OECD Economics Department Working Papers No. 235

Modelling Manufacturing Export Volumes Equations: A System Estimation Approach

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https://dx.doi.org/10.1787/308783210136

OECD

Unclassified **ECO/WKP(2000)8**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 06-Apr-2000
Dist. : 14-Apr-2000

English text only

ECONOMICS DEPARTMENT

ECO/WKP(2000)8
Unclassified

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ABSTRACT/RÉSUMÉ

International trade is a principle transmission mechanism by which developments in one country can have repercussions in others and how it is modelled is an important part of any multi-country model. This paper describes recent estimation work carried out by the OECD, which respecifies and updates the equations which determine manufactures export volumes in the OECD INTERLINK model. An important feature of this estimation work is that the relevant equations are estimated as a consistent system, allowing data acceptable parameter restrictions to be imposed across countries. For a number of countries and regions allowance is also made for the possible influence of supply-side factors on market share performance over and above that explained by changes in price competitiveness, using non-linear trend variables. The paper reports both estimation results and the simulation properties of the equations both in isolation and as part of corresponding country models and the fully linked world model.

JEL Code: C20,C22,C23,F17,F47
Keywords: Exports, Trade, Forecasting & Simulation

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Le commerce international est un mécanisme de transmission essentiel par lequel l'évolution de la situation dans un pays peut avoir des répercussions sur les autres pays, et la façon dont il est modélisé joue un rôle important dans tout modèle multinational. Ce document décrit le travail d'estimation récemment entrepris par l'OCDE qui modifie les specifications et met à jour les équations qui déterminent les volumes d'exportation de produits manufacturés dans le modèle INTERLINK de l'OCDE. Une caractéristique importante de ce travail est que les équations concernées sont estimées de façon à former un système cohérent, permettant de contraindre les coefficients à être identiques entre pays, lorsque les tests économétriques le justifient. Pour un certain nombre de pays et de régions, l'utilisation d'une tendance non linéaire permet aussi d'expliquer l'évolution de leurs parts de marchés par l'influence possible de facteurs d'offre, outre les effets dûs à l'évolution de leur compétitivité prix. Ce document présente à la fois les résultats de l'estimation et les propriétés dynamiques des équations individuelles, integrées dans les modèles des pays concernés, puis dans le modèle mondial.

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MODELLING MANUFACTURING EXPORT VOLUMES: A SYSTEM ESTIMATION APPROACH

by Keiko Murata, Dave Turner, Dave Rae and Laurence Le Fouler[1]

Introduction and Summary

1. Trade is a principle transmission mechanism by which developments in one country can have repercussions in others and so how it is modelled is an important part of any multi-country model, both for forecasting and simulation analysis. This paper describes recent estimation work to respecify and update the equations determining manufacturing export volumes which play a major role in the international linkage mechanisms of the OECD Secretariat's Interlink model.[2] Two distinctive features of this estimation are that: the relevant equations are mainly estimated as a system, which allows common parameters to be imposed across countries where such restrictions are data-acceptable; and for a number of countries a non-linear trend is included to capture the effect of supply side factors which influence changes in export market shares which cannot be explained by changes in price competitiveness.

2. Overall, the results support the use of this general approach for estimating equations in a multi-country model and allow greater confidence to be placed on evidence of significant cross-country differences, where relevant. Simulations tests confirm the broad acceptability of the estimated equations which are now embodied in the current version of the OECD Interlink model.

1. Modelling export volumes

1.1 Specification of the export equations

3. There are a number of strong prior reasons for thinking that export trade relationships need to be considered in the context of a system estimation approach. Firstly, by their very nature, export relationships (which are predominantly demand-based) represent the behaviour of a common set of agents in world markets rather than specifically those uniquely of the country in question. Thus it is often the tastes and preferences of this common set of agents which are being modelled and hence a degree of regularity in parameters might be expected across exporting countries.[3] Secondly, since within the overall model exports are typically modelled for a given level of world demand or world trade, a high degree of

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1. The authors are all members of the Macroeconomic Analysis and Systems Management Division of the OECD Economics Department. They are grateful to Pete Richardson and Ignazio Visco for comments and ideas based on previous drafts; and to Rosemary Chahed and Jan-Cathryn Davies for technical preparation.

2. See Richardson (1988) and Richardson *et. al* (2000) for general background on the structure and properties of the OECD Interlink model.

3. These may, of course, differ at the aggregate level across countries according to market and product structure.

consistency in responsiveness to some shocks is required to ensure that exports "add-up" across countries. In the absence of any "residually-determined" trade, this necessarily implies coefficient restrictions across country equations.

4. The basis for the specification of the estimated equations considered here, broadly consistent with a range of other studies, is the inverse relationship between manufacturing export performance and a measure of international competitiveness. Such a relationship is apparent for many, but not all, countries (see Figure 1).[4] Export performance here (and throughout this paper) is taken to be a measure of export market share, defined as export volumes divided by export market demand, where the latter is a weighted average of world manufacturing imports (with weights reflecting the importance of each export market to each individual exporting country in a common base year, 1995). Price competitiveness is defined in terms of relative export prices, where the prices of all competitors across all "third" markets are weighted together.[5,6]

5. Changes in relative competitiveness do not, of course, provide a complete explanation of changes in export performance but other factors, notably those associated with supply conditions or changes in the quality of products, are typically more difficult to model quantitatively. Two alternative approaches considered in earlier work capture trend movements in export performance, not explained by changes in price competitiveness involve the inclusion of a linear time trend or by allowing the long-run elasticity of exports with respect to market demand to differ from unity. Neither of these approaches consistently dominates the other in terms of their explanatory power across all OECD countries. However, a difficulty with both of them is that it is unreasonable to assume that a country's propensity to gain or lose market share remains fixed over time. In order to allow for such possibilities, a non-linear function of time has been included in the estimated equation, of the following form:

$$f(t) = \exp\left(\alpha(t-\beta)^2\right) \qquad [1]$$

where $\alpha < 0$ and t is a linear time trend. Note that this function tends to zero over time, which has the desirable property that at some point (possibly in the distant future) its effect on export performance is eventually eliminated. On the other hand, the functional form is sufficiently flexible to accommodate considerable variation in export performance over any estimation period.

6. Changes in a country's export performance may also be related to its stage of development. For example changes in industrial structure involving a switch of resources from primary production to manufacturing may involve rapid gains in market share, although such gains are likely to eventually moderate as the economy matures and specialises more in the provision of services. Such a profile may be re-enforced by foreign direct investment: inward foreign direct investment that facilitates catch-up in technical progress and product quality, and for a developed economy outward foreign direct investment may be a means of shifting manufacturing production offshore perhaps to be closer to markets or a cheaper source of labour[7]. More generally, the inclusion of the non-linear time trend represents an attempt to

4. The measure of relative export prices in Figure 1 has been inverted so that the postulated relationship between export performance and relative prices should produce a *positive* correlation between the two plotted series.

5. A measure of price competitiveness was used in preference to relative labour costs following work which found that it had greater explanatory power for most countries.

6. For further details of the relevant measures see Durand, *et al.*, (1992 and 1998).

7. See for example Pain and Wakelin (1998) who find that inward foreign direct investment generally has a positive effect on the trade performance of the eleven OECD countries which they examine.

capture the effect of supply-side factors in what otherwise might be classified as a standard demand driven model of exports.

7. There has been much recent discussion on the importance of supply-side factors in trade models, much of it relating to the observed relationship between estimated elasticities on foreign activity in export equations and the rate of growth of domestic output referred to as the "45-degree rule" (see Krugman [1989]). It has been argued that this empirical regularity suggests the need for the inclusion of a term measuring domestic supply in export equations. Such a term can be justified on the basis of new trade theories of trade which emphasise the importance of increasing returns to scale in production and the desire of consumers for greater variety (see Krugman [1989]). The non-linear trend variable included in the current specification may, therefore, capture such effects as an alternative to more direct proxies, such as real GDP or the capital stock of the exporting country.

8. The overall equation is specified in the following logarithmic dynamic error correction form:

$$\begin{aligned}\Delta \log XMPERF = {} & \alpha_0 + \alpha_1 \Delta \log XMPERF_{-1} + \alpha_2 \Delta \log XMVMKT \\ & + \alpha_3 \Delta \log XMVMKT_{-2} + \alpha_4 \Delta \log RPXM + \alpha_5 \Delta \log RPXM_{-1} \\ & + \alpha_6 \log XMPERF_{-1} + \alpha_7 \log RPXM_{-1} + \alpha_8 f(t).\end{aligned} \qquad [2]$$

where Δ denotes the first difference operator and:

XMPERF = XMV/XMVMKT = Manufacturing export performance,

XMV = Manufacturing export volume,

XMVMKT = Manufacturing export market demand,

RPXM = Relative manufacturing export prices,

f(t) = Non-linear time trend, as described in equation [1].

9. The dynamic form is specified in terms of changes in export performance so that even in the short-run the effect of a change in demand on export volumes is being implicitly evaluated against a null hypothesis of a unit elasticity. This specification is favoured over an alternative whereby the dependent variable is taken to be proportionate changes in export volumes [Δ ln XMV], because once statistically insignificant variables are dropped it is likely to imply less short-run variation in export market performance following a change in export market demand. It is, therefore, likely to reduce inconsistencies between changes in exports and imports at a global level.

1.2 General estimation procedure

10. The general approach adopted is to estimate equations for each country separately by OLS and subject them to a range of mis-specification tests. Only those equations which produce satisfactory results in terms of these tests, as well as plausible coefficient estimates, are included in the system estimation exercise (described below). Equations for those countries which are not suitable for inclusion in the system estimation are constructed through a combination of single equation estimation and judgement.

11. Thus, equation [1] was initially estimated separately for each country/region by OLS for 24 OECD countries and all non-OECD regions using semi-annual data, which for most OECD countries

covered the period 1975 to 1997.[8] Five OECD countries were excluded: Turkey and Iceland, because of the absence of any recent data on relative export prices; and Poland, Hungary and the Czech Republic due to the lack of sufficient historical data.

12. The non-linear time trend was included in the equation for any country for which a linear time trend was previously found to have been significant or for which the long-run demand elasticity was found to have been significantly different from unity. The parameters of the non-linear function were identified by conducting a grid search.

13. After dropping insignificant explanatory variables the equation was then subject to a series of misspecification tests. These include tests for autocorrelation (an LM-test for up to second order autocorrelation), normality in the residuals, functional form (the RESET test), Chow's predictive failure test (over the last three years of the sample) and Chow's structural stability test (dividing the estimation period in two). The outcome of the test results are used to try to improve the equations: for example, where the Chow test rejects the null of structural stability, the sample period is shortened; or the outcome of the normality or functional form tests may suggest the need to include dummy variables for particular outliers.

14. Having obtained a satisfactory set of individual OLS equations they are then estimated within a system so as to allow for the possibility of imposing common parameters across equations and to test for common residual influences. The non-OECD regions were not included in pooled estimation on the grounds that the data for these are less reliable. For the purpose of system estimation the equations are, however, re-specified in the following non-linear form to facilitate the testing of a common long-run response to competitiveness:

$$\begin{aligned}\Delta \log XMPERF = {} & \alpha_0 + \alpha_1 \Delta \log XMPERF_{-1} + \alpha_2 \Delta \log XMVMKT \\ & + \alpha_3 \Delta \log XMVMKT_{-2} + \alpha_4 \Delta \log RPXM + \alpha_5 \Delta \log RPXM_{-1} \\ & + \alpha_6 \left(\log XMPERF_{-1} + \beta_7 \log RPXM_{-1}\right) + \alpha_8 f(t).\end{aligned} \qquad [3]$$

where the "α" coefficients are consistent with equation [2] and $\beta_7 = \alpha_7/\alpha_6$. This re-specification means that the long-run price elasticity is a directly estimated parameter (β_7) that is clearly distinct from the coefficient which determines the speed of adjustment to equilibrium (α_6)[9]. The (country-specific) parameters defining the non-linear trend variable [α and β in equation [1]], remain fixed at the values obtained in the single equation estimation, although the parameter α_8 is allowed to vary.

15. Tests on the initial system regression results revealed a strong correlation of contemporaneous residuals across countries suggesting the need to use the method of Seemingly Unrelated Regression Estimation (SURE) rather than OLS.[10,11] Such a finding might be expected from at least two sources in this

8. Belgium and Luxembourg are combined.

9. This follows a similar approach to that adopted by Pain and Holland, (1998).

10. The test for contemporaneous correlation of residuals across system members is that proposed by Breusch and Pagan and is based on the sum of sample correlation coefficients of residuals across system members, see Breusch and Pagan (1980).

11. The SURE method estimates the system of equation exploiting any information on the correlation between contemporaneous errors across countries. Typically in system estimation of dynamic models with fixed effects, where the number of system members is large relative to the number of time periods, there is a need to instrument the lagged dependent variable to avoid estimation bias. However, in the present application where the number of time periods is relatively large (usually greater than 40) the potential bias is reduced (see Nickell, 1981) and so instrumental variables have not been used.

application: firstly, an (unexplained) increase in the export share for a major country is likely to be associated with an (unexplained) decline in the share of others. Secondly, there may be common region-specific omitted variables underlying export performance. Thus, all subsequent regressions were carried out using SURE methods.

16. In order to test for a common long-run price relative price elasticity, the restriction that the coefficient β_7 is the same across countries is tested. This test is initially carried out on the two countries which have a long-run competitiveness response which is closest to the average across all countries (excluding outliers) based on the single equation results. When this restriction was found to be valid (at the 5 per cent significance level) it was imposed and the next country with the coefficient closest to this common coefficient is tested. This process is repeated until all countries have been tested.

17. Further tests were then carried out, in the same manner, to establish whether the process of dynamic adjustment is similar across countries. Thus, subsequent tests examined whether the coefficients on variables on the error-correction terms (α_6) and the first difference of relative prices (α_4 and α_5) can be imposed at the same values across countries.

18. Although, as previously explained, most diagnostic checks were carried out at the stage of single-equation estimation, a final test for autocorrelation (of up to second order) is also carried out on the residuals of the final preferred set of system equations.

1.3 OLS estimation results

19. The single equation estimation results for OECD countries are summarised in Table 1. For those countries where a trend variable is statistically significant the results of using the non-linear trend variable are compared alongside those obtained from using a linear time trend. For most countries there is a correctly-signed long-run effect from relative prices, although the magnitude of this effect varies considerably across countries (among the G7 from -0.55 for the United States to more than –2 for Japan when linear trend is included).

20. A test of the alternative trend variables, whereby both the non-linear and linear time trend are included in the same regression, suggests that for five OECD countries (Austria, Mexico, Norway, Spain and Sweden) the non-linear trend is clearly preferred, although for the others it is difficult to distinguish between them on strictly statistical criteria (there are no equations for which the linear trend is clearly preferred to the non-linear trend). The contribution which the trend variable makes to export growth over the estimation period and which it would make over any projection period (to the year 2010) is shown in comparison with the estimated effect of the linear time trend in Figure 2.

21. In a number of cases the contribution of the non-linear trend to export growth varies considerably over the estimation and projection periods, particularly as might be expected in those countries which have undergone major changes in structure. An extreme case is Mexico (although Ireland is a similar example) where the contribution of the non-linear trend to export growth rises from nothing in the mid-1970s to peak in the early-1990s, when it is adding more than 6 per cent per annum to export growth, after which the contribution declines, but remains strongly positive. The positive contribution from the non-linear trend adds 4½ per cent to Mexican export growth in 1999H1 (which, coincidentally, is similar to that implied from the linear trend equation), but over a medium-term projection this contribution would steadily decline so that by 2010 it would be only 1 per cent per annum. Such behaviour is entirely consistent with the rapid industrialisation and integration of Mexico within the world trading system since the late 1980s. For most countries (Spain is an exception) the non-linear trend variable has the attractive feature that the magnitude

of its contribution to export growth over any projection horizon is smaller than that which would be implied by using a linear-time trend.

22. For most countries the non-linear trend variable is subsequently used (in preference to the linear trend variable) in the system estimation, but there are two important exceptions: Japan and Germany.

- For Germany the implied contribution from the non-linear trend becomes more negative over the estimation period and over any medium-term projection period would be exerting a stronger negative influence (equivalent to -2¼ per cent per annum in 1999 H1) on export growth than would be implied by a linear trend (-1 per cent per annum). However, it may be the case that German export performance was strongly influenced by the effects of reunification (if, for example, potential exports were diverted to Eastern Germany) during the 1990s. Because this is towards the end of the estimation period it is difficult to distinguish how permanent such effects are. To the extent that the (negative) effect of reunification on export performance are not permanent, the smaller negative effects implied by the use of the linear time trend may be more appropriate over any projection period.

- For Japan, the magnitude of the swing in the contribution of the non-linear trend appears to be implausible: in the late 1970s it adds 3 to 4 per cent per annum to export growth, consistent with its stage of development, but by 1999 H1 it subtracts almost 5 per cent per annum from export growth. The preferred specification for Japan, which is subsequently used in the system estimation, instead uses a measure of cumulated outward foreign direct investment to explain the trend in export performance, as explained in greater detail in separate section 1.4 below.

23. For six countries (France, Belgium, Korea, Netherlands, Norway and Ireland) it was necessary to reduce the sample estimation period in order to obtain a satisfactory equation. In particular, for most of these countries an equation estimated over the full sample period fails a test for structural stability.

24. For two OECD countries, Portugal and Greece, it was particularly difficult to obtain a satisfactory equation. The equation for Greece fails a number of misspecification tests, has a very high-standard error and an implausibly high-impact elasticity on relative prices (which is higher than the long-run elasticity). For Portugal the long-run response of prices is sensitive to slight changes in equation specification (compare for example the difference that the form of the trend variable makes to the estimate).

1.4 Japan: a special case

25. As an alternative to using either a linear or non-linear time trend the equation for Japan incorporates a measure of cumulated net foreign direct investment to explain the trend in export performance (this follows similar empirical work by both by Ban [1997] and the EPA [1996, 1997]). The main reason for adopting such a specification is that it provides a more plausible explanation of export performance, although on strictly econometric criteria it is difficult to discriminate between the inclusion of this variable rather than either of the other trended variables.

26. The form of the explanatory variable included comprises cumulated net outward foreign direct investment normalised by the business sector capital stock.[12] The functional form of the export equation

12. Inward foreign direct investment has been very small and so this is practically the same as using a measure of net foreign direct investment.

implies that a once-for-all permanent increase in this ratio will have a permanent negative effect on the *level* of export performance as export production is relocated abroad. The estimated effects imply that the strong outward foreign direct investment which took place in the early 1990s in response to the appreciation of the yen substantially reduced Japanese export performance in this period reducing export growth by more than 5 per cent per annum at its peak effect. However, more recently the rise in the FDI ratio has been more modest implying a negative contribution to export growth less than 1 per cent per annum.

27. The inclusion of the FDI ratio reduces the long-run price elasticity obtained from previous estimates, in the range of 2.5 to 3, to a value closer to 2, which is still high but nearer to the average for other countries. Moreover the speed of response of export volumes to a change in relative prices becomes much quicker with the median lag falling from about 4-5 semesters to 2-3 semesters, which is again is more in line with the results for other countries. This finding is explained by the fact that FDI is itself in part, responsive to changes in competitiveness, albeit with a longer lag. This result is confirmed by a simple dynamic regression explaining the FDI ratio in terms of movements in the real exchange rate. Indeed allowing for an endogenous response of both FDI and price competitiveness to a change in the exchange rate implies an overall response of export volumes which is similar to the larger (and slower) response implied by specifications which do not explicitly incorporate the FDI ratio.

1.5 System estimation results

28. A summary of the SURE estimation results for the preferred set of equations under each specification is provided in Table 2 and Figure 3, and the residuals are plotted in Figure 4. All equations pass a test for up to second order serial correlation of residuals. The average standard error across all system equations is about 3 per cent, although it is much higher for Spain, Korea, Australia and Mexico. The final preferred set of 21 equations have 24 freely-estimated coefficients (excluding intercepts and dummy variables) compared to the unrestricted system that has 63 coefficients. Thus, the final set of equations impose a total of 39 restrictions: 15 restrictions with respect to the long-run price elasticity, 9 with respect to the error correction coefficient and 15 with respect to the short-run price dynamics.

29. Fourteen countries accept a common long-run price elasticity of about (minus) unity. Among the G7, five countries accept this common long-run price elasticity, with Japan having a higher long-run price elasticity of -1.7, and the United States a lower elasticity of0.6.

30. The speeds of adjustment of export volumes to a change in relative export prices, illustrated in Figure 5 are relatively quick. Eleven countries complete at least 50 per cent of the long-run adjustment within the first two semesters and for sixteen countries 80 per cent of the adjustment is completed within six semesters. The adjustment is slowest for Korea: the median is 4-5 semesters with 80 per cent of the adjustment to a relative export price shock taking eleven to twelve semesters.

31. Differences between estimates of the relative price elasticities from the two alternative specifications including linear and non-linear time trend are relatively small for most countries compared to the difference between all of the above and the elasticities of previous Interlink equations, see Figure 6. For a majority of OECD countries the long-run price elasticity in the previous version of Interlink is set at -1.20 (with no countries having an elasticity smaller than unity), which might be compared to the common system elasticity of -0.99.[13] There are more marked differences among individual countries. Particularly

13. Direct comparisons with estimates from other studies are difficult because the explanatory variables used often differ in important respects. For example, the "income" variable is sometimes weighted foreign GDP (rather than imports) and consequently estimated income elasticities are typically much higher.

noteworthy are differences for the United States for which the previous Interlink elasticity is -1.4 compared to current estimates of around –0.6, and Japan for which the existing elasticity is -1.3 compared to current estimates of between -1.7 and -2.5 (depending on what allowance is made for the endogeneity of foreign direct investment). Other countries for which there is a particularly large difference between current estimates and Interlink are France, Netherlands, Norway and Ireland (in all cases the revised estimates are lower).

32. Some form of time-trend variable is present in the equations for thirteen countries. Evaluating the contribution which this makes to export growth in 1999 H1, the largest positive effect is for Mexico (adding 4.3 per cent per annum to export volume growth) and the largest negative effect is for Canada (equivalent to -1.9 per cent per annum). Of the G7 countries, three have negative time trend effects (Germany, France and Canada), the negative contribution from the rising foreign direct investment ratio reduces export growth in Japan in 1999, whilst for the other three countries a trend effect is absent.

33. The equations imply that for most countries export volumes adjust almost immediately to any change in export market demand. For only seven countries is there any temporary change in export performance following a shock to export market demand. Among the G7, Japan initially gains market share, whilst Italy and Canada temporarily lose market share following an increase in export market demand.

1.6 Estimating equations for countries for which system estimation is not feasible

34. For those OECD countries (Iceland, Turkey, Hungary, Czech Republic and Poland) for which insufficient data are available to estimate an equation, the response of export performance to relative prices obtained in the system estimation is assumed. The non-linear time trend effect is then estimated by looking at recent trends (and in the case of the Eastern European countries, looking at recent Economic Outlook projections) of export performance. For Greece and Portugal, the results obtained using single OLS equations are used which include the non-linear time trend.

35. For the non-OECD, equation [1] is estimated separately for each region by OLS, and the results presented in Table 3, alongside those obtained when a linear time trend is used instead of the non-linear trend. Overall the equations for the non-OECD perform less well in terms of the diagnostic tests than the equations estimated for the OECD countries. In particular, all equations are estimated over shortened samples (usually beginning in 1980) in order to obtain sensible parameter estimates and/or avoid failing tests for structural stability. The equation for Latin America has a particularly high standard error and fails a test for serial correlation of residuals at the 5 per cent significance level. The equation for China also has a high standard error and fails a Chow test for structural stability even over a shortened estimation period.

36. The use of the non-linear time trend is econometrically preferred over the linear time trend in the equations for Dynamic Asia, Africa and Middle East, and non-OECD Europe (in the equations for Other Asia and China this choice is not clear cut on purely econometric criteria). More importantly, the contribution of the non-linear trend to export performance appears to be more plausible than that of the linear trend (with the possible exception of non-OECD Europe where the magnitude of the negative contribution of the trend variable is very large in both cases). For example, for China and Dynamic Asia the linear trend would contribute nearly 10 and 6 per cent per annum, respectively, to export volume growth, whereas the contribution from the non-linear trend peaks in the late-1980s or early-1990s and by 1999 H1 would only add 5 and 0.7 per cent per annum, respectively, to export growth (see Figure 2).

37. The estimated long-run price elasticity is correctly signed and statistically significant for all non-OECD regions. In the case of both Latin America and Other Asia the estimate is about -0.9 and can

readily be imposed at the common long-run elasticity (of minus unity) obtained in the system estimation of OECD countries. For the other non-OECD regions the long-run elasticity is closer to -0.5 and the restriction that this is the same as the common long-run elasticity obtained in the system estimation of OECD countries is rejected.

2. Simulation properties

38. While single-equation diagnostics are important, it is often more informative to look at how the equations affect the properties of single-country or multi-country models. In this section the new equations are embedded and tested in the OECD's Interlink model for a number of standard simulation shocks.[14] The impact of an appreciation of the exchange rate is considered first by looking at each country on its own and then taking account of international spillovers. Further simulations look at the impact of a rise in government spending and in particular whether a fiscal expansion crowds out exports - the so-called "twin deficits" phenomenon.

2.1 Single-country properties

2.1.1 An appreciation of the exchange rate

39. The first set of simulations is run on an individual country basis. Each country's exchange rate is raised (appreciated) by 10 per cent and the model then simulates the impact using the equations for that country only. This approach contrasts with multi-country simulation, described in a following section, which takes account of international linkages. For example, a slow-down in the US economy would normally cause a slow-down in the rest of the world, which would then feed back on US exports and the US economy in general. For initial diagnostic purposes, these international linkages have been switched-off in the individual country simulations.

40. In addition both fiscal and monetary policies are assumed not to change, in the sense that real interest rates and real government spending and investment are held at their baseline levels.[15] Note that the nature of the shock is different for Euro members. For these, it is assumed that the *Euro* appreciates by 10 per cent, but the international linkages are still switched off. As an example, the French simulation shows the impact, using the French model, of a 10 per cent rise in the Euro while holding imports into Germany, Italy, etc, at their baseline levels. By shifting the Euro, the effective size of the shock to each Euro member is less than 10 per cent. In the case of France, a 10 per cent rise in the Euro is equivalent to a fall in French competitiveness of only 5.7 per cent because a significant proportion of France's exports go to other Euro members.

41. The results of the above exercise are summarised in Table 4 and Figure 7. The initial impact of the appreciation is a relatively sharp drop in manufactured exports for most countries. The average OECD country has exports 1½ per cent lower after one year and 2 per cent lower after two years. The US impact is similar to the OECD average while the impact on Japan is noticeably larger, reflecting Japan's higher relative price elasticity (Japan's exports are 2 per cent and 5 per cent lower in the first two years). The impacts on the major European economies are much smaller, which partly reflects the nature of the shock:

14 . A more comprehensive analysis of the simulation properties of the most recent version of the INTERLINK model is given by Richardson *et al.* (2000).

15 . A variety of alternative assumptions could be made based on alternative policy rules, but for diagnostic purposes those considered here are sufficient.

a 10 per cent appreciation of the Euro does not represent a 10 per cent drop in competitiveness for the Euro countries relative to their trading partners. OECD GDP is approximately ½ per cent lower after one year and ¾ per cent lower after two years.

42. Recall from Figure 3 that the long-run single-equation response to an exchange rate shock is approximately one-for-one for most OECD economies, which corresponds to a 10 per cent decline in exports for this shock. In contrast, the ultimate decline in exports is, however, clearly less severe when the whole country model is run; in fact, exports return to baseline in all countries in the long run.

43. There are several reasons for this recovery and the most important is that export prices (in domestic currency terms) also adjust to changes in competitiveness. Export prices are determined by domestic costs and by competitors' export prices, with competitors' prices having the most weight. Using the United States as an example, export prices in dollar terms fall by 2.7 per cent in the year following the appreciation - offsetting a sizeable proportion of the original exchange rate appreciation. Looking further ahead, prices are 5 per cent lower after five years and 10 per cent lower after ten years. In other words, the appreciation is effectively reversed within a decade. In Japan the adjustment to prices is much quicker: 5 per cent in the first year - wiping out half the effect of the appreciation - and 7.5 per cent after five years. The different adjustment speeds across countries reflect the differing degrees of pricing to market. For example, previous OECD empirical work (see for example Herd, 1987) suggests that Japan has a greater degree of pricing to market than does the United States or Europe, and so a change in the exchange rate is absorbed in domestic profit margins to a significantly greater extent. Even so, in real terms, the competitiveness positions of most economies are back where they started after five to ten years.

44. There is also a secondary channel operating in these simulations, although this is much less important. This works through a terms-of-trade or price-wedge effect. Real unit-labour costs from a producer's point of view (i.e. calculated using the GDP deflator) are approximately unchanged for most countries but real consumption wages (using the private consumption deflator) are higher. The wedge between production and consumption real wages is driven by a change in the terms of trade, which in turn is driven by different adjustment speeds for export and import prices. In the case of the United States, the terms of trade improve by 4 per cent in the first year; Japan's rise by 3.5 per cent; and the OECD average is 2.8 per cent. This causes a temporary increase in domestic consumption that partially offsets the fall in exports.

45. A further channel for the erosion of exchange rate effects is that by which higher exports raise GDP relative to potential, closing the "output gap". Such an effect would be expected to influence inflation in general and raise domestic costs entering the export price decision. Thus the stimulus to demand would also be expected to act as a force which returns export competitiveness towards baseline in the longer run.

2.1.2 Government spending shock

46. Next the impact of fiscal policy is considered, and the extent to which a rise in government spending crowds out exports. The impact of a rise in government spending will clearly depend on which parts of the budget are changed. For example, a rise in wage consumption is likely to bid up economy-wide wages by more than would an equivalent rise in non-wage consumption, and a rise in government investment may have a smaller impact than other parts of the budget if investment goods have a high import component. In this simulation, government real non-wage consumption is raised by 1 per cent of baseline GDP in each country. The nominal exchange rate and real interest rates are held at their baseline levels, and real government investment is assumed to be unchanged.

47. The results are broadly as expected and are summarised in Table 5. A rise in spending raises GDP by 1–1½ per cent after one year in the major economies, although this effect dies off relatively quickly. The United States has the strongest short-term government spending multiplier. The rise in domestic demand pushes up prices and wages in every country, leading to an appreciation of the real effective exchange rate (recall that the nominal exchange rate is fixed). This, in turn, crowds out exports. After three years, manufacturing exports are 0.6 per cent lower on average for OECD economies, although the impact is more severe in Japan. A direct consequence is a "worsening" of the trade account. After five years, the current-account balance as a proportion of GDP is 0.3 per cent lower. On average OECD economies see a worsening of two-thirds of a per cent of GDP, but the impact is noticeably more severe in Europe.

48. Comparing the United States and Europe, and ignoring the first-year impact effect, the United States experiences a significantly smaller impact on its current account despite a sharper decline in export volumes and, in fact, a more aggressive expansion of imports. The reason is that it has more pricing power on world markets. It is able to pass on a larger fraction of its domestic cost pressures. Its export prices are 5 per cent higher after five years, while its import prices are only 2 per cent higher. In contrast, the Euro area the corresponding Figures are 1.5 and 0.5 per cent. By expanding the domestic economy, the United States' terms of trade moves in its favour. However, there is no free lunch. US firms are not able to pass on all their cost increases: and corporate profits are permanently lower.

49. These results suggest a clear link between fiscal policy and the current account, despite key international transmission channels being switched off. In particular, additional and potentially large effects may occur if real interest rates and the nominal exchange rate are allowed to increase in response to the rise in spending. An endogenous monetary policy response is also likely to increase the degree of crowding out as that would lead to a further rise in interest and exchange rates in response to the inflationary pressure generated by the fiscal expansion.

2.2 Full model properties

2.2.1 Exchange rate shock

50. Exchange rate shocks for the United States, Japan, and the Euro area were also run using the whole model with all international linkages switched on. As before, real government consumption and investment are held at their baseline levels, as are real interest rates. However, this time there is a small difference for the Euro countries. For these countries it is assumed that the *area*'s real interest rate remains at its baseline level (i.e., the Euro short-term rate minus the Euro average inflation rate). Euro members will have their own inflation rate, so their individual real interest rates will also differ slightly. The main results are summarised by the dashed lines in Figure 7.[16]

51. Three features stand out when comparing the full model with the single-country results. First, impact effects on exports are generally stronger. For example, US exports fall by approximately twice as much in the first year when international feedbacks are accounted for. This is not a surprise. As an example, consider what happens in Germany when the US dollar appreciates. In the single-country simulation, it is assumed that all other countries (e.g. Germany) buy the same volume of imports. US exports drop because the higher exchange rate leads to a loss of market share. In other words, German buyers substitute away from US goods and towards, say, Japanese products. Second, not only does the

16. The dashed lines represent different simulations. In the US panel it represents the impact on US exports of a US dollar appreciation; the Japanese panel shows the impact of a yen shock, and so on.

United States lose market share, but the size of its market also falls. An appreciation of the US dollar makes domestic (German) goods more attractive, so in Germany there is a further substitution away from US exports and towards locally-made goods.

52. There is a third, simpler channel operating in these simulations. Weaker US exports lead to an economic slowdown in the United States, which then affects demand in the rest of the world. That is why the increase in US imports is not as large using the full model as it is looking at the single-country results. The same phenomenon is seen for Japanese exports following a yen appreciation. However, the difference between the single-country and full-model simulations is very small. This reflects the small impact that Japan has on the rest of the model. The spillovers from Europe are greater, reflecting the comparative size and openness of the Euro Area compared to Japan.

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Table 1. **Summary of single equation OLS results for manufacturing exports volumes[a]**

	United States	Japan			Germany		France		Italy	United Kingdom	Canada	
		I	II	III	I	II	I	II			I	II
Estimation period	76:2-97:1[e]	78:2-97:1	78:2-97:1	78:2-97:1[d]	76:2-97:1[e]	76:2-97:1[e]	83:1-97:1	83:1-97:1	76:2-97:1	76:2-97:2	76:2-97:1	76:2-97:1
Elasticity wrt relative prices												
: impact	-0.09	-0.47**	-0.18*	-0.32***	-0.21*	-0.23**	-0.32***	-0.17	-0.24	-0.22**	-0.49***	-0.47***
: long-run	-0.56***	-2.67***	-0.75***	-2.15***	-1.44**	-1.05**	-0.81***	-0.60***	-0.98***	-1.58***	-0.90***	-0.74***
Time trend[1]												
Linear		-1.13**			-1.04**		-0.75***				-2.86***	
Non-linear (in 99H1)[f]			-4.76***			-2.27***		-0.16***				-1.61**
Elasticity wrt market demand												
: Impact	1.00***	1.45***	1.21***	1.30***	1.00***	1.00***	1.00***	1.00***	0.60	1.00***	0.80***	0.74***
: Long-run	1.00***	1.00***	1.00***	1.00**	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***
Standard error[2]	2.04	1.42	1.60	1.79	1.73	1.72	1.16	1.25	3.19	1.82	2.70	2.75
Diagnostic tests[b]												
Autocorrelation					#	#				#		
Normality												
Functional form (RESET)	#			##	#	#	#		#			
Predictive failure												
Structural change	#						(c)	(c)				

Table 1 *(contd.)*. **Summary of single equation OLS results for manufacturing exports volumes**[a]

	Australia	Austria		Belgium	Denmark		Finland	Greece		Ireland		Korea	Mexico	
		I	II		I	II		I	II	I	II		I	II
Estimation period	76:1-97:1	76:2-94:2	80:1:94:2	81:1-96:1	76:2-96:2	76:2-96:2	76:2-96:2[e]	76:2-94:2	76:2-94:2	81:2-92:2	81:2-92:2	81:1-97:1	76:2-96:2	76:2-97:1
Elasticity wrt relative prices														
: Impact	-0.44***	-0.30***	-0.44***	-0.22	-0.14	-0.09	-0.28**	-1.38***	-1.38***	-0.81**	-0.80**	-0.33**	-0.56***	-0.48***
: Long-run	-1.12*	-0.82***	-0.94***	-1.13	-0.78**	-0.64**	-1.34***	-1.25***	-1.25***	-1.23	-1.15	-1.74***	-1.84***	-1.24***
Time trend[1]														
Linear		0.77***			0.94***			-1.36**		2.27			3.89**	
Non-linear (in 99H1)[f]			0.01***			0.02***			-1.13*		1.80			3.93***
Elasticity wrt market demand														
: Impact	0.59 (d)	1.00***	1.00***	0.57**	0.55***	0.55***	0.42**	1.00***	1.00***	1.00*	1.00***	1.00**	1.00***	1.00***
: Long-run	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00*	1.00	1.00**	1.00***	1.00***
Standard error[2]	4.27	2.00	1.50	2.34	2.68	2.73	3.25	9.57	9.57	3.10	3.08	4.90	5.65	5.33
Diagnostic tests[b]														
Autocorrelation			###					#	#					
Normality														
Functional form (RESET)	##			##				#	#			##		
Predictive failure														
Structural stability	#			(c)				#				(c)		

Table 1 *(contd.)*. **Summary of single equation OLS results for manufacturing exports volumes**[a]

	Netherlands [e]	New Zealand		Norway		Portugal [d]		Spain		Sweden [e]		Switzerland	
		I	II	I	II	I	II	I	II	I	II	I	II
Estimation period	84:1-96:2	76:2-97:1	76:2-97:2	81:1-97:2	81:1-97:2	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1
Elasticity wrt relative prices													
: Impact	-0.47**	-0.38**	-0.40**	-0.39***	-0.32**	-0.60***	-0.56***	-0.79***	-0.68***	-0.30***	-0.26***	-0.20*	-0.23*
: Long-run	-0.39**	-0.86	-0.96	-0.57**	-0.42***	-5.29***	-1.73***	-1.41***	-1.40***	-1.28***	-1.20***	-0.23	-0.17
Time trend[1]													
Linear		-1.66***		-1.66***		-		2.94***		-1.17***		-2.34***	
Non-linear (in 99H1)[f]			-0.00***		-0.14***		0.17***		4.61***		-0.14***		2.63***
Elasticity wrt market demand													
: Impact	1.00***	0.82***	0.80***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***
: Long-run	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***	1.00**	1.00**
Standard error[2]	2.29	4.09	4.02	3.12	2.88	4.20	3.79	5.31	4.97	1.76	1.70	2.40	2.48
Diagnostic tests[b]													
Autocorrelation	#												
Normality													
Functional form (RESET)				##									
Predictive failure													
Structural stability	##(c)			(c)	(c)								

1. Percentage per annum.
2. Percentage.

Notes:

(a) For those countries for which a trend variable is significant, two alternative equations are shown: (i) with a linear time trend and (ii) with a non-linear time trend. Statistical significance of the impact and long-run responses at the 10, 5 and 1 per cent significance levels are denoted by "*", "**" and "***", respectively;

(b) Failure of the tests at the 10, 5 and 1 per cent significance level is denoted by "#", "##", "###", respectively;

(c) Failure of structural stability test at the 5 per cent level over the full sample, but the reported equation relates to one estimated over a shorter sample;

(d) For Portugal, a non-linear trend is included although a linear trend is not significant. This is because the long-run price elasticity obtained in the model excluding a linear trend is high and seems to be correlated with a linear time trend;

(e) A seasonal dummy was included for Netherlands while a dummy for the period 1980H1 was included for Sweden;

(f) The contribution of the non-linear trend to export growth varies over the sample estimation period, but for purposes of comparison is evaluated here at 1999H1.

Table 2. **Summary of system estimation results**

	United States	Japan	Germany	France	Italy	United Kingdom	Canada	Australia	Austria	Belgium	Denmark
Dependent variable: Δ ln XMPERF											
Estimation period	76:2-97:1	78:1-97:1	76:2-97:1	83:1-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-97:1	76:2-94:2	81:1-96:1	76:2-97:1
Intercept	0.00	0.08***	-0.01**	-0.01***	0.02**	0.00	-0.14***	0.00	0.02***	0.02**	0.01
Δ ln RPXM	-0.08	-0.35***	-0.35***	-0.35***	-0.35***	-0.22***	-0.35***	-0.35***	-0.35***	-0.35***	-0.13
Error correction term γ*[ln XMPERF(-1) + θ*lnRPXM(-1)]											
γ	-0.33***	-0.18***	-0.11***	-0.33***	-0.33***	-0.16***	-0.33***	-0.16***	-0.61***	-0.15***	-0.33***
θ	-0.63***	-1.69***	-0.99***	-0.99***	-0.99***	-0.99***	0.99***	-0.99***	-0.99***	-0.99***	-0.62***
Time trend											
Linear (x 100)			-0.08***								
Non-linear				0.11***			0.54***		-0.06***		-0.05***
Δ ln XMPERF(-1)		0.39***									0.33***
Δ ln XMVMKT					-0.61***		-0.26***			-0.39***	-0.54***
Δ ln XMVMKT(-1)											
ΔΔ ln XMVMKT								-0.75***			
Δ ln RPXM(-1)			-0.18**				0.31***				
Other explanatory variables	(b)	(c)	(d)								
Standard error[1]	2.10	1.95	1.59	1.48	3.38	2.01	2.88	4.14	1.90	2.36	2.76
Time Trend[2]											
Linear			-0.76***								
Non-Linear (in 99H1)				-0.16***			-1.89***		0.01***		0.02***

Table 2 (*contd.)*. **Summary of system estimation results**

	Finland	Ireland	Korea	Mexico	Netherlands	New Zealand	Norway	Spain	Sweden	Switzerland
Dependent variable: Δ ln XMPERF										
Estimation period	76:2-97:1	81:1-92:2	81:1-97:1	76:2-97:1	84:1-96:2	76:2-97:1	81:-97:1	76:2-97:1	76:1-97:1	76:2-97:1
Intercept	0.06***	0.15***	0.01	0.37	0.00	0.03***	-0.02**	0.91***	0.00	0.34***
Δ ln RPXM	-0.35***	-0.17	-0.35***	-0.35***	-0.35***	-0.35***	-0.35***	-0.35***	-0.18***	-0.31***
Error correction term γ*[ln XMPERF(-1) + θ*lnRPXM(-1)]										
γ	-0.33***	-0.17***	-0.12***	-0.55***	-0.73***	-0.22***	-0.66***	-0.33***	-0.33***	-0.33***
θ	-0.99***	-0.99***	-1.69***	-0.99***	-0.54***	-0.99***	-0.42**	-0.99***	-0.99***	-0.48[e]
Time trend										
Linear (x 100)										-0.30***
Non-linear		-0.21***		-0.74***		0.05***	0.21***		0.11***	
Δ ln XMPERF(-1)	-0.24***			0.37***						0.36***
Δ ln XMVMKT	-0.38**					-0.31***				
Δ ln XMVMKT(-1)						-0.34***				
ΔΔ ln XMVMKT										
Δ ln RPXM(-1)		-0.17						-0.44**		
Other explanatory variables	(f)				(g)	(h)			(i)	
Standard error[1]	3.37	3.77	4.96	5.45	2.01	4.12	2.94	5.52	1.79	2.40
Time Trend[2]										
Linear										
Non-linear (in 99H1)		2.18***		4.27***		-0.00***	-0.15***	3.89***	-0.13***	-1.90***

1. Percentage.
2. Percentage per annum.

Notes:

(e) Imposed (freely estimated coefficient implausibly small).
(f) A dummy for the period 1991H1 was included.
(g) A seasonal dummy was included.
(h) A dummy for the period 1989H2 was included.
(i) A dummy for the period 1980H1 was included.

Table 3. **Single equation estimates for non-OECD regions**

	CHN[a]		ANC[a]		ASO[a]		AFM[a]		LAT[a]	SEE[a]	
	I	II	I	II	I	II	I	II		I	II
Dependent variable: Δ ln XMPERF											
Estimation period	84:1-95:2	84:1-95:2	80:1-95:2	81:1-95:2	80:1-95:2	80:1-95:2	80:1-95:2	80:1-95:2	80:1-95:2	80:1-92:2	80:1-92:2
Intercept	-2.85***	0.56***	-0.53	0.09***	0.23***	0.12***	-0.32***	0.05***	0.03**	0.66**	-.68***
Δ ln RPXM	-0.89***	-0.64***	-0.47***	-0.26*	-0.52***	-0.49***	-0.24**	-0.18**	-0.76**	-0.15	-0.31***
ln XMPERF(-1)	-0.53***	-0.71***	-0.17*	-0.45***	-0.15**	-0.17**	-0.31***	-0.51***	-0.16*	-0.15	-0.42***
ln RPXM(-1)	-0.34*	-0.34**	-0.18*	-0.20*	-0.17**	-0.15*	-0.24***	-0.18***	-0.14*	0.10	-0.24**
Time trend[1]											
Linear (x 100)	2.64***		0.49		0.24***		0.33***			-0.64	
Non-linear		-1.05***		-0.42***		-0.14***		-0.13***			0.93***
Δ ln XMPERF(-1)	0.47***	0.59***	0.57***	0.56***	0.45***	0.48***	0.45[e]	0.80***	0.43***	0.60***	0.60***
Δ ln XMVMKT					-0.60***	-0.59***	-0.59***		-0.71*		
Δ ln XMVMKT(-1)											
Δ ln RPXM(-1)											
Standard error[1]	3.43	3.25	2.26	2.00	2.02	2.02	2.12	1.74	4.11	2.65	2.10
Diagnostic tests[b]											
Autocorrelation	#	#			#	#	##		##		
Normality			##			#					
Functional form (RESET)								##	##	#	#
Predictive failure											
Structural change	###(c)	###(c)	(c)	#(c)	#(c)	(c)	#(c)	(c)	(c)	(c)	(c)
Long-run elasticities											
Relative prices	-0.63**	-0.48***	-1.08**	-0.44**	-1.14**	-0.90***	-0.78***	-0.36***	-0.88**	-0.69[d]	0.57***
Time [1]											
Linear	9.87***		5.89***		3.29***		2.11***			-8.54**	
Non-linear (in 99H1)		5.13***		0.76***		3.29***		0.05***			-9.73***

1. Percentage.
2. Percentage per annum.

Notes

(a) For some regions two alternative equations are shown: for which a trend variable is significant, two alternative equations are shown: (i) with a linear time trend and (ii) with a non-linear time trend. For other regions the market demand elasticity is not significantly different from unity and the time trend insignificant so only one equation is shown. Statistical significance of coefficients and long-run parameters at the 10, 5 and 1 per cent level is denoted by "*", "**" and "***" respectively. Key to regions: CHN=China; ANC= Dynamic Asia; ASO= Other Asia; AFM= Africa and Middle East; LAT= Latin America; SEE= Eastern and Central Europe.

(b) Failure at the 10, 5 and 1 per cent significance level is denoted by "#", "##"and "###" respectively.

(c) Failure of structural stability test over full sample, but reported equation and other test statistics relate to equation estimated over shorter sample.

(d) Imposed since otherwise the response to a change in relative prices generates pronounced fluctuations.

(e) A dummy for the period 1989H1 was included for Africa & Middle East (AFM).

Table 4. **Impact of an exchange rate shock**

(10 per cent appreciation of exchange rate, on a country-by-country basis)

Deviations from baseline, in per cent

	Years after shock				
	1	2	3	4	5
United States					
GDP level	-0.2	-0.7	-0.3	-0.1	0.1
Consumer price inflation	-0.7	-0.5	-0.8	-1.0	-1.2
Current account[1]	0.0	-0.1	-0.2	-0.3	-0.3
Manufactured exports	-1.3	-3.0	-3.5	-3.5	-3.1
Euro area					
GDP level	-0.6	-0.6	-0.4	-0.1	0.1
Consumer price inflation	-0.9	-0.8	-0.9	-0.9	-1.0
Current account[1]	-0.2	-0.4	-0.5	-0.5	-0.5
Manufactured exports	-1.2	-1.7	-1.5	-1.3	-0.9
Japan					
GDP level	-0.4	-1.0	-1.1	-1.0	-0.9
Consumer price inflation	-0.4	-0.7	-1.3	-1.5	-1.7
Current account[1]	-0.2	-0.4	-0.6	-0.7	-0.9
Manufactured exports	-2.0	-4.5	-5.9	-6.4	-6.6
OECD average[2]					
GDP level	-0.5	-0.8	-0.6	-0.3	-0.1
Consumer price inflation	-0.9	-0.8	-1.1	-1.2	-1.2
Current account[1]	-0.2	-0.4	-0.5	-0.6	-0.6
Manufactured exports	-1.4	-1.7	-3.1	-3.0	-2.7

1. Percentage of GDP.
2. Single country responses, averaged across OECD countries.

Note: Real government consumption and investment held at their baseline levels. Real interest rates are held at their baseline level.

Table 5. **Government spending shock**

(1 per cent rise in government non-wage consumption: country-by-country basis)

Deviations from baseline, in per cent

	Years after shock				
	1	2	3	4	5
United States					
GDP level	1.7	1.3	0.5	0.2	0.1
Consumer price inflation	0.2	0.9	1.4	1.5	1.5
Current account[1]	-0.5	-0.4	-0.2	-0.3	-0.4
Manufactured exports	0.0	-0.2	-0.7	-1.3	-2.0
Euro area					
GDP level	0.9	0.8	0.7	0.5	0.4
Consumer price inflation	0.2	0.4	0.5	0.6	0.6
Current account[1]	-0.5	-0.6	-0.7	-0.7	-0.9
Manufactured exports	0.0	-0.1	-0.3	-0.6	-0.8
Japan					
GDP level	1.4	1.1	0.7	0.5	0.4
Consumer price inflation	0.5	1.6	1.3	1.4	1.7
Current account[1]	-0.3	-0.2	-0.2	-0.2	-0.3
Manufactured exports	-0.1	-0.6	-1.5	-2.5	-3.8
OECD average[2]					
GDP level	1.2	1.0	0.6	0.4	0.2
Consumer price inflation	0.3	0.8	1.0	1.0	1.0
Current account[1]	-0.5	-0.4	-0.4	-0.5	-0.6
Manufactured exports	0.0	-0.2	-0.6	-1.0	-1.6

3. Per cent of GDP.
4. Single country responses, averaged across OECD countries.

Note: Real government investment held at its baseline level. Real interest rates are held at their baseline level.

Figure 1. Export performance and competitiveness
Index 1991 = 100, competitiveness as inverse of relative export prices

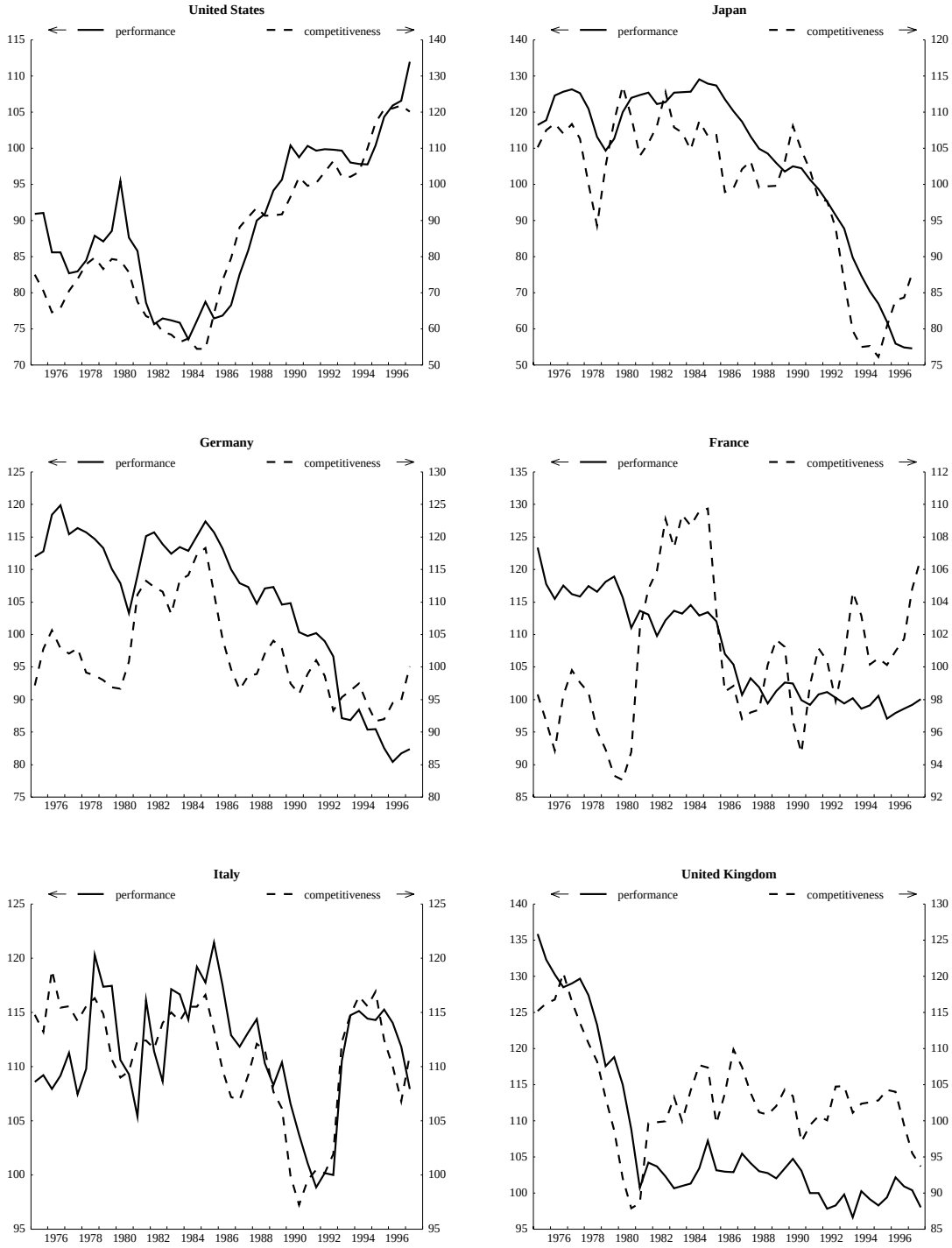


Figure 1. (Continued)
Index 1991 = 100, competitiveness as inverse of relative export prices

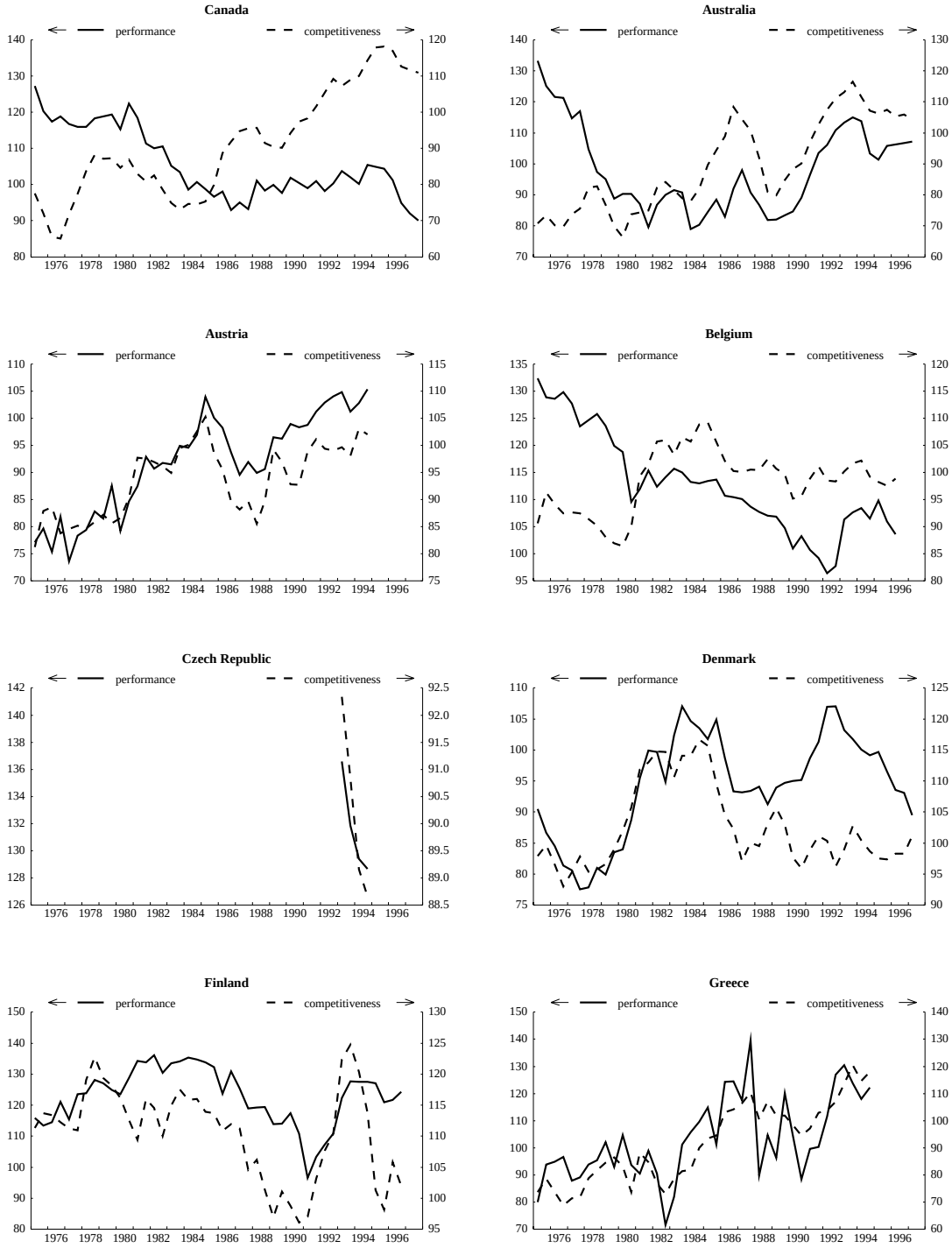


Figure 1. (Continued)
Index 1991 = 100, competitiveness as inverse of relative export prices

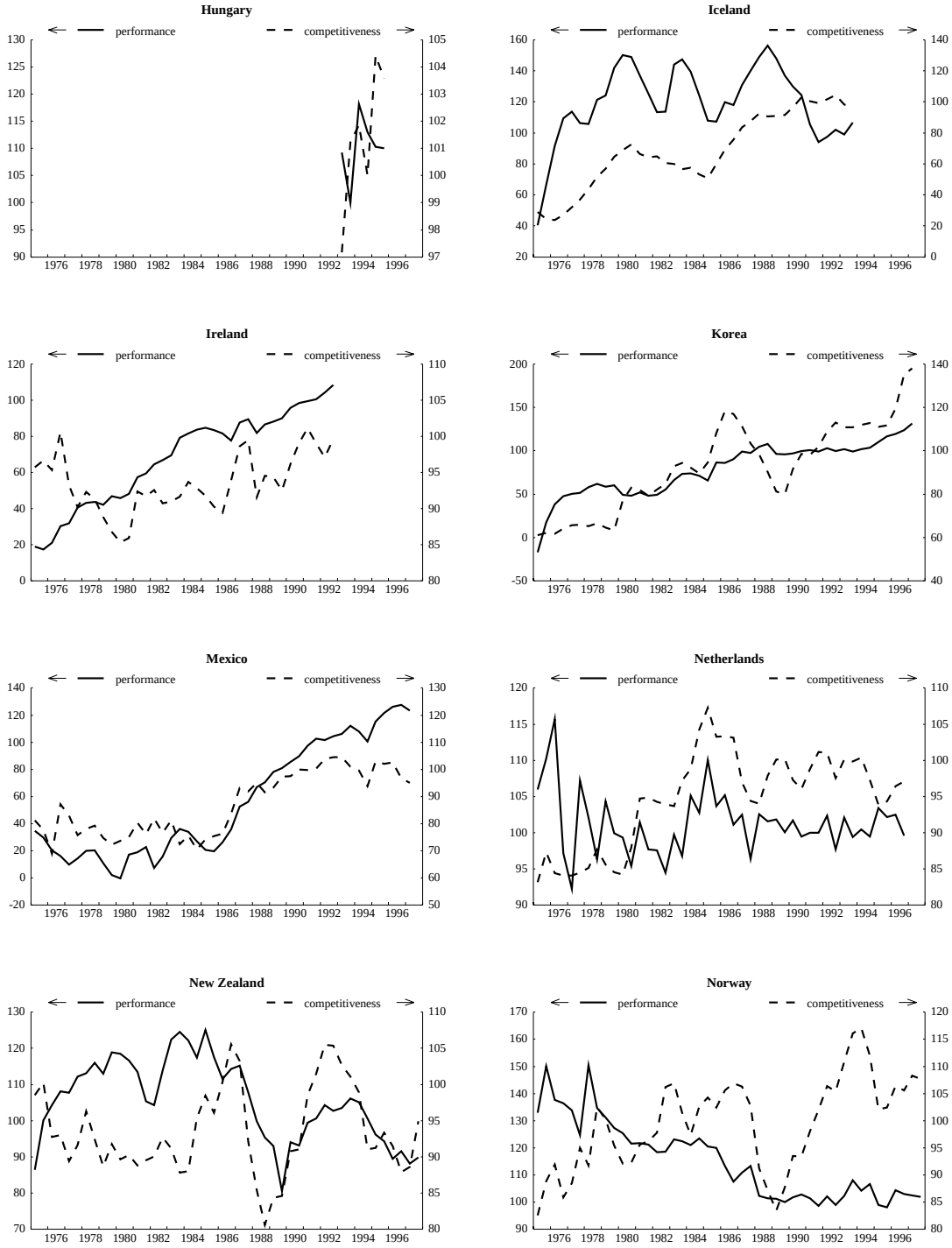


Figure 1. (Continued)
Index 1991 = 100, competitiveness as inverse of relative export prices

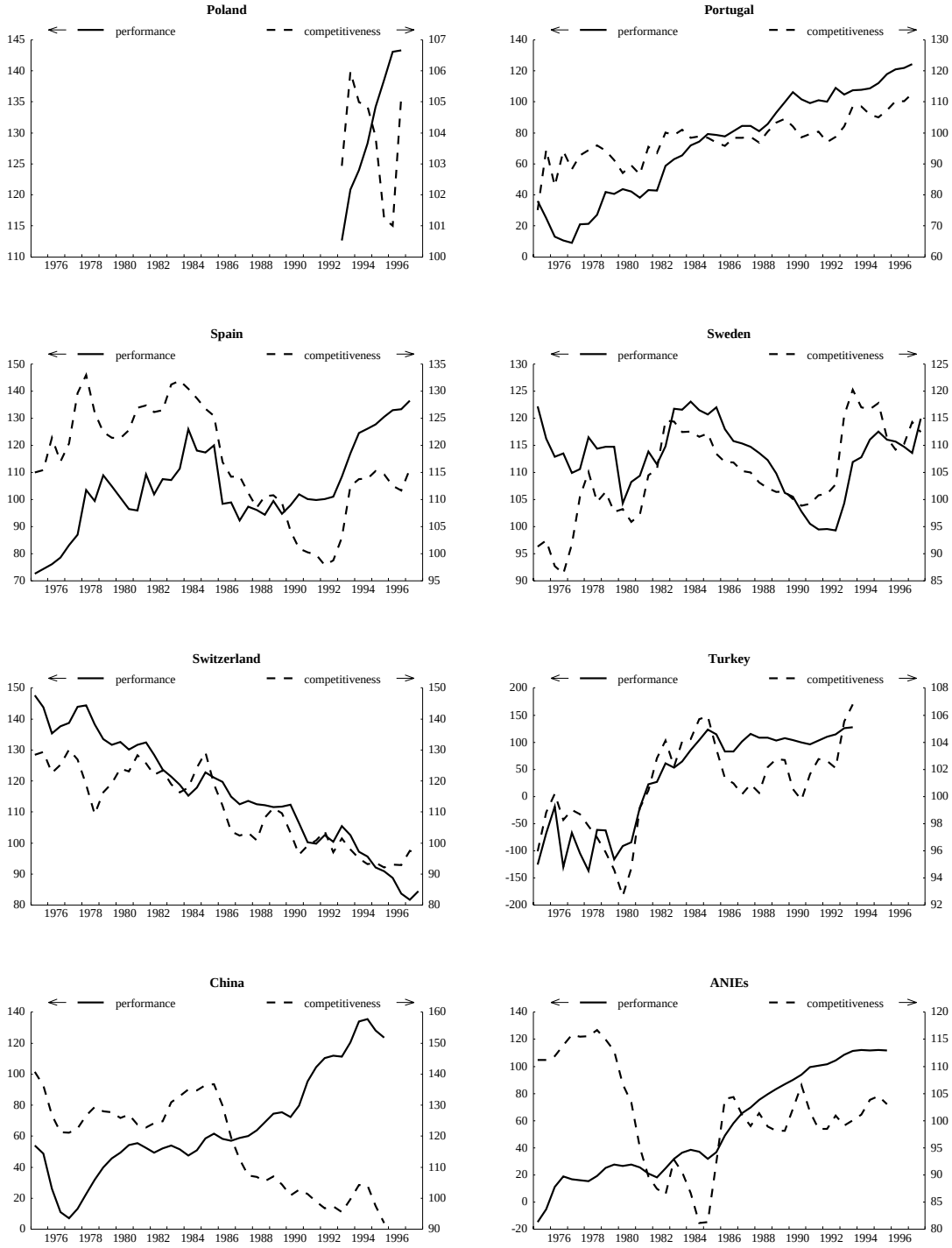


Figure 1. (Continued)
Index 1991 = 100, competitiveness as inverse of relative export prices

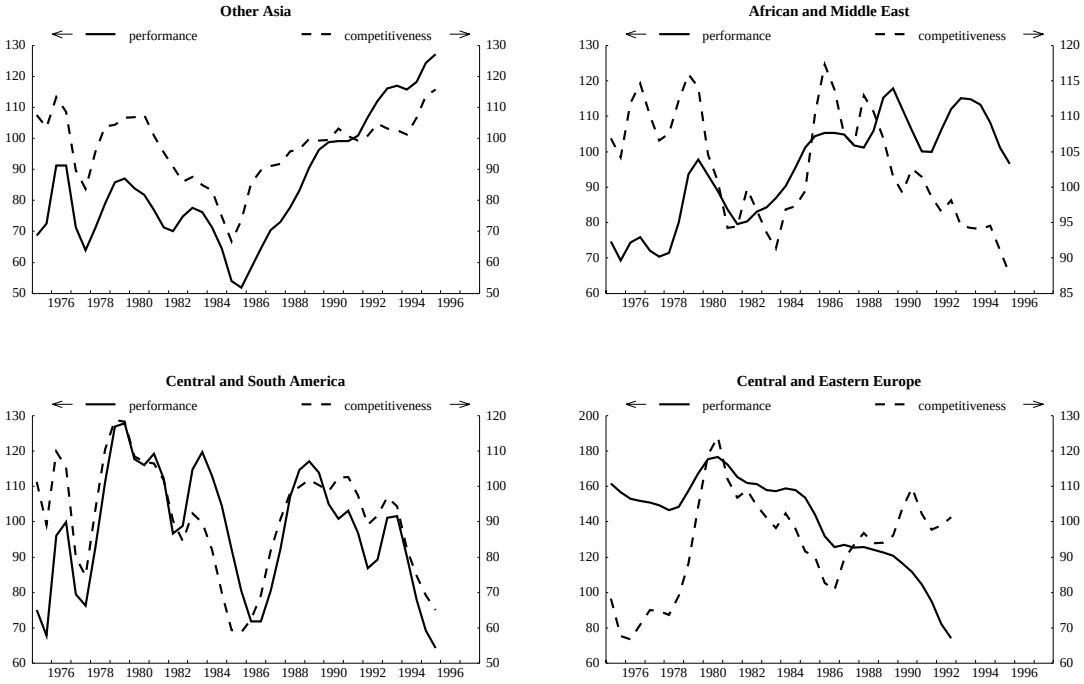
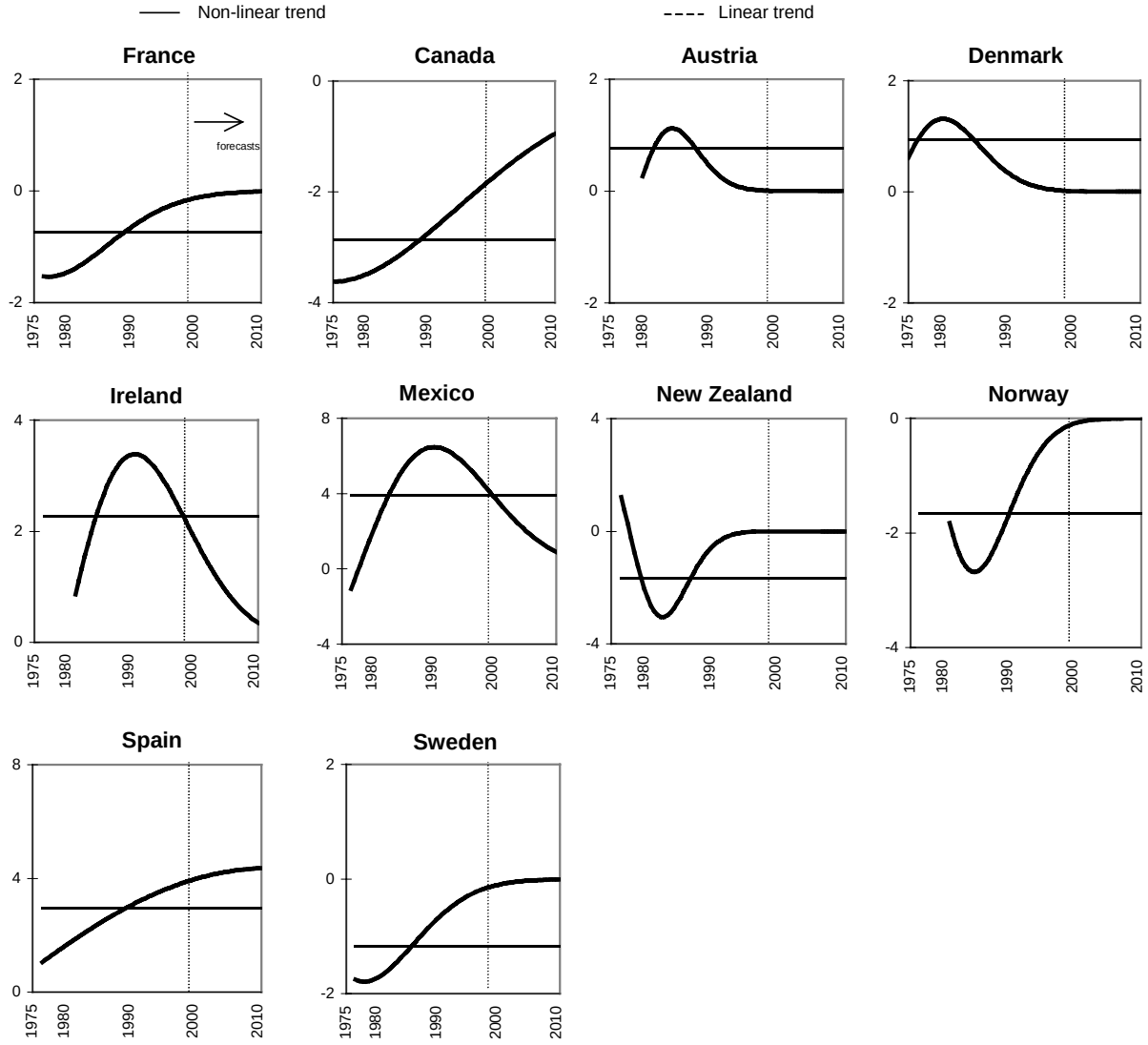
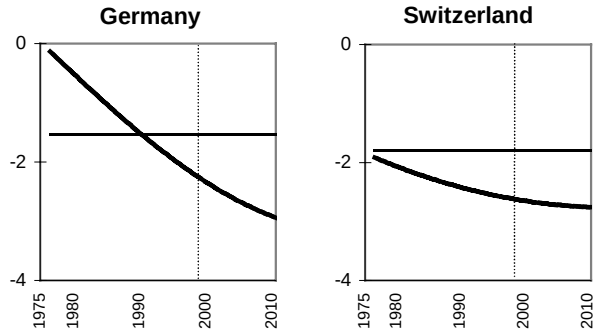


Figure 2. **Effects of time trend variable on manufacturing exports** [1,2]
(Contribution to export volume growth, per cent per annum.)

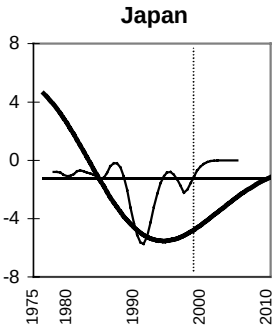
a. OECD countries where a non-linear time trend is preferred



b. OECD countries where a linear time trend is preferred in system equation



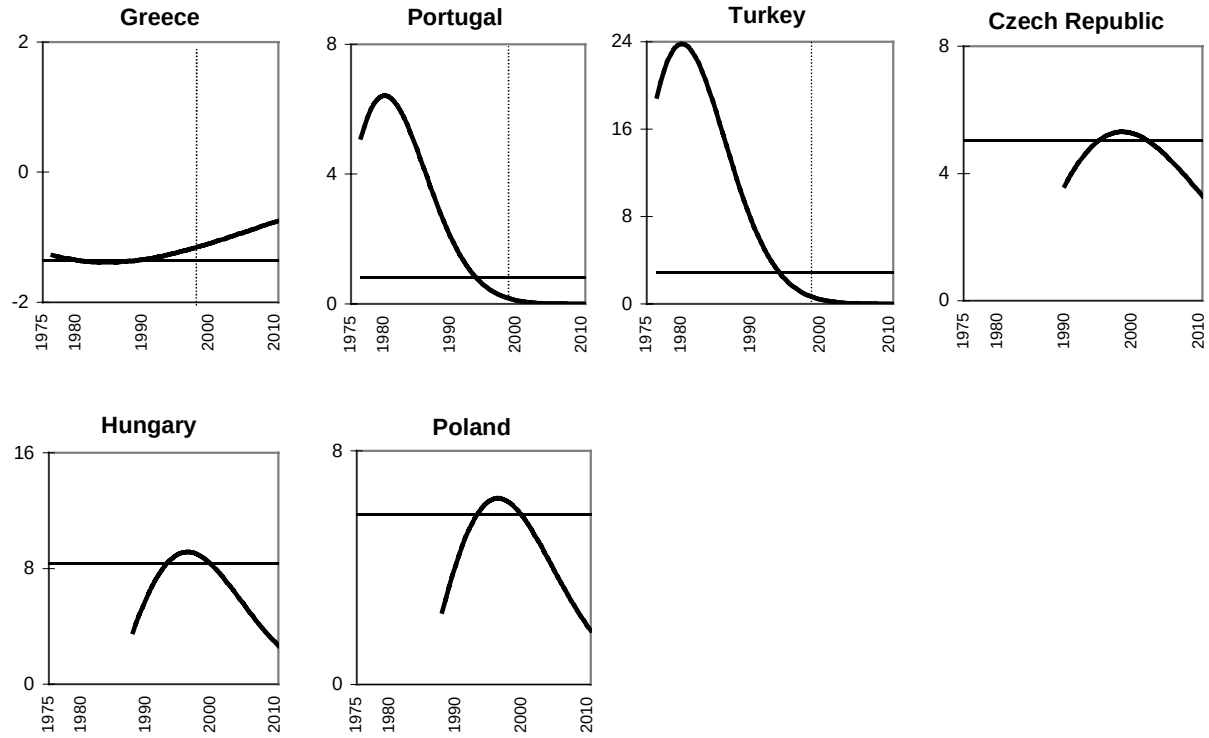
c. Japan



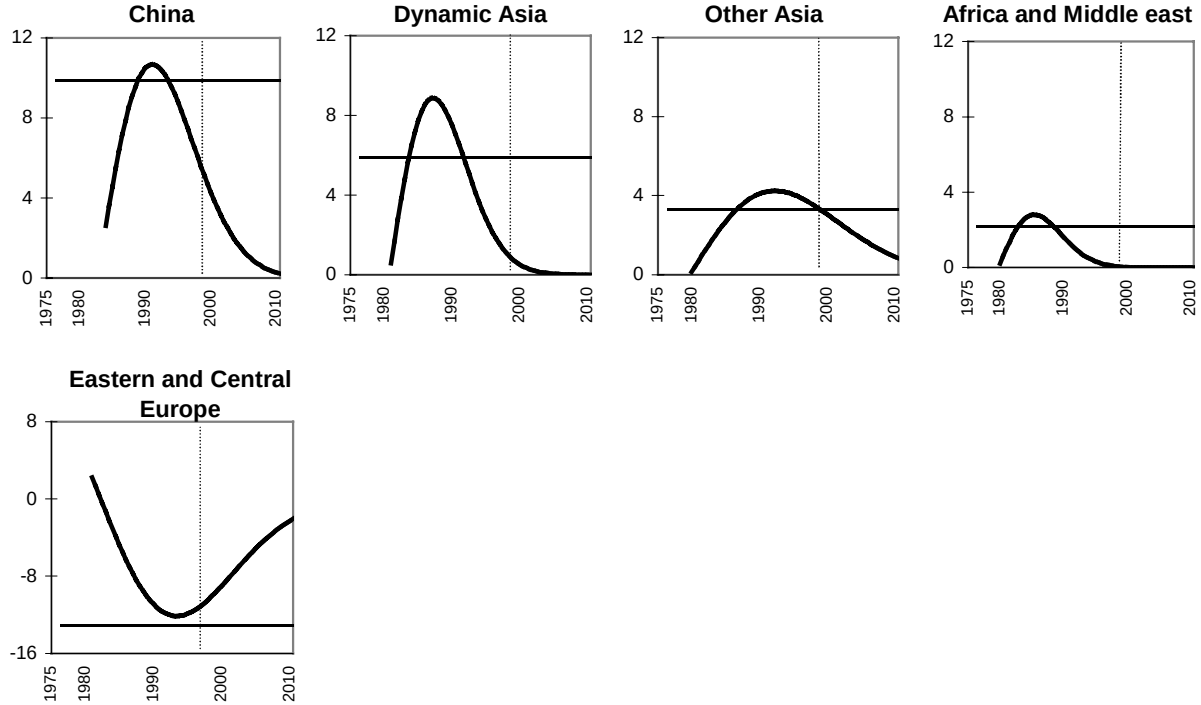
The thin solid line for Japan shows the effect of FDI variable.

Figure 2 (continued). **Effects of time trend variable on manufacturing exports**

d . OECD countries where a non-linear trend is preferred and not in a system estimation



e. Non-OECD area and regions with a non-linear time trend



1. Non-linear time trend effect is from the system of equations while the linear time trend effect is based on the single equation results.
2. Scales differ for different countries.

Figure 3. **Long run relative price elasticities**

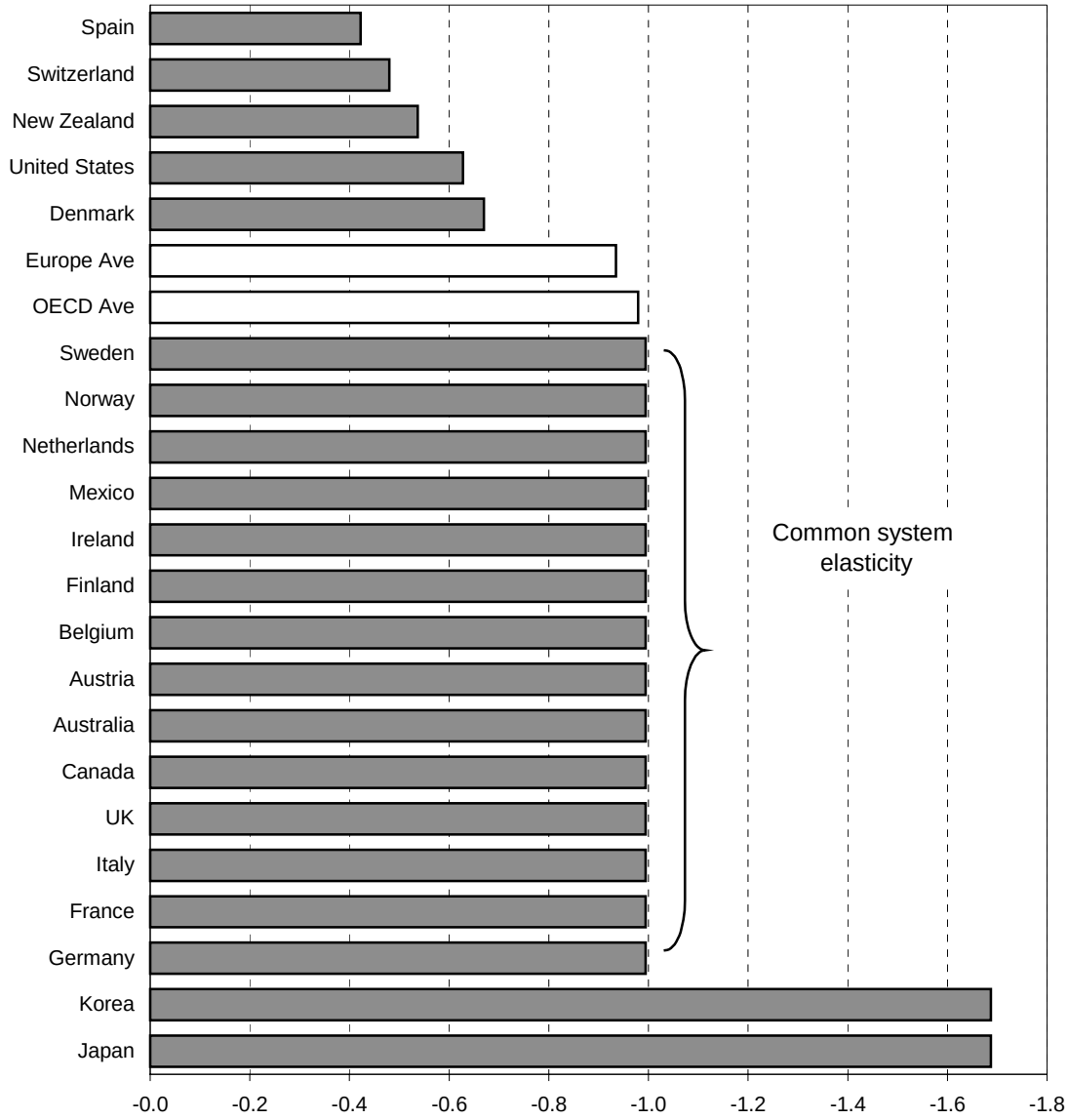


Figure 4. **Residuals from the system estimation**

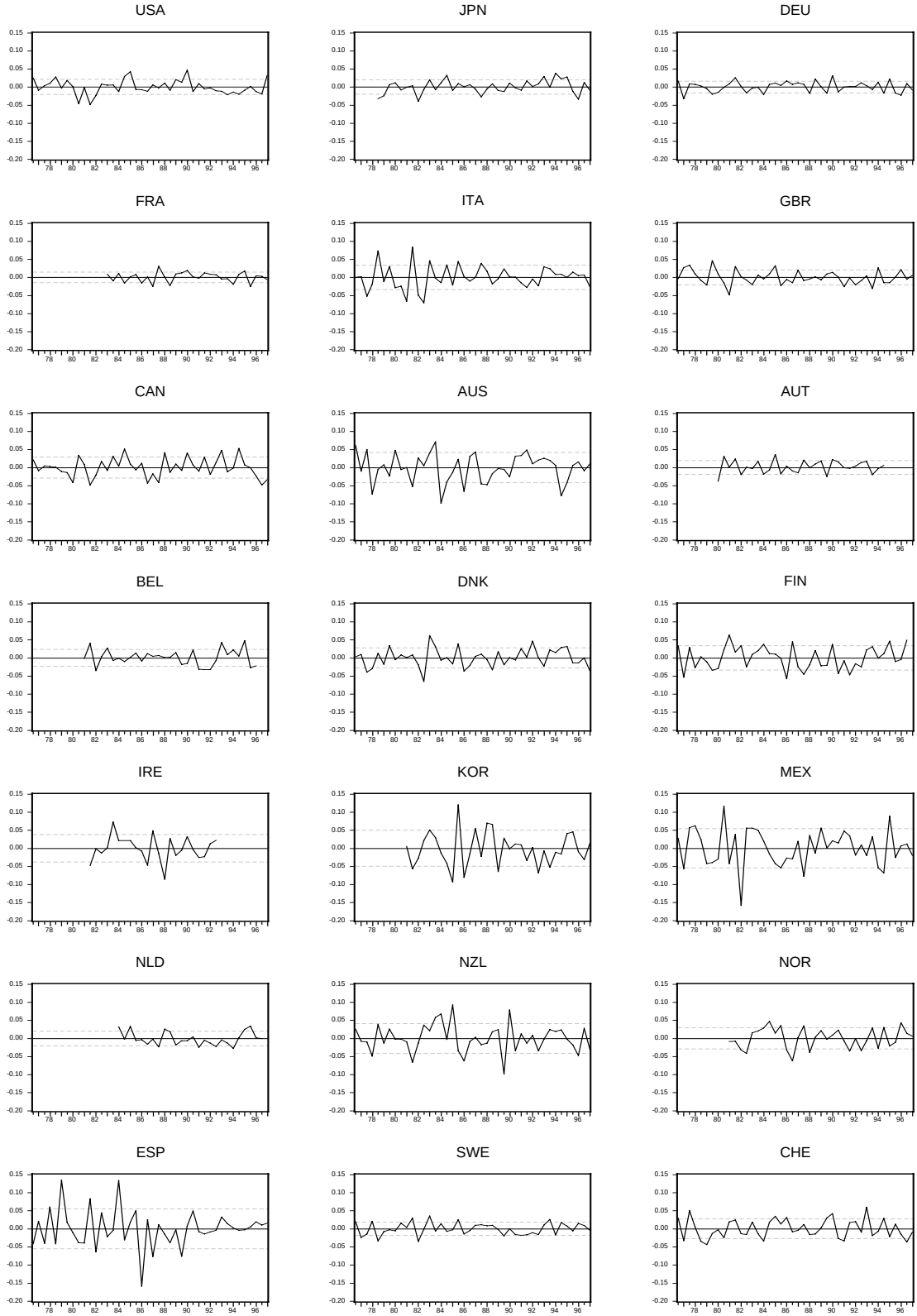


Figure 5. **The response of export volumes to a one percent fall in relative export prices**

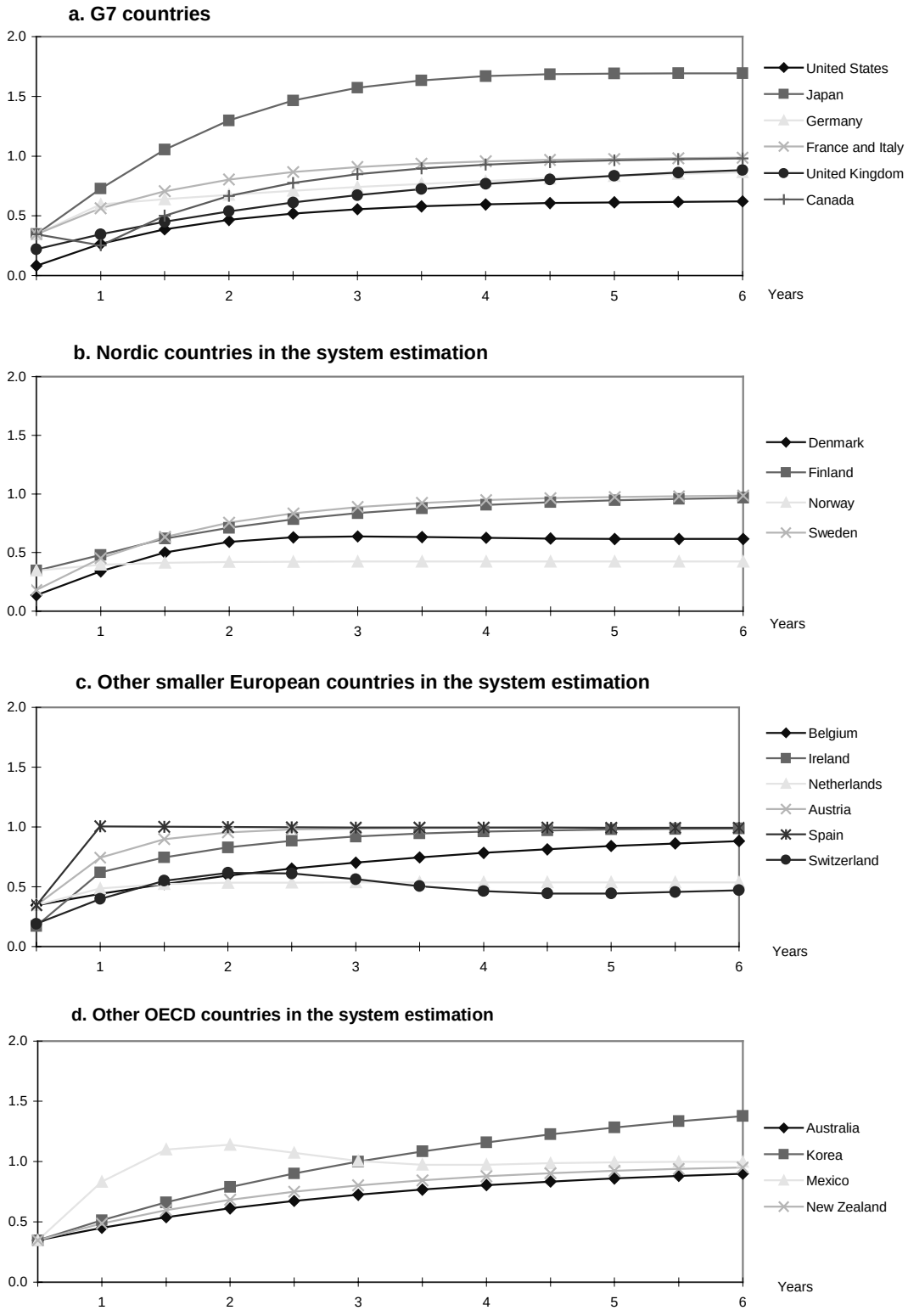


Figure 6. **Long-run price elasticities for each country included in system**

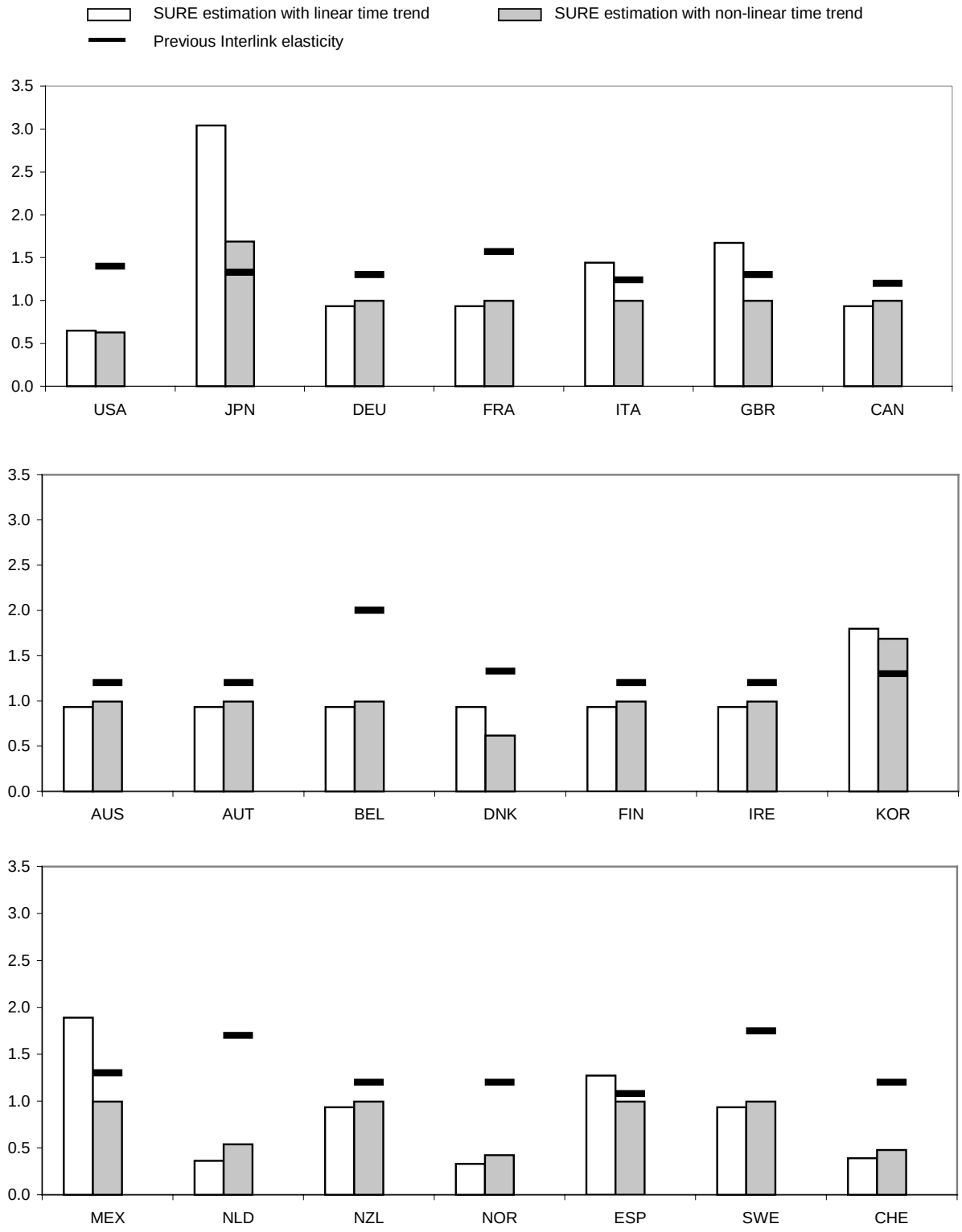
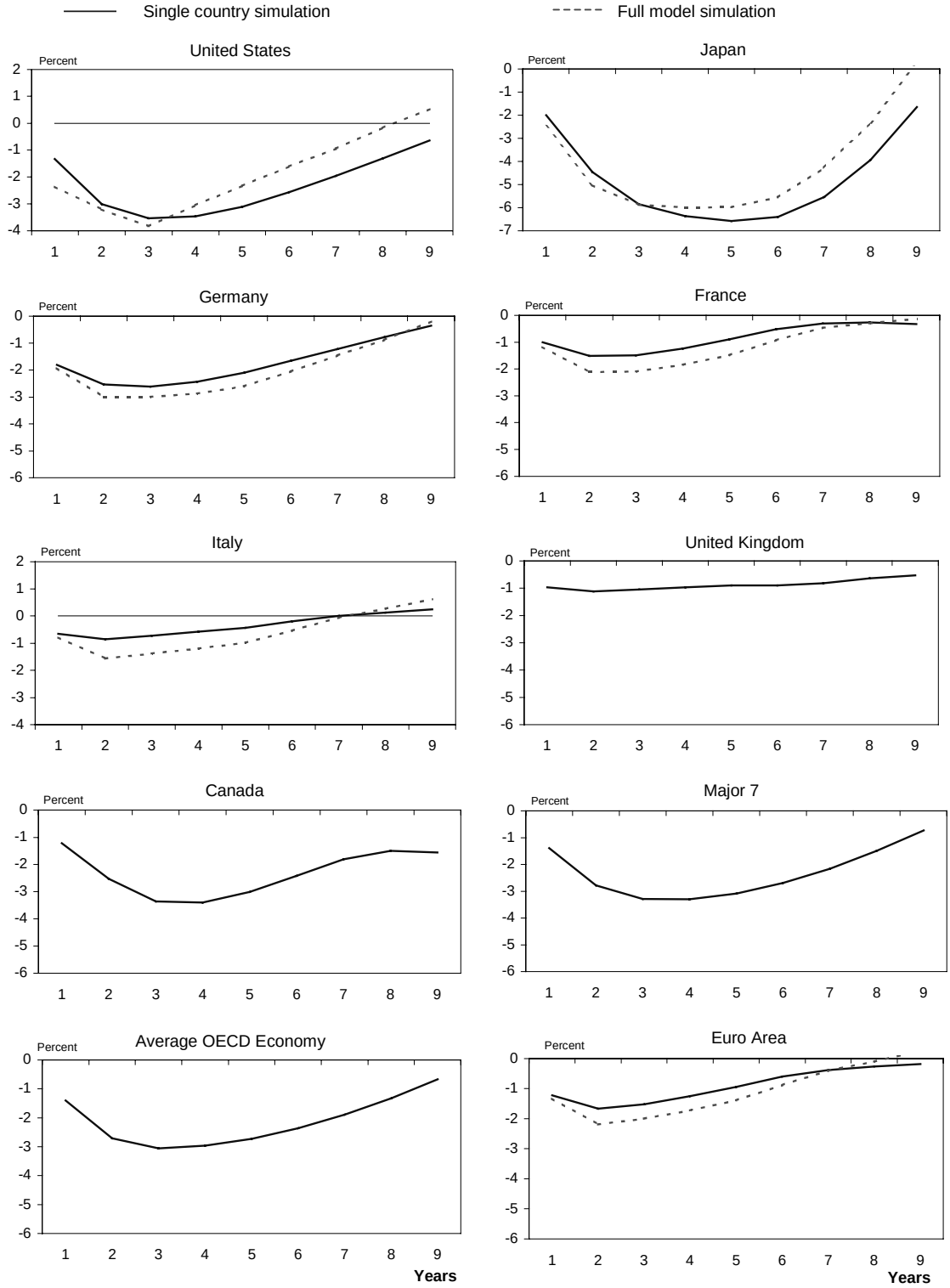


Figure 7. **Impact on exports of a ten percent exchange rate appreciation**
Deviations from baseline in percent.



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