifts in wealth are shown to be permanent. Spillovers are also strongly correlated with financial openness, with the *ratio of foreign assets to*

GDP yielding correlations of 0.84 and 0.64 in the first and second years of the shock, respectively.

4 Equity price shocks

The transmission mechanism of the financial sector of NiGEM is explored more closely in this section with a series of equity price shocks at the individual country and global levels. Tables 6-7 report the GDP multipliers emanating from an exogenous 10 per cent increase in equity prices that is sustained over two years. Single country shocks are reported for each of the Euro Area countries and the UK in Table 6, while Table 7 reports the results of a global equity price shock, where equity prices rise in all economies simultaneously.

The transmission of equity price shocks comes directly through asset price channels and indirectly through trade effects, where the magnitude of these disturbances depends on a several factors, including the degree of domestic stock market capitalization, the proportion of equities owned abroad, and the short and long run wealth effects in consumption and investment. Therefore, we would expect to find statistical correlations between measures of these indicators and the size of the multipliers determined from the shocks.

As discussed in Section 1, in countries where there is strong evidence of liquidity constrained behaviour and weak (or no) evidence of dynamic wealth effects, we would expect only marginal short run multiplier effects from the equity price shocks, but a build-up to a stronger long run effect. In addition, we would also expect the multiplier effects to be muted in countries where financial market liberalisation is less advanced, the marginal propensity to consume out of wealth is small and domestic stock market capitalization is low. Conversely, in countries with advanced financial systems, a larger propensity to consume out of wealth, strong dynamic wealth effects, and significant stock market capitalization we would expect to find larger multipliers.

Table 6 reports the single country equity price shocks where it is clear that the impact on GDP strengthens successively over the first three years. The evidence of short-run impacts of wealth on consumption is weak in all Euro Area economies. There is stronger evidence of long run wealth effects in the cointegrating vector, suggesting that this effect will feed through gradually over time. The delayed impact of the shock is pronounced in all of the Euro Area countries with the exception of the Netherlands and possibly Ireland, where the impact on GDP is largest in the second year. As the shock is temporary and

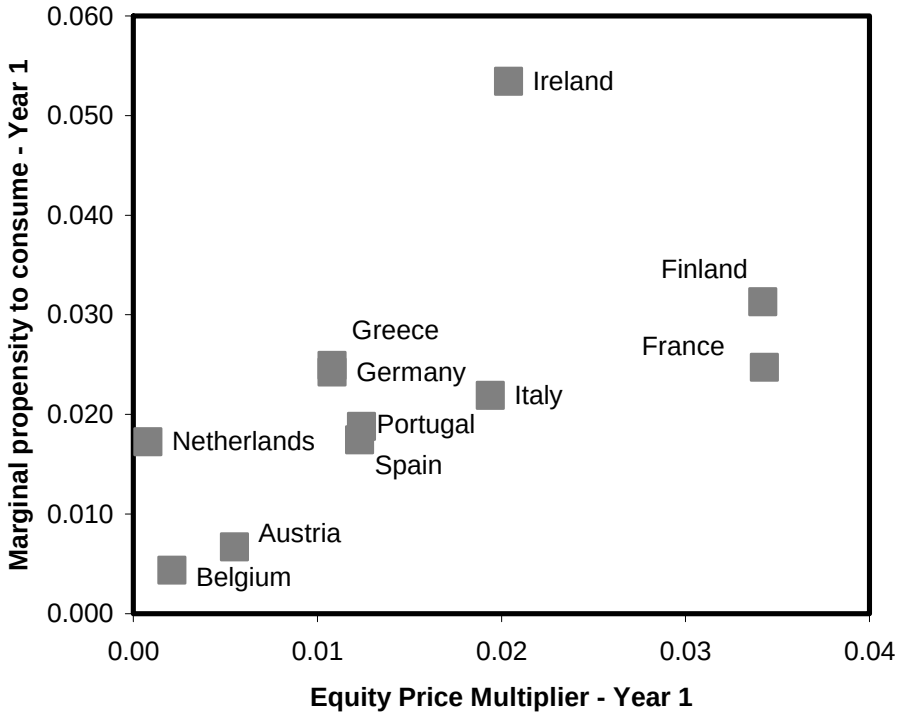
does not disrupt the long run determinants of supply or the wealth of the world economy, it has no long run effects. However, the actual pattern of adjustment in each country depends on the particular dynamics of consumption, asset accumulation and supply.

Table 6: Single country equity price shocks – real GDP multipliers*
(per cent difference from base)

	2005	2006	2007
Belgium	0.002	0.011	0.024
Finland	0.034	0.085	0.103
France	0.034	0.087	0.139
Germany	0.017	0.056	0.070
Greece	0.011	0.039	0.060
Ireland	0.020	0.051	0.051
Italy	0.019	0.057	0.073
Netherlands	0.001	0.002	0.001
Austria	0.006	0.023	0.041
Portugal	0.012	0.047	0.069
Spain	0.012	0.060	0.112
UK	0.034	0.073	0.054

* All equity price variables raised by 10% for 2 years

Chart 4: Equity shock multipliers and MPC out of wealth



The equity price rise has a direct impact on the financial wealth holdings of the personal sector. As financial wealth rises, so does consumer expenditure, with the size of the impact on consumption closely related to the marginal propensity to consume out of income shown in Chart 1. The relationship between the *marginal propensity to consume out of wealth* and the equity shock multipliers is illustrated in Chart 4, with a correlation of 0.66. Multipliers also depend on the *share of financial wealth held in equities*, and this is reflected in correlations of 0.43 and 0.47 in the first and second years of the shock, respectively. The *short-run impact of wealth on consumption* exhibits a correlation of 0.80 with the multiplier in the first year of the shock and 0.65 in the second year of the shock.

Single country equity price shocks that persist for only two years have a small impact on the domestic economy, as wealth effects on consumption are small and some equities are owned by foreigners. The equity leakages abroad have a small positive impact on output in the rest of the world, as does the rise in import demand in the shocked economy. But again, these effects are very small when equity price rises take place in one country at a time. Coordinated equity price movements are likely to have much larger effects. In recent years, equity market shocks have exhibited a high level of cross-country correlation (Davis, 2003), so we simulate a common global rise in equity prices where we find that spillover effects magnify the impact on output significantly. Table 7 reports the GDP multipliers in response to a global equity price rise of 10 per cent, sustained for two years. Standard monetary policy feedback rules and government solvency constraints are in place.

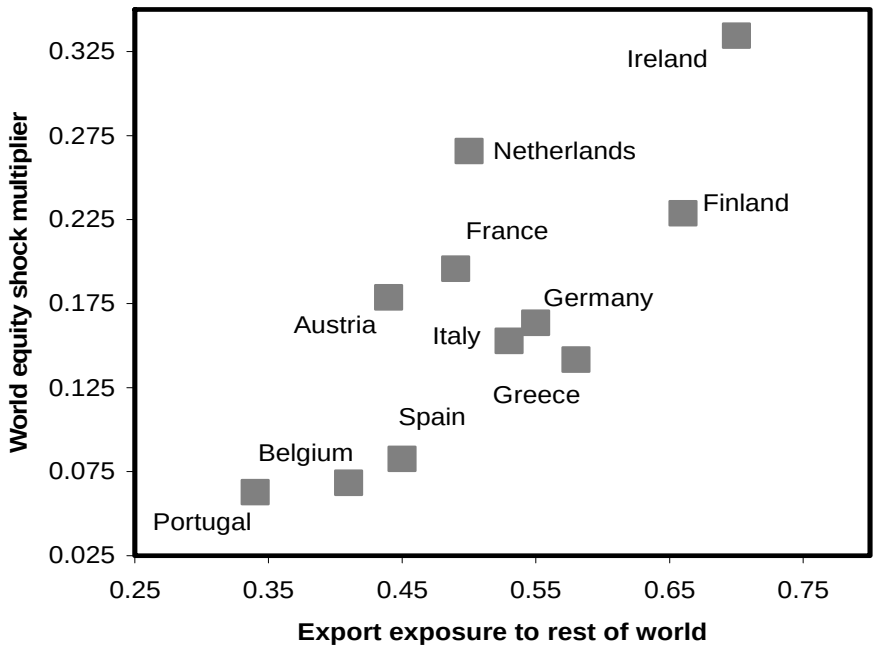
Table 7: World equity price shock - Real GDP multipliers*
(per cent difference from base)

	2005	2006	2007
Belgium	0.066	0.132	0.137
Finland	0.231	0.442	0.497
France	0.189	0.289	0.190
Germany	0.159	0.320	0.262
Greece	0.096	0.096	-0.025
Ireland	0.299	0.435	0.175
Italy	0.147	0.309	0.283
Netherlands	0.258	0.381	0.193
Austria	0.169	0.279	0.137
Portugal	0.078	0.022	-0.181
Spain	0.079	0.192	0.179
Euro Area	0.160	0.288	0.217
US	0.655	1.040	0.415
UK	0.172	0.270	0.165

* All equity price variables raised by 10% for 2 years

Multipliers tend to rise with *openness*, measured as the share of total trade to GDP, in response to a global shock, with a correlation of 0.31 in the first year. More open economies clearly benefit more from spillover effects. Financial openness and integration also has a positive impact on the multipliers, and the *ratio of foreign assets to GDP* shows a correlation of 0.63 in the first year. Trade exposure to countries outside the Euro Area is particularly important. This reflects the fact that equity price impacts in countries such as the US and the UK tend to be somewhat higher than they are in the larger Euro Area economies. The GDP multiplier in the first two years of the global shock is more than twice as high in the US than in any of the Euro Area economies. This is largely attributable to the presence of Tobin Q effects on investment in the US. We find that investment in the US tends to speed up when real equity prices rise. There is little evidence that the same holds true in EU economies. Without the Tobin's Q effect, the impact of an equity price rise on US output would be about 4 times smaller in the second year of the shock, and output would return to base much more quickly. There is also a greater marginal propensity to consume out of wealth in the US, as shown in Chart 1, and few liquidity constraints. It also reflects the greater importance of equities in the US economy, as stock market capitalisation in 2004 was approximately 125 per cent of GDP, whereas it was approximately 50 per cent of GDP in the Euro Area.

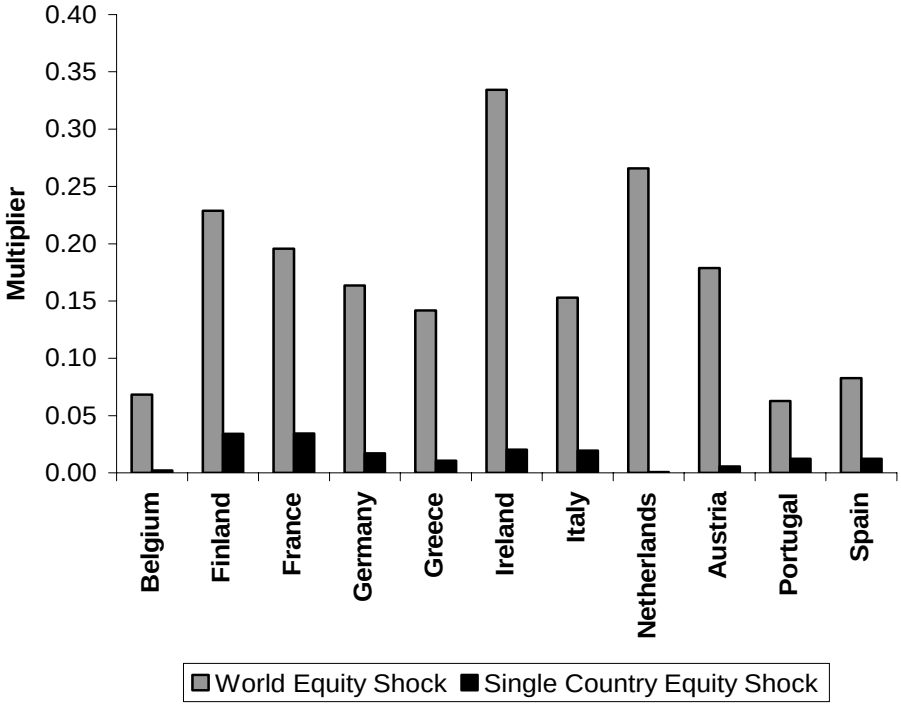
Chart 5: World equity shock multipliers and global export exposure



Those countries that conduct high levels of trade with the US, such as Ireland, tend to have higher multipliers. Chart 5 plots the impact on GDP after one year in response to a global equity price shock against the export exposure outside the Euro Area. Clearly, as exposure rises, the multiplier also tends to rise.

Impact effects of net wealth in consumption are also positively related with the multipliers showing strong and sustained effects over the short run, with correlations above 0.5 for the first three years. The multiplier effect stemming from the *MPC from wealth* is also strong and sustained with correlations of 0.72, 0.67 and 0.44 in the first three years, respectively.

Chart 6: World versus single country equity price multipliers



The importance of global spillover effects for Euro Area countries is illustrated in Chart 6, which illustrates the GDP multipliers in the first year associated with the world and single country equity price shocks. Roughly 80-90 per cent of the multiplier effects in the first two years can be attributed to global spillovers. Corresponding with the pattern in Chart 5, the output effects determined through trade channels dwarf those transmitted through domestic wealth channels.

5 Conclusions

Financial market openness is clearly a factor behind the propagation of shocks in the world economy. More integrated economies are more exposed to spillovers from external shocks, while they return to equilibrium more quickly in response to domestic shocks. Equity market effects may come from their impact on consumption or their impact on investment. While we find evidence that equity prices affect consumption in most economies, the evidence to support a direct effect on investment is weak, at least outside the US and the UK.

Our research on the determinants of consumption suggests that the impact of changes in wealth on consumption in the Euro Area is, as least in the short term, small, although it builds-up over time. Hence, the impact of any shock to equity prices, at home or abroad, is likely to be limited. We undertake two sets of experiments. The first involves fiscal shocks, and it is clear that the pattern of multipliers is closely related to levels of import penetration, which allow the expansionary effects to leak abroad. Openness to foreign financial markets, as measured by the ratio of foreign liabilities to GDP, also reduces the scale of the multiplier, while the speed of response to the shock is related to the extent of liquidity restraints in the economy. Interest rates, and hence equity prices, do not move much in response to a single country shock, but do respond to a Euro Area-wide fiscal expansion. Multipliers in response to the Area-wide shock are correlated with the share of financial wealth held in equities, as equity prices fall.

We also undertake temporary equity price shocks, and in general when we shock Euro Area equity markets, the effects are small. A global shock, along the lines of those we have seen in the last decade, does have a noticeable impact, however. Spillovers from global equity price shocks account for 80 to 90 per cent of the impacts of a global shock in the Euro Area, with most of the spillover coming from the US. This reflects the fact that the US response to a change in wealth is higher than it is in the Euro Area, in part because equity wealth to income is 2.5 times higher, and also because there are stronger impact effects of wealth on consumption. This in turn is driven by the significantly higher level of direct equity wealth ownership in the US, where over half of households own equities directly, whilst in Europe most equities in individual wealth are owned by institutions that offer life assurance and pensions.

Table A1: Single equation consumption estimates – full wealth specification*

	OE	GR	FR	IT	SP	UK	GE	NL	BG	PT	IR	US
Sample	80Q1-04Q4	78Q2-04Q4	74Q1-04Q3	74Q1-04Q4	80Q4-04Q4	79Q1-02Q4	74Q1-04Q4	80Q1-04Q4	74Q1-04Q4	80Q4-04Q4	77Q3-04Q4	74Q1-04Q4
Constant	-0.008	-0.004	-0.01	-0.046	-0.011	-0.019	-0.297	-0.038	-0.01	-0.055	-0.017	-0.038
	(1.2)	(1.1)	(1.6)	(4.3)	(3.5)	(2.0)	(4.8)	(3.5)	(1.3)	(6.1)	(2.7)	(1.7)
ECM	-0.064	-0.033	-0.063	-0.059	-0.0833	-0.085	-0.391	-0.109	-0.044	-0.102	-0.092	-0.127
	(2.03)	(2.8)	(2.97)	(4.6)	(2.8)	(2.8)	(5.5)	(4.1)	(1.92)	(3.6)	(3.2)	(2.6)
ln RPDI(-1)	0.964	0.872	0.886	0.632	0.894	0.928	0.776	0.900	0.936	0.913	0.887	0.806
	(20.7)	(21.2)	(19.8)	(10.1)	(20.2)	(28.2)	(20.4)	(26.0)	(17.7)	(21.2)	(24.5)	(18.4)
ln RNW(-1)	0.036	0.128	0.114	0.368	0.106	0.072	0.224	0.10	0.064	0.087	0.113	0.194
D ln RPDI	0.205	0.490		0.134	-0.065	0.171	0.683	0.093	0.175		0.280	0.155
	(2.5)	(7.8)		(2.2)	(1.1)	(3.7)	(10.8)	(1.6)	(2.0)		(4.7)	(2.5)
D ln RPDI(-1)			0.358							0.077		
			(3.2)							(1.9)		
D ln RNW	0.007	-0.004		0.022	0.004		0.2E-3	-0.7E-3	-0.005	-0.005		0.034
	(0.4)	(0.7)		(1.7)	(0.7)		(0.01)	(0.08)	(0.48)	(0.45)		(2.32)
D ln RNW(-1)			0.026			0.029					0.026	
			(2.18)			(2.9)					(2.4)	
D ln RPH	0.014	-0.062	0.018	-0.019	0.074		0.223	0.088	0.059	0.255	0.009	
	(0.21)	(1.0)	(0.4)	(1.7)	(2.6)		(1.9)	(2.2)	(1.68)	(5.6)	(0.3)	
D ln RHW(-1)**						0.16**						0.154**
						(5.9)						(2.6)
Intercept dummy			92Q1-04Q4				90Q1-04Q4			86Q1-04Q4		
Adj. R^2	0.30	0.53	0.32	0.45	0.54	0.71	0.69	0.33	0.13	0.54	0.56	0.51
SE	0.012	0.007	0.006	0.005	0.004	0.004	0.006	0.007	0.006	0.007	0.008	0.004
LM4	11.6	23.8	11.0	19.8	2.6	4.4	8.7	2.9	5.2	2.5	4.8	2.0

* Finland is not show here as it appears as seen in Table 2

****** Denotes real housing wealth

Table A2: Single Country GC Shock Correlations*

	Real GDP Multipliers			Economic Indicators									
	2005	2006	2007	SR wealth in C[a]	SR Income in C[b]	MPC from wealth (year 1)[c]	Fin. wealth in equities (2004)[d]	Invest. /GDP (2004)[e]	Import penetra-tion (2004)[f]	Total trade /GDP (2004)[g]	Share of trade with Euro Area (2000)[h]	Foreign assets /GDP (2004)[i]	Foreign liabs. /GDP (2004)[i]
Belgium	0.16	0.30	0.26	0.00	0.17	0.00	0.23	0.18	0.46	1.73	0.59	3.92	3.59
Finland	0.43	0.62	0.30	0.02	0.44	0.02	0.36	0.16	0.26	0.78	0.34	1.71	1.89
France	0.59	0.65	0.15	0.03	0.34	0.02	0.22	0.16	0.22	0.57	0.51	2.01	1.94
Germany	0.53	0.60	0.14	0.00	0.74	0.02	0.13	0.17	0.26	0.76	0.45	1.61	1.52
Greece	0.53	0.58	0.16	0.00	0.48	0.01	0.17	0.23	0.25	0.56	0.42	0.62	1.28
Ireland	0.25	0.30	0.08	0.03	0.28	0.04	0.24	0.22	0.41	1.55	0.30	8.48	8.67
Italy	0.51	0.70	0.27	0.02	0.13	0.01	0.17	0.17	0.22	0.57	0.47	1.02	1.09
Netherlands	0.41	0.42	0.03	0.00	0.10	0.01	0.18	0.16	0.40	1.41	0.50	3.62	3.67
Austria	0.52	0.62	0.17	0.00	0.23	0.00	0.09	0.21	0.33	1.02	0.56	1.74	1.89
Portugal	0.47	0.54	0.13	0.00	0.08	0.01	0.14	0.22	0.30	0.76	0.66	1.64	2.21
Spain	0.38	0.61	0.36	0.00	0.00	0.01	0.35	0.23[j]	0.26	0.65	0.55	1.03[k]	1.39[k]
2005 Correlations				0.08	0.35	-0.06	-0.39	-0.14	-0.82	-0.83	0.06	-0.68	-0.66
2006 Correlations				0.10	0.17	-0.16	-0.06	-0.13	-0.93	-0.93	0.09	-0.83	-0.82
2007 Correlations				-0.01	-0.18	-0.24	0.60	0.04	-0.35	-0.33	0.09	-0.44	-0.46

* Data sources: NIESR, International Financial Statistics, Datastream

[a] Dynamic coefficient estimate in consumption

[b] Dynamic coefficient estimate on real personal disposable income (taken as indicator of liquidity constraints)

[c] MPC=dC/dNW=dlogC/dlogNW*C/NW, fourth quarter value

[d] Personal sector financial wealth as a ratio to domestic equity stock

[e] Private sector investment as a ratio to real GDP

[f] Imports as a ratio to total final expenditure

[g] Measure of trae openness: Total trade (exports plus imports) as a ratio to real GDP

[h] Euro Area trade as a ratio to total trade

[i] Measure of financial openness: domestic gross assets and liabilities as a ratio to real GDP

[j] Based on 2001 values

[k] Based on 2003 values

Table A3: Euro Area GC Shock Correlations*

	Real GDP Multipliers			Economic Indicators									
	2005	2006	2007	SR wealth in C[a]	SR Income in C[b]	MPC from wealth (year 1)[c]	Fin. wealth in equities (2004)[d]	Invest. /GDP (2004)[e]	Import penetra-tion: (2004)[f]	Total trade /GDP (2004)[g]	Share of trade with Euro Area (2000)[h]	Foreign assets /GDP (2004)[i]	Foreign liabs. /GDP (2004)[i]
Belgium	0.29	0.54	0.46	0.00	0.17	0.00	0.23	0.18	0.46	1.73	0.59	3.92	3.59
Finland	0.56	0.80	0.36	0.02	0.44	0.02	0.36	0.16	0.26	0.78	0.34	1.71	1.89
France	0.77	0.80	0.11	0.03	0.34	0.02	0.22	0.16	0.22	0.57	0.51	2.01	1.94
Germany	0.69	0.77	0.16	0.00	0.74	0.02	0.13	0.17	0.26	0.76	0.45	1.61	1.52
Greece	0.66	0.69	0.13	0.00	0.48	0.01	0.17	0.23	0.25	0.56	0.42	0.62	1.28
Ireland	0.56	0.53	-0.01	0.03	0.28	0.04	0.24	0.22	0.41	1.55	0.30	8.48	8.67
Italy	0.67	0.91	0.31	0.02	0.13	0.01	0.17	0.17	0.22	0.57	0.47	1.02	1.09
Netherlands	0.87	0.91	0.01	0.00	0.10	0.01	0.18	0.16	0.40	1.41	0.50	3.62	3.67
Austria	0.90	1.00	0.15	0.00	0.23	0.00	0.09	0.21	0.33	1.02	0.56	1.74	1.89
Portugal	0.71	0.78	0.07	0.00	0.08	0.01	0.14	0.22	0.30	0.76	0.66	1.64	2.21
Spain	0.51	0.77	0.36	0.00	0.00	0.01	0.35	0.23[j]	0.26	0.65	0.55	1.03[k]	1.39[k]
2005 Correlations				-0.01	0.06	-0.07	-0.59	-0.10	-0.29	-0.31	0.09	-0.23	-0.21
2006 Correlations				-0.14	-0.14	-0.39	-0.33	-0.24	-0.44	-0.46	0.26	-0.58	-0.58
2007 Correlations				-0.14	-0.13	-0.39	0.50	-0.17	-0.08	-0.05	0.16	-0.36	-0.41

*Data sources and footnotes as reported in Table A.2

Table A4: Euro Area GC Shock relative to Single Country GC Shock Correlations*

	Real GDP Multipliers			Economic Indicators									
	2005	2006	2007	SR wealth in C[a]	SR Income in C[b]	MPC from wealth (year 1)[c]	Fin. wealth in equities (2004)[d]	Invest. /GDP (2004)[e]	Import penetra-tion: (2004)[f]	Total trade /GDP (2004)[g]	Share of trade with Euro Area (2000)[h]	Foreign assets /GDP (2004)[i]	Foreign liabs. /GDP (2004)[i]
Belgium	1.79	1.81	1.80	0.00	0.17	0.00	0.23	0.18	0.46	1.73	0.59	3.92	3.59
Finland	1.32	1.30	1.19	0.02	0.44	0.02	0.36	0.16	0.26	0.78	0.34	1.71	1.89
France	1.29	1.23	0.72	0.03	0.34	0.02	0.22	0.16	0.22	0.57	0.51	2.01	1.94
Germany	1.29	1.29	1.11	0.00	0.74	0.02	0.13	0.17	0.26	0.76	0.45	1.61	1.52
Greece	1.23	1.20	0.86	0.00	0.48	0.01	0.17	0.23	0.25	0.56	0.42	0.62	1.28
Ireland	2.21	1.76	-0.12	0.03	0.28	0.04	0.24	0.22	0.41	1.55	0.30	8.48	8.67
Italy	1.32	1.29	1.13	0.02	0.13	0.01	0.17	0.17	0.22	0.57	0.47	1.02	1.09
Netherlands	2.15	2.17	0.51	0.00	0.10	0.01	0.18	0.16	0.40	1.41	0.50	3.62	3.67
Austria	1.72	1.61	0.85	0.00	0.23	0.00	0.09	0.21	0.33	1.02	0.56	1.74	1.89
Portugal	1.52	1.43	0.53	0.00	0.08	0.01	0.14	0.22	0.30	0.76	0.66	1.64	2.21
Spain	1.34	1.26	1.01	0.00	0.00	0.01	0.35	0.23[j]	0.26	0.65	0.55	1.03[k]	1.39[k]
2005 Correlations				-0.01	-0.36	0.16	-0.13	0.08	0.88	0.89	-0.09	0.84	0.83
2006 Correlations				-0.20	-0.38	-0.12	-0.18	-0.11	0.89	0.88	0.09	0.64	0.61
2007 Correlations				-0.33	0.10	-0.60	0.15	-0.33	-0.08	-0.07	0.31	-0.52	-0.59

*Data sources and footnotes as reported in Table A.2

Table A5: Single Country Equity Price Shock Correlations*

	Real GDP Multipliers			Economic Indicators									
	2005	2006	2007	SR wealth in C[a]	SR Income in C[b]	MPC from wealth (year 1)[c]	Fin. wealth in equities (2004)[d]	Invest. /GDP (2004)[e]	Import penetra-tion: (2004)[f]	Total trade /GDP (2004)[g]	Share of trade with Euro Area (2000)[h]	Foreign assets /GDP (2004)[i]	Foreign liabs. /GDP (2004)[i]
Belgium	0.002	0.011	0.024	0.00	0.17	0.00	0.23	0.18	0.46	1.73	0.59	3.92	3.59
Finland	0.034	0.085	0.103	0.02	0.44	0.02	0.36	0.16	0.26	0.78	0.34	1.71	1.89
France	0.034	0.087	0.139	0.03	0.34	0.02	0.22	0.16	0.22	0.57	0.51	2.01	1.94
Germany	0.017	0.056	0.070	0.00	0.74	0.02	0.13	0.17	0.26	0.76	0.45	1.61	1.52
Greece	0.011	0.039	0.060	0.00	0.48	0.01	0.17	0.23	0.25	0.56	0.42	0.62	1.28
Ireland	0.020	0.051	0.051	0.03	0.28	0.04	0.24	0.22	0.41	1.55	0.30	8.48	8.67
Italy	0.019	0.057	0.073	0.02	0.13	0.01	0.17	0.17	0.22	0.57	0.47	1.02	1.09
Netherlands	0.001	0.002	0.001	0.00	0.10	0.01	0.18	0.16	0.40	1.41	0.50	3.62	3.67
Austria	0.006	0.023	0.041	0.00	0.23	0.00	0.09	0.21	0.33	1.02	0.56	1.74	1.89
Portugal	0.012	0.047	0.069	0.00	0.08	0.01	0.14	0.22	0.30	0.76	0.66	1.64	2.21
Spain	0.012	0.060	0.112	0.00	0.00	0.01	0.35	0.23[j]	0.26	0.65	0.55	1.03[k]	1.39[k]
2005 Correlations				0.80	0.38	0.66	0.43	-0.38	-0.60	-0.49	-0.50	-0.05	-0.06
2006 Correlations				0.65	0.32	0.55	0.47	-0.19	-0.74	-0.66	-0.37	-0.23	-0.22
2007 Correlations				0.51	0.16	0.30	0.48	-0.08	-0.77	-0.72	-0.11	-0.38	-0.37

*Data sources and footnotes as reported in Table A.2

Table A6: World Equity Price Shock Correlations*

	Real GDP Multipliers			Economic Indicators									
	2005	2006	2007	SR wealth in C[a]	SR Income in C[b]	MPC from wealth (year 1)[c]	Fin. wealth in equities (2004)[d]	Invest. /GDP (2004)[e]	Import penetra-tion: (2004)[f]	Total trade /GDP (2004)[g]	Share of trade with Euro Area (2000)[h]	Foreign assets /GDP (2004)[i]	Foreign liabs. /GDP (2004)[i]
Belgium	0.07	0.14	0.15	0.00	0.17	0.00	0.23	0.18	0.46	1.73	0.59	3.92	3.59
Finland	0.23	0.44	0.48	0.02	0.44	0.02	0.36	0.16	0.26	0.78	0.34	1.71	1.89
France	0.20	0.32	0.22	0.03	0.34	0.02	0.22	0.16	0.22	0.57	0.51	2.01	1.94
Germany	0.16	0.33	0.25	0.00	0.74	0.02	0.13	0.17	0.26	0.76	0.45	1.61	1.52
Greece	0.14	0.15	0.00	0.00	0.48	0.01	0.17	0.23	0.25	0.56	0.42	0.62	1.28
Ireland	0.33	0.54	0.32	0.03	0.28	0.04	0.24	0.22	0.41	1.55	0.30	8.48	8.67
Italy	0.15	0.33	0.32	0.02	0.13	0.01	0.17	0.17	0.22	0.57	0.47	1.02	1.09
Netherlands	0.27	0.40	0.20	0.00	0.10	0.01	0.18	0.16	0.40	1.41	0.50	3.62	3.67
Austria	0.18	0.31	0.15	0.00	0.23	0.00	0.09	0.21	0.33	1.02	0.56	1.74	1.89
Portugal	0.06	-0.01	-0.35	0.00	0.08	0.01	0.14	0.22	0.30	0.76	0.66	1.64	2.21
Spain	0.08	0.21	0.18	0.00	0.00	0.01	0.35	0.23[j]	0.26	0.65	0.55	1.03[k]	1.39[k]
2005 Correlations				0.56	0.24	0.72	0.07	-0.27	0.20	0.31	-0.77	0.63	0.63
2006 Correlations				0.59	0.26	0.67	0.23	-0.42	0.11	0.26	-0.79	0.53	0.50
2007 Correlations				0.51	0.29	0.44	0.46	-0.55	-0.05	0.11	-0.70	0.23	0.16

*Data sources and footnotes as reported in Table A.2

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