# An examination of the ex-post macroeconomic impacts of CSF 1994-99 on Objective 1 countries and regions

## Greece, Ireland, Portugal, Spain, East Germany and Northern Ireland

**Final Report (December 20th, 2002)**

**The Economic and Social Research Institute (ESRI)**

**in association with**

**Gesellschaft für Finanz und Regionalanalysen (GEFRA)**

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# Table of contents

## [1] Introductory remarks

The CSF came into existence as a result of the major reforms and extensions of EU regional policy that were initiated in the context of planning for the development of the Single Market during the years 1985-88 (Cecchini, 1988). The political rationale behind the CSF came from the fear that not all EU member states and regions were likely to benefit equally from the Single Market. In particular, the less advanced economies of the Southern and Western periphery (mainly Greece, Ireland and Portugal, together with significant regions in Spain, Italy, Germany and the UK), were felt to be particularly vulnerable unless they received increased development aid.[1]

This report was prepared as part of a wider study - being co-ordinated by ECOTEC - of the *ex-post* impacts of CSF 94-99 on all the states and regions that were designated as Objective 1. In it we describe how we evaluated the macroeconomic impact on the three main EU Objective 1 countries (Greece, Ireland and Portugal) and on three of the four large Objective 1 regions (in Spain, East Germany and Northern Ireland) of the Community Support Framework that was in operation during the six years 1994-99 (henceforth, CSF 94-99).[2] The analysis of CSF macroeconomic impacts at national and regional levels requires the development and use of economic models whose main purpose is to formalise views about how economies of states and large regions work, and how the CSF expenditures and policies are likely to improve the functioning of those economies. Without such models it would be impossible to carry out quantitative analysis of CSF impacts at an aggregate level.

In the cases of Greece, Ireland and Portugal, there were already in existence HERMIN models that could be updated and adapted for use in the ex-post evaluation exercise (Bradley, Herce and Modesto, 1995; ESRI, 2000). In the case of Spain, there was a national HERMIN model, which could be updated and adapted for use in the analysis of the Spanish CSF 94-99 impacts, but only at the at the national level of aggregation (Bradley, Herce and Modesto, 1995). In the cases of East Germany and Northern Ireland, earlier versions of regional HERMIN models were available and could be updated and adapted for the ex-post evaluation of CSF 94-99 (see Bradley, Morgenroth and Untiedt, 2000, for East Germany and Bradley and Wright, 1994, for Northern Ireland).[3]

The present analysis of the macro impacts of CSF 1994-99 is being executed as part of a much larger project within which eleven separate national teams are engaged in the examination of the ex-post impacts of CSF 94-99 at a very detailed institutional and

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[1] In total, there were eleven Objective 1 CSFs during the period 1994-99. Three involved the designation of entire states as Objective 1 (Greece, Ireland and Portugal). Four involved the designation of large macro-regions as Objective 1 (the less developed regions of Spain, East Germany, Northern Ireland within the UK, and the Italian *Mezzogiorno*). The remaining four Objective 1 regions are in France, Belgium, the Netherlands and Austria, and are not considered to require a model-based macroeconomic evaluation.

[2] The ex-post data for CSF 94-99 show that in some of the national and regional CSFs there was some carry-over of expenditure into the years 2000 and 2001. While we take that into account, nevertheless, the bulk of expenditure was concentrated into the core six-year period 1994-99.

[3] It had been hoped to include the Italian *Mezzogiorno* in the macro evaluation exercise, but it was not possible to conclude arrangements for the development of a new HERMIN model in time for inclusion in this project.

microeconomic level. It is important to distinguish the different objectives and methodologies of these two separate elements of the wider project.

*(a) The national CSF-94-99 studies*:

The national studies are based on a comprehensive and detailed examination of data from each of the eleven Objective 1 CSFs. All possible stages of aggregation are taken into account: a selection of individual projects; the separate Operational Programmes, as well as the entire CSF. The tools of analysis available for use in these national studies tend to be descriptive, mainly qualitative and evaluations are based to a large extent on subjective judgements that are informed by analysis and interviews with a wide range of actors involved in the planning, execution, monitoring and evaluation of the eleven national CSFs that made up the Objective 1 part of EU Structural Fund aid.[4] Although some micro and project-based quantitative or cost-benefit analyses appear to have been carried out over the period 1994-99, they are few in number, and it is difficult to draw firm quantitative conclusions from these studies.

*(b) The macroeconomic CSF 94-99 impact evaluation*:

The macroeconomic impact evaluation discussed in this report has very different objectives and methodology to those of the National studies. It operates at the most aggregated level of analysis. So, the data on the actual implementation of CSF 94-99 needs to be aggregated up into essentially three major conceptual policy initiatives:

i. Investment in improved <u>physical infrastructure</u>;
ii. Investment in improvements in <u>human resources</u> (education and training); and
iii. Expenditures on direct <u>aid to the productive sector</u> (investment support, R&D, management training in the widest sense, etc).

Although qualitative aspects are also present in the macroeconomic analysis, as they are in the National studies, the present work is based almost entirely on the use of detailed quantitative macroeconomic models of the economies of the states and regions being studied. Thus, to the extent that these models provide a credible representation of the way in which CSF-type policies affect the economy, then some quantitative conclusions concerning CSF impacts can be drawn. Finally, the models can be used to explore the extent that the aggregate CSF 94-99 may have a greater impact than the sum of its individual parts, due to the existence of spill-over and externality effects that are difficult to conceptualise and measure at the more disaggregated micro or Operational Programme level of analysis.

While the model-based macroeconomic analysis holds out the promise of quantification of CSF impacts, it is important not to exaggerate the potential of this methodology. Anyone expecting a simple, single, easily derived "correct" answer to a question such as "what was the impact of CSF 94-99 on GDP?", will be disappointed. Indeed, such a question is conceptually vague and ill-posed, for the following reasons:

[4] Although the allocation of funds to the Objective 1 areas made up the bulk of the entire Structural Fund allocations for the period 1994-99, there were in total five separate Objectives that addressed a range of more narrowly focused issues such as youth unemployment, long-term unemployment, areas of declining industries, etc.

a) The exclusive focus on the causal impacts of the CSF policies (in isolation) on economic activity tends to neglect the fact that economic activity in any country or region is affected by a wide range of other policy shocks (e.g., fiscal, monetary, industrial, social, labour market, etc.) and other external shocks (developments in world growth, oil shocks, wars, etc.). The beneficial impacts of CSF 94-99 are likely to operate in conjunction with other policy shocks, and it may be difficult or impossible to disentangle the isolated impacts of the CSF in a completely satisfactory way.

b) The manner of incorporating the CSF mechanisms into the HERMIN models draws on very recent economic research that itself has only begun to address the questions of the relationship between increased public investment and the consequences for economic growth and development;

c) The HERMIN models themselves are not above criticism, and other models could be used and would give different answers. For example, the Commission's own QUEST model – which incorporates strong "crowding-out" mechanisms due to the inclusion of model-consistent expectations mechanisms– tends to give lower CSF impacts.

d) A recent survey of cohesion policy analysis by researchers at the Dutch CPB suggests that simpler single-equation econometric techniques should be used in preference to structural macro models, and this approach also suggests much smaller policy impacts (Ederveen *et al*, 2002(a) and (b)). We return to this issue in our concluding section.

In the light of the above observations, we have structured our report in a way that contains some explanatory background material in order to provide a context for the model simulations. We feel that the model should not be regarded as a "black box", but that the nature and implication of the simulations should be explained in terms of the underlying mechanisms that operate within the models. In Section 2 we draw on the databases of macroeconomic and macro-sectoral variables that were developed as part of the HERMIN model construction in order to illustrate how the six economies contained in our sample performed during the implementation phases of CSF 94-99. However, it should be stressed that a strong economic performance during this period (such as that of Ireland) does not provide any conclusive proof that the CSF 94-99 policies were the only force driving the growth. The historical outturn during this period (and the projected outturn from the year 2000 onwards) were obviously influenced by the CSF policies, but were also influenced by a wide range of other non-CSF issues and events. Thus, we stress that the historical outturn merely provides the "CSF-inclusive" baseline that we use in later sections in order to isolate and quantify the specific CSF 94-99 effects using the HERMIN models.

In Section 3 we describe in summary form how the detailed CSF 94-99 policy initiatives were aggregated into three main categories mentioned above: namely, physical infrastructure, human resources and direct aid to productive sectors. Where possible, we comment on the relationship between the planned (or ex-ante) CSF financial tables (drawn from the CSF treaty documents of 1993/94) and the realized (or ex-post) CSF financial tables, to the extent that these were made available to the ESRI team by the national teams in the wider project. We also describe how the CSF 94-99 policy initiatives were incorporated into the HERMIN models, with an emphasis on the distinction between the short-term demand (or Keynesian) impacts, and the medium and longer-term supply-side impacts that endure after the CSF 94-99 programmes are completed and the investment expenditures cease.[5]

In Section 4 we examine the CSF 94-99 impacts on the six countries and regions included in our sample. We first deal with the four countries (Greece, Ireland, Portugal and Spain), and then deal with the two regions (East Germany and Northern Ireland).[6] It needs to be stressed that a crucial assumption is made in the analysis described in this section. Namely, we adopt a common assumption on the magnitudes of the externality or spill-over parameters that capture the effectiveness of the CSF in terms of its long-term impacts on the level of activity and productivity. The values that we select are in the mid-range of results reported in the international literature (see Appendix 4 below). Thus, the differences between the CSF impact effects contained in Section 4 arise purely from the different properties of the HERMIN models (as calibrated by the historical data) rather than from any subjective assumptions about the effectiveness of the design of the CSF as a national tool for promoting cohesion. In other words, the results address the following question: if each of the CSFs had been implemented with equal efficiency and effectiveness, how did the structure of the different economies influence the CSF impacts?

In Section 5 we carry out a sensitivity analysis , based on variations in the above-mentioned crucial externality/spill-over parameters. The higher the values assumed for these parameters, the better the long-term CSF impacts on the level of activity and productivity. However, due to a paucity of empirical studies of the impacts of infrastructure and human capital on the performance of these six economies, we are unable to select parameter values with any degree of precision. This is not due to any intrinsic failure of the HERMIN models. Rather, it is due to the lack of a sufficiently authoritative and relevant body of previous economic research in the Objective 1 states and regions. We make best use of existing research findings, and attempt to isolate results that are most relevant to the Objective 1 economies, even when the research was based on other regions and countries (refer Appendix 4). Moreover, the reports drawn up by the national teams can be used to provide some guidance in the selection of "externality/spill-over" parameters and the analysis was reviewed after these reports became available to the ESRI and GEFRA teams.

We conclude in Section 6 with a summary of our main findings and some observations on how the macroeconomic analysis could be extended to the mid-term review of CSF 2000-06 and the ex-ante analysis of the National Development Plans being prepared for implementation in the economies of the applicant states of Central and Eastern Europe. We also make a series of recommendations in the light of our analysis.

The report has four appendices. In Appendix 1 we provide a note on how human capital is measured in the HERMIN model simulations of CSF 94-99. In Appendix 2 we provide a list

[5] When CSF 94-99 was complete at the end of the year 1999 – with some modest carryover to 2001 – it was replaced by CSF 2000-2006. Thus, CSF 94-99 was conceptually a component part of a continuum of three CSFs that covered the periods 1989-93, 1994-99 and 2000-06. However, in this project we consider CSF 94-99 as an isolated investment programme that started in 1994 and ended (effectively) in 1999.

[6] As previously noted, the Spanish CSF 94-99 only applied to the poorer regions and not to the whole economy. However, our macroeconomic impact evaluation is carried out "as if" the entire Spanish economy was Objective 1. Methodologies for handling the individual Spanish regions do not yet exist, but the development of a new regional methodology has been the subject of a recent research contract awarded to REMI Inc. by DG-REGIO.

of the suites of computer files that were developed to operate the national and regional HERMIN models. Technical queries related to the interpretation of the impact analysis can be resolved by detailed examination of these files, which can be made available on request[7]. Appendix 3 deals with the data revisions in East Germany. Appendix 4 summarises the international empirical liture findings concerning the impacts of physical infrastructure and human capital on economic activity.

[7] Examination of the files will require specialised software: TSP-GIVEWIN for the databases and econometric operations; WINSOLVE for the model simulation operations.

## [2] Macroeconomic performance during CSF 1994-99

### 2.1 Introductory remarks

As will be explained in the next section, the evaluation of the impact of CSF 1994-99 on each of the six Objective 1 economies in our sample will be derived by using the appropriate HERMIN model to separate out the CSF impacts from the historical outturn for the within sample period (mainly 1994-2000), and to separate the CSF impacts from a projected baseline for the period 2001 to 2010.

The databases that were developed mainly for the period 1980-2000 contain the historical outturn for the years over which CSF 1994-99 was operating. It is of interest to examine some summary aspects of these data in order to develop an understanding of the performance of each economy for the period of operation of the CSF. The impacts of the CSF for the period 1994-99 are mainly on the demand side. While the CSF Operational Programmes were being implemented, and the expenditures were being incurred, there were significant, but transitory, demand-side impacts. For the period beyond 1999, where we have to rely on a model-based projection of the likely outturn, the expenditures are assumed to terminate, the demand-side impacts vanish (as we shall see), and the enduring beneficial impacts come from the impacts of the increased stock of infrastructure and human capital on output and productivity.

The data for each economy is presented in a standardised format. We start with a summary table of macroeconomic aggregates. We follow with a series of tables giving data on sectoral performance in levels form and in growth form. The levels form are presented in order to provide some variables that can be used to "scale" the CSF impacts in terms of their size relative to an appropriate macroeconomic variable (such as GDP, investment, employment, etc.).[8]

### 2.2 Greece

In this section we present the data for the Greek economy, covering the period 1993-2000, during which CSF 94-99 was in operation. Data for the earlier period from 1980 was also contained in the HERMIN database for the Greek model, but is not shown in the tables. As explained in the relevant computer files listed in Appendix 2, the data were drawn from a series of international sources, including the OECD, EUROSTAT (CRONOS) and the DG-ECFIN internal database (AMECO), Hence, there are likely to be some methodological differences with national sources.

Table 2.2.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the public sector borrowing requirement (GBORR, expressed as a percentage of GDP), and the net trade surplus (NTSVR, also expressed as a percentage of GDP, where a net deficit

[8] It should be noted that the "levels" data are presented in national currency units, since the euro was not formally adopted for most of the period of operation of CSF 1994-99. The national accounting and other data are only available in national currency units for most of this period and it was not possible to develop the national databases in the euro. However, for each economy we present exchange rate data that will permit the tables to be converted to ecus or euros.

is shown as a negative number). Some patterns of behaviour over the period of implementation of CSF 94-99 stand out clearly. The growth rate built up gradually over the period and peaked in 2000 at 4.3 percent. However, the unemployment rate rose steadily from 8.6 percent in 1993 to 11.7 percent in 1999. The Public Sector Borrowing Requirement (denoted by GBORR in the table) declined over the period, reaching a low of 2.5 percent of GDP in 2000. The net trade deficit showed a tendency to drift upwards, and remained in the band 6-8.5 percent of GDP.

Table 2.2.1: Macroeconomic aggregates

| Date | GDPM | UR | GBORR | NTSVR |
|---|---|---|---|---|
| 1994 | 0.29 | 8.89 | 10.81 | -5.93 |
| 1995 | 1.49 | 9.17 | 10.70 | -6.96 |
| 1996 | 2.07 | 9.75 | 9.21 | -7.61 |
| 1997 | 3.38 | 10.01 | 5.94 | -7.19 |
| 1998 | 2.97 | 10.92 | 4.73 | -8.58 |
| 1999 | 3.25 | 11.65 | 3.38 | -7.97 |
| 2000 | 4.29 | 11.05 | 2.53 | -8.13 |

Note: GDPM (annual % change); UR (% of labour force); GBORR and NTSVR (% of GDP)

Table 2.2.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the Greek case, these can be converted by using the Greek DRM – euro/ecu exchange rate for the year 1995.

Table 2.2.2: Macroeconomic variables: levels

| Date | GDPFC | L | I |
|---|---|---|---|
| 1993 | 23611 | 3717 | 6529 |
| 1994 | 23947 | 3786 | 6204 |
| 1995 | 24426 | 3820 | 6439 |
| 1996 | 24855 | 3805 | 6847 |
| 1997 | 25724 | 3784 | 7363 |
| 1998 | 26550 | 3940 | 8204 |
| 1999 | 27271 | 3910 | 8792 |
| 2000 | 28381 | 3898 | 9346 |

Note: GDPFC and I (DRM mill, 1995 prices); L (thousands)

Table 2.2.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or "public" sector (OG). The high growth rate of market services – a sector that includes building and construction – is apparent, and is related to the large building and construction element of the CSF. Other sectors showed more modest growth, but the strong performance of manufacturing in the year 2000 is notable.

Table 2.2.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 0.29 | 0.68 | 1.39 | 5.85 | -0.30 |
| 1995 | 1.49 | 1.18 | 6.48 | -4.04 | -7.89 |
| 1996 | 2.07 | 3.95 | 2.32 | -3.32 | 1.29 |
| 1997 | 3.38 | 1.44 | 4.63 | 0.71 | 2.81 |
| 1998 | 2.97 | 1.27 | 4.31 | 2.61 | 1.28 |
| 1999 | 3.25 | 1.53 | 3.71 | 1.43 | 0.48 |
| 2000 | 4.29 | 5.08 | 6.34 | 0.37 | -1.33 |

Table 2.2.4 shows the total and sectoral growth rates in employment, while Table 2.2.5 shows the growth rates of sectoral gross fixed capital formation (or "investment"). The employment growth performance is erratic, with the year 1998 standing out as a year of strong sectoral employment growth. In the case of investment, the high growth occurred in market services (which includes building and construction) and in the public sector (which may also contain a large element of construction activities associated with the CSF).

Table 2.2.4: Sectoral employment growth rates (annual % change)

| Date | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | 1.87 | -0.78 | 4.42 | -0.53 | 0.59 |
| 1995 | 0.90 | -0.25 | 1.74 | -0.98 | 1.97 |
| 1996 | -0.40 | 0.16 | -1.12 | -1.60 | 2.44 |
| 1997 | -0.55 | -3.35 | 1.36 | -3.39 | 0.15 |
| 1998 | 4.13 | 2.81 | 6.82 | -0.28 | 2.83 |
| 1999 | -0.77 | -1.45 | -0.29 | -3.52 | 1.30 |
| 2000 | -0.31 | -1.47 | 1.34 | -4.96 | 0.71 |

Table 2.2.5: Sectoral investment growth rates (annual % change)

| Date | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | -4.98 | 11.63 | -7.30 | -0.11 | 2.17 |
| 1995 | 3.80 | 4.11 | 1.97 | -0.13 | 11.04 |
| 1996 | 6.34 | 8.39 | 10.90 | 8.39 | 2.00 |
| 1997 | 7.53 | 7.76 | 7.68 | 7.76 | 7.97 |
| 1998 | 11.42 | 1.27 | 14.96 | 2.61 | 10.50 |
| 1999 | 7.17 | 1.53 | 5.98 | 1.43 | 14.70 |
| 2000 | 6.30 | 5.08 | 8.33 | 0.37 | 8.80 |

The next two tables focus on the performance of manufacturing. Table 2.2.6 shows the level of GDP in manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.2.2 for information of units), and Table 2.2.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The following features of performance are noteworthy. Throughout the period of CSF 94-99, both wage (WT) and price (POT) inflation fell, but there were increases in "real" unit labour costs (RULCT). In other words, there was a decline in profitability of Greek manufacturing. The growth rate of labour productivity (LPRT), which is a key driving force in promoting cohesion – was high, other than for the year 1998, where employment growth (2.8 percent) exceeded output growth (1.3 percent), and productivity declined.

Table 2.2.6: Sectoral levels: manufacturing

| Date | OT | LT | IT |
|---|---|---|---|
| 1993 | 3201 | 632 | 498 |
| 1994 | 3223 | 627 | 556 |
| 1995 | 3261 | 625 | 578 |
| 1996 | 3390 | 626 | 627 |
| 1997 | 3439 | 605 | 676 |
| 1998 | 3483 | 622 | 684 |
| 1999 | 3536 | 613 | 695 |
| 2000 | 3716 | 604 | 730 |

Note: OT and IT: (DRM mill, 1995 prices); LT (thousands)

Table 2.2.7: Sectoral growth rates: manufacturing (annual % change)

| Date | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 0.68 | -0.78 | 11.63 | 1.47 | 6.76 | 10.99 | 0.25 |
| 1995 | 1.18 | -0.25 | 4.11 | 1.44 | 8.53 | 10.23 | 0.38 |
| 1996 | 3.95 | 0.16 | 8.39 | 3.78 | 5.91 | 11.07 | -0.74 |
| 1997 | 1.44 | -3.35 | 7.76 | 4.96 | 1.46 | 8.72 | 2.47 |
| 1998 | 1.27 | 2.81 | 1.27 | -1.49 | 1.42 | 3.10 | 2.53 |
| 1999 | 1.53 | -1.45 | 1.53 | 3.02 | 4.39 | 4.60 | -2.61 |
| 2000 | 5.08 | -1.47 | 5.08 | 6.65 | 0.10 | 6.07 | -0.85 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.2.8 shows the level of GDP in market services (ON), employment numbers (LLN) and investment (IN) (see Table 2.2.2 for information of units), and Table 2.2.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). Similar (declining) trends in wage (WN) and price (PON) inflation are apparent in market services as was the case for manufaturing, together with some years of a strong growth trend in labour productivity (LPRN). The year 1998 is again anomalous, with the growth in employment exceeding that of output, with a consequential decline in productivity.

Table 2.2.8: Sectoral levels: market services

| Date | ON | LLN | IN |
|---|---|---|---|
| 1993 | 14061 | 1686 | 3226 |
| 1994 | 14256 | 1761 | 2991 |
| 1995 | 15179 | 1791 | 3050 |
| 1996 | 15531 | 1771 | 3382 |
| 1997 | 16251 | 1795 | 3642 |
| 1998 | 16952 | 1917 | 4187 |
| 1999 | 17581 | 1912 | 4437 |
| 2000 | 18695 | 1938 | 4807 |

Note: ON and IN: (DRM mill, 1995 prices); LLN (thousands)

Table 2.2.9: Sectoral growth rates: market services (annual % change)

| Date | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | 1.39 | 4.42 | -7.30 | -2.90 | 9.43 | 10.91 |
| 1995 | 6.48 | 1.74 | 1.97 | 4.66 | 4.09 | 12.49 |
| 1996 | 2.32 | -1.12 | 10.90 | 3.48 | 9.23 | 13.18 |
| 1997 | 4.63 | 1.36 | 7.68 | 3.23 | 5.72 | 11.85 |
| 1998 | 4.31 | 6.82 | 14.96 | -2.34 | 5.10 | 5.25 |
| 1999 | 3.71 | -0.29 | 5.98 | 4.01 | 2.42 | 4.57 |
| 2000 | 6.34 | 1.34 | 8.33 | 4.93 | -0.64 | 5.01 |

We conclude our presentation of the Greek economic performance over the period of operation of CSF 94-99 with Table 2.2.10, which shows the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was steady growth in private consumption (CONS), rising from 1.9 percent in 1994 to 2.9 percent in 2000, growth in government consumption (G) was more modest, while there was strong growth in gross fixed capital formation. Thus, Greek growth could be characterised as having been investment led, rather than consumption-led.

Table 2.2.10: Expenditure aggregates: annual % change

| Date | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1994 | 1.27 | 1.94 | -1.10 | -4.98 |
| 1995 | 2.12 | 2.52 | 5.60 | 3.80 |
| 1996 | 2.19 | 2.39 | 0.89 | 6.34 |
| 1997 | 3.62 | 2.79 | 2.99 | 7.53 |
| 1998 | 3.27 | 3.05 | 1.66 | 11.42 |
| 1999 | 3.47 | 2.95 | -0.12 | 7.17 |
| 2000 | 4.12 | 2.90 | 0.80 | 6.30 |

## 2.3 Ireland

In this section we present the data for the Irish economy, covering the period 1993-1999, during which CSF 94-99 was in operation.[9] As explained in the relevant computer files listed in Appendix 2, the data were drawn from a series of mainly national sources, but includes some data series taken from the OECD, EUROSTAT (CRONOS) and the DG-ECFIN internal database (AMECO),

Table 2.3.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the public sector borrowing requirement (GBORR, expressed as a percentage of GDP), and the net trade surplus (NTSVR, also expressed as a percentage of GDP, where a net deficit is shown as a negative number). Some patterns of behaviour over the period of implementation of CSF 94-99 stand out clearly. This was a period of historically high economic growth in Ireland, rising rapidly from 5.3 percent in 1994 to over 10 percent in 1999. Only in the year 2002 – an out-of-sample year for our model database - did the growth

[9] The Irish HERMIN model database is derived as a by-product of the database for the large-scale HERMES model. The data for the year 2000 are regarded as preliminary, and subject to large revisions. Consequently, they are excluded, and the database covers the period 1970-1999. Revised data for the national accounts in 2000 were issued on October 16, 2002.

fall to 3.5 percent. At the start of CSF 94-99 the unemployment rate was high (almost 17 percent). But it declined steadily during the period of operation of CSF 94-99, reached just over 7.5 percent in 1999, and declined further to below 5 percent in the following two years. The PSBR started at almost 5 percent of GDP, but by 1999 the surplus in the public finances had reached over 7 percent of GDP. Only in 2002 was their a return to deficits. Finally, a strong net trade surplus was inherited from the era of the previous CSF 89-93, and continued to build up, reaching almost 14 percent of GDP by the year 1999.

Table 2.3.1: Macroeconomic aggregates

| Date | GDPM | UR | GBORR | NTSVR |
|---|---|---|---|---|
| 1994 | 5.32 | 15.57 | 4.63 | 9.79 |
| 1995 | 9.37 | 13.30 | 4.03 | 11.39 |
| 1996 | 7.46 | 12.86 | 2.72 | 11.53 |
| 1997 | 10.49 | 11.79 | 1.79 | 12.55 |
| 1998 | 9.36 | 9.77 | -0.05 | 11.47 |
| 1999 | 10.52 | 7.61 | -7.54 | 13.98 |

Note: GDPM (annual % change); UR (% of labour force); GBORR and NTSVR (% of GDP)

Table 2.3.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the Irish case, these can be converted by using the Irish pound – euro/ecu exchange rate for the year 1995.

Table 2.3.2: Macroeconomic variables: levels

| Date | GDPFC | L | I |
|---|---|---|---|
| 1993 | 40874 | 1152 | 7117 |
| 1994 | 42921 | 1188 | 7968 |
| 1995 | 46890 | 1248 | 8987 |
| 1996 | 50614 | 1297 | 10465 |
| 1997 | 55592 | 1338 | 12341 |
| 1998 | 60888 | 1427 | 14384 |
| 1999 | 67146 | 1515 | 16391 |

Note: GDPFC and I (£IR mill, 1995 prices); L (thousands)

Table 2.3.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or “public” sector (OG). The high growth rate of manufacturing is particularly striking, and was driven by the strong performance of the foreign-owned, export-oriented high technology multi-national sector. Market services – a sector that includes building and construction – also performed strongly, partially driven by large building and construction element of the CSF. Other sectors (agriculture and the government sector) showed more modest growth.

Table 2.3.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 5.32 | 10.16 | 4.29 | -2.43 | 2.73 |
| 1995 | 9.37 | 18.60 | 7.22 | 4.76 | 2.65 |
| 1996 | 7.46 | 7.44 | 7.97 | 6.62 | 4.74 |
| 1997 | 10.49 | 18.01 | 7.78 | 0.22 | 0.98 |
| 1998 | 9.36 | 17.23 | 8.34 | 0.44 | 1.35 |
| 1999 | 10.52 | 16.32 | 10.40 | -4.42 | 2.28 |

Table 2.3.4 shows the total and sectoral growth rates in employment, while Table 2.3.5 shows the growth rates of sectoral gross fixed capital formation (or “investment”). The employment growth performance was very strong, with big increases in manufacturing and market services for almost all years of operation of CSF 94-99. However, offsetting declines in employment were registered in agriculture. In the case of investment, there was very high growth in all sectors initially, but investment growth in agriculture reversed and became negative in the later years, mirroring a general decline in agriculture conditions.

Table 2.3.4: Sectoral employment growth rates (annual % change)

| Date | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | 3.13 | 5.15 | 3.38 | -1.39 | 3.34 |
| 1995 | 5.05 | 5.14 | 5.83 | 0.70 | 5.71 |
| 1996 | 3.93 | 0.55 | 4.99 | -3.50 | 8.76 |
| 1997 | 3.19 | 8.79 | 4.00 | -2.90 | -0.51 |
| 1998 | 6.60 | 3.18 | 13.23 | -5.99 | 1.13 |
| 1999 | 6.22 | 2.13 | 8.93 | 0.07 | 6.17 |

Table 2.3.5: Sectoral investment growth rates (annual % change)

| Date | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | 11.95 | 8.88 | 1.44 | 21.25 | 25.41 |
| 1995 | 12.80 | 4.48 | 13.07 | 27.22 | 6.09 |
| 1996 | 16.45 | 27.36 | 10.93 | 5.83 | 33.38 |
| 1997 | 17.92 | 15.22 | 27.19 | -5.97 | 15.25 |
| 1998 | 16.56 | 20.63 | 26.55 | 0.49 | 10.83 |
| 1999 | 13.96 | -3.63 | 24.86 | -9.56 | 18.27 |

The next two tables focus on the performance of manufacturing. Table 2.3.6 shows the level of GDP in manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.3.2 for information of units), and Table 2.3.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The following features of performance are noteworthy. Throughout the period of CSF 94-99, both wage (WT) and price (POT) inflation was moderate in light of the very high growth rates being experienced in the economy. The Social Partnership between government, trades unions and employers’ organisations contributed to the wage moderation. Given the high growth in productivity, there were dramatic declines in “real” unit labour costs (RULCT). In other words, there was a big increase in profitability of Irish manufacturing.

Table 2.3.6: Sectoral levels: manufacturing

| Date | OT | LT | IT |
|---|---|---|---|
| 1993 | 10960 | 229 | 1301 |
| 1994 | 12074 | 241 | 1417 |
| 1995 | 14319 | 254 | 1481 |
| 1996 | 15385 | 255 | 1886 |
| 1997 | 18157 | 277 | 2173 |
| 1998 | 21284 | 286 | 2621 |
| 1999 | 24757 | 292 | 2526 |

Note: OT and IT: (£IR mill, 1995 prices); LT (thousands)

Table 2.3.7: Sectoral growth rates: manufacturing (annual % change)

| Date | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 10.16 | 5.15 | 8.88 | 4.77 | 0.26 | 1.93 | -2.97 |
| 1995 | 18.60 | 5.14 | 4.48 | 12.79 | 1.89 | 2.79 | -10.56 |
| 1996 | 7.44 | 0.55 | 27.36 | 6.85 | 0.32 | 6.71 | -0.45 |
| 1997 | 18.01 | 8.79 | 15.22 | 8.48 | 2.18 | 0.40 | -9.41 |
| 1998 | 17.23 | 3.18 | 20.63 | 13.62 | 4.15 | 7.59 | -9.08 |
| 1999 | 16.32 | 2.13 | -3.63 | 13.89 | 2.14 | 5.12 | -9.63 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.3.8 shows the level of GDP in market services (ON), employment numbers (LLN) and investment (IN) (see Table 2.3.2 for information of units), and Table 2.3.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). Trends in wage (WN) and price (PON) inflation were higher than in the exposed manufacturing sector. Productivity growth was also more modest, and this may have led to wage-price pressures on the exposed manufacturing sector in the way predicted by the Balassa-Samuelson effect.

Table 2.3.8: Sectoral levels: market services

| Date | ON | LLN | IN |
|---|---|---|---|
| 1993 | 21394 | 533 | 3058 |
| 1994 | 22311 | 551 | 3102 |
| 1995 | 23921 | 583 | 3507 |
| 1996 | 25827 | 612 | 3890 |
| 1997 | 27835 | 637 | 4948 |
| 1998 | 30158 | 721 | 6262 |
| 1999 | 33294 | 785 | 7818 |

Note: ON and IN: (£IR mill, 1995 prices); LLN (thousands)

Table 2.3.9: Sectoral growth rates: market services (annual % change)

| Date | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | 4.29 | 3.38 | 1.44 | 0.88 | 0.83 | 5.37 |
| 1995 | 7.22 | 5.83 | 13.07 | 1.31 | 5.54 | 2.72 |
| 1996 | 7.97 | 4.99 | 10.93 | 2.83 | 4.84 | 5.94 |
| 1997 | 7.78 | 4.00 | 27.19 | 3.63 | 5.71 | 6.56 |
| 1998 | 8.34 | 13.23 | 26.55 | -4.31 | 9.45 | 4.69 |
| 1999 | 10.40 | 8.93 | 24.86 | 1.35 | 4.66 | 7.60 |

We conclude our presentation of the Irish economic performance over the period of operation of CSF 94-99 with Table 2.3.10, which shown the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was steady growth in private consumption (CONS), rising from 4.4 percent in 1994 to 8.2 percent in 2000, growth in government consumption (G) was very similar, while there was very strong growth in gross fixed capital formation. Thus, Irish growth could be characterised as having been investment led, rather than consumption-led, but had developed into a partially consumption-driven process by the end of the period of operation of CSF 94-99.

Table 2.3.10: Expenditure aggregates: annual % change

| Date | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1994 | 6.19 | 4.36 | 4.13 | 11.95 |
| 1995 | 10.58 | 4.38 | 3.01 | 12.80 |
| 1996 | 8.05 | 6.31 | 3.15 | 16.45 |
| 1997 | 11.17 | 7.27 | 5.45 | 17.92 |
| 1998 | 7.87 | 7.33 | 5.53 | 16.56 |
| 1999 | 11.17 | 8.22 | 6.49 | 13.96 |

## 2.4 Portugal

In this section we present the data for the Portuguese economy, covering the period 1993-2000, during which CSF 94-99 was in operation. Data for the earlier period from 1980 was also contained in the HERMIN database for the Portuguese model, but is not shown in the tables. As explained in the relevant computer files listed in Appendix 2, the data were drawn from a series of international sources, including the OECD, EUROSTAT (CRONOS) and the DG-ECFIN internal database (AMECO), Hence, there are likely to be some methodological differences with national sources.

Table 2.4.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the public sector borrowing requirement (GBORR, expressed as a percentage of GDP), and the net trade surplus (NTSVR, also expressed as a percentage of GDP, where a net deficit is shown as a negative number). Some patterns of behaviour over the period of implementation of CSF 94-99 stand out clearly. After a slow start in 1994, the aggregate GDP growth rate remained remarkably steady at about 3.5 percent. The unemployment rate was also fairly steady, but showed a slight tendency to decline over the CSF 94-99 period. The PSBR declined slightly over the period, reaching a low of 1.3 percent of GDP in 1998. The net trade deficit showed a tendency to drift upwards, and remained in the band 6-10 percent of GDP.

Table 2.4.1: Macroeconomic aggregates

| Date | GDPM | UR | GBORR | NTSVR |
|---|---|---|---|---|
| 1994 | 0.89 | 6.35 | 2.74 | -6.13 |
| 1995 | 3.29 | 6.67 | 3.83 | -5.55 |
| 1996 | 3.79 | 7.11 | 2.46 | -5.88 |
| 1997 | 3.88 | 6.66 | 1.85 | -6.82 |
| 1998 | 3.81 | 5.14 | 1.31 | -8.14 |
| 1999 | 3.59 | 4.50 | 1.45 | -9.51 |
| 2000 | 3.66 | 4.08 | 1.97 | -10.43 |

Note: GDPM (annual % change); UR (% of labour force); GBORR and NTSVR (% of GDP)

Table 2.4.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the Portuguese case, these can be converted by using the Portuguese escudo – euro/ecu exchange rate for the year 1995.

Table 2.4.2: Macroeconomic variables: levels

| Date | GDPFC | L | I |
|---|---|---|---|
| 1993 | 13531 | 4913 | 5189 |
| 1994 | 13547 | 4862 | 5334 |
| 1995 | 13998 | 4825 | 5609 |
| 1996 | 14545 | 4538 | 5946 |
| 1997 | 15055 | 4615 | 6810 |
| 1998 | 15603 | 4739 | 7335 |
| 1999 | 16120 | 4825 | 7772 |
| 2000 | 16612 | 4909 | 8157 |

Note: GDPFC and I (Escud mill, 1995 prices); L (thousands)

Table 2.4.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or "public" sector (OG). The relatively high growth rate of market services – a sector that includes building and construction – is apparent, and is related to the large building and construction element of the CSF. Manufacturing output also grew, with a peak growth rate of 9.3 percent in the year 1996, followed by a reduction to a more modest 4 percent towards the end of the CSF 94-99 period. Agriculture showed erratic behaviour, with a decline of 8 percent in 1997, but a rise of 10.5 percent in 1999. The public sector growth rate increased over the period from zero in 1994 to a peak of almost 5 percent in 1999. Other sectors showed more modest growth, but the strong performance of manufacturing in the year 2000 is notable.

Table 2.4.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 0.89 | 1.23 | -3.59 | 5.11 | -0.29 |
| 1995 | 3.29 | 3.74 | 6.08 | 0.53 | 1.43 |
| 1996 | 3.79 | 9.26 | 3.08 | 6.28 | 0.32 |
| 1997 | 3.88 | 6.96 | 5.13 | -8.03 | 2.15 |
| 1998 | 3.81 | 3.90 | 6.32 | -6.50 | 3.61 |
| 1999 | 3.59 | 3.36 | 4.94 | 10.52 | 4.92 |
| 2000 | 3.66 | 4.18 | 4.73 | -2.48 | 4.18 |

Table 2.4.4 shows the total and sectoral growth rates in employment, while Table 2.4.5 shows the growth rates of sectoral gross fixed capital formation (or "investment"). The employment growth performance in all sectors was erratic. There is some cause for concern that the internationally published sources of sectoral data my be partially the cause of these employment fluctuations. Investment behaviour is less erratic, with a build-up in investment growth to the later CSF years 1997-98. The strong growth in services investment in noteworthy.

Table 2.4.4: Sectoral employment growth rates (annual % change)

| Date | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | -1.04 | -0.60 | -1.89 | 1.45 | -0.87 |
| 1995 | -0.75 | -3.98 | 0.48 | -2.71 | 0.81 |
| 1996 | -5.94 | 1.38 | -11.39 | 2.86 | -5.31 |
| 1997 | 1.69 | -0.16 | 2.62 | 1.56 | 1.69 |
| 1998 | 2.68 | 0.90 | 5.03 | 0.68 | 0.60 |
| 1999 | 1.82 | -2.30 | 1.37 | 10.52 | 2.00 |
| 2000 | 1.73 | -1.00 | 4.20 | -2.48 | 1.50 |

Table 2.4.5: Sectoral investment growth rates (annual % change)

| Date | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | 2.79 | 12.51 | 3.62 | 4.56 | -4.98 |
| 1995 | 5.17 | -2.51 | 2.36 | 8.12 | 23.21 |
| 1996 | 6.01 | 6.30 | 4.29 | 6.30 | 14.73 |
| 1997 | 14.53 | 14.40 | 15.12 | 14.40 | 11.66 |
| 1998 | 7.71 | 1.93 | 14.10 | -1.01 | -4.15 |
| 1999 | 5.95 | 3.05 | 6.53 | 3.64 | 10.28 |
| 2000 | 4.95 | 1.60 | 6.35 | -5.98 | 3.39 |

The next two tables focus on the performance of manufacturing. Table 2.4.6 shows the level of GDP in manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.4.2 for information of units), and Table 2.4.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The following features of performance are noteworthy. Throughout the period of CSF 94-99, wage inflation (WT) tended to fall, and price inflation (POT) remained very low. The steady growth in labour productivity resulted in a decline in real unit labour costs (RULCT). In other words, there was a rise in profitability of Portuguese manufacturing.

Table 2.4.6: Sectoral levels: manufacturing

| Date | OT | LT | IT |
|---|---|---|---|
| 1993 | 2841 | 1025 | 397 |
| 1994 | 2876 | 1019 | 446 |
| 1995 | 2983 | 978 | 435 |
| 1996 | 3260 | 991 | 462 |
| 1997 | 3486 | 990 | 529 |
| 1998 | 3623 | 999 | 539 |
| 1999 | 3744 | 976 | 556 |
| 2000 | 3901 | 966 | 564 |

Note: OT and IT: (Escud mill, 1995 prices); LT (thousands)

Table 2.4.7: Sectoral growth rates: manufacturing (annual % change)

| Date | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 1.23 | -0.60 | 12.51 | 1.85 | 6.05 | 7.05 | -1.98 |
| 1995 | 3.74 | -3.98 | -2.51 | 8.04 | 2.99 | 10.71 | -0.71 |
| 1996 | 9.26 | 1.38 | 6.30 | 7.77 | -0.44 | 9.50 | -0.88 |
| 1997 | 6.96 | -0.16 | 14.40 | 7.13 | 0.17 | -1.92 | -4.79 |
| 1998 | 3.90 | 0.90 | 1.93 | 2.98 | 0.23 | 4.35 | 1.13 |
| 1999 | 3.36 | -2.30 | 3.05 | 5.79 | 1.33 | 5.10 | -0.35 |
| 2000 | 4.18 | -1.00 | 1.60 | 5.24 | 2.92 | 5.90 | -2.22 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.4.8 shows the level of GDP in market services (ON), employment numbers (LLN) and investment (IN) (see Table 2.4.2 for information of units), and Table 2.4.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). The behaviour of wage and price inflation reflects the sheltered nature of the market services sector, where prices tend to be determined as a mark-up on unit labour costs. There appears to have been very high productivity growth in the years 1997-98, but this declined towards the end of the decade.

Table 2.4.8: Sectoral levels: market services

| Date | ON | LLN | IN |
|---|---|---|---|
| 1993 | 7582 | 2336 | 2370 |
| 1994 | 7310 | 2292 | 2455 |
| 1995 | 7754 | 2303 | 2513 |
| 1996 | 7993 | 2041 | 2621 |
| 1997 | 8403 | 2094 | 3018 |
| 1998 | 8934 | 2199 | 3443 |
| 1999 | 9375 | 2230 | 3668 |
| 2000 | 9819 | 2323 | 3901 |

Note: ON and IN: (Escud mill, 1995 prices); LLN (thousands)

Table 2.4.9: Sectoral growth rates: market services (annual % change)

| Date | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | -3.59 | -1.89 | 3.62 | -1.73 | 11.05 | 5.49 |
| 1995 | 6.08 | 0.48 | 2.36 | 5.57 | 1.64 | 4.25 |
| 1996 | 3.08 | -11.39 | 4.29 | 16.34 | 3.99 | 2.74 |
| 1997 | 5.13 | 2.62 | 15.12 | 2.45 | 4.33 | 5.49 |
| 1998 | 6.32 | 5.03 | 14.10 | 1.23 | 2.68 | 1.10 |
| 1999 | 4.94 | 1.37 | 6.53 | 3.52 | 0.13 | 3.01 |
| 2000 | 4.73 | 4.20 | 6.35 | 0.50 | 2.93 | 5.53 |

We conclude our presentation of the Portuguese economic performance over the period of operation of CSF 94-99 with Table 2.10, which shown the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was fairly steady growth in private consumption (CONS), rising from 2.2 percent in 1994 to 5 percent in 1997. Growth in government consumption (G) showed a similar tendency to rise, while there was strong growth in gross fixed capital formation. Thus, Portuguese growth could be characterised as having been investment led, rather than consumption-led.

Table 2.4.10: Expenditure aggregates: annual % change

| Date | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1993 | | | | |
| 1994 | 2.19 | 2.21 | 2.10 | 2.79 |
| 1995 | 3.17 | 1.60 | 2.18 | 5.17 |
| 1996 | 3.92 | 3.09 | 3.42 | 6.01 |
| 1997 | 5.01 | 3.15 | 2.17 | 14.53 |
| 1998 | 3.97 | 5.95 | 3.04 | 7.71 |
| 1999 | 3.48 | 4.96 | 4.54 | 5.95 |
| 2000 | 3.48 | 2.49 | 3.75 | 4.95 |

## 2.5 Spain

In this section we present the data for the Spanish economy, covering the period 1993-2000, during which CSF 94-99 was in operation. Data for the earlier period from 1980 was also contained in the HERMIN database for the Spanish model, but is not shown in the tables. As explained in the relevant computer files listed in Appendix 2, the data were drawn from a series of international sources, including the OECD, EUROSTAT (CRONOS) and the DG-ECFIN internal database (AMECO), Hence, there are likely to be some methodological differences with national sources.

Table 2.5.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the public sector borrowing requirement (GBORR, expressed as a percentage of GDP), and the net trade surplus (NTSVR, also expressed as a percentage of GDP, where a net deficit is shown as a negative number). Some patterns of behaviour over the period of implementation of CSF 94-99 stand out clearly. The growth rate built up gradually over the period from 2.1 percent in 1994 and peaked in 2000 at 4.1 percent. However, the unemployment rate took some time to fall, from a high of 21.7 percent of the labour force in 1993 to a low of 13.1 percent in 2000. The PSBR declined over the period, reaching a low of 0.3 percent of GDP in 2000. The net trade deficit was small but erratic, and the largest deficit occurred in 2000 (2.2 percent of GDP).

Table 2.5.1: Macroeconomic aggregates

| Date | GDPM | UR | GBORR | NTSVR |
|---|---|---|---|---|
| 1994 | 2.10 | 21.73 | 4.82 | -0.10 |
| 1995 | 2.71 | 20.69 | 5.15 | -0.18 |
| 1996 | 2.44 | 20.25 | 4.05 | 0.49 |
| 1997 | 3.94 | 19.01 | 2.41 | 0.98 |
| 1998 | 4.32 | 17.10 | 1.57 | 0.05 |
| 1999 | 4.02 | 14.52 | 0.86 | -1.25 |
| 2000 | 4.07 | 13.10 | 0.27 | -2.20 |

Note: GDPM (annual % change); UR (% of labour force); GBORR and NTSVR (% of GDP)

Table 2.5.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the Spanish case, these can be converted by using the Spanish peseta – euro/ecu exchange rate for the year 1995.

Table 2.5.2: Macroeconomic variables: levels

| Date | GDPFC | L | I |
|---|---|---|---|
| 1993 | 63877 | 13329 | 17467 |
| 1994 | 65280 | 13298 | 17837 |
| 1995 | 67140 | 13580 | 19271 |
| 1996 | 68713 | 13748 | 19931 |
| 1997 | 71246 | 14147 | 20754 |
| 1998 | 74104 | 14653 | 22761 |
| 1999 | 76872 | 15162 | 24774 |
| 2000 | 80018 | 15624 | 26149 |

Note: GDPFC and I (Pst mill, 1995 prices); L (thousands)

Table 2.5.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or "public" sector (OG). The steady rise in aggregate GDP growth was driven by manufacturing, market services and the public sector in broadly similar terms. The behaviour of growth in the agriculture sector was erratic.

Table 2.5.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 2.10 | 3.89 | 2.48 | -10.68 | 0.46 |
| 1995 | 2.71 | 4.11 | 3.84 | -10.35 | 2.47 |
| 1996 | 2.44 | 1.40 | 0.65 | 17.55 | 2.64 |
| 1997 | 3.94 | 5.98 | 3.57 | 2.27 | 1.63 |
| 1998 | 4.32 | 5.08 | 3.62 | 1.54 | 3.61 |
| 1999 | 4.02 | 2.78 | 4.08 | -3.05 | 3.73 |
| 2000 | 4.07 | 4.05 | 4.25 | 1.47 | 4.05 |

Table 2.5.4 shows the total and sectoral growth rates in employment, while Table 2.5.5 shows the growth rates of sectoral gross fixed capital formation (or "investment"). The employment growth performance was fairly steady in aggregate (L), and was driven mainly by manufacturing and market services. Agriculture tended to decline, while there was some modest growth in public sector employment. In the case of investment, the high aggregate growth (I) was driven mainly by investment by market services, and was clearly influenced by the CSF infrastructural and communications investments carried out by that sector.

Table 2.5.4: Sectoral employment growth rates (annual % change)

| Date | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | -0.23 | -1.96 | 0.82 | -4.00 | 0.22 |
| 1995 | 2.12 | 1.68 | 2.34 | -4.54 | 4.77 |
| 1996 | 1.23 | 2.39 | 0.97 | 1.45 | 0.81 |
| 1997 | 2.90 | 4.60 | 3.11 | 0.29 | 1.82 |
| 1998 | 3.58 | 5.13 | 4.05 | 0.09 | 2.19 |
| 1999 | 3.47 | 3.27 | 4.98 | -3.66 | 2.17 |
| 2000 | 3.04 | 2.97 | 5.65 | -1.84 | -2.61 |

Table 2.5.5: Sectoral investment growth rates (annual % change)

| Date | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | 2.12 | 2.53 | 2.53 | 2.53 | 2.53 |
| 1995 | 8.04 | 8.25 | 8.25 | 8.25 | 8.25 |
| 1996 | 3.42 | 2.08 | 2.08 | 2.08 | 2.08 |
| 1997 | 4.13 | 5.01 | 5.00 | 5.01 | 5.01 |
| 1998 | 9.67 | 4.05 | 12.42 | -3.27 | 4.02 |
| 1999 | 8.85 | -0.62 | 12.15 | -7.35 | 2.51 |
| 2000 | 5.55 | -1.78 | 8.23 | -6.40 | 0.14 |

The next two tables focus on the performance of manufacturing. Table 2.5.6 shows the level of GDP in manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.5.2 for information of units), and Table 2.5.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The following features of performance are noteworthy. Throughout the period of CSF 94-99, both wage (WT) and price (POT) inflation were at modest levels, but labour productivity growth (LPRT) was very low after the year 1995. Consequently, there were increases in "real" unit labour costs (RULCT). In other words, there was a decline in profitability of Spanish manufacturing.

Table 2.5.6: Sectoral levels: manufacturing

| Date | OT | LT | IT |
|---|---|---|---|
| 1993 | 12108 | 2453 | 1560 |
| 1994 | 12579 | 2405 | 1599 |
| 1995 | 13096 | 2445 | 1731 |
| 1996 | 13280 | 2504 | 1767 |
| 1997 | 14074 | 2619 | 1856 |
| 1998 | 14789 | 2753 | 1931 |
| 1999 | 15200 | 2843 | 1919 |
| 2000 | 15816 | 2928 | 1885 |

Note: OT and IT: (Pst mill, 1995 prices); LT (thousands)

Table 2.5.7: Sectoral growth rates: manufacturing (annual % change)

| Date | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 3.89 | -1.96 | 2.53 | 5.96 | 0.41 | 3.97 | -3.04 |
| 1995 | 4.11 | 1.68 | 8.25 | 2.39 | 5.62 | 2.60 | -4.95 |
| 1996 | 1.40 | 2.39 | 2.08 | -0.97 | 3.48 | 5.55 | 2.70 |
| 1997 | 5.98 | 4.60 | 5.01 | 1.32 | 1.48 | -0.29 | -2.63 |
| 1998 | 5.08 | 5.13 | 4.05 | -0.05 | 0.64 | 1.62 | 0.93 |
| 1999 | 2.78 | 3.27 | -0.62 | -0.48 | 0.27 | 2.01 | 2.60 |
| 2000 | 4.05 | 2.97 | -1.78 | 1.05 | 1.32 | 2.36 | 0.28 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.5.8 shows the level of GDP, employment numbers and investment (see Table 2.5.2 for information of units), and Table 2.5.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). The trends in wage (WN) and price (PON) inflation are characteristic of the "sheltered" nature of the sector, and are probably passed on to the exposed manufacturing sector as cost increases for inputs.

Table 2.5.8: Sectoral levels: market services

| Date | ON | LLN | IN |
|---|---|---|---|
| 1993 | 39902 | 7125 | 10343 |
| 1994 | 40890 | 7183 | 10605 |
| 1995 | 42460 | 7351 | 11479 |
| 1996 | 42737 | 7422 | 11717 |
| 1997 | 44261 | 7653 | 12304 |
| 1998 | 45862 | 7963 | 13831 |
| 1999 | 47735 | 8360 | 15512 |
| 2000 | 49765 | 8832 | 16789 |

Note: ON and IN: (Pst mill, 1995 prices); LLN (thousands)

Table 2.5.9: Sectoral growth rates: market services (annual % change)

| Date | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | 2.48 | 0.82 | 2.53 | 1.65 | 4.22 | 3.77 |
| 1995 | 3.84 | 2.34 | 8.25 | 1.46 | 4.15 | 4.16 |
| 1996 | 0.65 | 0.97 | 2.08 | -0.31 | 3.77 | 3.18 |
| 1997 | 3.57 | 3.11 | 5.00 | 0.44 | 2.77 | 6.79 |
| 1998 | 3.62 | 4.05 | 12.42 | -0.42 | 2.84 | 3.86 |
| 1999 | 4.08 | 4.98 | 12.15 | -0.85 | 3.27 | 2.29 |
| 2000 | 4.25 | 5.65 | 8.23 | -1.32 | 4.11 | 1.80 |

We conclude our presentation of the Spanish economic performance over the period of operation of CSF 94-99 with Table 2.5.10, which shows the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was steady and rising growth in private consumption (CONS), from 2.2 percent in 1994 to over 4 percent after 1998, growth in government consumption (G) was more modest. As noted previously, there was strong growth in gross fixed capital formation. Thus, Spanish growth during the operation of CSF 94-99 could be characterised as having been a mixture of a consumption and investment led process.

Table 2.5.10: Expenditure aggregates: annual % change

| Date | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1994 | 2.16 | 0.91 | -0.34 | 2.12 |
| 1995 | 2.89 | 1.59 | 1.81 | 8.04 |
| 1996 | 2.76 | 2.16 | 1.27 | 3.42 |
| 1997 | 3.76 | 3.09 | 2.87 | 4.13 |
| 1998 | 4.54 | 4.53 | 3.66 | 9.67 |
| 1999 | 4.23 | 4.70 | 2.93 | 8.85 |
| 2000 | 4.06 | 3.98 | 2.63 | 5.55 |

## 2.6 East Germany

In this section we present the data for the East German regional economy that were used in the model construction, covering the period 1993-1997, i.e., for the first four of the six years during which CSF 94-99 was in operation. As shown in Appendix 3, the German regional accounts are in the process of undergoing major methodological revisions, and data prepared on the new basis are not yet available to us. Wherever possible we use these data to supplement our database to give a more complete picture of the East German Economy during the period 1994-99. Some data for the earlier period from 1990 onwards were also contained in the HERMIN database for the East German regional model, but are not shown in the tables. As explained in the relevant computer files listed in Appendix 3, the data were drawn from a series of mainly German national international sources, augmented where necessary by OECD, EUROSTAT (CRONOS) and the DG-ECFIN internal database (AMECO).

Table 2.6.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the regional public sector deficit (EGDEFR, expressed as a percentage of regional GDP), and the net trade surplus (NTSVR, also expressed as a percentage of regional GDP, where a net deficit is shown as a negative number). Some patterns of behaviour over the 1993-97 sub-period of implementation of CSF 94-99 stand out clearly. The aggregate growth rate was highest at the start of the CSF period (almost 10 percent in 1994), and declined steadily to just 2 percent in 1997. After 1997 the rate (now measured on the new basis) slowed even further and in 1999 it was only just above 1 percent.[10] During the period 1994-99 the rate of unemployment rose steadily, and was over 18 percent by 1997. In 1998 the unemployment rate rose further to 19.5 percent and since then it appears to have stabilised at a that high value. The regional deficit and the regional net trade deficit declined slightly over the CSF period, but remained high. The East German region remains heavily dependent on transfers from the other German regions.

Table 2.6.1: Macroeconomic aggregates

| Date | GDPM | UR | EGDEFR | NTSVR |
|---|---|---|---|---|
| 1993 | | 15.32 | 49.84 | -72.16 |
| 1994 | 9.84 | 13.25 | 45.10 | -69.12 |
| 1995 | 5.65 | 14.13 | 41.86 | -62.00 |
| 1996 | 2.35 | 15.13 | 41.61 | -59.14 |
| 1997 | 1.97 | 18.23 | 36.80 | -50.86 |
| 1998 | 1.3 | 19.50* | na | na |
| 1999 | 1.1 | 19.00* | na | na |

Note: GDPM (annual % change); UR (% of labour force)
GBORR and NTSVR (% of GDP); * Board of Economic Advisors (2002);

Table 2.6.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the German case, these can be converted by using the DM – euro/ecu exchange rate for the year 1995.

[10] See Appendix 3 for an explanation on the changes in methodology for regional data collection in Germany.

Table 2.6.2: Macroeconomic variables: levels

| Date | GDPFC | L | I |
|---|---|---|---|
| 1993 | 207158 | 5734 | 136347 |
| 1994 | 226656 | 5847 | 160325 |
| 1995 | 239960 | 5932 | 163802 |
| 1996 | 244511 | 5840 | 162282 |
| 1997 | 249338 | 5646 | 156906 |

Note: GDPFC and I (DRM mill, 1995 prices); L (thousands)

Table 2.6.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or "public" sector (OG).[11] The sectoral pattern of GDP growth is mixed. The decline in the aggregate growth rate of GDPM appears to have been caused by a virtual collapse in the growth of market services output: from over 11 percent in 1994 to a half of one percent in 1997. Over the same period, the manufacturing sector grew fairly rapidly, and the public sector continued to decline. The manufacturing sector was acting as the "engine" of East German growth since the mid-nineties, but the industrial basis was too small so that the "engine" was too weak to pull the aggregate growth rate up. Even today the manufacturing sector is growing above average, but the market service sector (including the building and construction sector) is such a high portion of the overall economy that the aggregate growth rate is nearly zero.

Table 2.6.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 9.84 | 11.13 | 12.98 | 2.89 | -3.68 |
| 1995 | 5.65 | 7.94 | 6.76 | 2.56 | -0.97 |
| 1996 | 2.35 | 5.60 | 1.25 | 15.57 | -1.73 |
| 1997 | 1.97 | 9.25 | 0.51 | 2.75 | -1.32 |

Table 2.6.4 shows the total and sectoral growth rates in employment, while Table 2.6.5 shows the growth rates of sectoral gross fixed capital formation (or "investment"). The employment growth performance is erratic, with the year 1994 standing out as a year of strong employment growth in the aggregate, driven entirely by just under 9 percent growth in market services employment growth. By the year 1997 all four sectors were registering declines in employment. The behaviour of sectoral investment growth was also erratic, with no pattern emerging other than that of weakness. By the year 1997 investment declined in all four sectors, an observation that holds for the rest of the period 1994 – 99.

Table 2.6.4: Sectoral employment growth rates (annual % change)

| Date | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | 1.97 | -6.41 | 8.63 | -2.62 | -5.75 |
| 1995 | 1.46 | -1.89 | 4.24 | -1.14 | -2.87 |
| 1996 | -1.56 | -3.67 | -0.07 | -4.30 | -3.58 |
| 1997 | -3.32 | -1.93 | -3.13 | -0.84 | -5.71 |

[11] It should be noted that below the aggregate level of economic activity it is impossible to compare the result of the old system to those of the new system. Therefore we decided not to update the series.

Table 2.6.5: Sectoral investment growth rates (annual % change)

| Date | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | 17.59 | 2.41 | 18.09 | -4.94 | 15.90 |
| 1995 | 2.17 | 0.25 | -0.80 | 19.79 | -7.20 |
| 1996 | -0.93 | -5.22 | -2.70 | -1.64 | -1.85 |
| 1997 | -3.31 | -4.57 | -4.99 | -0.75 | -4.25 |

The next two tables focus on the performance of manufacturing. Table 2.6.6 shows the level of GDP in manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.6.2 for information of units), and Table 2.6.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The following features of performance are noteworthy. Even before the period of CSF 94-97, price inflation (POT) had fallen and was locked into the wider German low rate of inflation. However, the rate of wage inflation only declined during the period of operation of CSF 94-99, starting at over 16 percent in 1994 and ending at just over 3 percent in 1997. Productivity in manufacturing grew very strongly (at annual rates of between 10 and 18 percent), resulting in a steady decline in "real" unit labour costs. In other words, there was an increase in profitability of East German manufacturing during this period. The high growth rate of labour productivity (LPRT), which is a key driving force in promoting cohesion, was accompanied by large-scale shedding of labour. During the period 1998 – 1999 we observe a further small decline in employment and a continuing high growth rate of labour productivity.

Table 2.6.6: Sectoral levels: manufacturing

| Date | OT | LT | IT |
|---|---|---|---|
| 1993 | 47374 | 1181 | 35404 |
| 1994 | 52648 | 1105 | 36256 |
| 1995 | 56826 | 1084 | 36346 |
| 1996 | 60008 | 1044 | 34447 |
| 1997 | 65556 | 1024 | 32874 |

Note: OT and IT: (DM mill, 1995 prices); LT (thousands)

Table 2.6.7: Sectoral growth rates: manufacturing (annual % change)

| Date | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 11.13 | -6.41 | 2.41 | 18.74 | -0.21 | 16.19 | -1.94 |
| 1995 | 7.94 | -1.89 | 0.25 | 10.02 | 1.74 | 9.79 | -1.92 |
| 1996 | 5.60 | -3.67 | -5.22 | 9.62 | 0.34 | 5.58 | -4.01 |
| 1997 | 9.25 | -1.93 | -4.57 | 11.40 | -0.49 | 3.21 | -6.89 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.6.8 shows the level of GDP in market services (ON), employment numbers (LLN) and investment (IN) (see Table 2.6.2 for information of units), and Table 2.6.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). Declining trends in wage (WN) and price (PON) inflation are apparent in market services, as was the case for manufacturing, But growth in productivity (LPRN) was much slower. Perhaps this pattern is consistent with much of the benefits of the CSF-led investment expenditures leaking out to the wider German economy, and not staying within East Germany.

Table 2.6.8: Sectoral levels: market services

| Date | ON | LLN | IN |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1993 | 123452 | 3085 | 50983 |
| 1994 | 139481 | 3351 | 60208 |
| 1995 | 148910 | 3493 | 59724 |
| 1996 | 150768 | 3491 | 58114 |
| 1997 | 151542 | 3381 | 55215 |

Note: ON and IN: (DM mill, 1995 prices); LLN (thousands)

Table 2.6.9: Sectoral growth rates: market services (annual % change)

| Date | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | 12.98 | 8.63 | 18.09 | 4.01 | 4.46 | 4.87 |
| 1995 | 6.76 | 4.24 | -0.80 | 2.41 | 2.79 | 4.67 |
| 1996 | 1.25 | -0.07 | -2.70 | 1.32 | 2.91 | 2.97 |
| 1997 | 0.51 | -3.13 | -4.99 | 3.76 | 0.89 | 1.88 |

We conclude our presentation of the East German economic performance over the period of operation of CSF 94-99 with Table 2.6.10, which shows the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was initially a high growth in private consumption (CONS), but this declined from just under 10 percent in 1994 to just under 2 percent in 1997. Growth in government consumption (G) was more erratic, with a high of 12 percent in 1995 and a low of –2.5 percent in 1997. Thus, East German growth could be characterised as having been initially investment led, but the boost to activity did not result in a sustained cohesion process. Of course, this might be determined by the wider performance of the German economy that by problems specific to East Germany and the CSF.

Table 2.6.10: Expenditure aggregates: annual % change

| Date | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1993 | | | | |
| 1994 | 9.84 | 2.46 | 1.15 | 17.59 |
| 1995 | 5.65 | 3.77 | 11.98 | 2.17 |
| 1996 | 2.35 | 0.39 | 1.00 | -0.93 |
| 1997 | 1.97 | -2.39 | -2.45 | -3.31 |

## 2.7 Northern Ireland

In this section we present the data for the Northern Ireland economy, covering the period 1993-1999, during which CSF 94-99 was in operation. Partial data for the earlier period from 1981 was also contained in the HERMIN database for the Northern Ireland model, but are not shown in the tables. The data were drawn from a series of mainly UK and local Northern Ireland sources. It is well known that the UK regional accounts are subject to frequent and major revisions, and are not always revised in a way that is consistent with previous years. Hence, the data are likely to show some discontinuities.

Table 2.7.1 gives the key macroeconomic aggregates: growth in GDP (GDP at constant market prices, GDPM), the unemployment rate, expressed as a percentage of the labour force (UR), the regional public sector deficit (NIDEFR, expressed as a percentage of regional GDP), and the net trade surplus (NTSVR, also expressed as a percentage of GDP, where a net deficit is shown as a negative number).[12] Some patterns of behaviour over the period of implementation of CSF 94-99 stand out clearly. The growth rate was highest in the early years of operation of CSF 94-99, but declined steadily afterwards. The unemployment rate was very high for all six years, but started to decline towards the end of the period, and the decline has continued thereafter. The regional (Northern Ireland) public sector deficit has declined somewhat, indicating a slow easing of the dependency of the region on financial transfers from the UK (the so-called "subvention"). The net trade deficit was also very high, and showed little tendency to decline. Overall, the region could be characterised as one of low growth, high dependency on outside aid, and a declining rate of unemployment that is partially driven by out-migration.

Table 2.7.1: Macroeconomic aggregates

| YEAR | GDP | UR | NIDEFR | NTSVR |
|---|---|---|---|---|
| 1993 | 4.10 | 16.15 | 23.01 | -42.58 |
| 1994 | 5.35 | 15.03 | 22.27 | -31.45 |
| 1995 | 7.06 | 13.86 | 18.95 | -28.09 |
| 1996 | 1.25 | 13.70 | 18.03 | -29.78 |
| 1997 | 4.47 | 11.42 | 15.01 | -25.57 |
| 1998 | 0.71 | 10.08 | 15.28 | -26.40 |
| 1999 | 1.16 | 9.31 | 18.02 | -28.72 |

Note: GDPM (annual % change); UR (% of labour force); NIDEFR and NTSVR (% of GDP)

Table 2.7.2 presents the level of GDP, total numbers employed, and total investment. It should be noted that all real variables (e.g., GDPFC – real GDP at factor cost- and I – total gross fixed capital formation) are expressed in constant 1995 prices and in the national currency. In the Northern Ireland case, these can be converted by using the £sterling – euro/ecu exchange rate for the year 1995.

Table 2.7.2: Macroeconomic variables: levels

| YEAR | GDPFC | L | I |
|---|---|---|---|
| 1993 | 12824.57 | 579.22 | 6134.56 |
| 1994 | 13314.76 | 585.10 | 5111.37 |
| 1995 | 14297.00 | 608.84 | 5582.83 |
| 1996 | 14539.67 | 623.24 | 5634.87 |
| 1997 | 15200.91 | 652.67 | 5814.80 |
| 1998 | 15385.56 | 666.13 | 5956.27 |
| 1999 | 15597.78 | 677.43 | 5978.74 |

Note: GDPFC and I (£ mill, 1995 prices); L (thousands)

Table 2.7.3 shows the sectoral growth rates of GDP for the total (GDPM), as well as for manufacturing (OT), market services (ON), agriculture (OA) and the non-market or "public" sector (OG). Only the market services sector displayed any relatively steady growth. Growth in manufacturing was erratic and generally low, and that of agriculture was very erratic. The public sector – which was already very large as a share of total regional GDP – showed no tendency to grow any further after the first two years of CSF 94-99.[13]

[12] The regional public sector deficit is defined as the difference between regional public expenditure and regional tax and other revenue. It does not have to be financed at the regional level, but forms a part of the total UK public sector borrowing requirement.

[13] The years of high sectoral growth – 1994-95 – probably owed more to the cease-fire and subsequent peace process than to CSF aid.

Table 2.7.3: Sectoral GDP growth rates (annual % change)

| Date | GDPM | OT | ON | OA | OG |
|---|---|---|---|---|---|
| 1994 | 5.35 | 8.26 | -2.39 | 21.89 | 7.79 |
| 1995 | 7.06 | 1.15 | 8.42 | 11.67 | 9.55 |
| 1996 | 1.25 | 3.32 | 2.37 | 1.24 | -0.26 |
| 1997 | 4.47 | 0.36 | 8.64 | 4.99 | 1.28 |
| 1998 | 0.71 | 1.06 | 2.54 | -5.54 | 0.51 |
| 1999 | 1.16 | 4.03 | 0.54 | 8.03 | -0.27 |

Table 2.7.4 shows the total and sectoral growth rates in employment, while Table 2.7.5 shows the growth rates of sectoral gross fixed capital formation (or "investment"). The employment growth performance in manufacturing was very erratic, with the years 1994 and 1997 standing out as years of sharp decline and sharp growth, respectively. Employment in market services registered steady increases, with 1997 the only year where employment declined. In the case of investment, the only significant growth occurred in market services (which includes building and construction). The erratic sectoral behaviour is partly explained by the relatively small size of the Northern Ireland economy, with a consequential "lumpiness" in employment and investment. In other words, a change in activity in a small number of individual projects can seriously distort the pattern of growth or decline. However, an additional factor may be that the regional data is not always comparable between years.

Table 2.7.4: Sectoral employment growth rates (annual % change)

| YEAR | L | LT | LLN | LA | LG |
|---|---|---|---|---|---|
| 1994 | 1.02 | -18.68 | 7.08 | 14.64 | 3.09 |
| 1995 | 4.06 | 6.15 | 3.30 | 8.42 | 3.41 |
| 1996 | 2.36 | -2.07 | 7.00 | -14.97 | 1.86 |
| 1997 | 4.72 | 22.79 | -5.14 | 20.16 | 6.60 |
| 1998 | 2.06 | 1.72 | 5.60 | 0.13 | -0.96 |
| 1999 | 1.70 | -4.43 | 4.70 | 0.37 | 1.59 |

Table 2.7.5: Sectoral investment growth rates (annual % change)

| YEAR | I | IT | IN | IA | IG |
|---|---|---|---|---|---|
| 1994 | -16.68 | -11.17 | -22.06 | -1.21 | -13.87 |
| 1995 | 9.22 | 5.45 | 8.68 | 23.99 | 10.23 |
| 1996 | 0.93 | 3.59 | 1.73 | -1.56 | -1.52 |
| 1997 | 3.19 | -0.19 | 8.61 | -11.50 | 0.15 |
| 1998 | 2.43 | 0.02 | 5.50 | -12.74 | 1.59 |
| 1999 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 |

The next two tables focus on the performance of manufacturing. Table 2.7.6 shows the level of GDP for manufacturing (OT), employment numbers (LT) and investment (IT) (see Table 2.7.2 for information of units), and Table 2.7.7 shows a range of measures of manufacturing performance (some repeated from earlier tables for convenience). The "lumpiness" of behaviour seriously distorts the overall picture here as well. For example, the behaviour of productivity growth varies from a 30 percent rise in 1994 to an 18 percent fall in 1997. Throughout the period of CSF 94-99, both wage (WT) and price (POT) inflation fell, but there were dramatic variations in "real" unit labour costs (RULCT).

Table 2.7.6: Sectoral levels: manufacturing

| YEAR | OT | LT | IT |
|---|---|---|---|
| 1993 | 2629.98 | 110.26 | 1200.61 |

| | | | |
|---|---|---|---|
| 1994 | 2847.20 | 89.66 | 1066.53 |
| 1995 | 2880.00 | 95.17 | 1124.61 |
| 1996 | 2975.72 | 93.20 | 1165.00 |
| 1997 | 2986.53 | 114.44 | 1162.81 |
| 1998 | 3018.17 | 116.41 | 1163.03 |
| 1999 | 3139.65 | 111.26 | 1167.41 |

Note: OT and IT: (£ mill, 1995 prices); LT (thousands)

Table 2.7.7: Sectoral growth rates: manufacturing (annual % change)

| YEAR | OT | LT | IT | LPRT | POT | WT | RULCT |
|---|---|---|---|---|---|---|---|
| 1994 | 8.26 | -18.68 | -11.17 | 33.13 | 3.25 | 3.44 | -26.27 |
| 1995 | 1.15 | 6.15 | 5.45 | -4.71 | 5.30 | 6.56 | 6.52 |
| 1996 | 3.32 | -2.07 | 3.59 | 5.50 | 3.77 | 2.58 | -5.95 |
| 1997 | 0.36 | 22.79 | -0.19 | -18.26 | 2.93 | 3.37 | 23.92 |
| 1998 | 1.06 | 1.72 | 0.02 | -0.65 | -0.06 | 9.81 | 10.63 |
| 1999 | 4.03 | -4.43 | 0.38 | 8.84 | -0.94 | 3.18 | -4.01 |

The next two tables show comparable data for the market services sector, which includes the building and construction sub-sector. Table 2.7.8 shows the level of GDP, employment numbers and investment (see Table 2.7.2 for information of units), and Table 2.7.9 shows a range of measures of market services performance (some repeated from earlier tables for convenience). Similar (declining) trends in wage (WN) and price (PON) inflation are apparent in market services as was the case for manufacturing, together with a strong growth in labour productivity (LPRN) for certain years.

Table 2.7.8: Sectoral levels: market services

| YEAR | ON | LLN | IN |
|---|---|---|---|
| 1993 | 5929.03 | 221.20 | 2892.57 |
| 1994 | 5787.58 | 236.86 | 2254.54 |
| 1995 | 6275.00 | 244.68 | 2450.32 |
| 1996 | 6423.41 | 261.79 | 2492.61 |
| 1997 | 6978.37 | 248.33 | 2707.28 |
| 1998 | 7155.79 | 262.24 | 2856.31 |
| 1999 | 7194.38 | 274.56 | 2867.08 |

Note: ON and IN: (£ mill, 1995 prices); LLN (thousands)

Table 2.7.9: Sectoral growth rates: market services (annual % change)

| YEAR | ON | LLN | IN | LPRN | PON | WN |
|---|---|---|---|---|---|---|
| 1994 | -2.39 | 7.08 | -22.06 | -8.84 | 0.48 | 1.61 |
| 1995 | 8.42 | 3.30 | 8.68 | 4.96 | 1.25 | 5.80 |
| 1996 | 2.37 | 7.00 | 1.73 | -4.33 | 2.86 | 4.44 |
| 1997 | 8.64 | -5.14 | 8.61 | 14.53 | 3.47 | 1.13 |
| 1998 | 2.54 | 5.60 | 5.50 | -2.90 | 3.90 | 5.15 |
| 1999 | 0.54 | 4.70 | 0.38 | -3.97 | 2.49 | 4.98 |

We conclude our presentation of the Northern Ireland economic performance over the period of operation of CSF 94-99 with Table 2.10, which shows the growth rates in the main expenditure aggregates: private consumption (CONS), public consumption (G), and gross fixed capital formation (I). It is noted that while there was steady growth in private consumption (CONS), rising from 0.8 percent in 1994 to 4.7 percent in 1999, growth in government consumption (G) was more modest, while there were some years of strong growth in gross fixed capital formation. Thus, Northern Ireland growth could be characterised as having been mainly consumption-led, rather than investment-led.

Table 2.7.10: Expenditure aggregates: annual % change

| YEAR | GDPE | CONS | G | I |
|---|---|---|---|---|
| 1994 | 5.35 | 0.84 | 2.98 | -16.68 |
| 1995 | 7.06 | 1.11 | 2.69 | 9.22 |
| 1996 | 1.25 | 4.02 | 1.46 | 0.93 |
| 1997 | 4.47 | 2.15 | 0.43 | 3.19 |
| 1998 | 0.71 | 2.32 | 1.89 | 2.43 |
| 1999 | 1.16 | 4.72 | -1.45 | 0.38 |

# [3] How CSF 1994-99 is inserted into the HERMIN models

### 3.1 Simplifying and aggregating the CSF programmes

Before any macroeconomic evaluation of the CSF can take place, the large number of individual investment and other programmes need to be amalgamated into more aggregate economic categories. There are various reasons for this. First, although it is necessary to present a CSF in great administrative detail for the purposes of organisation and implementation, there is less rationale for this detail from an economic perspective. Second, if the unit of analysis is a country or a single macro-region of a country, there is no requirement to distinguish, say, the impact of a new road in one sub-region as compared with another sub-region.[14] Finally, if we aggregate the CSF expenditures into economically meaningful categories, we can make use of research on the impacts of public investment on the performance of the private sector.

The most useful and logical categories for aggregating the CSF is as follows:

i. Investment expenditures on physical infrastructure;
ii. Investment expenditure on human resources;
iii. Expenditures on direct production/investment aid to the private sector.

For each of these economic categories of public and private expenditure, there are three possible sources of funding:

i. EU transfers in the form of subventions to the domestic public authorities, as set out in the CSF treaties;
ii. Domestic public sector co-financing, as set out in the CSF treaties;
iii. Domestic private sector co-financing, as set out in the CSF treaties.

Inclusion of the private sector co-financing is of questionable value, other than is cases where draw-down of public funds is made explicitly dependent on the provision of private co-finance. But, of course, there are indirect impacts of publicly financed CSF investment on private sector investment which are included in the analysis. Since these indirect effects are automatically included in our analysis, and since considerable uncertainty and ambiguity surrounds the driving mechanisms behind the private sector CSF co-finance expenditures, we are inclined to exclude them from our analysis.[15]

CSF actions influence the Objective 1 economies through a mixture of supply and demand effects. Short term demand (or Keynesian) effects arise in the models as a consequence of increases in the expenditure and income policy instruments associated with CSF policy initiatives. Through the "multiplier" effects contained in the models, there will be knock-on increases in all the components of domestic expenditure (e.g., total investment, private consumption, the net trade surplus, etc.) and the components of domestic output and income.

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[14] Of course, in the design of a CSF, a sub-regional breakdown is an essential part of comparing the benefits of alternative investment strategies. But our brief in this project is to analyse the macro impacts of the actual CSF 94-99, and not to speculate on the likely impacts of alternative CSFs.

[15] In previous model-based macroeconomic analysis of the CSF carried out for the European Commission, it was suggested that we should exclude all private sector co-finance.

These demand effects are of transitory importance and are not the *raison d'etre* of the CSF, but merely a side-effect. Rather, the CSF interventions are intended to influence the long-run supply potential of the economy. These so-called "supply-side" effects arise through policies designed to:

(i) increase investment in order to improve physical infrastructure as an input to private sector productive activity;

(ii) increase in human capital, due to investment in training, an input to private sector productive activity;

(iii) channel public funding assistance to the private sector to stimulate investment, thus increasing factor productivity and reducing sectoral costs of production and of capital.

Thus the CSF interventions are designed in order to improve the regional aggregate stock of public infrastructure and human capital, as well as the private capital stock. Providing more and better infrastructure, increasing the quality of the labour force, or providing investment aid to firms, are the mechanisms through which the CSF improves the output, productivity and cost competitiveness of the economy. In a certain sense, these policies create conditions where private firms enjoy the use of additional productive factors at no cost to themselves. Alternatively, they may help to make the current private sector inputs that firms are already using available to them at a lower cost, or the general conditions under which firms operate are improved as a consequence. In all these ways, positive externalities may arise out of the CSF interventions.

Recent advances in growth theory have addressed the role of spill-overs or externalities which arise from public investments, for example in infrastructure or in human capital. Furthermore this literature has investigated how technical progress can be affected directly through investment in research and development (R&D). Here too externalities arise when innovations in one firm are adopted elsewhere, i.e., when such innovations have public good qualities.

Two types of beneficial externalities are likely to enhance the mainly demand-side (or neo-Keynesian) impacts of well designed investment, training and aid policy initiatives. The first type of externality is likely to be associated with the role of improved infrastructure and training in boosting output directly. This works through mechanisms such as attracting productive activities through foreign direct investment, and enhancing the ability of indigenous industries to compete in the international market place. We refer to this as an output externality since it is well known that the range of products manufactured in developing countries changes during the process of development, and becomes more complex and technologically advanced.

The second type of externality arises through the increased total or embodied factor productivity likely to be associated with improved infrastructure or a higher level of human capital associated with training and education. We refer to this as a factor productivity externality. Of course, a side effect of increased factor productivity is that, in the restricted context of fixed output, labour is shed. The prospect of such "jobless growth" is particularly serious in economies where the recorded rate of unemployment and well as the rate of hidden unemployment is already high. Thus, the factor productivity externality is a two edged process: industry and market services become more productive and competitive, but labour demand is weakened if output is fixed. However, on the plus side, factor productivity is driven up, real incomes rise, and these effects cause knock-on multiplier and other benefits throughout the economy. Thus, the role of the output externality is more unambiguously beneficial: the higher it is, the faster the period of transitional growth to a higher income plateau.

The elasticities, particularly in relation to infrastructure, have been chosen on the basis of an exhaustive literature review (details are available in Bradley, Morgenroth and Untiedt, 2000). The empirical literature suggests that the values for the elasticity of output with respect to increases in infrastructure are likely to be in the region between 5 and 40 per cent, with small regions and countries characterised by values nearer the lower end of the scale (5 to 20 per cent).[16] With respect to human capital, elasticities in the same range also appear reasonable. Since such elasticities do not always exist for all of the Objective 1 countries, we are forced to utilise those for analogous or more advanced economies. However, sensitivity analysis has been carried out and is discussed in detail in section 5.

How enduring are the beneficial externality elasticities likely to be? The infrastructure deficit in the Objective 1 countries is quite large, and is unlikely to match up to the level pertaining in the more developed EU countries until well after the year 2010. Given this and the fact that there are substantial returns to the elimination of bottlenecks which will take some time to accomplish, it is quite reasonable to expect that the chosen elasticities will capture the benefits properly over the time period for which the simulations have been carried out, i.e., 1994-2010. For the same reasons it is unlikely that diminishing returns will set in.

### 3.2 HERMIN: a macro-sectoral modelling framework

The first element of the CSF analysis comes from the research literature on the relationship between infrastructure, human capital and growth. A second essential element draws on the research literature on macroeconomic modelling. A special modelling framework – HERMIN - was designed in the early 1990s for use in CSF analysis in Objective 1 countries (Bradley *et al*, 1995). The theoretical underpinning of the HERMIN model is that of a two-sector small open economy model with a Keynesian role for domestic demand. The two-good model assumes two domestic sectors, one producing mainly internationally traded and the other mainly non-traded goods and services. The mainly traded sector is identified with manufacturing. The mainly non-traded sector is identified with market services. Both sectors produce with constant returns to scale technologies and with sector-specific physical capital.

The non-traded sector operates rather like a closed economy, where firms are price setters in the output market and price takers in factor markets. Thus, they maximise their profits subject to the production function constraint. In the traded goods sector, businesses are assumed to be a mixture of domestically owned local firms and externally owned multinationals. With limited market power, the pricing behaviour of the traded sector goods is a mixture of both price taking and price setting behaviour. The extension of the supply-side of the traded goods sector towards a more realistic model allows output of the sector to be determined both by domestic factor costs as well as by external and internal demand.

[16] The implications of these externality elasticities will become clearer below when we set out the actual functional relationships that are incorporated into the HERMIN models.

To be of use for CSF analysis, there were three requirements which the empirical implementation of the HERMIN model needed to satisfy:

(i) The model must be disaggregated into a small number of crucial sectors which permits the identification and treatment the key sectoral shifts in a developing economy over the years of the CSFprogramme.

(ii) The model must specify the mechanisms through which the Objective 1 national or regional economy is inter-connected to the external world. The external economy is a very important direct and indirect factor influencing the economic growth and convergence of the smaller Objective 1 countries, through trade of goods and services, inflation transmission, international population migration (mainly in the case of Ireland) and inward foreign direct investment

(iii) The modelling framework must recognise that a possible conflict may exist between actual situation in the less developed Objective 1 countries, as captured in the HERMIN model calibrated with historical data from the recent past, and the new configuration/structure towards which these economies are evolving in the world of EMU and the Single European Market.

Thus the HERMIN model framework focuses on key structural features of an Objective 1 economy with respect to such issues as:

(a) Economic openness, exposure to world trade, and response to external and internal shocks;

(b) Relative sizes and characteristics of the traded and non-traded sectors and their development, production technology and structural change;

(c) Wage and price determination mechanisms;

(d) The functioning and flexibility of labour markets with the possible role of international and inter-regional labour migration;

(e) The role of the public sector and public debt, and the interactions between the public and private sector trade-offs in public policies.

To satisfy these requirements, the HERMIN framework is designed as a macroeconometric model composed of four sectors: manufacturing (a mainly traded sector), market services (a mainly non-traded sector), agriculture and government (or non-market) services.[17] The model is made up of three main blocks:

- A <u>supply</u>-side (determining output, factor inputs, wages, prices, productivity, etc.);
- An <u>absorption</u> side (determining the expenditure side of the national accounts such as consumption, stock changes, etc.);
- An <u>income distribution</u> side (determining private and public sector income).

[17] Available data do not permit us to identify traded and non-traded sectors precisely. Our use of manufacturing and market services serves as a rough approximation.

Conventional Keynesian mechanisms are at the core of the HERMIN model. Thus, the interaction of the expenditure and income distribution sub-components generate the standard multiplier properties of the HERMIN model.[18] However, the model also has neoclassical features, mainly associated with the supply sub-component. Thus, output in manufacturing is not simply driven by demand. It is also influenced by price and cost competitiveness, where firms seek out minimum cost locations for production (Bradley and Fitz Gerald, 1988). In addition, factor demands in manufacturing and market services are derived using a CES production function, where the capital/labour ratio is sensitive to relative factor prices. The incorporation of a structural Phillips curve mechanism in the wage bargaining mechanism introduces further relative price effects.

The schematic structure of the HERMIN model is illustrated in Figure 3.1. The national accounts define three ways of measuring GDP: the output basis, the expenditure basis and the income basis. On the output basis, HERMIN disaggregates four sectors: manufacturing (OT), market services (ON), agriculture (OA) and the public (or non-market) sector (OG). On the expenditure side, HERMIN disaggregates into five components: private consumption (CONS), public consumption (G), investment (I), stock changes (DS), and the net trade balance (NTS). National income is determined on the output side, and disaggregated into private and public sector elements.

Since all elements of output are modelled, the output-expenditure identity is used to determine the net trade surplus/deficit residually. The output-income identity is used to determine corporate profits residually. Finally, the equations in the model can be classified as behavioural or identity. In the case of the former, economic theory and calibration to the data are used to define the relationships. In the case of identities, these follow from the logic of the national accounts, but have important consequences for the behaviour of the model as well.

The model functions as an integrated systems of equations, with interrelationships between all their sub-components. The essential core of the model consists of a smaller number of equations, of which only about 20 are fully behavioural in the economic sense. The main behavioural equations that have to be calibrated are as follows:

- *Manufacturing*:
  - (a) GDP in manufacturing
  - (b) Joint factor demand system in manufacturing (employment and investment)
  - (c) Manufacturing GDP deflator
  - (d) Average annual earnings in manufacturing

- *Market services*
  - (a) GDP in marketed services
  - (b) Joint factor demand system in marketed services (employment and investment)
  - (c) Marketed services GDP deflator

- *Agriculture*
  - (a) GDP in agriculture, forestry and fishing
  - (b) Labour input in agriculture, forestry and fishing

[18] Expectations in the HERMIN model are assumed to be autoregressive (i.e., static or backward-looking). It should be noted that the Commissions own QUEST model contains forward-looking (or model consistent) expectation mechanisms. These result in policy "crowding out" and much smaller multipliers. But since the bulk of CSF expenditures are on mainly public goods (e.g., physical infrastructure and education/training), it might be questioned if "crowding out" is fully relevant.

(c) Investment in agriculture, forestry and fishing

- *Demographics*
  (a) Population in three age cohorts
  (b) Net migration flows (in the case of Ireland)
- *Absorption*
  (a) Household consumption

The models are calibrated using time series of national accounts data from the period 1980-2000 and earlier versions are described in ESRI, 1997. The full model listings of the most recent calibrations are available on request from the ESRI.[19]

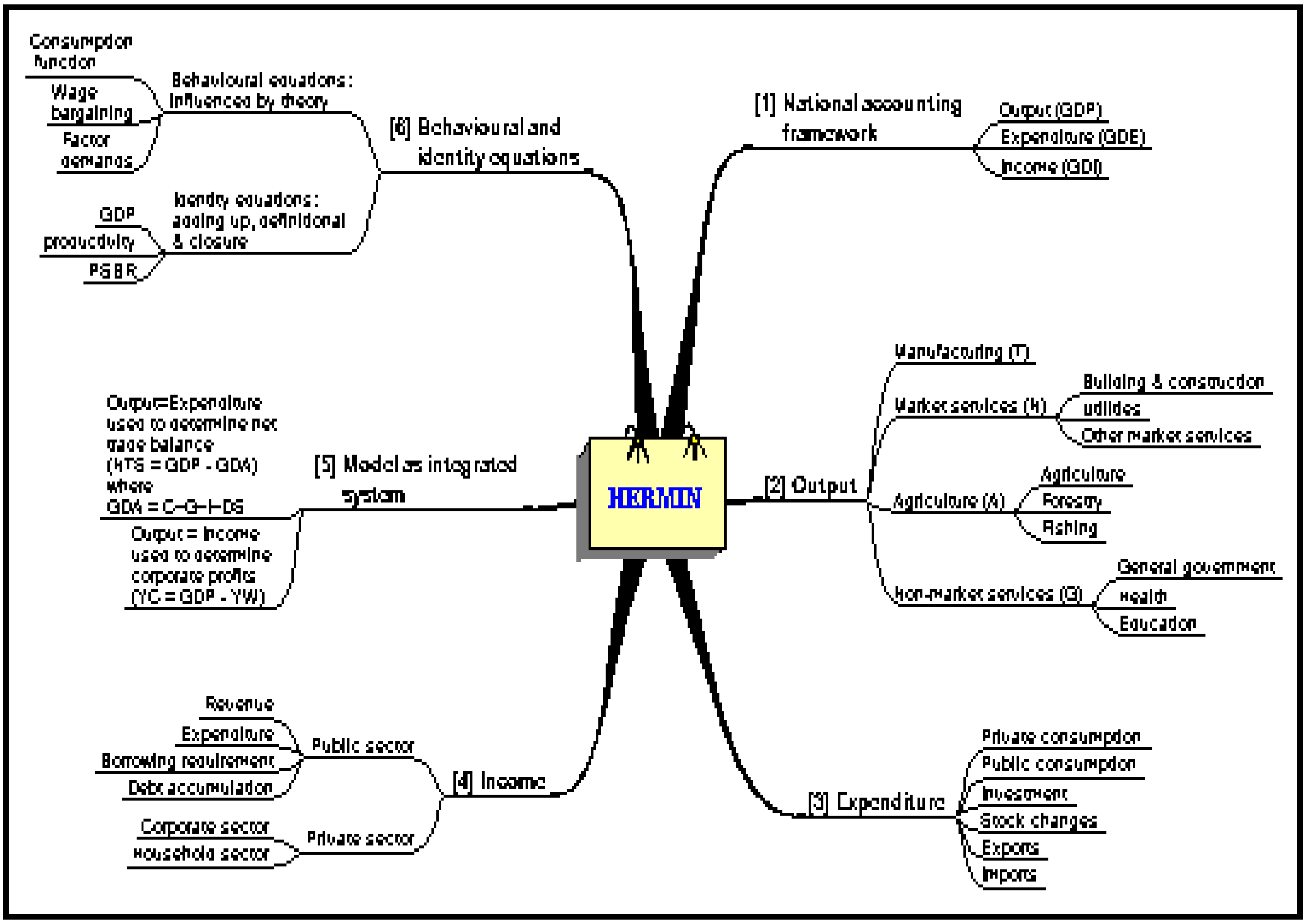


**Figure 3.1: Schematic outline of HERMIN modelling approach**

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[19] The HERMIN model databanks were developed in Excel and TSP format, and model calibration was carried out using TSP. The models were constructed and simulated using the WINSOLVE software package. Full details of the complex series of computer files that serve to support each national and regional HERMIN model are given in Appendix 1.

### 3.3 Linking the externality mechanisms into the model structure

*Output externalities*

The output externalities can be viewed as operating directly through the multinational and indigenous firm location and growth process that is so important in the case of the EU periphery and, more recently, in the CEE countries, and draws directly from the extensive literature surveyed in Bradley, Morgenroth and Untiedt (2000). The treatment of the manufacturing sector in HERMIN posits a supply side approach in which the share of the world's output being allocated to, or generated within, a peripheral country or region is determined by measures of domestic and international cost competitiveness (Bradley and Fitz Gerald, 1988).

However, this neglects the fact that many industries will require more than simply an appropriate level of, say, labour costs before they locate in, or grow spontaneously in, the EU periphery. Without an available labour force that is qualified to work in these industries, or without appropriate minimum levels of physical infrastructure, many firms simply may not be able even to consider the periphery as a location for production. Thus, a more realistic framework is one which posits a two stage process in which basic infrastructural and labour force quality dictates the number of industries which could conceivably locate in the periphery, while competitiveness decides how many of the industries which can locate in the periphery actually do locate there.

One simple way of describing this process is to link the growth of infrastructure and the increases in human capital to a modified version of the HERMIN behavioural equation that is used to determine manufacturing sector output (OT). The theory underlying the macroeconomic modelling of a small open economy requires that this equation reflect both purely supply side factors, such as the real unit labour costs and international price competitiveness, as well as the extent of dependence of output on a general level of world demand, e.g. through operations of multinational enterprises (MNEs). By contrast, domestic demand should play only a limited role in a purely traded sector, mostly in terms of its impact on the rate of capacity utilisation. However, our classification of the traded sector as being made up of manufacturing is somewhat imperfect in practice, since manufacturing in any but extreme cases includes a large number of sheltered subsectors producing non-traded items. Hence, we would expect domestic demand to play a more substantial role in this sector, possibly also influencing capacity output decisions of firms. We therefore posit a hybrid supply-demand equation of the form:

$$\begin{aligned}\log(OT) = a_1 + a_2 \log(OW) + a_3 \log(ULCT / POT) \\ + a_4 \log(FDOT) + a_5 \log(POT / PWORLD) + a_6 t\end{aligned}$$

where OW represents the crucial external (or world) demand, and FDOT represents the influence of domestic absorption. We further expect OT to be negatively influenced by real unit labour costs (ULCT/POT) and the relative price of domestic versus world goods (POT/PWORLD).

To take account of output externalities associated with infrastructure and human capital, the following two terms are added to the above equation:

$$\eta_1 \log(KGINF_t / KGINF_0) + \eta_2 \log(NTRAIN_t / NTRAIN_0)$$

where output in the manufacturing sector (*OT*) is now directly influenced by any increase in the stock of infrastructure and human capital (KGINF and NTRAIN, respectively) over and above a baseline value for these stocks ($KGINF_0$ and $NTRAIN_0$, respectively). Thus, if the stock of infrastructure increases by 1 per cent relative to the baseline stock, output in manufacturing (OT) is boosted by $\eta_1$ per cent. If the stock of human capital increases by 1 per cent relative to the baseline stock, output in manufacturing (OT) is boosted by $\eta_2$ per cent.[20]

Such a modification attempts to capture the notion that a peripheral region or country can now attract a greater share of mobile investment than it otherwise could in the absence of improved infrastructure and human capital. Another, demand side, way of interpreting this externality could be to assume that the CSF may improve the quality of goods produced domestically and thus improve the demand for goods produced by firms already located in the country, whether foreign or indigenous.

*Factor productivity externalities*

A factor productivity externality can be associated with improved supply conditions in the economy brought about as a result of investment in human capital and public infrastructure. These can be incorporated into HERMIN by endogenising the "scale" parameter in the CES production function, 'A', which is now modelled as a function of the stock of public and human capital. Increases in the value of 'A' imply that for a given amount of inputs a higher level of output is produced.

We can illustrate this schematically in terms of the simple production function

$$Q = A * f(L, I)$$

where A is the scale parameter, which can be considered to represent the state of technology, and L and I are the labour and investment inputs, respectively.

Public infrastructural investment will increase the efficiency of the market services sector by cutting down on the costs of producing transport and other communication services, and by opening up greater opportunities for domestic competition to take place in the provision of non-traded goods. Such cost reductions will have a favourable supply-side effect on the internationally exposed manufacturing sector.

The infrastructure factor productivity externality can be incorporated into the production process in manufacturing and market services as follows:

$$A_t = A_0 \left( KGINF_t / KGINF_0 \right)^{\eta}$$

[20] It has to be admitted that we ignore any interactions and complementarities that may exist between physical infrastructure and human capital, since so little is known about this aspect of the CSF.

where $A_0$ is the original (i.e., pre-CSF) estimated value of the scale parameter and $\eta$ is an unknown externality elasticity that can be assigned different numerical values in the empirical model. The variable *KGINF* is the stock of public infrastructure, computed as an accumulation of real infrastructure investments (using the perpetual inventory method with a specified depreciation rate). The baseline stock of infrastructure, $KGINF_0$, is taken as the stock that would have been there in the absence of any CSF infrastructural investments made during the period under consideration.

Similarly, the CSF Social Fund programmes on education and training can be considered to promote the efficiency of the workforce in both manufacturing and services sectors and can give rise to a human capital externality. Incorporation of externality effects associated with the accumulation of human capital is not as straightforward as in the infrastructure case, since there is no readily available measure of the stock of human capital equivalent to the stock of infrastructure. However, one can estimate a measure of the extra number of trainees funded by the CSF schemes (see below for details). Hence, as a first approximation, one can use the inputs into training as a measure of the unknown outputs, although if the training courses are badly designed and poorly executed, the relationship between training and increased human capital will be tenuous.

Suppose we assume that, prior to the implementation of the CSF, the existing number of members of the labour force trained to a specified level, $NTRAIN_0$, is known. If the CSF increases are used to fund an additional number of trainees, giving a total of $NTRAIN_t$ trained members of the labour force in year t, then the scale parameter in the production function can be modified as follows:

$$A_t = A_0 \left( NTRAIN_t \ / \ NTRAIN_0 \right)^{\eta}$$

where $A_0$ is the original estimated value of the scale parameter. In the empirical model, this externality is incorporated into the treatment of both the manufacturing and service sectors.

### 3.4 Modelling CSF physical infrastructure impacts

The HERMIN model assumes that any CSF-based expenditure on physical infrastructure that is directly financed by EU aid subvention (IGVCSFEC) is matched by a domestically financed public expenditure (IGVCSFDP) and a domestic privately financed component (IGVCSFPR). Hence, the total public and private NDP infrastructural expenditure (IGVCSF) is defined in the model as follows (in current prices):

$$\text{IGVCSF} = \text{IGVCSFEC} + \text{IGVCSFDP} + \text{IGVCSFPR}$$

Inside the HERMIN model, these CSF-related expenditures are converted to real terms (by deflating the nominal expenditures by the investment price) and added to any existing (non-CSF) real infrastructural investment, determining total real investment in infrastructure (IGINF). Using the perpetual inventory approach, these investments are accumulated into a notional ‘stock’ of infrastructure (KGINF):

$$\text{KGINF} = \text{IGINF} + (1-0.02) * \text{KGINF}(-1)$$

where a 2 per cent rate of stock depreciation is assumed. This accumulated stock is divided by the (exogenous) baseline non-CSF stock ($KGINF_0$) to give the CSF-related relative improvement in the stock of infrastructure (KGINFR):

$$KGINFR = KGINF / KGINF_0$$

It is this ratio that enters into the calculation of any externalities associated with improved infrastructure, as described above.

As regards the public finance implications of the CSF, the total cost of the increased public expenditure on infrastructure (IGVCSF - IGVCSFPR) is added to the domestic public sector capital expenditure (GK). Of course, any increase in the domestic public sector deficit (GBOR) is reduced by the extent of EU CSF-related aid subventions (IGVCSFEC). Whether or not the post-CSF public sector deficit rises or falls relative to the no-CSF baseline will depend both on the magnitude of domestic co-financing and the stimulus imparted to the economy by the NDP shock. This differs from programme to programme.

In the absence of any externality mechanisms, the standard HERMIN model can only effectively calculate the mainly demand (or Keynesian) effects of the CSF infrastructure programmes, the supply effects being only included to the very limited extent that they are captured by induced shifts in relative prices. It is already well known that the policy multipliers are relatively small in the case of Ireland and somewhat larger in the cases of Greece, Portugal and Spain. (ESRI, 1997). However, the HERMIN model permits us to introduce various externality effects to augment the conventional demand-side impacts of the CSF infrastructure programmes in order to capture likely additional supply-side benefits. In each case, the strength of the externality effect is defined as a fraction of the improvement of the stock of infrastructure over and above the baseline (no-CSF) projected level, i.e.,

$$\text{Externality effect} = KGINFR^{\eta}$$

where $\eta$ is the externality elasticity. The way in which the externality elasticity can be approximately calibrated numerically, drawing on the empirical growth theory research literature, was discussed above (see Bradley, Morgenroth and Untiedt, 2000 for full details). In all the model-based simulations reported below, the externality effects are phased in linearly over a five year period from 1994, reflecting the implementation stages of the CSF 94-99 programmes and the fact that benefits from improved infrastructure may only be exploited with a lag by the private sector in terms of increased activity.[21]

Externality effects associated with improved infrastructure are introduced into the following areas of the HERMIN model:

i. The <u>direct</u> influence on manufacturing output (OT) of improved infrastructure (KGINF), i.e. any rise in the stock of infrastructure relative to the no-NDP baseline (KGINFR) will be reflected in a rise in output.

ii. <u>Total factor productivity</u> (TFP) in the manufacturing and service sectors is increased

[21] Hence, 0.2 of the full externality effect occurs in the year 1994; 0.4 by the year 1995; 0.6 by the year 1996; 0.8 by the year 1997 and the full impact by the year 1998 and onwards.

The first type of externality is an unqualified benefit to the economy, and directly enhances its performance in terms of increased manufacturing output. However, the second type is likely to have a negative down-side, in that labour is shed as total factor productivity improves, unless output can be increased to offset this loss. Inevitably production will become less labour intensive in a way that may differ from the experience of more developed economies in the EU core.

### 3.5 Modelling CSF human resources impacts

The HERMIN model assumes that any expenditure on human resources directly financed by CSF aid subvention from the EU (GTRSFEC) is matched by a domestically financed public expenditure (GTRSFDP). Hence, the total expenditure on human resources (GTRSF) is defined in the model as follows (in current prices):

$$GTRSF = GTRSFEC + GTRSFDP$$

As regards the public finance implications for each of the Objective 1 countries, the total cost of the increased expenditure on human resources (GTRSFEC+GTRSFDP) is added to public expenditure on income transfers (GTR). However, the increase in the domestic public regional deficit (GBOR) is reduced by the extent of CSF aid subventions (GTRSFEC).

Since the full institutional detail of the CSF human resource training and education programmes cannot be handled in a small macroeconomic model like HERMIN, one needs to simplify drastically. Each trainee or participant in a training course is assumed to be paid an average annual income (WTRAIN), taken to be a fraction of the average industrial wage (WT). Each instructor is assumed to be paid the average annual wage appropriate to the market service sector (WN). We assume an overhead on total wage costs to take account of buildings, equipment, materials, etc (OVERHD), and a trainee-instructor ratio of 15:1 (TRATIO).[22] Hence, total CSF expenditure (GTRSF) can be written as follows (in nominal terms):

$$GTRSF = (1+OVERHD) * (SFTRAIN*WTRAIN + LINS*WN)$$

where SFTRAIN is the number of trainees being supported and LINS is the number of instructors, defined as SFTRAIN/TRATIO. This formula is actually inverted in the HERMIN model and used to estimate the approximate number of extra trainees that can be funded by the CSF for a given total expenditure GTRSF on human resources, i.e.,

$$SFTRAIN = (GTRSF/(1+OVERHD)) / (WTRAIN + WN/TRATIO)$$

The wage bill of the CSF programme (SFWAG) is as follows:

$$SFWAG = SFTRAIN*WTRAIN + LINS*WN$$

The number of CSF-funded trainees (measured in trainee-years) is accumulated into a 'stock' (KSFTRAIN) by means of a perpetual inventory-like formula, with a ‘depreciation’ rate of 5 per cent:

[22] In the cases of Greece, Portugal, Spain, East Germany and Northern Ireland, the overhead on Social Fund expenditures is taken as 30 per cent. In the case of Ireland, a value of 50 per cent is used.

$$KSFTRAIN = SFTRAIN + (1-0.05) * KSFTRAIN(-1)$$

In order to quantify the increase in the stock of human capital (measured in trainee years), we need to define the initial pre-CSF stock of human capital, $KTRAIN_0$. This is a conceptually difficult challenge, and we are forced to simplify drastically (see Appendix 1 for details). We base our measure of human capital on the average number of years of formal education and training that the labour force has achieved prior to the CSF. We can cut through the complex details of the education system and stylise is as follows:

$$KTRAIN_0 = YPLS*FPLS*DPLS + YHS*FHS*DHS + YNUT*FNUT*DNUT + YUT*FUT*DUT$$

where the notation is as follows:

YPLS = standardised number of years in primary and lower secondary cycle
FPLS = fraction of population with primary and lower secondary cycle education
DPLS = "discount" factor for years of primary and lower secondary cycle

YHS = standardised number of years higher secondary cycle
FHS = fraction of population with higher secondary education
DHS = "discount" factor for years of higher secondary cycle

YNUT = standardised number of years in non-university tertiary cycle
FNUT = fraction of population with non-university tertiary education
DNUT = "discount" factor for years of non-university tertiary cycle

YUT = standardised number of years in university tertiary cycle
FUT = fraction of population with university tertiary cycle
DUT = "discount" factor for years university tertiary cycle

The reason for including a "discount" factor is as follows. Although many studies assume that a single year of primary cycle education adds as much to human capital (and is as valuable a contribution as an input to productive working activity), as one year of university education, this is very unlikely to be true. Adding up the years of education without weighting them is likely to bias the level of human capital upwards. For example, since primary and lower secondary level education is becoming the norm throughout the EU, we might discount these years relative to years of higher secondary, tertiary non-universi9ty and tertiary university. If one sets the discount factor to zero, this is equivalent to assuming that primary and lower secondary education is a prerequisite for acquiring human capital, and not a part of human capital.

The accumulated stock of CSF trainees (KSFTRAIN) is added to the exogenous baseline stock of trained workers ($KTRAIN_0$) and is divided by the baseline stock to give the relative improvement in the proportion of trained workers associated with the CSF human resources programmes:

$$KTRNR = (KTRAIN_0+KSFTRAIN) / KTRAIN_0$$

It is this ratio (KTRNR) that enters into the calculation of externalities associated with improved human resources.

In the absence of any externality mechanisms, the HERMIN model can only calculate the income-expenditure effects of the CSF human resource programmes. These effects can be limited in magnitude. In addition, a sizeable fraction of the CSF payments to trainees will simply replace existing unemployment transfers. The 'overhead' element of these programmes (equal to OVERHD*SFWAG) is assumed to boost non-wage public consumption directly.

The HERMIN model introduces externality effects to augment the demand-side impacts of the CSF human resource programmes. In each case, the strength of the externality effect is defined as a fraction of the improvement of the stock of 'trained' workers over and above the baseline (no-CSF) projected level, i.e.,

$$\text{Externality effect} = \text{KTRNR}^{\eta}$$

here $\eta$ is the externality elasticity. In all the model-based simulations reported below, the externality effects are phased in linearly over a five year period from 1994, reflecting the implementation stages of the CSF programmes and the fact that benefits from improved infrastructure may only be exploited with a lag by the private sector in terms of increased activity.

Two types of externality effects associated with human capital are introduced into the HERMIN model:

i. The direct influence on manufacturing output (OT) of improved human capital, i.e. any rise in the "stock" of human capital relative to the no-CSF baseline (proxied by KTRNR) will be reflected in a rise in output.

ii. Labour embodied technical change in the manufacturing and service sectors is increased, where a given output can now be produced by less workers or where any increased level of sectoral output can become more skill intensive but less employment intensive

A final change made to the HERMIN model to handle the CSF human resources programmes relates to the impact on the rate of unemployment of moving people out of the labour force and into temporary training schemes. It is well known that untrained and/or unskilled workers compete in the labour market in a very ineffective way, and are much more likely to end up as long-term unemployed than are skilled/trained workers (Layard, Nickell and Jackman, 1991). For simplicity it is assumed in subsequent analysis of the CSF human resource investment impacts that all trainees are in the unskilled or semi-skilled category, and that their temporary removal from the labour force for the duration of their training scheme has almost no effect on wage bargaining behaviour through the Phillips curve 'pressure' effect in the HERMIN wage equation. This assumption is consistent with the stylised facts of the hysteresis in Irish and Portuguese labour markets (Bradley, Whelan and Wright, 1993; Modesto and das Neves, 1993). It is implemented in the HERMIN model by defining a 'corrected' measure (URP) of the unemployment rate (UR) for use in the Phillips curve.

## [4] Simulating the macroeconomic impacts of CSF 1994-99

### 4.1 Introduction

The national and regional Community Support Frameworks consist of major public investment programmes aimed at improving the quality of physical infrastructure, human resources (or human capital), as well as providing direct grant aid to the three main productive sectors (manufacturing, market services and agriculture). In this section we analyse the impacts of CSF 94-99 on a range of macroeconomic and macro-sectoral variables with the aid of four national and two regional HERMIN models.

The context in which we execute this macro-sectoral impact evaluation exercise is as follows:

i. We carry out a model simulation starting in the year 1993 (the year before CSF 94-99 was implemented), and continue the simulation out to the year 2010, i.e., eleven years after the termination of CSF 94-99.

ii. For the purposes of isolating the separate impacts of CSF 94-99, we ignore the carry-over impacts of CSF 89-93, as well as the continuation of CSF aid under the current CSF 2000-2006. It will be recalled that in the data presented in section 2, the actual outturn for the period 1994-2000 (when available) was presented. Thus, this outturn included the carry-over from CSF 89-93, the implementation of CSF 94-99, and the initial year of CSF 2000-2006 (when available). Simple examination of the outturn can present a misleading impression of the likely role played by CSF 94-99 in isolation from other CSFs.

iii. We then "extract" the CSF 94-99 policy shocks, i.e., we set the CSF 94-99 expenditures at zero and re-simulate the model. No other changes are made., and no attempt is made to design a "substitute" domestically funded public investment programme that would have replaced a "missing" CSF 94-99. This is a very artificial assumption, since in the absence of CSF 94-99 there almost certainly would have been substitute domestically funded public investment programme, albeit smaller in magnitude.

iv. Ideally we should use the actual ex-post realised CSF expenditures. But these were not available for every country or region.[23] In the interests of uniformity, in this section we have used the planned CSF expenditure data as contained in the CSF 94-99 treaty documents. While these give a fairly accurate total for the expenditures, they do not always give an accurate picture of the ex-post scheduling of the expenditures. This is only an important issue in the case of Greece, where the planned even spread of expenditures over the six years 1994-99 was actually implemented in a very different way. Ex-post, the Greek CSF expenditures were re-programmed to the later years. We return to this issue in Section 5, where we examine issues of robustness.

v. It might be held that, in the absence of such large-scale public policy shocks, the underlying structure of the economies would have changed and that the use of HERMIN models calibrated with CSF-inclusive data is invalid (the so-called "Lucas

[23] Complete ex-post CSF 1994-99 data were only available for Northern Ireland , Portugal and Ireland.

critique" of the use of econometric models to analyse policy impacts). However, the HERMIN models contain explicit sub-models of the structural changes that are associated with the operation of the CSF, so the validity of the Lucas critique is weakened.

vi. The "without-CSF" simulation results are subtracted from the "with-CSF" simulation results, and this is used as a measure of the contribution of the CSF.

To assist in the interpretation of the CSF simulation results, it is useful to keep some summary measures in mind. The total size of the CSF in each country relative to its GDP (GECSFRAT) is shown in Table 4.1.1. The CSF expenditures have been converted into local currencies (being used during the period of operation of CSF 94-99), and the actual GDP outturn is used to calculate the percentage share, GECSFRAT. As a share of total GDP, the largest CSFs were that of Greece and Portugal, where the CSF expenditures constituted about 3 percent of GDP per annum. The next largest was that of East Germany, about 2 percent of GDP. The next largest was that of Ireland, between 1.5 and 1.8 percent of GDP. Spain was the smallest, at about 1.2 percent of GDP.[24]

**Table 4.1.1:** Total CSF expenditure as percentage of GDP (GECSFRAT)

| | Greece | Ireland | Portugal | Spain | East Germany | Northern Ireland[25] |
|---|---|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 3.19 | 1.68 | 3.17 | 1.16 | 2.01 | 1.00 |
| 1995 | 3.05 | 1.75 | 3.03 | 1.15 | 1.78 | 1.12 |
| 1996 | 2.99 | 1.67 | 3.00 | 1.17 | 1.83 | 1.47 |
| 1997 | 2.89 | 1.56 | 2.95 | 1.19 | 1.92 | 1.19 |
| 1998 | 2.90 | 1.50 | 2.96 | 1.22 | 1.98 | 0.96 |
| 1999 | 2.95 | 1.39 | 3.00 | 1.24 | 1.94 | 0.90 |

A measure of the growth in the stock of physical infrastructure relative to the case where there had been no CSF (i.e., the no-CSF baseline), denoted by KGINFR, is shown in Table 4.1.2. An explanation of how the "stock" of infrastructure is calculated was given in the previous section. Third, a measure of the growth in the "stock" of human capital relative to its non-CSF baseline (KTRNR), is also shown in Table 4.1.2. An explanation of how the "stock" of human capital is calculated was given in the previous section. These variables are presented for the case of CSF 94-99.[26]

Clearly, these two proxies for CSF-induced growth in the stock of physical infrastructure and human capital are very imperfect. For example, in the case of human capital, the Greek system of education – where a high fraction of the work force is educated at tertiary level, and

[24] In the case of Spain, only certain regions were designated Objective 1. But our Spanish HERMIN model is for the entire economy, and we treat the CSF "as if" Spain was an Objective 1 country. In the case of East Germany and Northern Ireland, we have proper regional models.
[25] The values of GECSFRAT for Northern Ireland in 2000 and 2001 are 0.65 and 0.34 respectively.
[26] It should be noted that the numbers in all subsequent tables show only the magnitude of the public expenditure, i.e., the EU funds and the national co-financing. All private expenditure has been excluded. This means, that the numbers represent a lower bound of impact, since all public expenditure should be additional to the economy.

the cycle lasts 11 years, will result in a high baseline measure of human capital. Hence, the CSF-induced changes will appear correspondingly smaller. The opposite is the case for Portugal, and Ireland and Spain are intermediate cases. In the case of Northern Ireland – a region of the United Kingdom – the level of physical infrastructure was already quite high even before CSF 94-99, so the induced change relative to the pre-CSF baseline is correspondingly low.

**Table 4.1.2(a):** Percentage increase in "stock" of physical infrastructure (KGINFR) and stock of human capital (KTRNR) relative to the no-CSF baseline

| | Greece | | Ireland | | Portugal | | Spain | |
|---|---|---|---|---|---|---|---|---|
| | KGINFR | KTRNR | KGINFR | KTRNR | KGINFR | KTRNR | KGINFR | KTRNR |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1.41 | 1.00 | 1.08 | 1.45 | 3.46 | 3.79 | 1.19 | 0.68 |
| 1995 | 2.70 | 1.88 | 2.25 | 2.85 | 6.33 | 7.16 | 2.26 | 1.35 |
| 1996 | 3.88 | 2.71 | 3.32 | 4.12 | 8.81 | 10.95 | 3.30 | 1.99 |
| 1997 | 4.94 | 3.50 | 4.27 | 5.45 | 11.01 | 14.21 | 4.32 | 2.63 |
| 1998 | 5.99 | 4.07 | 5.12 | 6.55 | 13.23 | 17.41 | 5.38 | 3.27 |
| 1999 | 6.98 | 4.80 | 5.78 | 7.55 | 15.33 | 20.51 | 6.50 | 3.95 |
| 2010 | 4.77 | 2.76 | 2.51 | 4.11 | 8.70 | 11.52 | 4.58 | 2.06 |

**Table 4.1.2(b):** Percentage increase in "stock" of physical infrastructure (KGINFR) and stock of human capital (KTRNR) relative to the no-CSF baseline

| | East Germany | | Northern Ireland | |
|---|---|---|---|---|
| | KGINFR | KTRNR | KGINFR | KTRNR |
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 0.92 | 0.44 | 0.08 | 0.31 |
| 1995 | 1.63 | 0.79 | 0.16 | 0.54 |
| 1996 | 2.27 | 1.15 | 0.38 | 0.80 |
| 1997 | 2.88 | 1.49 | 0.49 | 1.02 |
| 1998 | 3.46 | 1.82 | 0.57 | 1.20 |
| 1999 | 3.99 | 2.14 | 0.66 | 1.36 |
| 2010 | 2.04 | 1.21 | 0.62 | 0.84 |

## 4.2 Greece

In Table 4.2.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources.

Although the magnitudes of the CSF impacts will differ from model to model, the characteristic pattern is repeated for all models, and merits some explanation. The planned CSF expenditures in each case follow a similar pattern. This pattern involves a subdivision into the three main economic categories (physical infrastructure, human resources and aid to the productive sectors), and within these categories, a roughly equal amount of expenditure for each of the six years, with a one sixth share being spent per annum. In terms of its demand-side (or Keynesian) impacts, this will result in a sharp increase in activity in the first year, and the increase will be sustained for the six years 1994-99, inclusive. However, after the year 1999 we make the artificial assumption that the CSF expenditures cease abruptly, and the demand-side (or Keynesian) impacts return to zero. So, there is a public expenditure contraction, and the only longer term benefits stem from the externalities associated with the increase in the stock of physical infrastructure and human capital.

In reality, this is likely to follow a somewhat different pattern. As the new CSF is implemented, the construction and training programmes are likely to be phased in more gradually, even if the actual financial expenditures are batched as in the CSF treaty. In the case of the Greek CSF, even the planned expenditures were radically altered, and phased to be "back-loaded" towards the middle and end of the period of operation of CSF 94-99. In the absence of detailed information on the actual phasing of CSF activities on the ground, we are obliged to use the published financial data that are available. While the actual pattern of CSF impacts are artificial, the smoothed average effect is probably fairly realistic.

Turning to Table 4.2.1, the CSF increases Greek GDP (measured at constant market prices) by about 2 percent during the period 1994-99. This impact falls to below 0.5 percent in 2000, but increases gradually to just under 0.7 percent by the year 2010. In the early years, the CSF reduces the unemployment rate by about 1.4 percentage points (in the initial year), but this declines to a reduction of 0.3 percentage points by 1999. After the demand-side (or Keynesian) stimulus is removed, the unemployment rate rises again. But of course in practice one would never observe this "pure" impact, since in the post-CSF 94-99 era, many other external and policy variables would also be changing (e.g., the implementation of CSF 2000-06).

**Table 4.2.1**: Greece: aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 2.01 | -1.38 |
| 1995 | 1.94 | -1.19 |
| 1996 | 1.95 | -0.97 |
| 1997 | 1.90 | -0.68 |
| 1998 | 2.03 | -0.40 |
| 1999 | 2.16 | -0.31 |
| 2000 | 0.44 | +1.00 |
| 2005 | 0.71 | +0.68 |
| 2010 | 0.66 | +0.58 |

In comparing the sizes of the impacts on the level of GDP for the four countries and two regions, the size (or scale) of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of cumulative CSF multiplier, defined as follows:

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.2.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99. The cumulative CSF multiplier is seen to rise from the value 0.67 for 1994-99, to 0.76 for 1994-2002, and rises to 1.07 for 1994-2020. Thus, after all CSF 94-99 expenditures cease after the year 1999, there are continuing supply-side benefits from the CSF in later periods, due to the externality mechanisms described in the previous section. In the absence of such mechanisms, the cumulative CSF multiplier would remain at a value of about 0.7.

**Table 4.2.2**: Greece: synthetic CSF cumulative "multiplier" on GDP

| | |
|---|---|
| 1994-1999 | 0.67 |
| 1994-2002 | 0.76 |
| 1994-2010 | 1.07 |

In Table 4.2.3 we show the impact on the levels of sector GDP in terms of a percentage deviation from a no-CSF baseline. In the Greek case, these are relatively low (as will be seen later when we examine the other models). A full explanation would require a very detailed examination of the structure and calibration of the Greek HERMIN model. But the most important explanatory factors are the relatively closed nature of the Greek economy, the small scale of much manufacturing activity, and the limited links between the provision of business services to manufacturing. These condition the structure and calibration of the Greek HERMIN model. The impact on manufacturing peaks at 3.4 percent in 1999 (i.e., the CSF raises the level of GDP arising in manufacturing by 3.4 percent above the no-CSF baseline).[27] The rise in GDP in market services (ON) is partially explained by the fact that the building and construction sector in included in the N-sector. The rise in the public sector output is mainly due to the state-operated training schemes. The overall impact on GDP at constant factor cost (GDPFC) is similar to the impact on GDP at constant market prices (Table 4.2.1).

[27] It needs to be strongly emphasised that the HERMIN model posits a relationship between the level of CSF expenditures and the level of economic activity. Other models of the "new growth" variety posit a relationship between the level of CSF expenditures and the growth rate of economic activity. The empirical evidence tends to point towards level rather than growth impacts (Sianesi and Van Reenen, 2002).

**Table 4.2.3**: Greece: CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.20 | 2.76 | 1.80 | 2.15 |
| 1995 | 1.27 | 2.59 | 1.83 | 2.09 |
| 1996 | 1.62 | 2.51 | 1.94 | 2.13 |
| 1997 | 2.16 | 2.35 | 1.69 | 2.06 |
| 1998 | 2.91 | 2.37 | 1.71 | 2.19 |
| 1999 | 3.38 | 2.45 | 1.72 | 2.30 |
| 2002 | 2.58 | 0.29 | 0.06 | 0.54 |
| 2010 | 2.04 | 0.32 | 0.06 | 0.49 |

OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

In Table 4.2.4 we examine the crucial impacts on manufacturing in more detail. In a situation where productivity growth was unaffected by the CSF, the growth in output (OT) and employment (LT) would be identical, since the CES production assume constant returns to scale. However, the factor productivity externality mechanisms drive a wedge between output and employment growth. It is seen that productivity rises steadily, peaks at 2.3 percent about the no-CSF level in the year 1999, and remains positive thereafter. Of course, after CSF 94-99 terminates in 1999, this rise in productivity tends to exacerbate the rise in unemployment, other things being equal.

**Table 4.2.4**: Greece: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.20 | 1.05 | 0.16 | 17.47 |
| 1995 | 1.27 | 0.84 | 0.42 | 17.23 |
| 1996 | 1.62 | 0.80 | 0.82 | 16.46 |
| 1997 | 2.16 | 0.81 | 1.34 | 15.94 |
| 1998 | 2.91 | 0.89 | 2.00 | 17.37 |
| 1999 | 3.38 | 1.05 | 2.31 | 18.17 |
| 2002 | 2.58 | 0.58 | 1.99 | 2.27 |
| 2010 | 2.04 | 0.58 | 1.45 | 1.83 |

Note:
OT denotes output in manufacturing; LT denotes manufacturing employment; LPRT denotes labour productivity; IT denotes manufacturing investment.

Our final table shows the impacts of CSF 94-99 on the public sector borrowing requirement (GBORR) and the net trade surplus (NTSVR), both expressed as a percentage share of GDP. It is seen that the impact of the CSF on the Greek economy is too weak to generate a balanced or surplus in the public accounts. The borrowing requirement rises by between 0.5 and 0.8 of a percentage point of GDP each year. In addition, the net trade surplus falls each year, by between 2 and declining to 0.7 percentage points of GDP per annum.

**Table 4.2.5**: Greece: CSF impacts on regional deficits (GBORR) and trade surplus (NTSVR) (percentage of GDP, deviation from baseline)[28]

| | GBORR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 0.51 | -1.97 |
| 1995 | 0.55 | -1.79 |
| 1996 | 0.63 | -1.57 |
| 1997 | 0.71 | -1.47 |
| 1998 | 0.80 | -1.53 |
| 1999 | 0.87 | -1.66 |
| 2002 | 0.49 | -0.60 |
| 2010 | 0.47 | -0.67 |

## 4.3 Ireland

In Table 4.3.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources. From the table it is seen that the impact on GDP peaks at just under 3 percent in the year 1999, and in the longer term the impact is just over 1 percent. During the operation of CSF 94-99 the effect is to reduce the rate of unemployment, and the pattern follows the Greek case: i.e., an initial one percentage point cut in the unemployment rate, followed by smaller impacts as the productivity impacts of the CSF build up, and a reversal of these cuts after the termination of the CSF beyond 1999.[29]

**Table 4.3.1**: Ireland: aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 1.61 | -0.96 |
| 1995 | 2.02 | -1.07 |
| 1996 | 2.17 | -0.92 |
| 1997 | 2.34 | -0.73 |
| 1998 | 2.76 | -0.51 |
| 1999 | 2.83 | -0.35 |
| 2000 | 1.56 | +0.53 |
| 2005 | 1.20 | +0.49 |
| 2010 | 1.00 | +0.40 |

In comparing the sizes of the impacts on the level of GDP for the four countries, the size of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of aggregate CSF multiplier:

[28] Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

[29] Once again, it should be stressed that the CSF shock being analysed consists of CSF 94-99 in isolation. The impacts that the model simulates post-1999 would never be observed in practice because CSF 2000-06 will take over, or in the case of Ireland, the domestic funding of CSF 2000-06 is very much larger.

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.3.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99. What is striking in this table is that the cumulative CSF 94-99 multipliers are quite large for Ireland compared to Greece.[30] Clearly the Irish economy responds to the CSF shock in a more growth-oriented way, and the greater degree of openness facilitates greater transitional growth. This phenomenon has been observed in other research on CSF impacts, to which we will return in our concluding section. (Ederveen *et al*, 2002(b)).

**Table 4.3.2**: Ireland: synthetic CSF cumulative "multiplier" on GDP

| | |
|---|---|
| 1994-1999 | 1.44 |
| 1994-2002 | 1.88 |
| 1994-2010 | 2.83 |

In Table 4.3.3 we show the impacts on sectoral output (real GDP). Clearly the relatively high impacts on manufacturing (OT) are driving the overall impacts, together with the implementation impacts on market services (which include the crucial building and construction activities). However, the latter effects largely vanish after the completion of CSF 94-99, while the manufacturing impacts continue beyond 1999, albeit at a lower (supply-side) level.

**Table 4.3.3**: Ireland: CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.41 | 2.15 | 1.35 | 1.67 |
| 1995 | 1.78 | 2.66 | 1.45 | 2.04 |
| 1996 | 2.50 | 2.59 | 1.54 | 2.22 |
| 1997 | 3.36 | 2.51 | 1.52 | 2.45 |
| 1998 | 4.41 | 2.51 | 1.54 | 2.86 |
| 1999 | 4.71 | 2.37 | 1.58 | 2.96 |
| 2002 | 3.23 | 0.30 | 0.14 | 1.40 |
| 2010 | 2.00 | 0.29 | 0.14 | 1.06 |

Note:
OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

Turning to the specifics of the manufacturing impacts, it is seen that the output growth is split between employment and productivity growth in roughly equal proportions. In contrast to the Greek case, this facilitates relatively strong employment growth, even in the presence of strong productivity growth.

[30] It should be recalled that the same externality elasticities are used in all the CSF simulations reported in this Section of the report. Only in the next section do we vary the elasticities.

**Table 4.3.4**: Ireland: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.41 | 1.25 | 0.16 | 12.04 |
| 1995 | 1.78 | 1.38 | 0.39 | 13.40 |
| 1996 | 2.50 | 1.63 | 0.86 | 11.58 |
| 1997 | 3.36 | 1.87 | 1.47 | 11.38 |
| 1998 | 4.41 | 2.29 | 2.07 | 10.79 |
| 1999 | 4.71 | 2.41 | 2.24 | 12.08 |
| 2002 | 3.23 | 1.26 | 1.95 | 2.80 |
| 2010 | 2.00 | 0.76 | 1.22 | 1.78 |

OT denotes output in manufacturing; LT denotes manufacturing employment; LPRT denotes labour productivity; IT denotes manufacturing investment.

Finally, Table 4.3.5 suggests that in the case of Ireland the CSF had a neutral impact on the public sector borrowing requirement, and a small negative impact on the net trade surplus. This is due to the revenue buoyancy caused by the impact of the CSF on the tax base.

**Table 4.3.5**: Ireland: CSF impacts on regional deficits (GBORR)
and trade surplus (NTSVR)
(percentage of GDP, deviation from baseline)[31]

| | GBORR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | -0.03 | -0.77 |
| 1995 | -0.03 | -0.90 |
| 1996 | -0.08 | -0.77 |
| 1997 | -0.04 | -0.63 |
| 1998 | +0.05 | -0.42 |
| 1999 | +0.26 | -0.42 |
| 2002 | +0.21 | +0.18 |
| 2010 | +0.17 | +0.05 |

### 4.4 Portugal

In Table 4.4.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources. Here the aggregate impacts on GDP are quite large, and peak at just over 4.5 percent in 1999. The impact on the rate of unemployment follow the Greek and Irish patterns, with an initial strong negative impact, followed by smaller negative impacts, and a reversal of the sign of the impacts after the CSF is complete. The same *caveats* apply here (see footnote 29 above).

[31] Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

**Table 4.4.1**: Portugal: aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 2.72 | -2.21 |
| 1995 | 2.78 | -1.76 |
| 1996 | 2.87 | -1.31 |
| 1997 | 3.30 | -0.73 |
| 1998 | 4.04 | -0.16 |
| 1999 | 4.66 | -0.05 |
| 2000 | 2.20 | +1.93 |
| 2005 | 2.40 | +1.09 |
| 2010 | 2.06 | +0.82 |

In comparing the sizes of the impacts on the level of GDP for the four countries, the size of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of aggregate CSF multiplier:

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.4.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99, where the cumulative CSF multipliers are seen to be at the higher end of the scale.

**Table 4.4.2**: Portugal: synthetic CSF cumulative "multiplier on GDP

| | |
|---|---|
| 1994-1999 | 1.12 |
| 1994-2002 | 1.53 |
| 1994-2010 | 2.55 |

The impacts on Portuguese sectoral output are shown in Table 4.4.3. Here, the impacts on manufacturing are higher than in the case of Ireland, with knock-on consequences for the market services sector (i.e., in addition to the direct building and construction impacts). These impacts are being driven by the large increases in the stock of physical infrastructure and human capital that were shown previously in Table 4.1.2(a). There is a possibility that the externality elasticities are too high for Portugal, and that lower values would be more appropriate. Nevertheless, the Portuguese model simulations suggest that the CSF impacts are still large.

**Table 4.4.3**: Portugal: CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 2.39 | 4.39 | 1.60 | 3.23 |
| 1995 | 2.70 | 4.27 | 1.43 | 3.27 |
| 1996 | 4.17 | 4.16 | 0.92 | 3.42 |
| 1997 | 6.20 | 4.16 | 0.94 | 3.97 |
| 1998 | 9.00 | 4.44 | 0.80 | 4.81 |
| 1999 | 10.65 | 4.82 | 0.85 | 5.47 |
| 2002 | 8.65 | 1.43 | -0.63 | 2.77 |
| 2010 | 5.96 | 1.14 | -0.63 | 2.09 |

Note:
OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

The detailed impacts on manufacturing are shown in Table 4.4.4, where the strong productivity growth induced by the CSF externality mechanisms is apparent. As suggested above, this effect may be overstated, and will be examined further in the next section. Nevertheless, it is probably the case that the impact of CSF 94-99 on Portuguese manufacturing output was very strong, and is known to have been accompanied by a large inflow of foreign direct investment (see ESRI, 1997). This appears to have induced a radical transformation of the sector, rather like the impact on the Irish manufacturing sector in the 1980s. The traditional nature of much of Portuguese manufacturing (with many labour intensive low productivity firms) began to change under the impact of EU entry, and the first two CSFs. It should be noted that the Portuguese economy is more open than the Greek economy, but less open than the Irish economy.

**Table 4.4.4**: Portugal: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 2.39 | 1.89 | 0.49 | 18.83 |
| 1995 | 2.70 | 1.49 | 1.19 | 20.36 |
| 1996 | 4.17 | 1.77 | 2.36 | 21.06 |
| 1997 | 6.20 | 2.26 | 3.85 | 20.38 |
| 1998 | 9.00 | 3.00 | 5.83 | 23.00 |
| 1999 | 10.65 | 3.74 | 6.65 | 24.76 |
| 2002 | 8.65 | 2.96 | 5.53 | 6.60 |
| 2010 | 5.96 | 2.10 | 3.77 | 4.71 |

Note:
OT denotes output in manufacturing; LT denotes manufacturing employment;
LPRT denotes labour productivity; IT denotes manufacturing investment.

Finally, Table 4.4.5 suggests that CSF 94-99 added to the Portuguese borrowing requirement and increased the trade deficit, but by much less than the Greek case.

**Table 4.4.5**: Portugal: CSF impacts on regional deficits (GBORR) and trade surplus (NTSVR)
(percentage of GDP, deviation from baseline)[32]

| | GBORR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 0.45 | -1.90 |
| 1995 | 0.45 | -1.59 |
| 1996 | 0.37 | -0.97 |
| 1997 | 0.34 | -0.83 |
| 1998 | 0.43 | -1.01 |
| 1999 | 0.50 | -1.27 |
| 2002 | 0.33 | -0.86 |
| 2010 | 0.26 | -0.45 |

## 4.5 Spain

In Table 4.5.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources.

In the case of Spain, it must be stressed that the country was divided into Objective 1 regions and non-Objective 1 regions. Hence, in the following Tables what we show are the impacts on the entire Spanish economy, and not just on the Objective 1 regions. In the case of the aggregate GDP impacts, these appear small, but should be scaled in terms of the size of the CSF relative to the Spanish GDP (refer Table 4.1.1).

**Table 4.5.1**: Spain: aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 1.10 | -0.98 |
| 1995 | 1.18 | -0.83 |
| 1996 | 1.25 | -0.57 |
| 1997 | 1.32 | -0.19 |
| 1998 | 1.39 | +0.30 |
| 1999 | 1.39 | +0.60 |
| 2000 | 0.18 | +1.78 |
| 2005 | 0.63 | +0.38 |
| 2010 | 0.58 | +0.35 |

In comparing the sizes of the impacts on the level of GDP for the four countries, the size of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of aggregate CSF multiplier:

32 Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.5.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99. The cumulative multipliers are bigger than the Greek case, but smaller than the Portuguese case.

**Table 4.5.2**: Spain: synthetic CSF cumulative "multiplier on GDP

| | |
|---|---|
| 1994-1999 | 1.07 |
| 1994-2002 | 1.23 |
| 1994-2010 | 1.77 |

The impacts on sectoral GDP are shown in Table 4.5.3, where the impacts are similar in magnitude to the Greek case. But we are unable to extract the separate impacts on the Spanish Objective 1 regions and can merely present the overall impacts on the sectors of the entire Spanish economy. Table 4.5.4 shows the detailed impacts of the manufacturing sector. Once again, there is a fairly even split between employment and productivity growth.

**Table 4.5.3**: Spain: CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.17 | 1.32 | 0.56 | 1.16 |
| 1995 | 1.34 | 1.34 | 0.58 | 1.24 |
| 1996 | 1.74 | 1.38 | 0.56 | 1.32 |
| 1997 | 2.31 | 1.34 | 0.62 | 1.40 |
| 1998 | 3.11 | 1.30 | 0.64 | 1.49 |
| 1999 | 3.69 | 1.25 | 0.69 | 1.52 |
| 2002 | 2.78 | 0.00 | 0.21 | 0.21 |
| 2010 | 2.04 | 0.29 | 0.21 | 0.61 |

Note:
OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

**Table 4.5.4**: Spain: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.17 | 1.37 | -0.20 | 6.60 |
| 1995 | 1.34 | 1.28 | 0.06 | 6.44 |
| 1996 | 1.74 | 1.24 | 0.49 | 6.97 |
| 1997 | 2.31 | 1.27 | 1.03 | 7.43 |
| 1998 | 3.11 | 1.36 | 1.73 | 8.19 |
| 1999 | 3.69 | 1.53 | 2.13 | 9.08 |
| 2002 | 2.78 | 1.04 | 1.73 | 2.41 |
| 2010 | 2.04 | 0.80 | 1.23 | 1.76 |

Note:
OT denotes output in manufacturing; LT denotes manufacturing employment;
LPRT denotes labour productivity; IT denotes manufacturing investment.

Finally, Table 4.5.5 suggests that CSF 94-99 may have increased the borrowing requirement slightly in the early years, and by over 1 percentage point of GDP in the later years. There was also a modest deterioration in the net trade balance.

**Table 4.5.5**: Spain: CSF impacts on regional deficits (GBORR)
and trade surplus (NTSVR)
(percentage of GDP, deviation from baseline)[33]

| | GBORR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 0.0 | -0.80 |
| 1995 | -0.02 | -0.76 |
| 1996 | 0.01 | -0.74 |
| 1997 | 0.12 | -0.73 |
| 1998 | 0.32 | -0.74 |
| 1999 | 0.55 | -0.82 |
| 2002 | 1.55 | -0.45 |
| 2010 | 0.74 | -0.20 |

## 4.6 East Germany

We now turn to the two Objective 1 regional economies for which we have regional HERMIN models, taking East Germany first. In Table 4.6.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources.

The East German economy started from a very low base after German unification, and it is not surprising that the HERMIN model suggests that – other things being equal – the East

[33] Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

German economy is likely to grow rapidly.[34] Table 4.6.1 suggests that the impact of CSF 94-99 on the level of aggregate GDP may be as high as 4 percent by the year 1999, and will continue into the post-CSF 94-99 period. The impact on reducing the unemployment rate is also very strong, although this is reversed in the period after the termination of CSF 94-99. The usual *caveats* apply here (see footnote 29 above).

**Table 4.6.1**: East Germany: aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 2.75 | -1.89 |
| 1995 | 2.85 | -1.85 |
| 1996 | 2.92 | -1.76 |
| 1997 | 3.24 | -1.73 |
| 1998 | 3.71 | -1.49 |
| 1999 | 3.95 | -1.32 |
| 2000 | 1.51 | +0.67 |
| 2005 | 2.76 | +1.26 |
| 2010 | 4.68 | +1.74 |

In comparing the sizes of the impacts on the level of GDP for the four countries, the size of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of aggregate CSF multiplier:

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.6.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99. These are among the highest cumulative multipliers. However, the stalled convergence of East Germany is also apparent in the data examined earlier in Section 2. The problem here is probably more associated with the poor performance of the economy of the western regions (i.e., the former West Germany) than with any failure in the CSF. The HERMIN analysis suggests that the CSF impacts were large and positive, but of course other negative effects from the external economy have dominated.

**Table 4.6.2**: East Germany: synthetic CSF cumulative "multiplier on GDP

| | |
|---|---|
| 1994-1999 | 1.69 |
| 1994-2002 | 2.11 |
| 1994-2010 | 4.44 |

The sectoral impacts of GDP are shown in Table 4.6.3, with the detailed manufacturing impacts in Table 4.6.4. Here, the strongest impacts emanate from the market services sector (which includes building and construction activity). However, unlike the previous four

[34] The new growth theory suggests that the crucial driving force for convergence of a lagging economy is the initial state of the economy (Barro and Sala-y-Martin, 1995).

national economies, the continued strong externality-driven growth of manufacturing induces further growth in the market services sector. By the year 2010, the overall increase in the level of GDP (at constant factor cost) is almost 4 percent. Once again, there is a fairly even split between employment growth and productivity growth in manufacturing.

**Table 4.6.3**: East Germany: CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.11 | 3.48 | 1.19 | 2.46 |
| 1995 | 1.34 | 3.49 | 1.05 | 2.51 |
| 1996 | 1.73 | 3.53 | 1.12 | 2.62 |
| 1997 | 2.24 | 3.82 | 1.20 | 2.92 |
| 1998 | 2.90 | 4.24 | 1.20 | 3.32 |
| 1999 | 3.24 | 4.45 | 1.20 | 3.54 |
| 2002 | 2.01 | 1.52 | -0.06 | 1.43 |
| 2010 | 3.02 | 4.94 | -0.06 | 3.70 |

Note:
OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

**Table 4.6.4**: East Germany: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 1.11 | 1.09 | 0.02 | 5.31 |
| 1995 | 1.34 | 1.16 | 0.19 | 5.31 |
| 1996 | 1.73 | 1.30 | 0.43 | 6.15 |
| 1997 | 2.24 | 1.52 | 0.72 | 7.08 |
| 1998 | 2.90 | 1.81 | 1.07 | 7.67 |
| 1999 | 3.24 | 1.98 | 1.23 | 7.83 |
| 2002 | 2.01 | 1.00 | 1.00 | 1.21 |
| 2010 | 3.02 | 2.36 | 0.64 | 2.34 |

Note:
OT denotes output in manufacturing; LT denotes manufacturing employment;
LPRT denotes labour productivity; IT denotes manufacturing investment.

In the case of a region, public sector deficits and trade deficits are not of major concern. The financing implications are the responsibility of the national authorities and not of the regional authorities. Nevertheless, they give a measure of the success or otherwise of the regional economy. A regional deficit signals dependency on fiscal transfers from the nation. A regional trade deficit signals an inability to produce locally and a dependence on imports, which needs to be financed by private and public sector inflows. What Table 4.6.5 suggests is that CSF 94-99 caused a reduction in the regional East German fiscal balance of between 1.5 and 2 percentage points of GDP (EGDEFR). On the other hand, the net trade surplus increased modestly as a percent of GDP (NTSVR). In both cases, there was a reversal of these effects in the post CSF 94-99 period, but of small size.

**Table 4.6.5**: East Germany: CSF impacts on regional deficits (EGDEFR) and trade surplus (NTSVR)
(percentage of GDP, deviation from baseline)[35]

| | EGDEFR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | -1.96 | 0.60 |
| 1995 | -1.71 | 0.60 |
| 1996 | -1.74 | 0.53 |
| 1997 | -1.69 | 0.29 |
| 1998 | -1.59 | 0.17 |
| 1999 | -1.43 | 0.00 |
| 2002 | +0.56 | -0.44 |
| 2010 | +0.80 | -0.28 |

## 4.7 Northern Ireland

We now turn to the regional economy of Northern Ireland. Northern Ireland is one of the less developed regions of the United Kingdom, but since the UK is at the average GDP per capita within the EU, it is clear that Northern Ireland is relatively better off than the countries of the Southern EU periphery. Nevertheless, it was designated Objective 1 for the purposes of CSF 94-99 and was the largest UK region to be thus designated. Since we had full ex-post CSF financial data on Northern Ireland from an early stage, we use these data rather than the ex-ante planning data used in all the previous simulations. As was seen from Table 4.1.1, the CSF expenditures continued beyond 1999 and were sizeable in the years 2000 and 2001.

In Table 4.7.1 we show the impact of the CSF on aggregate real GDP at market prices (as a percentage change relative to the no-CSF baseline), and on the unemployment rate (as a difference relative to the no-CSF baseline). This simulation captures both the direct demand-side (or Keynesian) impacts as well as additional supply-side impacts that are associated with the improvement in infrastructure and human resources.

The Northern Ireland economy started from a moderately high base in 1993, but was only beginning to emerge from a period of over a quarter of a century of civil unrest and violence that had a severe negative impact on private sector activity.[36] Table 4.7.1 suggests that the impact of CSF 94-99 on the level of aggregate GDP rose to just above 1.75 percent by the year 1996, but that the positive impact on the level of GDP declined almost to zero after 2001. The impact on reducing the unemployment rate was modest, peaking at a reduction of just over 0.7 percentage points in the year 1996, but declining to almost zero after 2001. The usual *caveats* apply here (see footnote 29 above).

[35] Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

[36] The first "cease fires" of the main paramilitary organisations were announced in 1994, subsequently broke down, and were reinstated. The Belfast Agreement that eventually led to devolved government only came at the end of the period of CSF 94-99. So the political context of CSF 94-99 in Northern Ireland continued to be one of uncertainty and evolution.

**Table 4.7.1**: Northern Ireland:
aggregate CSF 94-99 impacts on GDP and unemployment

| | GDPE | UR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | 1.09 | -0.41 |
| 1995 | 1.27 | -0.51 |
| 1996 | 1.77 | -0.71 |
| 1997 | 1.59 | -0.57 |
| 1998 | 1.34 | -0.43 |
| 1999 | 1.27 | -0.39 |
| 2000 | 1.08 | -0.35 |
| 2001* | 0.67 | -0.18 |
| 2002 | 0.18 | +0.04 |
| 2010 | 0.12 | +0.04 |

* CSF 1994-99 expenditures terminated after the year 2001.

In comparing the sizes of the impacts on the level of GDP between countries and regions, the size of the CSF injection (both EU and domestic public co-finance) must be borne in mind. As a guide we can construct a type of aggregate CSF multiplier:

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

This is shown in Table 4.7.2 for the years 1994-99, 1994-2002 and 1994-2010 for CSF 94-99. These are among the lowest cumulative multipliers. Subsequent tables suggest that much of the CSF was spent on construction and training activities, and that the manufacturing sector – where the enduring long-lasting impacts of the CSF tend to arise – was less affected. This, the long-run benefits were truncated and the cumulative multipliers were correspondingly smaller.

**Table 4.7.2**: Northern Ireland: synthetic CSF cumulative “multiplier on GDP

| | |
|---|---|
| 1994-1999 | 1.24 |
| 1994-2002 | 1.33 |
| 1994-2010 | 1.48 |

The sectoral impacts of GDP are shown in Table 4.6.3, with the detailed manufacturing impacts in Table 4.6.4. Here, the strongest impacts emanate from the market services sector (which includes building and construction activity). However, unlike the previous East German case, the weak induced growth of manufacturing induces very little further growth in the market services sector after the termination of CSF 94-99. By the year 2010, the overall increase in the level of GDP (at constant factor cost) is merely 0.12 percent. Most of the growth comes in terms of higher labour productivity rather than in terms of higher output. The modest growth in manufacturing investment (IT) is very striking, and stems mainly from the fact that no funds appear to have been allocated in the Northern Ireland CSF to direct aid to manufacturing, as in all the previous five national and regional CSFs.

**Table 4.7.3**: Northern Ireland:
CSF impacts on sectoral GDP (% change over baseline)

| | OT | ON | OG | GDPFC |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 0.30 | 1.86 | 0.83 | 1.12 |
| 1995 | 0.25 | 2.44 | 0.62 | 1.31 |
| 1996 | 0.44 | 3.51 | 0.65 | 1.84 |
| 1997 | 0.39 | 2.90 | 0.83 | 1.65 |
| 1998 | 0.46 | 2.39 | 0.68 | 1.39 |
| 1999 | 0.57 | 2.20 | 0.67 | 1.32 |
| 2002 | 0.43 | 0.23 | -0.03 | 0.19 |
| 2010 | 0.41 | 0.04 | -0.03 | 0.12 |

Note:
OT denotes output in manufacturing; ON, market services; OG public services; GDPFC, total GDP;

**Table 4.7.4**: Northern Ireland: CSF impacts on manufacturing sector:
Output, employment, productivity and investment
(% change over baseline)

| | OT | LT | LPRT | IT |
|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 |
| 1994 | 0.30 | 0.30 | 0.00 | 0.52 |
| 1995 | 0.25 | 0.14 | 0.11 | 0.79 |
| 1996 | 0.44 | 0.22 | 0.22 | 1.22 |
| 1997 | 0.39 | 0.02 | 0.37 | 1.26 |
| 1998 | 0.46 | 0.00 | 0.46 | 1.23 |
| 1999 | 0.57 | 0.07 | 0.50 | 1.20 |
| 2002 | 0.43 | 0.00 | 0.44 | 0.55 |
| 2010 | 0.41 | 0.12 | 0.29 | 0.24 |

Note:
OT denotes output in manufacturing; LT denotes manufacturing employment;
LPRT denotes labour productivity; IT denotes manufacturing investment.

As previously noted in the case of East Germany, in the case of a region, public sector deficits and trade deficits are not of major concern. The financing implications are the responsibility of the national authorities and not of the regional authorities. Nevertheless, they give a measure of the success or otherwise of the regional economy. A regional deficit signals dependency on fiscal transfers from the nation. A regional trade deficit signals an inability to produce locally and a dependence on imports, which needs to be financed by private and public sector inflows. What Table 4.7.5 suggests is that CSF 94-99 caused a reduction in the regional Northern Ireland fiscal balance - with a consequential reduction in the UK "subvention" to Northern Ireland - of about one half of one percentage points of GDP (NIDEFR). Unlike the case of East Germany, in Northern Ireland the effect of the CSF was that the net trade surplus fell modestly as a percent of GDP (NTSVR). In both cases, there was a reversal of these effects in the post CSF 94-99 period, but of small size.

**Table 4.7.5**: Northern Ireland: CSF impacts on regional deficits (NIDEFR) and trade surplus (NTSVR)
(percentage of GDP, deviation from baseline)[37]

| | NIDEFR | NTSVR |
|---|---|---|
| 1993 | 0 | 0 |
| 1994 | -0.25 | -0.32 |
| 1995 | -0.27 | -0.43 |
| 1996 | -0.50 | -0.43 |
| 1997 | -0.43 | -0.23 |
| 1998 | -0.45 | +0.02 |
| 1999 | -0.50 | +0.04 |
| 2002 | -0.06 | +0.15 |
| 2010 | +0.03 | 0.00 |

### 4.8 Summary and conclusions on impact analysis

As stated at the start of this section, we have assumed a common set of externality elasticities for all four country and the two regional HERMIN models. These elasticities are at the middle of the range of values found in a comprehensive survey of the international literature. In addition, the externality mechanisms have been implemented in identical fashion in all six models, as follows:

i. Increases in the stock of physical infrastructure and in the stock of human capital directly increase output in the manufacturing (or mainly traded) sector;

ii. A one percent increases in either stock increases the level of output by an amount equal to the value assumed for the relevant elasticity parameter ($\eta_1$ or $\eta_2$);

iii. Increases in the stock of physical infrastructure and in the stock of human capital have no direct impacts on output in the market services (or mainly non-traded) sector;

iv. Increases in the stock of physical infrastructure boost total factor productivity in a similar fashion in both the manufacturing (mainly traded) sector as well as in the market services (mainly non-traded) sector;

v. Increases in the stock of human capital boost labour-embodied technical progress in both sectors, and thereby boost labour productivity;

vi. All these externality mechanisms operate in addition to the conventional demand-side (or Keynesian) mechanisms that arise only during the actual implementation phase of the CSF, and vanish once the CSF is fully implemented.

Since identical CSF mechanisms as well as identical elasticities are assumed, the simulation outturns can only differ because the underlying model structures have different properties. This will arise fairly naturally through the different sectoral structures in the economies being studied, the differing degrees of openness, the different calibrated parameter values in the HERMIN behavioural equations, etc. So, the simulations in this section only give a partial answer to the question: "what is the impact of the CSF on an Objective 1 economy?". If the CSFs were implemented in each region in such a way that they were equally effective, then

[37] Note: A "+" sign indicates a deterioration (or rise) in the borrowing requirement (GBORR) but an improvement (or rise) in the net trade surplus (NTSVR), both expressed as a percentage of GDP.

the simulations that we have just described in this section answer the question. Perhaps the best summary indicator of CSF effectiveness is given by the "cumulative" multiplier presented earlier for each model. We recall that the CSF cumulative multiplier is defined as follows:

*Cumulative CSF multiplier:*

*Cumulative % increase in GDP / Cumulative CSF share in GDP*

These cumulative multipliers are summarised in a single table below for comparative purposes (Table 4.8.1).

Table 4.8.1: CSF 94-99: Cumulative Objective 1 multipliers

| | Greece | Ireland | Portugal | Spain | East Germany | Northern Ireland |
|---|---|---|---|---|---|---|
| 1994-1999 | 0.67 | 1.44 | 1.12 | 1.07 | 1.69 | 1.24 |
| 1994-2002 | 0.76 | 1.88 | 1.53 | 1.23 | 2.11 | 1.33 |
| 1994-2010 | 1.07 | 2.83 | 2.55 | 1.77 | 4.44 | 1.48 |
| LR ranking | 6 | 2 | 3 | 4 | 1 | 5 |

If we rank the economies in terms of the size of the cumulative multiplier for the extended period 1994-2010 (i.e., including eleven years after CSF 94-99 terminates), then East Germany comes first. However, this is an anomalous case since the initial situation of East Germany at the start of CSF 94-99 was very much less advantageous that the other five. Although the re-structuring of East German industry was well in hand by 1994, it was not complete. The state of the physical infrastructure was also poor, and this served to magnify the impacts of the CSF on building an improved stock of infrastructure. Nevertheless, the cumulative multipliers suggest that CSF 94-99 made a significant contribution to promoting cohesion in East Germany, even if this was dominated in the overall picture by the sluggish performance of the overall German economy.

The second country in the ranking is Ireland, with Portugal a close third. Spain is an intermediate case. Northern Ireland and Greece come last in the rankings. In a sense this provides corroboration to the recent research of Ederveen *et al* (2002(b)), who suggest that the effectiveness of structural Funds depend on what they call "conditioning" variables, and the most important of these is "openness". The Irish economy is the most open in the EU. Portugal is also quite open, relative to its size. Spain is less open, but Greece is the least open. The case of Northern Ireland is slightly anomalous, in that it has a very large public sector, and its manufacturing sector is weighted towards more traditional activities (clothing, textiles, traditional engineering) which are sold mainly locally or within the United Kingdom.

Factors such as these partially explain the rankings in Table 4.8.1. The economic structure of the five "normal" Objective 1 economies has been encapsulated in the HERMIN models and serves to condition the effectiveness of the CSF impacts, as measured by the cumulative multipliers. Perhaps the lesson to be drawn from the analysis contained in this section is that structural change in an economy – involving openness, institutional quality, etc. – is driven by forces beyond the CSF. The CSF may serve to accelerate these changes, but it is the wider challenges of EU membership that probably dominate.

# [5] Robustness and sensitivity analysis

### 5.1 Introductory remarks

The core of the CSF interventions is designed to influence the supply-side of the Objective 1 economies. Earlier in sections 3 and 4 we described how output and factor productivity externalities are incorporated to the system of model equations, which serve to link the CSF interventions directly with the supply-side of the economy.

If we could base our choice of externality elasticities firmly on local research then we could propose specific elasticity values that were appropriate for specific models. Unfortunately we do not have access to such research findings. Indeed, in our project research carried out as part of the wider ex-post evaluation of CSF 94-99, we were unable to access any research of a microeconomic nature that would help guide us in our selection of infrastructural and human capital elasticities. We were forced to fall back on the international literature, and make use of findings in a range of countries that have similarities with the Objective 1 economies. For example, research based on the individual States of the USA can be used to gain insight into the likely elasticity values for small open economies on the EU periphery.

The international empirical literature, although vast, is somewhat ambiguous about the appropriate magnitude of the externalities. Different researchers use different methodologies, and arrive at different conclusions.[38] Faced with this situation, there are two possible strategies. The first would be to wait until the research results are available in the cohesion countries and to stand aside from any attempt to quantify the likely macroeconomic impacts of the CSF. The second would be to carry out the macroeconomic evaluation exercises with a range of externality elasticities and to exercise judgement on the most appropriate values for each country based on a wide range of information about the situation in each country.

For example, in the case of the Irish CSF, there is a body of evidence that suggests that the ESF training schemes – as implemented by the State Training Agency FAS, were reasonably well targeted, closely integrated with other economic development policies, and were reasonably effective (Honohan (ed.), 1997; Denny, Harmon and O'Connell (2000)). This might suggest that externality elasticities near the top of the international range might be appropriate. In the case of the Greek CSF, the limited information that we have on the extensive re-phasing (or "re-programming") of CSF 94-99 might suggest that difficulties may have arisen at the design and implementation stages of many of the Operational Programmes. This might suggest that lower values for the externality elasticities should be used. In both extreme cases, a sensitivity analysis needs to be carried out to explore how the CSF impact changes as the two types of externalities – with respect to physical infrastructure and with respect to human capital - are varied from low to high values. For this exercise, the numbers shown in table 5.1 have been used.

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[38] For example, in the case of research on the influence of human capital, see the recent Institute of Fiscal Studies review by Sianesi and Van Reenen (2002).

**Table 5.1**: Elasticities used in simulation runs

| | | Factor productivity elasticities | | |
|---|---|---|---|---|
| | | **0.00** | **0.20** | **0.40** |
| **Output elasticities** | **0.00** | Zero – Zero | | |
| | **0.20** | | Medium – Medium | |
| | **0.40** | | | High - High |

It should be recalled that in the simulations reported in the previous section, the "medium-medium" combination was used throughout the analysis, and the differences between the outcomes was a result of the different underlying macroeconomic structures of the six economies.

5.2: Sensitivity analysis

In the case "zero - zero" elasticities we effectively only have the conventional Keynesian demand-side effect. Minor neoclassical effects (through shifting relative prices) can arise, but they are dominated by the straightforward Keynesian effects. We can anticipate what the model simulations will produce for this case. While the CSF is being implemented (i.e., while there are positive expenditure streams of CSF investment programmes), there will be demand-side (or Keynesian) impacts. But in the complete absence of "stock" effects (through the improved infrastructure and human capital), these demand-side impacts will rapidly return to zero.

In the case of the "high-high" combination, the supply-side effects become much more relevant, particularly over time as the stocks of physical infrastructure and human capital build up. Compared to the findings taken from the empirical literature, our high elasticities sometimes fall into the middle of the observed scale, but we deliberately adopted a conservative approach. Here we get the demand-side impacts while the CSF is being implemented, and this is accompanied by a gradual build up of supply-side impacts that continue even after the CSF is terminated. Eventually depreciation effects set in and the economy will start converging back towards the original no-CSF baseline level of activity. But this is a long drawn out process, and will continue long after the terminal year of our simulations, namely the year 2010.

It would be possible to extend Table 5.1 to include asymmetric options (e.g., of the "high-low" variety). But we have little indication from the literature that such options are relevant. The optimum balance between investment in physical infrastructure and human resources is a topic that deserves detailed investigation, but we cannot pursue it further in this report. A balanced development of physical infrastructure appears to be the best option and has been adopted in most of the Objective 1 CSFs.

The following set of six tables present the simulation results for the three stylised CSF scenarios, namely a "zero-zero" choice of externality elasticities for physical infrastructure and human capital; a "medium-medium" choice, where both elasticities are assumed to take the values 0.20 (as in the simulations reported in Section 4); and a "high-high" option, where both elasticities are assumed to take the values 0.40, i.e., values that are towards the upper range of results found in the international literature.

We have already commented on the rather low impacts of CSF 94-99 on the Greek economy. What Table 5.2 suggests is that the outcome is relatively insensitive to the degree of "optimality" of the design of the CSF.[39] The policy implication is a challenging one. Namely, that a series of structural and institutional changes may be necessary before CSF-type programmes are able to produce significant cohesion impacts of the type that occurred in Ireland and Portugal.

**Table 5.2**: Greece: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 2.00 | -1.42 | 2.01 | -1.38 | 2.03 | -1.34 |
| 1995 | 1.89 | -1.35 | 1.94 | -1.19 | 2.00 | -1.03 |
| 1996 | 1.83 | -1.31 | 1.95 | -0.97 | 2.06 | -0.64 |
| 1997 | 1.71 | -1.27 | 1.90 | -0.68 | 2.10 | -0.09 |
| 1998 | 1.73 | -1.25 | 2.03 | -0.40 | 2.35 | +0.44 |
| 1999 | 1.77 | -1.31 | 2.16 | -0.31 | 2.56 | +0.68 |
| 2002 | 0.21 | -0.09 | 0.50 | +0.78 | 1.15 | +1.65 |
| 2010 | 0.28 | -0.14 | 0.66 | +0.58 | 1.09 | +1.39 |

The case of Ireland is illustrative of the type of rapid growth that can occur if the structure of the economy has been oriented towards competitive growth and active participation in the Single European Market (see ESRI, 1997 for background to this point). The "zero-zero" impacts are the multiplier impacts that tend to accompany investment shocks that are directed mainly at construction and training schemes, i.e., shocks that have rather low leakages out of the economy. Moving from "zero-zero" to "high-high" produces very significant boosts to GDP, and suggests that the appropriate elasticities in the Irish case may be at the upper range of the international research findings. However, high human capital elasticities imply high productivity growth, and the "high-high" scenario has smaller cuts in unemployment than in the "low-low" case. We have seen in Section 2 that Ireland experienced very high employment growth even in the presence of very high growth in labour productivity. To understand this we would need to move outside the narrow analysis of CSF impacts and consider a wider range of policy initiatives that accompanied the CSF, e.g., policy towards attracting foreign direct investment, the Social Partnership that served to moderate inter-sectoral wage inflation (Nolan *et al*, eds., 2000), and the agglomeration effects that characterised the computer and pharmaceutical sectors (see Bradley, 2001).

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[39] In our terminology, the design of a CSF is "optimal" when it is such as to have the maximum positive impact on the development of the economy. In large part, this means that the externality elasticities are at the highest possible values. A CSF is "sub-optimal" when the design and implementation produce a lower impact than possible alternatives. In the context of our present lack of microeconomic research on CSF impacts, the notion of CSF "optimality" is more of ex-post than of ex-ante use. We suggest that the concept is related to the issues of conditionality explored by Ederveen *et al*, 2002 (b).

**Table 5.3**: Ireland: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1.57 | -0.98 | 1.61 | -0.96 | 1.65 | -0.93 |
| 1995 | 1.82 | -1.16 | 2.02 | -1.07 | 2.21 | -0.97 |
| 1996 | 1.74 | -1.12 | 2.17 | -0.92 | 2.61 | -0.71 |
| 1997 | 1.56 | -1.09 | 2.34 | -0.73 | 3.16 | -0.38 |
| 1998 | 1.48 | -1.05 | 2.76 | -0.51 | 4.09 | +0.01 |
| 1999 | 1.33 | -0.99 | 2.83 | -0.35 | 4.40 | +0.29 |
| 2002 | -0.08 | +0.06 | 1.43 | +0.531 | 2.77 | +1.16 |
| 2010 | -0.02 | +0.02 | 1.00 | +0.40 | 2.15 | +0.82 |

The Portuguese case is shown in Table 5.4, and resembles the Irish case in most of its characteristics. However, the cuts in the unemployment rate that occur in the "zero-zero" scenario become significant rises in the unemployment arte in the "high-high" scenario. This suggests that there is a degree of risk in Portugal that the restructuring of the economy away from traditional, low productivity, traditional sectors towards higher productivity modern sectors (or even the modernisation of traditional sectors by adoption of new technologies) may produce periods of "jobless" growth.

**Table 5.4**: Portugal: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 2.66 | -2.32 | 2.72 | -2.21 | 2.78 | -2.09 |
| 1995 | 2.55 | -2.18 | 2.78 | -1.76 | 3.00 | -1.35 |
| 1996 | 2.31 | -2.21 | 2.87 | -1.31 | 3.45 | -0.43 |
| 1997 | 2.26 | -2.17 | 3.30 | -0.73 | 4.41 | +0.67 |
| 1998 | 2.42 | -2.29 | 4.04 | -0.16 | 5.83 | +1.92 |
| 1999 | 2.64 | -2.40 | 4.66 | -0.05 | 6.92 | +2.26 |
| 2002 | 0.69 | -0.53 | 2.30 | +1.53 | 4.93 | +3.18 |
| 2010 | 0.31 | -0.27 | 2.06 | +0.82 | 4.16 | +2.11 |

Table 5.5 shows the Spanish case, where there is only modest improvement as one moves from "zero-zero" to "high-high". However, we noted previously that in the Spanish case we are using a national HERMIN model to analyse a CSF that only applies to a subset of regions. A clearer picture may emerge if regional methodologies are developed to examine the Spanish case. With these *caveats* in mind, what our results suggest is that the Spanish CSF may be sub-optimal in the terminology used above.

**Table 5.5**: Spain: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1.10 | -1.05 | 1.10 | -0.98 | 1.11 | -0.91 |
| 1995 | 1.16 | -1.08 | 1.18 | -0.83 | 1.20 | -0.56 |
| 1996 | 1.21 | -1.13 | 1.25 | -0.57 | 1.29 | 0.00 |
| 1997 | 1.26 | -1.16 | 1.32 | -0.19 | 1.38 | +0.84 |
| 1998 | 1.29 | -1.21 | 1.39 | +0.30 | 1.49 | +1.96 |
| 1999 | 1.29 | -1.24 | 1.39 | +0.60 | 1.50 | +2.74 |
| 2002 | 0.08 | -0.02 | 0.40 | +1.18 | 0.11 | +1.75 |
| 2010 | 0.06 | -0.05 | 0.58 | +0.35 | 1.42 | +1.30 |

Table 5.6 considers the case of East Germany. We have already drawn attention to the finding that the CSF impacts on East Germany are ranked first among the six economies in our study. From the table we see that as the elasticities increase, the GDP impacts rise. But the increased CSF impacts are quite modest. This is due to the fact that the East German HERMIN model characterises the economy are being very closely linked to, and dependent on the economy of the former West Germany. Consequently, most of the mechanisms that facilitate competitive growth in economies like Portugal and Ireland, are absent from East Germany. For example, all wages and prices in East Germany are determined by the overall German equivalent, which means in practice the wage and price level in the former West Germany. In such an institutional framework, the mechanisms of the CSF are blunted, and produce the impacts shown in Table 5.6. Starting from such a low base on quality physical infrastructure and human resources, the dominant long-run impacts probably come from German Unification in association with the CSF.

**Table 5.6**: East Germany: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 2.75 | -1.93 | 2.75 | -1.89 | 2.75 | -1.86 |
| 1995 | 2.76 | -1.92 | 2.85 | -1.85 | 2.94 | -1.78 |
| 1996 | 2.85 | -1.98 | 2.92 | -1.76 | 2.98 | -1.54 |
| 1997 | 2.91 | -1.98 | 3.24 | -1.73 | 3.58 | -1.48 |
| 1998 | 3.18 | -1.85 | 3.71 | -1.49 | 4.25 | -1.13 |
| 1999 | 3.41 | -1.80 | 3.95 | -1.32 | 4.50 | -0.84 |
| 2002 | 1.42 | +0.54 | 2.11 | +1.01 | 2.15 | +1.48 |
| 2010 | 4.43 | +1.43 | 4.68 | +1.74 | 4.93 | +2.05 |

Finally, in Table 5.7 we turn to Northern Ireland. We have already commented on the fact that the Greek and Northern Ireland cases display a high degree of similarity. The CSF impacts are low. Increasing the externality elasticities produces only a small improvement. The long-run sustained CSF impacts are very small. The explanations are probably the same as those offered in the Greek case: namely, that a series of structural and institutional changes may be necessary before CSF-type programmes are able to produce significant cohesion impacts of the type that occurred in Ireland and Portugal.

**Table 5.7**: Northern Ireland: zero, medium and high elasticities: impacts on GDP and unemployment

| | ZERO-ZERO | | MEDIUM-MEDIUM | | HIGH-HIGH | |
|---|---|---|---|---|---|---|
| | GDPE | UR | GDPE | UR | GDPE | UR |
| | % dev from base | dev from base | % dev from base | dev from base | % dev from base | dev from base |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1.08 | -0.42 | 1.09 | -0.41 | 1.09 | -0.41 |
| 1995 | 1.25 | -0.52 | 1.27 | -0.51 | 1.29 | -0.50 |
| 1996 | 1.73 | -0.73 | 1.77 | -0.71 | 1.81 | -0.69 |
| 1997 | 1.53 | -0.61 | 1.59 | -0.57 | 1.65 | -0.53 |
| 1998 | 1.24 | -0.50 | 1.34 | -0.43 | 1.43 | -0.37 |
| 1999 | 1.16 | -0.46 | 1.27 | -0.39 | 1.38 | -0.31 |
| 2002 | 0.08 | -0.03 | 0.18 | +0.04 | 0.29 | +0.13 |
| 2010 | 0.02 | -0.01 | 0.12 | +0.04 | 0.23 | +0.11 |

# [6] Conclusions and recommendations

## 6.1 Introduction

In this report we have used a series of six different HERMIN models to evaluate the impact of CSF 94-99 on the cohesion performance of four Objective 1 countries (Greece, Ireland, Portugal and Spain) and two large Objective 1 regions (East Germany and Northern Ireland) The ideal way to carry out such an evaluation would be to have a single EU-wide model that distinguished the above Objective 1 economies from among all other EU member states and regions of member states. In such an idealised situation we would simply examine the path of each of the Objective 1 economies as they evolved over time both with and without the aid of Structural Funds and would be able to address such questions as:

i. What is the precise impact of CSF 94-99 on the cohesion objective for each of the recipient economies, i.e., on the GDP per head in the Objective 1 economy relative to the continually evolving EU average?

ii. If the CSF transfers have to be funded by transfers from the wealthier EU member states, what effect does the higher rate of taxation have on the donor country performance?

Unfortunately we do not have any such idealised model and have to make do with six HERMIN models that operate in stand-alone mode, i.e., in a situation where the world outside the particular Objective 1 economy being studied is not modelled, but is assumed to be exogenous. This is not such a serious assumption, since the Objective 1 economies are very much smaller that the other wealthier member states. For example, Ireland can be assumed to be "post-recursive" to the rest of the EU in the sense that events outside Ireland will have a big influence on Ireland, but the Irish economy is so small that it will have little or no reverse influence on the rest of the EU.

But a more serious consequence of not having an integrated EU model is that we are only able to quantify the difference between a national scenario where the CSF is in operation and one where the CSF is absent. We have seen in Sections 4 and 5 above that the CSF impact measured in this way is usually positive, but the cohesion objective might still deteriorate rather than improve if the other countries were growing even faster that the Objective 1 economy.

In our summary and conclusions we focus on three aspects of the analysis: the question of how the details of CSF 94-99 were captured in the model simulations; the actual results, and what they tell us about the effectiveness of implementation of CSF 94-99; and the critiques of macromodel-based analysis of Structural Funds that have been made recently, particularly in two reports produced by the Dutch CPB (Ederveen *et al*, 2002 (a) and (b)). We follow with some brief recommendations.

## 6.2 Capturing the CSF in the model

The CSF treaty documents drawn up in late 1993 or early 1994 contain a detailed description of the state of each Objective 1 economy; full details of the investment policies proposed for implementation over the duration of the CSF; detailed financial tables showing how much of the funding is to be spent under each priority axis; details of the three main sources of finance

: the EU, domestic public co-finance and domestic private co-finance; and treatment of the additionality principle. These tables are referred to as the “ex-ante” or “planned” expenditures.

However, over the course of CSF implementation the actual expenditures can differ from the planned expenditures, mainly with respect to timing. In an ideal situation, analysts would have access to equivalent tables to those contained in the CSF treaty documents, but showing the ex-post or realised expenditures. Unfortunately, these were not available for all of the six cases that we studied. In the case of Northern Ireland, such tables were made available at an early date. In the case of Ireland and Portugal, similar tables became avail late in the project schedule, and indicated that the planned and realised CSF expenditures were very similar. In the case of Greece, partial information was available, which indicated that there had been extensive re-programming of the planned CSF expenditures. Within the treaty total, the realised CSF expenditures were “back-loaded”, i.e., the actual expenditures were phased in with a delay, with short-falls in the early years of CSF 94-99 being made up by over-spending in the later years. Finally, in the case of Spain and East Germany, only partial ex-post expenditure tables were made available.

Even with complete ex-post or realised CSF expenditure tables, it is not completely clear how these financial allocations are related to the actual programme implementation on the ground. This is an important point, since in our CSF impact analysis we make the assumption that the financial flows of CSF funding are very closely related to the actual real investment activity. If there is a lag between financial flows and actual real activity, then our results may be inaccurate on timing, but are probably still correct in the longer term.

### 6.3 The HERMIN model simulations

The model simulations have already been described and interpreted in detail. But it is worth highlighting some issues in the results. During the implementation of the CSF, the increased public expenditures generate multiplier effects. Within the HERMIN models these transient multiplier effects tend to be larger than those in models such as the Commission’s QUEST. This is mainly due to the fact that HERMIN uses static or backward-looking expectation mechanisms, while QUEST uses model consistent or forward-looking expectation mechanisms. In addition, the HERMIN models make a clear distinction between public investment in building and construction activities (which have small import propensities) and investment in machinery and equipment (which tend to have very high import propensities, particularly in small open economies like Ireland).

However welcome are the transient demand-side impacts of the CSF that accompany the implementation stage, it is the longer term enduring impacts that are most important. These have been captured by the externality mechanisms that are described in Section 3, and are driven by the CSF-induced increase in the stock of physical infrastructure and human capital. We have described how we selected externality elasticities from the international literature and implemented then in the HERMIN models. In Section 4 we used a standard set of elasticities common to all models, and broadly representative of the mid range of international findings. In Section 5 we carried out a sensitivity analysis for each of the six models, selecting zero, medium and high elasticity values.

In is important when our numerical results are interpreted that it is understood that the CSF in the HERMIN models cannot raise the growth rate of GDP permanently. While the CSF investment expenditures are being made, and the stocks of physical infrastructure and human capital are increasing, the growth rate of GDP does indeed increase above the no-CSF baseline value. However, when the CSF terminates, the two stocks stabilize at their new (higher) values, the growth rate returns to its baseline value, but the level of GDP is at a higher value. Thus, the enduring benefit of the CSF is a semi-permanent higher level of GDP and not a permanent rise in the growth rate.[40]

In the absence of any permanent increase in the GDP growth rate, the actual impacts of CSF 94-99 as simulated in the HERMIN models can appear quite small. We summarise the impacts of GDP that were derived from all six models in Table 6.1 below.

Table 6.1: Increase in the level of GDP (% change over baseline)

| | East Germany | Portugal | Ireland | Greece | Spain | Northern Ireland |
|---|---|---|---|---|---|---|
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 2.75 | 2.72 | 1.61 | 2.01 | 1.10 | 1.09 |
| 1995 | 2.85 | 2.78 | 2.02 | 1.94 | 1.18 | 1.27 |
| 1996 | 2.92 | 2.87 | 2.17 | 1.95 | 1.25 | 1.77 |
| 1997 | 3.24 | 3.30 | 2.34 | 1.90 | 1.32 | 1.59 |
| 1998 | 3.71 | 4.04 | 2.76 | 2.03 | 1.39 | 1.34 |
| 1999 | 3.95 | 4.66 | 2.83 | 2.16 | 1.39 | 1.27 |
| 2002 | 2.11 | 2.30 | 1.43 | 0.50 | 0.40 | 0.18 |
| 2010 | 4.68 | 2.06 | 1.00 | 0.66 | 0.58 | 0.12 |

The cumulative CSF multipliers are shown in Table 6.2, where East Germany, Ireland and Portugal show the largest impacts. These are considerably larger than conventional investment multipliers, mainly due to the output and productivity-enhancing effects induced by the CSF.

Table 6.2: CSF 94-99: Cumulative Objective 1 multipliers

| | Greece | Ireland | Portugal | Spain | East Germany | Northern Ireland |
|---|---|---|---|---|---|---|
| 1994-1999 | 0.67 | 1.44 | 1.12 | 1.07 | 1.69 | 1.24 |
| 1994-2002 | 0.76 | 1.88 | 1.53 | 1.23 | 2.11 | 1.33 |
| 1994-2010 | 1.07 | 2.83 | 2.55 | 1.77 | 4.44 | 1.48 |
| LR ranking | 6 | 2 | 3 | 4 | 1 | 5 |

## 6.4 Critiques and alternative approaches

The macromodel-based approach to CSF impact analysis has recently been criticised in two papers published by the Dutch CPB (Ederveen *et al*, 2002 (a) and (b)). They make the perfectly valid point that macromodels like HERMIN do not seek to establish if there is a positive impact on the cohesion objective due to CSF policies. Rather, they characterise the model-based research as "imposing" the impacts. But of course this imposition is not arbitrary. It draws on a large and authoritative research literature and uses elasticity values that are consistent with this literature.

The alternative approach suggested by Ederveen *et al* is to set up Barro-type growth regressions and augment them with CSF variables. Thus, the basic Barro-type regression will

[40] The stocks on physical infrastructure and human capital eventually decay due to depreciation. See Sianesi and Van Reenen, 2002, for a discussion of "level" versus "growth rate" impacts of investment in human capital.

have growth of GDP as the dependent variable and the initial level of GDP per head, the domestic savings rate, population growth, etc., as independent variables. They insert the Structural Fund expenditures into such a model and seek to estimate statistically significant and positive coefficients.[41] In general they fail to find any significant Structural Fund effect. Adding a "conditioning" variable (such as openness, institutional quality, corruption index, etc.) suggests that a few countries like Ireland did benefit from an increased growth rate that was associated with the Structural Funds.

We suggest that this approach suffers from the fact that it posits a model where the only CSF impact looked for is one on the growth rate. In most of the sample of thirteen EU countries and for most of the sample period 1960-95, the regional aid was trivially small, and was unlikely to affect the growth rate. The HERMIN model posits a less stringent levels effect, and draws on the international literature to support it. If the CPB approach were to be restricted to the poorer EU member states, and excluded such high income countries as Denmark, Sweden, the Netherlands, France, etc., then significant effects on growth might reasonably be sought. However, the panel regression technique requires a wide range of countries, which frustrates application of the technique to Objective 1 countries in isolation.

### 6.5 Recommendations

We restrict our recommendations to matters related to the analysis of CSF impacts, since the individual country studies are in a better position to discuss the details of the CSF with a view to drawing lessons for future CSFs.

First, the continuing macroeconomic analysis would be made more accurate if the CSF financial tables were kept up to date on a regular basis. This would appear to be a task for DG-REGIO rather than for the individual member states.

Second, it is important to bring together as wide a range of impact evaluation techniques as possible. This is an area where all new insights are welcome. We recommend that DG-REGIO facilitate this research, at the very least by disseminating results. The MEANS programme is an obvious vehicle for this work.

Third, the HERMIN and QUEST model-based analysis could be greatly improved if there was a programme of microeconomic or cost-benefit analysis of CSF programmes from which HERMIN and QUEST could draw. Such work could be used to guide the selection of the crucial externality elasticities. We recommend that DG-REGIO co-ordinate the dissemination of such research.

Finally, the construction of some of the HERMIN models was severely hampered by the lack of consistent time series of data. These problems, as well as our approach to tackling them, are documented in the MS Excel files of basis input data, as explained in Appendix 2 below. In this respect the DG-ECFIN internal database was invaluable. The CRONOS data, on the other hand, were riddled with inconsistencies and missing data. We recommend that DG-REGIO take an interest in the provision of good quality data for the purposes of CSF impact evaluation.

[41] A pooled cross-section regression is used, with thirteen EU countries in the data set and using seven five-year periods from 1960-65 through 1990-95.

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## Appendix 1: Measuring human capital

If one is to study the relationship between human capital and growth, it is necessary to have a methodology for measuring the level or the flow of human capital. In most studies in this area a simple approach is adopted that does not distinguish between the level at which the education takes place (see Sianesi and Van Reenen, 2002 for an up-to-date survey). In such approaches, years spent in education are simply counted and years in primary school are treated in the same way as years spent in university. This simplification is often necessitated by the unavailability of data for many countries. However, in the case of the six countries covered in this report, reliable and comparable data are collected annually by the OECD, together with a common classification of different types of education.

In order to measure the impact of that proportion of the EU Structural Funds in CSF 94-99 that were devoted to the development of human capital, the starting stock of human capital is needed. Since the ex-post evaluation is focused on the period 1994 to 1999, this starting stock is needed for the year 1994.

The most basic variable that is required to measure the stock of human capital is the educational attainment of the population. This simply records the percentage of the population by their highest level of attainment. The breakdown chosen by the OECD refers to four levels of educational attainment:

i. Primary and lower secondary education (PS)
ii. Higher secondary education (HS)
iii. Non-university tertiary education (NUT)
iv. University education (UT)

Primary and lower secondary education are grouped together since these are the most basic levels of education and lower second level education tends to be the minimum level of education at which children leave school. Table A2.1 shows that there are large differences between the countries in our study. For example, Portugal has a very high percentage of the population in the primary and lower secondary group and consequently only small percentages in the higher groups. The opposite is true for Germany.

Table A2.1: Educational Attainment:
Percentage of population classified by highest level of attainment (1994)

| | Primary and Lower Secondary | Higher Secondary | Non University Tertiary | University Tertiary |
|---|---|---|---|---|
| Greece | 55 | 27 | 6 | 12 |
| Ireland | 55 | 27 | 10 | 9 |
| Portugal | 81 | 8 | 3 | 7 |
| Spain | 74 | 11 | 4 | 11 |
| Germany | 16 | 62 | 10 | 13 |
| Italy | 67 | 26 | | 8 |
| UK | 26 | 54 | 9 | 12 |

Source: OECD Education at a Glance, 1996

Table A2.1 refers to the whole population and ignores generational differences. In order to further evaluate these differences, it is useful to analyse the educational attainment of persons aged 25 to 34 years. This also yields a more accurate picture of the likely future development of human capital. Table A2.2 shows particularly low rates of attainment in Portugal, Spain and Italy.

Table A2.2: Educational attainment:
Percentage of the population aged 25 to 34
which has attained at least upper secondary or third level education, 1995

| | Upper Secondary and Higher | Tertiary education |
|---|---|---|
| Greece | 64 | 26 |
| Ireland | 64 | 27 |
| Portugal | 31 | 14 |
| Spain | 47 | 27 |
| Germany | 89 | 21 |
| Italy | 49 | 8 |
| UK | 86 | 23 |

Source: OECD Education at a Glance, 1997

The usual measure of human capital in the economic literature is years of schooling. However, this variable ignores the important differences between the educational systems of the countries in question, and this can introduce biases into the measure of human capital. Table A2.3 highlights these difference by giving details of the typical cumulative years of schooling required to complete a particular level. For example, in order to complete lower secondary level education, a pupil in Ireland, Spain and Germany will spend 10 years in school, while students in Portugal and Italy require just 8 years. The table also shows the additional years that are required to attain the next highest level of education which can be readily worked out by subtracting the years required for the lower level from the years required for the higher level. It should be noted that the University level does not build on the non-university tertiary level, rather both tertiary levels tend to be at the same time by different non-overlapping groups, and build on the higher secondary levels.

Table A2.3: Cumulative years of schooling required to attain
a specified level of education (1994)

| | Primary and Lower Secondary | Higher Secondary | Non University Tertiary | University Tertiary |
|---|---|---|---|---|
| Greece | 9 | 12 | 15 | 23 |
| Ireland | 10 | 13 | 15 | 16 |
| Portugal | 8 | 12 | 14 | 16 |
| Spain | 10 | 12 | 14 | 17 |
| Germany | 10 | 13 | 15 | 19 |
| Italy | 8 | 13 | 13 | 20 |
| UK | 9 | 13 | 15 | 16 |

Source: OECD Education at a Glance, 1996

A further issue that arises is the fact that the participation in the labour force is not equal for all levels of educational attainment. As is obvious from Table A2.4 below, persons with a lower level of education are less likely to participate in the labour force than those with a higher level of education. This clearly reflects the fact that those with a higher level of education have invested more in their education and are therefore seeking a return to their investment as well as the fact that these individuals also tend to have more opportunities to gain employment since their skill are more in demand. Of course this also means that a given programme that increases the human capital of individuals will not result in all individuals finding employment or even seeking employment.

Table A2.4: Labour force participation by educational attainment (percentage, 1994)

| | Primary and Lower Secondary | Higher Secondary | Non University Tertiary | University Tertiary | Total |
|---|---|---|---|---|---|
| Greece | 62 | 67 | 84 | 87 | 67 |
| Ireland | 58 | 73 | 85 | 89 | 67 |
| Portugal | 72 | 84 | 87 | 95 | 75 |
| Spain | 58 | 80 | 88 | 87 | 65 |
| Germany | 56 | 76 | 85 | 88 | 75 |
| Italy | 58 | 73 | 85 | 89 | 67 |
| UK | 64 | 82 | 87 | 91 | 79 |

Source: OECD Education at a Glance, 1996

# Appendix 2: Computer files associated with the CSF analysis

### A1.1 Introductory remarks

The HERMIN models were developed using three computer programs. MS Excel was used whenever spreadsheets were needed. The construction of the HERMIN model databases as well as the econometric work were carried out using TSP 4.5 in association with GIVEWIN. Finally, the model simulations were carried out using WINSOLVE, developed by Dr Richard Pearse.

For each of the six HERMIN models we list the complete set of computer files that were developed and used in this report. These files fall into four general types. First, the data generation files provide complete documentation of the construction of the databases. Second, the model calibration files show how TSP/GIVEWIN was used to obtain values for the parameters in the behavioural equations. Third, the WINSOLVE model construction and testing files show how the model was built and tested. This set contains a fully annotated listing of each model. Fourth, the specific files used to simulate CSF 94-99 are listed.

### A1.2 Greece

#### *(a) Data generation files in the sequence of their use*

**HERMIN_GRE.XLS**: The master data spreadsheet for the "basic" data used in HG4. The HERMIN folder gathers the “basic” data.

**HERGRE.WK1**: Generated from HERMIN_GRE.XLS by extracting the "HERMIN" folder, transposing, and saving in LOTUS format. Use “paste special”, and save “values” and “transpose”.

**GREDATA.TSP**: TSP batch file used to create a TSP database version of data in HERGRE.WK1.

**HG4BASIC.TLB**: TSP database created by GREDATA.TSP above.

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators).

**HERDATA.TSP**: Generates all the data needed in the Greek HERMIN model (HG4.TXT), using HG4BASIC.TLB and NIGEMINT.TLB as inputs. Stores results in HG4DB.TLB

**HG4DB.TLB**: The TSP database containing all the data for the Greek HERMIN model

#### *(b) Behavioural equation model calibration*

**HG4MODEL_CALIBRAT.DOC**: Model listing in WINSOLVE format and using WINSOLVE notation conventions (see WINSOLVE handouts). All references to CSF mechanisms have been removed for clarity. This version of the model listing is intended for exposition of the basic HERMIN model structures and is not for simulation.

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**CALIBRAT_SHORT.OUT**: TSP regression output produced by batch file CALIBRAT_SHORT.TSP

**HERJFD0.TSP**: TSP batch file used to explore the factor ratio equation calibration

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALCT.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**HERJFDCALCN.TSP**: TSP batch file used to calculate the values of LLN and IN predicted within sample by the calibrated joint factor demand system for market services.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**WTEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in manufacturing (WT)

**CONSEQ.TSP**: TSP batch file used to explore the calibration of the equation for household consumption (CONS)

***(c) WINSOLVE model simulation files***

**HG4.TXT**: The simulation version of the Portuguese HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HG4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HG41.XLS), to be read into the model by WINSOLVE.

**HG41.XLS**: See HG4VXLS1.TSP description above.

**HG4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HG42.XLS), to be read into the model by WINSOLVE.

**HG42.XLS**: See HG4VXLS1.TSP description above.

**HG4.SDF**: The data for the model HG4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HG41.XLS and HG42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HG4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HG4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HG4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HG4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HG4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HG4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HG4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HG4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HG4LGBBud.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, but with the policy-feedback rule switched on and the direct tax rate endogenised.

**HG4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HG4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**GRECSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file PORCSFDB.TLB.

**GRECSFDB.TLB**: TSP database file generated by GRECSFDAT.TSP, containing CSF data for 1989-2006.

**GRECSFDB.TSP**: TSP batch file containing a dump of the contents of the database, GRECSFDB.TLB.

**CSFHG4T.LOG**: WINSOLVE batch file to simulate the impact of the three Greek CSFs for 1989-93, 1994-99 and 2000-06, using default values of the externality elasticities contained in the current version of the model (HG4.TXT).

## A1.3 Ireland

***(a) Data generation files in the sequence of their use***

**NIE2000.TLB**: The master database containing the complete Irish national accounts and all other data required for the large-scale ESRI medium-term model.

**NIGEM.WK1**: Lotus spreadsheet containing the international data from NIGEM, needed for the Irish HERMIN model.

**NIGEM.TSP**: TSP batch file that inputs NIGEM.WK1 and generates NIGEMINT.TLB (see below).

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators). Generated by NIGEM.TSP (see above).

**HERDATA.TSP**: Generates all the data needed in the Irish HERMIN model (HI4.TXT), using NIE2000.TLB and NIGEMINT.TLB as inputs. Stores results in HI4DB.TLB

**HI4DB.TLB**: The TSP database containing all the data for the Irish HERMIN model

***(b) Behavioural equation model calibration***

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**CALIBRAT_SHORT.OUT**: TSP regression output produced by batch file CALIBRAT_SHORT.TSP

**HERJFD0.TSP**: TSP batch file used to explore the factor ratio equation calibration

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALC.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**WTEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in manufacturing (WT)

**CONSEQ.TSP**: TSP batch file used to explore the calibration of the equation for household consumption (CONS)

***(c) WINSOLVE model simulation files***

**HI4.TXT**: The simulation version of the Irish HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HI4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HI41.XLS), to be read into the model by WINSOLVE.

**HI41.XLS**: See HI4VXLS1.TSP description above.

**HI4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HI42.XLS), to be read into the model by WINSOLVE.

**HI42.XLS**: See HI4VXLS1.TSP description above.

**HI4.SDF**: The data for the model HI4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HI41.XLS and HI42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HI4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HI4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HI4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HI4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HI4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HI4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HI4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HI4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HI4LGBBud.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, but with the policy-feedback rule switched on and the direct tax rate endogenised.

**HI4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HI4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**IRLCSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file IRLCSFDB.TLB.

**IRLCSFDB.TLB**: TSP database file generated by IRLCSFDAT.TSP, containing CSF data for 1989-2006.

**IRLCSFDB.TSP**: TSP batch file containing a dump of the contents of the database, IRLCSFDB.TLB.

**CSFHI4T.LOG**: WINSOLVE batch file to simulate the impact of the three Irish CSFs for 1989-93, 1994-99 and 2000-06, using default values of the externality elasticities contained in the current version of the model (HI4.TXT).

### A1.4 Portugal

***(a) Data generation files in the sequence of their use***

**HERMIN_PORT.XLS**: The master data spreadsheet for the "basic" data used in HP4. The HERMIN folder gathers the “basic” data.

**Wages rates HERMIN.XLS**: A spreadsheet used to check the relative wage rates between the T, N, A and G sectors.

**ChWPort.DOC**: A graph showing the sectoral wage relativities, used for monitoring the quality of the data.

**HERPORT.WK1**: Generated from HERMIN_PORT.XLS by extracting the "HERMIN" folder, transposing, and saving in LOTUS format. Use “paste special”, and save “values” and “transpose”.

**PORTDATA.TSP**: TSP batch file used to create a TSP database version of data in HERPORT.WK1.

**HP4BASIC.TLB**: TSP database created by PORTDATA.TSP above.

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators).

**HERDATA.TSP**: Generates all the data needed in the Portuguese HERMIN model (HP4.TXT), using HP4BASIC.TLB and NIGEMINT.TLB as inputs. Stores results in HP4DB.TLB

**HP4DB.TLB**: The TSP database containing all the data for the Portuguese HERMIN model

***(b) Behavioural equation model calibration***

**HP4MODEL_CALIBRAT.DOC**: Model listing in WINSOLVE format and using WINSOLVE notation conventions (see WINSOLVE handouts). All the numerical coefficients in the behavioural equations have been replaced by the letters ZZZ. All references to CSF mechanisms have been removed for clarity. This version of the model listing is not intended for simulation.

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**HERJFD0.TSP**: TSP batch file used to explore the factor ratio equation calibration

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALC.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**WTEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in manufacturing (WT)

**WNEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in market services (WN)

***(c) WINSOLVE model simulation files***

**HP4.TXT**: The simulation version of the Portuguese HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HP4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HP41.XLS), to be read into the model by WINSOLVE.

**HP41.XLS**: See HP4VXLS1.TSP description above.

**HP4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HP42.XLS), to be read into the model by WINSOLVE.

**HP42.XLS**: See HP4VXLS1.TSP description above.

**HP4.SDF**: The data for the model HP4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HP41.XLS and HP42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HP4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HP4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HP4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HP4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HP4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HP4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HP4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HP4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HP4LGBBud.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, but with the policy-feedback rule switched on and the direct tax rate endogenised.

**HP4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HP4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**PORCSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file PORCSFDB.TLB.

**PORCSFDB.TLB**: TSP database file generated by PORCSFDAT.TSP, containing CSF data for 1989-2006.

**PORCSFDB.TSP**: TSP batch file containing a dump of the contents of the database, PORCSFDB.TLB.

**CSFHP4T.LOG**: WINSOLVE batch file to simulate the impact of the three Portuguese CSFs for 1989-93, 1994-99 and 2000-06, using the default values of the externality elasticities contained in the current version of the model (HP4.TXT).

### A1.5 Spain

***(a) Data generation files in the sequence of their use***

**HERMIN_SPA.XLS**: The master data spreadsheet for the "basic" data used in HS4. The HERMIN folder gathers the "basic" data.

**HERSPA.WK1**: Generated from HERMIN_SPA.XLS by extracting the "HERMIN" folder, transposing, and saving in LOTUS format. Use "paste special", and save "values" and "transpose".

**SPADATA.TSP**: TSP batch file used to create a TSP database version of data in HERSPA.WK1.

**HS4BASIC.TLB**: TSP database created by SPADATA.TSP above.

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators).

**HERDATA.TSP**: Generates all the data needed in the Spanish HERMIN model (HS4.TXT), using HS4BASIC.TLB and NIGEMINT.TLB as inputs. Stores results in HS4DB.TLB

**HS4DB.TLB**: The TSP database containing all the data for the Spanish HERMIN model

***(b) Behavioural equation model calibration***

**HS4MODEL_CALIBRAT.DOC**: Model listing in WINSOLVE format and using WINSOLVE notation conventions (see WINSOLVE handouts). All references to CSF mechanisms have been removed for clarity. This version of the model listing is intended for exposition of the basic HERMIN model structures and is not for simulation.

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**CALIBRAT_SHORT.OUT**: TSP regression output produced by batch file CALIBRAT_SHORT.TSP

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALC.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**ONEQ.TSP**: TSP batch file used to explore the calibration of the equation for market services output (ON)

***(c) WINSOLVE model simulation files***

**HS4.TXT**: The simulation version of the Portuguese HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HS4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HS41.XLS), to be read into the model by WINSOLVE.

**HS41.XLS**: See HS4VXLS1.TSP description above.

**HS4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HS42.XLS), to be read into the model by WINSOLVE.

**HS42.XLS**: See HS4VXLS1.TSP description above.

**HS4.SDF**: The data for the model HS4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HS41.XLS and HS42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HS4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HS4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HS4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HS4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HS4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HS4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HS4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HS4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HS4LGBBud.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, but with the policy-feedback rule switched on and the direct tax rate endogenised.

**HS4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HS4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**SPACSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file PORCSFDB.TLB.

**SPACSFDB.TLB**: TSP database file generated by SPACSFDAT.TSP, containing CSF data for 1989-2006.

**SPACSFDB.TSP**: TSP batch file containing a dump of the contents of the database, SPACSFDB.TLB.

**CSFHS4T.LOG**: WINSOLVE batch file to simulate the impact of the three Spanish CSFs for 1989-93, 1994-99 and 2000-06, using default values of the externality elasticities contained in the current version of the model (HS4.TXT).

### A1.6 East Germany

***(a) Data generation files in the sequence of their use***

**HERMIN_GE.XLS**: The master data spreadsheet for the "basic" data used in HGE4. The HERMIN folder gathers the “basic” data.

**HERGE.WK1**: Generated from HERMIN_GE.XLS by extracting the "HERMIN" folder, transposing, and saving in LOTUS format. Use “paste special”, and save “values” and “transpose”.

**GEDATA.TSP**: TSP batch file used to create a TSP database version of data in HERGE.WK1.

**HGE4BASIC.TLB**: TSP database created by GEDATA.TSP above.

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators).

**HERDATA.TSP**: Generates all the data needed in the East German HERMIN model (HGE4.TXT), using HGE4BASIC.TLB and NIGEMINT.TLB as inputs. Stores results in HGE4DB.TLB

**HGE4DB.TLB**: The TSP database containing all the data for the East German HERMIN model

***(b) Behavioural equation model calibration***

**HGE4MODEL_CALIBRAT.DOC**: Model listing in WINSOLVE format and using WINSOLVE notation conventions (see WINSOLVE handouts). All references to CSF mechanisms have been removed for clarity. This version of the model listing is intended for exposition of the basic HERMIN model structures and is not for simulation.

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**CALIBRAT_SHORT.OUT**: TSP regression output produced by batch file CALIBRAT_SHORT.TSP

**HERJFD0.TSP**: TSP batch file used to explore the factor ratio equation calibration

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALCT.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**HERJFDCALCN.TSP**: TSP batch file used to calculate the values of LLN and IN predicted within sample by the calibrated joint factor demand system for market services.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**WTEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in manufacturing (WT)

**CONSEQ.TSP**: TSP batch file used to explore the calibration of the equation for household consumption (CONS)

***(c) WINSOLVE model simulation files***

**HGE4.TXT**: The simulation version of the East German HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HGE4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HGE41.XLS), to be read into the model by WINSOLVE.

**HGE41.XLS**: See HGE4VXLS1.TSP description above.

**HGE4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HGE42.XLS), to be read into the model by WINSOLVE.

**HGE42.XLS**: See HGE4VXLS1.TSP description above.

**HGE4.SDF**: The data for the model HGE4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HGE41.XLS and HGE42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HGE4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HGE4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HGE4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HGE4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HGE4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HGE4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HGE4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HGE4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HGE4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HGE4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**GECSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file GECSFDB.TLB.

**GECSFDB.TLB**: TSP database file generated by GECSFDAT.TSP, containing CSF data for 1989-2006.

**GECSFDB.TSP**: TSP batch file containing a dump of the contents of the database, GECSFDB.TLB.

**CSFHGE4T.LOG**: WINSOLVE batch file to simulate the impact of the East German CSF for 1994-99, using default values of the externality elasticities contained in the current version of the model (HGE4.TXT).

### A1.7 Northern Ireland

***(a) Data generation files in the sequence of their use***

**HERMIN_NI.XLS**: The master data spreadsheet for the "basic" data used in HNI4. The HERMIN folder gathers the "basic" data.

**HERNI.WK1**: Generated from HERMIN_NI.XLS by extracting the "HERMIN" folder, transposing, and saving in LOTUS format. Use "paste special", and save "values" and "transpose".

**NIDATA.TSP**: TSP batch file used to create a TSP database version of data in HERNI.WK1.

**HNI4BASIC.TLB**: TSP database created by NIDATA.TSP above.

**NIGEMINT.TLB**: A TSP database containing international data generated from the NIESR NIGEM database (manufacturing output and price deflators).

**HERDATA.TSP**: Generates all the data needed in the Northern Ireland HERMIN model (HNI4.TXT), using HNI4BASIC.TLB and NIGEMINT.TLB as inputs. Stores results in HNI4DB.TLB

**HNI4DB.TLB**: The TSP database containing all the data for the Northern Ireland HERMIN model

***(b) Behavioural equation model calibration***

**HNI4MODEL_CALIBRAT.DOC**: Model listing in WINSOLVE format and using WINSOLVE notation conventions (see WINSOLVE handouts). All references to CSF mechanisms have been removed for clarity. This version of the model listing is intended for exposition of the basic HERMIN model structures and is not for simulation.

**CALIBRAT.TSP**: TSP batch file used to explore a wide range of variants of the HERMIN behavioural equations

**CALIBRAT_SHORT.TSP**: Short version of CALIBRAT.TSP used to calibrate the selected calibrations of the behavioural equations actually used in the model. This file may change as the model changes.

**CALIBRAT_SHORT.OUT**: TSP regression output produced by batch file CALIBRAT_SHORT.TSP

**HERJFD0.TSP**: TSP batch file used to explore the factor ratio equation calibration

**HERJFDCT.TSP**: TSP batch file used to calibrate the factor demand system for manufacturing (T) sector.

**HERJFDCALCT.TSP**: TSP batch file used to calculate the values of LT and IT predicted within sample by the calibrated joint factor demand system for manufacturing.

**HERJFDCN.TSP**: TSP batch file used to calibrate the factor demand system for marketed services (N) sector.

**HERJFDCALCN.TSP**: TSP batch file used to calculate the values of LLN and IN predicted within sample by the calibrated joint factor demand system for market services.

**OTEQ.TSP**: TSP batch file used to explore the calibration of the equation for manufacturing output (OT)

**WTEQ.TSP**: TSP batch file used to explore the calibration of the equation for the wage rate in manufacturing (WT)

**CONSEQ.TSP**: TSP batch file used to explore the calibration of the equation for household consumption (CONS)

***(c) WINSOLVE model simulation files***

**HNI4.TXT**: The simulation version of the Northern Ireland HERMIN model, that contains all the calibration coefficients as well as the CSF mechanisms.

**HNI4VXLS1.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HNI41.XLS), to be read into the model by WINSOLVE.

**HNI41.XLS**: See HNI4VXLS1.TSP description above.

**HNI4VXLS2.TSP**: TSP batch file used to write half of the HERMIN variables to an XLS file (HNI42.XLS), to be read into the model by WINSOLVE.

**HNI42.XLS**: See HNI4VXLS1.TSP description above.

**HNI4.SDF**: The data for the model HNI4.TXT in WINSOLVE format, saved from inputting the two above XLS files, HNI41.XLS and HNI42.XLS. All other files with extension SDF are generated by WINSOLVE simulations.

**HNI4HIST.LOG**: WINSOLVE batch file to carry out a within-sample single-equation residual checking simulation.

**HNI4STATIC.LOG**: WINSOLVE batch file to carry out a within-sample static system simulation.

**HNI4DYNAMIC.LOG**: WINSOLVE batch file to carry out a within-sample dynamic system simulation.

**HNI4PROJ0.LOG**: WINSOLVE batch file used to carry out the projection of the exogenous variables and the behavioural equation errors over the out-of-sample period 2001-2020.

**HNI4PROJ1.LOG**: WINSOLVE batch files used to simulate out-of-sample for the period 2001-2020, using the projections developed in HNI4PROJ0.LOG above. These two LOG files are always run together, in this sequence.

**HNI4OW.LOG**: WINSOLVE batch file to carry out shocks to the components of OW, world output.

**HNI4LG.LOG**: WINSOLVE batch file to carry out a shock to LG, public sector employment, with the policy-feedback rule switched off and the direct tax rate exogenised.

**HNI4IGV.LOG**: WINSOLVE batch file to carry out a shock to IGV, public sector investment.

**HNI4PRICE.LOG**: WINSOLVE batch file to carry out a shock to all the exogenous price variables.

***(d) WINSOLVE model simulation files for CSF analysis***

**NICSFDAT.TSP**: TSP batch file to carry out conversion of old SIMPC format batch files for CSF to WINSOLVE format. Generates the TSP database file NICSFDB.TLB.

**NICSFDB.TLB**: TSP database file generated by NICSFDAT.TSP, containing CSF data for 1989-2006.

**NICSFDB.TSP**: TSP batch file containing a dump of the contents of the database, NICSFDB.TLB.

**CSFHNI4T.LOG**: WINSOLVE batch file to simulate the impact of the Northern Ireland CSF for 1994-99, using default values of the externality elasticities contained in the current version of the model (HNI4.TXT).

## Appendix 3: Methodological changes in East German data

The regional HERMIN model for East Germany was set up using data for the period 1991 to 1997/98. During the time the model was build the regional national account system for Germany rested upon a national system of national account. The basis foundation of this system was the systematic of industrial branches WZ79 (Systematik der Wirtschaftszweige 1979). The data used in setting up the model came from this source.

In the meantime a new systematic of national accounts was introduced. At the national level there is the European System of Nation Accounts (ESNA) that forms the basis foundation for all EU countries to have European wide harmonized data. In Germany this systematic was tested during the nineties and revised national results were first presented in 1998. The collection and gathering of data under the old scheme ended in 1998. At the regional level the data were collected for the "Länder" (NUTS-II). As for the national level the regional data under the old scheme generally end in 1998. The "Arbeitskreis VGR der Länder", responsible for the regional national account, published in 2000 the final results up to 1998. At the aggregate level the series end in 1998, whereas at the sectoral level or on the consumption side most series end in 1996/97.

In 2001 regional data at the aggregate level under the ESNA were first published. During 2002 sectoral data and time series concerning the production, distribution and use of the regional followed, so that we now have a complete system of regional national accounts for East Germany and the period 1991 to 2001.

Because the HERMIN model for East Germany uses data under the old scheme that were available at the beginning of 2000 and it is impossible to match data from the old and the new system, there is no possibility to update the data basis of the model in a substantial way.

To ensure that the prediction about the ex-post impact of the Structural Funds in East Germany do not differ to much for the years 1998 and 1999 the new aggregate results were compared with the model results for that period.

GDP at Market prices

| Year | WZ 79 (old) | ESNA (new) |
|---|---|---|
| 1991 | 186.04 | 202.63 |
| 1992 | 237.44 | 260.26 |
| 1993 | 287.05 | 318.64 |
| 1994 | 325.12 | 368.46 |
| 1995 | 352.81 | 393.27 |
| 1996 | 367.55 | 409.69 |
| 1997 | 376.62 | 417.15 |
| 1998 | n.a. | 425.03 |
| 1999 | n.a. | 433.84 |
| 2000 | n.a. | 436.14 |

GDP at constant prices

| Year | WZ 79 (old), 1991=100* | ESNA (new) 1995=100 |
|---|---|---|
| 1991 | 186.04 (260.00) | 275.73 |
| 1992 | 200.35 (280.00) | 301.89 |
| 1993 | 218.36 (305.17) | 337.89 |
| 1994 | 239.36 (334.52) | 393.27 |
| 1995 | 252.45 (352.81) | 406.02 |
| 1996 | 259.11 (362.12) | 410.92 |
| 1997 | 265.50 (371.05) | 415.64 |
| 1998 | | 420.98 |
| 1999 | | 425.77 |
| 2000 | | |

* based to 1995=100

Growth rates of GDP at constant prices

| Year | WZ 79 (old) | ESNA (new) |
|---|---|---|
| 1991 | | |
| 1992 | 7.7 | 9.5 |
| 1993 | 9.0 | 11.9 |
| 1994 | 9.6 | 16.4 |
| 1995 | 5.5 | 3.2 |
| 1996 | 2.6 | 1.2 |
| 1997 | 2.5 | 2.4 |
| 1998 | | 1.3 |
| 1999 | | 1.1 |
| 2000 | | |