The Effects of CSF 1994-1999 on the Portuguese Economy

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This paper tries to assess the macroeconomic effects of the CSF 1994-99 on the Portuguese economy using the macroeconomic HERMIN-Portugal model. To that end, after briefly presenting the main characteristics of the model and providing an overview of the Portuguese CSF programmes, we offer a detailed description of the methodology used in the quantification of the effects of those CSF programmes. The contribution to growth of these programmes, both separately and jointly, is analysed and compared with a stylised projection of the Portuguese economy used as benchmark. A major novelty of the current work is the consideration of supply effects. The simulation exercises performed show that the CSF 1994-99 package has potentially important effects on the Portuguese economy. This work suggests that the injection of the CSF funds could trigger a response pattern that would increase the level of GDP by more than amount injected.

1. Introduction

The purpose of this paper is to discuss the effects of the Community Support Framework (CSF) 1994-99 on the Portuguese economy. Our analysis is based on simulation exercises made using the macroeconometric model HERMIN-Portugal developed at the Universidade Católica Portuguesa by the authors (see Modesto and Neves (1995)). The remainder of the paper is organised as follows. Next section presents briefly the main characteristics of HERMIN-Portugal. Then, section 3 provides an overview of the main features of the Portuguese CSF expenditures as stated in the Portuguese Regional Development Plan

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(PDR). Section 4 describes the methodology used in the quantification of the macroeconomic effects of the CSF. The results of the CSF policy analysis are presented in section 5. Finally, in section 6 some brief concluding remarks are made.

2. The HERMIN-Portugal model

The basic philosophy underlying the construction of the HERMIN-Portugal model was to obtain a rather simple and flexible core model of the Portuguese economy that could, nevertheless, replicate the main economic mechanisms of our economy. Moreover, we also wanted a model that could be used to study the growth of the Portuguese economy in the context of a wider study of growth in the European periphery. Indeed, HERMIN-Portugal was developed as part of a research project intended to build comparable macro models for four countries of the European periphery (Greece, Ireland, Portugal and Spain) and to use these models to assess the effects of CSF on growth.[1]

The HERMIN-Portugal model structure is therefore similar to the one of the other country's models as it was decided to adopt a common modelling framework to maximise comparability between countries. Nevertheless, the main specificities of the Portuguese economy do show up in the model.

HERMIN-Portugal is a model with four sectors: agriculture (A), a non-market goods sector (N), which is mainly government, the tradable

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1 This was an EC research contract entitled "Economic and Environmental Impact of the CSF: Modelling Growth and Development in the EC Periphery", under contract no. JOU2-CT92-D257 with the Directorate General XII of the European Commission, involving teams from Greece, Ireland, Portugal and Spain.

goods sector (T) that coincides with the manufacturing industry and finally the non-traded goods sector (S) that includes marketed services, building and construction and energy. This choice of disaggregation was justified by the desire to keep the model as small and simple as possible while separating sectors driven by different forces and types of behaviour. Moreover, for open economies, models that do not distinguish between tradables and non-tradables are not well suited to analyse some type of shocks and may produce misleading results. This characteristic of HERMIN-Portugal allows it to be used to study the sectoral effects of policy actions which is something that QUEST, a macroeconometric model developed by the European Commission (see Brandsma et. al. (1991)) can not analyse.

3. The Portuguese CSF 1994-99: an overview

The broad lines of the Portuguese CSF 1994-99 are described in a document prepared by the Portuguese government, the *Regional Development Plan* (PDR), where a set of selected programmes to be co-financed by EU aid subventions was proposed to the Commission.[2] This document represented the beginning of an extended set of negotiations between the Portuguese government and the Commission. In this first proposal, the Portuguese government requested total financial support of 3.500 millions of contos. After the analysis of the submission, in February 1994 the Commission decided to assign a total amount of 3.250 millions of

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2 "Plano de Desenvolvimento Regional. Preparar Portugal para o século XXI", Ministério do Planeamento e da Administração do Território, Secretaria de Estado do Planeamento e do Desenvolvimento Regional, Julho de 1993.

contos to Portugal. The detailed allocation of these funds is explained in a document that was published in 1994.[3]

The three main objectives set by the Portuguese government for the evolution of the Portuguese economy until the year 2000 are the following:

1. A sustained growth in the context of the EMU;

2. Preparing the Portuguese economy for competition in a global economy;

3. Improvement of the standards of living in Portugal.

The achievement of these goals relies heavily on the CSF. The aim of the CSF is to narrow the gap between the peripheral and the core regions of the EC, promoting the Treaty objective of economic cohesion. The Portuguese CSF is therefore a series of operational programmes which are set in the context of a comprehensive framework for tackling the structural problems of the Portuguese economy.

3.1 The economic background to the plan[4]

After a period of very satisfactory economic growth, at rates clearly above EU average, the Portuguese economy suffered a slowdown in 1991 and 1992 (2.2 and 1.5 per cent, respectively) and a recession in 1993

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3 "Quadro Comunitário de Apoio 1994-1999. Plano de Desenvolvimento Regional", Ministério do Planeamento e da Administração do Território, Secretaria de Estado do Planeamento e do Desenvolvimento Regional, Fevereiro de 1994.

4 The data used in this subsection is drawn from the 1993 Annual Report of the Bank of Portugal.

(minus one per cent). In the beginning of the nineties, some progresses on the inflation front have been achieved, and the official figure decreased from 13.4 in 1990 to 6.5 per cent in 1993. The reverse happened with the unemployment rate, which increased from 4.1 per cent in 1991 to 5.5 per cent in 1993.

Both export and import growth accelerated since 1986, when Portugal joined the EC. A trade deficit of some 10 per cent of the GDP is a stylised feature of the Portuguese economy. However, the current account has remained fairly balanced since the mid eighties.

Adherence to the public finance Maastricht criteria was very close in 1992: total debt was 61.7 per cent of GDP and the General Government deficit was 3.3 per cent of GDP. However, these values seriously worsened in 1993, particularly the public deficit (67.3 and 7.2 respectively).

In 1991 and 1992, the Portuguese economy performed very well in terms of nominal and real convergence. However, 1993 showed some reversal as far as the second target is concerned. The continuation and reinforcement of CSF programmes is therefore vital for the purposes of real convergence between the Portuguese economy and the remaining members of the EU.

In general, the main weaknesses in the Portuguese economy can be characterised in the following distinct categories:

a) Serious shortcomings in general education and in vocational training;

b) Inadequate economic infrastructure, whether it concerns communications, telecommunications or energy;

c) Inadequate productive structure, for European standards, with traditional low-productivity industrial sectors playing major roles, as well as an agricultural sector characterised by very low productivity levels;

d) An underdeveloped health system, existence of disadvantaged social groups and environment problems;

e) Particular economic vulnerability of the interior regions of Portugal.

These five lines of action are the priorities of the Portuguese 1994-99 CSF, as described in section 3.2 below.

3.2. Priorities of the Portuguese CSF 1994-99

The PDR identifies four specific priorities, for the period 1994-99:

1. Development of human resources and promotion of employment;

2. Improvement of the competitiveness of the Portuguese economy;

3. Promotion of life quality and social cohesion;

4. Promotion of regional development.

Therefore the main expenditures covered by these type of policies concern measures designed to improve the educational or skill levels of the labour force; policies aimed to promote research; infrastructural investments and grants or other subsidies to agriculture, industry and

services, in order to help reduce the costs associated with the adoption of new technologies, the production of new products or the access to new markets; measures to increase standards of living and to assist disadvantaged groups; and specific measures to exploit the growth potential of regions and local development.

In table 3.1 we present the allocation of total public expenditures amongst these four areas of intervention and the corresponding shares of the EU and the Portuguese government contributions. Note that cohesion funds, worth 3 061 millions ECU's, are not allocated amongst these four priorities. These funds will be mainly used to finance projects in the area of transports and environment. Also private sector contributions, expected to reach a total of 6 642 million ECUs, are not allocated amongst the four priorities in table 3.1. Moreover, European Investment Bank loans to finance projects to improve infrastructures, mainly transports and energy, and other economic projects could reach 1.300 millions of contos. However, this is an indicative amount, subject to the economic and national interest of the projects submitted to the EIB and therefore does not appear in table 3.1.

One can see that expenditures on measures designed to improve competitiveness of the Portuguese economy represent nearly half of total expenditures. Moreover, around 40% of these funds are allocated to investment in infrastructure (roads, bridges, airports, harbours, energy, telecommunications, etc.) while the rest is devoted to measures aiming at modernising the Portuguese economy through selected sectoral grants.

Regional development measures correspond to 21.6% of total expenditures. As these measures also include infrastructure expenditures at

the regional level we will obtain an even higher proportion of resources allocated to infrastructural investment. Another major area of intervention is human resources and employment representing 20.4% of total expenditures.

Table 3.1
Portuguese Structural Funds Expenditures: 1994-1999

10^6 ECU	Total of Public Expenditures	EC structural funds contribution	National Contribution
1-Human Resources and Employment	4 079 (20.4%)	3 060	1 020
Education, Science and Technology	2 233 (11.2%)	1 675	558
Training and Employment	1 846 (9.2%)	1 385	462
2-Competitiveness Measures	9 582 (47.8%)	6 306	3 275
Infrastructures	3 781 (18.9%)	1 987	1 794
3-Life quality and social cohesion	1 774 (8.9%)	1 264	510
4-Regional Development	4 327 (21.6%)	3 144	1 183
Technical Assistance	275 (1.4%)	206	69
Total	**20 037 (100%)**	**13 980**	**6 057**

3.3. Detailed spending proposals of the Portuguese CSF 1994-99

In this section we describe briefly how the four specific priorities referred in the previous section are to be addressed.

3.3.1. Development of human resources and promotion of employment

The process of real convergence implies an overall development strategy based on boosting productivity and creating higher quality and better-paid jobs, without an increase in the rate of unemployment. It is therefore vital for Portugal to prepare human resources to meet the needs of the productive sectors of the economy in the context of a global economy. The following main targets were defined:

a) Improvement in the quality of the education system;

b) Development of Science and Technology activities;

c) Improvement of the training structure;

d) Promotion of employment.

Improvement of educational infrastructure, reform of the educational system and improvement in the quality of education through an appropriate training of instructors, are the main directions to assure the first target. An increase in research grants, improvement in scientific infrastructures and the promotion of joint university-firm programmes will be carried out in order to promote the development of Science and Technology activities. The third target will be achieved through appropriate training schemes that will make it less difficult for young people to obtain a first job in cases when they have not concluded the secondary school or any other relevant professional education. Finally, promotion of employment will be done through training of the unemployed and of the groups more affected by technological changes.

3.3.2. Improvement of the competitiveness of the Portuguese economy

The main targets of this priority are the following:

a) To increase the international competitiveness of the Portuguese economy;

b) To eliminate or reduce comparative structural disadvantages;

c) To increase the attractiveness of Portugal for international investors;

d) To improve the skills of the labour force.

These results will be achieved through the creation of economic infrastructure with a direct impact on economic growth and through sectoral grants to eliminate or reduce comparative structural disadvantages of the Portuguese economy.

In Portugal, economic infrastructure, whether in transport, telecommunications or energy, are generally inadequate. Moreover, there is a tendency towards saturation of the geographical area near the coast. The CSF for the years 1989-93 was very successful in the improvement of infrastructure of this type. However, there is still much scope for intervention in this area, namely in what regards road and rail links with Europe, improvement of national communications between the major urban centres and the coast with the interior areas of the country, and within Lisboa and Porto, and finally an increase in the competitiveness of port facilities.

As far as the modernisation of the functioning of the economy is concerned, the main objective is to increase private productive investment in agriculture, fisheries, tourism, industry and services, through the concession of selective sectoral grants. The main part of these funds will be devoted to industry and agriculture: respectively 11.1 percent and 11.7 per cent of total public CSF expenditures.

3.3.3 Promotion of life quality and social cohesion

The main objectives of this priority are the following:

a) Environment protection:

b) Improvement in urban environment;

c) Dramatic improvement in health services;

d) Promotion of social cohesion.

The first target will be achieved through a control of the impact of economic activity on the environment. Urban environment issues will be promoted through an improvement in urban infrastructures and restoration of urban degraded areas. The third target will be achieved through an improvement of existing hospital facilities and development of human resources in the health sector. Finally, social cohesion will be promoted through specific measures to assist disadvantaged groups like the long duration unemployed, handicapped and other disadvantaged social groups.

3.3.4 Promotion of regional development

The main objectives of this fourth priority are the following:

a) To fully exploit the growth potential of the regions (Norte, Centro, Lisboa e Vale do Tejo, Alentejo, Algarve, Açores, and Madeira);

b) To avoid the desertification of the interior regions of Portugal, in favour of a migration to the main urban centres like Lisbon and Oporto;

c) To improve the quality of life of rural and interior parts of Portugal.

Specific interventions are defined for each one of the above defined regions. Development of infrastructures and regional systems of incentives to promote the activity of small and medium sized firms are the main actions to achieve the objectives defined above.

3.4 Official projections of the impact of CSF 1994-99

The amount of CSF funds to be transferred to Portugal over the period 1994-99 (3 250 millions of contos, including Cohesion Funds) corresponds to an average annual amount of 4.2 per cent of GDP in 1992.[5] The corresponding domestic public sector contribution corresponds to an additional 1.8 per cent of GDP. This represents a massive injection of funds into the Portuguese economy and is expected to induce sustained effects on growth. The final version of the PDR 1994-99 estimates the following impact on the Portuguese economy:

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5 The GDP figures implicit in this work are prior to the recent revision of Portuguese National Accounts, where GDP has been revised upwards some 15 per cent.

- An impact on the annual growth rate of GDP of around 0.5% (0.7% if the national contributions are taken into account);
- The level of GDP per capita would, consequently, exceed by 3 per cent the level that would be observed if the CSF 94-99 had not taken place (4.2 per cent if national public expenditure is considered);
- The level of investment will approach 31.5 per cent of GDP by 1999 (29 per cent without structural funds);
- 75 per cent of the total amount of funds to be transferred will be allocated to investment: 67 per cent to building and construction and 33 per cent to equipment; the building and construction sector will therefore benefit in a direct way from CSF funds and it is expected to grow 3.7 per cent per year (two thirds of which are due to the CSF impact). This will represent an increase in the level of construction output of about 22 per cent (14 per cent due to the CSF impact);
- Private consumption is expected to increase by an additional 0.5 per cent per year as a result of the CSF;
- Imports will increase by an additional 1 per cent per year;
- CSF programmes are expected to generate some 90,000 additional jobs over the 6 years.

These estimates of the impact of the 1994-99 were obtained by the Portuguese Central Planning Office, through the use of a modelling procedure that does not consider supply-side effects of CSF. This

methodology is only valid for short run analysis and does not capture the effects of production externalities. Therefore, it is vital to incorporate these type of externalities in the economic analysis of the impact of CSF funds, in order to get a more realistic description of the macroeconomic effects of policies that aim at increasing the stock of infrastructures or at improving the educational or skill levels of the labour force. The HERMIN based analysis to be described in the following section does this.

4. A quantification of the effects of CSF 1994-99

The total amount of CSF funds to be transferred to Portugal over the six year period 1994-1999 (2 977 millions contos) represents an average yearly inflow of 3.8 per cent of GDP in 1992.[6] The corresponding national contribution (1173 million of contos) amounts to an additional 1.5 per cent. One should therefore expect a major impact on the Portuguese economy. Our ultimate goal is to identify and model the channels through which the CSF expenditures operate and use HERMIN-Portugal to assess the macroeconomic impact of these supply oriented policies. Our first task is therefore to group Portuguese CSF expenditures into economically more useful categories in such a way that these can be handled easily within our model. We considered the following types of expenditures:

1- Productive infrastructure;

2- Other infrastructure;

3- Human Capital;

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6 Including cohesion funds but excluding the Azores and Madeira Islands as our model only considers the Portuguese Mainland.

4- Aids to private investment;

5- Urban renewal;

6- Social cohesion transfers.

Productive infrastructure include investment expenditures on roads, bridges, airports, harbours, energy, telecommunications, whether carried out at the national or at the regional level. These expenditures represent 28.3 per cent of EU CSF aid subventions and 31.2 per cent of total public CSF expenditures.

The category "other" infrastructure concern expenditure on educational and scientific-related infrastructure, environment and urban infrastructure, improvement of hospital facilities and local and rural development, whether carried out at the national or at the regional level. These expenditures amount to 23.2 per cent of EU CSF aid subventions and 21.7 per cent of total public CSF expenditures.

Human Capital expenditures are on training and employment, improvement in the quality of education, reform of the educational system and on the development of science and technology activities. Human capital expenditures make up 14.7 per cent of EU CSF aid subventions and 14 per cent of total public CSF expenditures.

Aids to private investment include expenditures on measures designed to increase the competitiveness of the Portuguese economy, namely the concession of selective sectoral grants to increase private productive investment in agriculture industry and services. These expenditures represent 29.7 per cent of EU CSF aid subventions and 28.6 per cent of total public CSF expenditures.

Urban renewal includes expenditures on urban infrastructure and on the improvement of urban environment. They amount to 2 per cent of EU CSF aid subventions and to 2.3 per cent of total public CSF expenditures.

Finally social cohesion transfers are simply aids to long term unemployed, handicapped persons or other disadvantaged social groups. These expenditures represent 2.2 per cent of EU CSF aid subventions and 2.1 per cent of total public CSF expenditures.

In Table 4.1 we present the allocation of CSF expenditures according to our proposed classification as a percentage of GDP per year. Moreover, to ease the task of the reader we also provide the corresponding rate of national participation.

Table 4.1
Allocation of CSF 1994-99 Expenditures

Type of Expenditure	EU Subvention (% of GDP)	Domestic Contribution (% of GDP)	Domestic Co-financing ratio
1. Productive Infrastructures	1.08%	0.59%	54.40%
2. Other Infrastructures	0.89%	0.27%	30.30%
3. Human Capital	0.56%	0.19%	33.00%
4. Aids to private investment	1.14%	0.40%	34.28%
4.1 Aids to agriculture investment	0.50%	0.17%	33.30%
4.2 Aids to T sector investment	0.47%	0.16%	33.30%
4.3 Aids to S sector investment	0.17%	0.07%	40.00%
5. Urban renewal	0.08%	0.05%	61.00%
6. Social cohesion transfers	0.08%	0.03%	33.80%
Total	3.83%	1.53%	39.40%

Our next task is to inject these expenditures in HERMIN-Portugal and to model, when not already present, the channels through which they operate.

4.1 CSF and externalities

Like any other public expenditures programme the CSF imply demand effects that HERMIN-Portugal, as any other macroeconometric model, is perfectly capable of handling. However, when using a macroeconometric model in order to analyse the macroeconomic effects of a supply oriented expenditure package like the CSF, aimed at inducing substantial structural change in the beneficiary sectors, it is of paramount importance to be able to replicate adequately the likely long run supply effects.[7] This section deals with the conceptual issues associated with this need.

In our analysis of the CSF, supply effects are assumed to be associated only with three programmes:

(i) Productive Infrastructure;

(ii) Human Capital Expenditures;

(iii) Aids to Private Investment.

Providing more or better infrastructure, improving the quality of the labour force or granting structural aid to firms is bound to reduce production costs and to increase productivity either by lowering transport costs, increasing the productivity of labour or reducing the cost of capital. In all these cases, however, the economy benefits from a positive production externality associated with public policy actions. Private firms and economic agents in general, have access to additional productive factors at no cost. The importance of the concept of production externalities in explaining growth performance has been stressed by recent

7 These supply effects work through costs, productivity and competitiveness, and they increase output, reduce imports and boost exports. Moreover, they will also help to attenuate the demand- side inflationary preassures.

studies on growth theory. For example Barro (1991), Aschauer (1989) and Munnell (1992, 1993) claim that externalities associated with public infrastructure have important effects on productivity while others stress the effects of human capital externalities on growth (see Rebelo (1991) and Lucas (1988)). Therefore it seems that one should incorporate these type of externalities in the model in order to get a more realistic description of the macroeconomic effects of policies that aim at increasing the stock of infrastructure or at improving the educational or skill levels of the labour force.[8]

Moreover, some of the CSF expenditures, for example R&D grants or the creation of industrial sites, by improving the environment where productive activities take place and contributing to the sophistication of the goods produced, may attract new firms in a better position to compete in the internal and external markets and improve the export performance of the country.[9]

We will call these respectively "productivity" and "export" externalities. They are modelled as follows.

Factor Productivity Externalities

Production in the tradable and non-tradable sectors of HERMIN-Portugal is described by a CES production function.

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8 See Bradley, Whelan and Wright (1993) for a more detailed discussion on this point.

9 The importance of these effects has been stressed for example by Porter (1986).

$$Q_t = A\left\{\alpha\left[\exp(\lambda_L t)L_t\right]^{-\rho} + (1-\alpha)\left[\exp(\lambda_K t)K_t\right]^{-\rho}\right\}^{-1/\rho}$$

were Q, L and K are respectively, value-added, employment and the capital stock, A is a scale parameter, $\sigma = 1/(1+\rho)$ is the elasticity of substitution, α is a factor intensity parameter, and λ_L and λ_K are the rates of technical progress embodied, respectively, in labour and capital.

The basic idea is that infrastructure and human capital externalities increase total factor productivity in the private non-agricultural sector. Therefore we incorporate the effect of these externalities in the model by endogeneising the parameter A of both sectors in the following way:

$$A_t = A_0\left(\frac{KINF_t}{KINF_0}\right)^{\eta_1}\left(\frac{KTRAIN_t}{KTRAIN_0}\right)^{\eta_2}$$

where $KINF_0$ and $KTRAIN_0$ are the stock of infrastructure and human capital in the absence of any CSF expenditures, and $KINF_t$ and $KTRAIN_t$ are the stock of infrastructure and human capital resulting from the CSF expenditures programme. A_0 is the original value of the parameter and η_1 and η_2 are elasticities that reflect the size of the externality effect.

Export Externalities

These externalities are assumed to increase the intrinsic quality of Portuguese goods and therefore operate through exports in the following way:

$$QXOT = QXOT_0\left(\frac{KINF_t}{KINF_0}\right)^{\delta_1}\left(\frac{KTRAIN_t}{KTRAIN_0}\right)^{\delta_2}\left(\frac{I_t}{I_0}\right)^{\delta_3}.$$

Here $QXOT_0$ is the level of exports in the absence of any CSF expenditures and QXOT are the exports associated with the CSF expenditures programme. I_t and I_0 are respectively the level of private non-residential investment in the tradable sector that would be attained with and without CSF aids to private investment. Again δ_1, δ_2 and δ_3 are the corresponding elasticities.

Note that we also assume that aids to investment influence the performance of the agricultural sector in a way to be specified later.

4.2 Incorporating the CSF into the HERMIN-Portugal model

In this section we describe in some detail our approach to the quantification of the medium to long term impacts of the CSF 1994-1999 on the Portuguese economy using the HERMIN-Portugal model. We set out the way in which the CSF are incorporated into the model, using simple approximations that capture the main ingredients of the expenditures programme and that try to highlight the main mechanisms involved. We examine each category of expenditures in turn. The purpose of this section is to provide the reader with the information relevant for the understanding of the simulations performed later on.

4.2.1 Productive infrastructure

Productive infrastructure expenditures are injected in the model as an increase in public investment. These expenditures represent therefore an increase in demand, the consequences of which the model is quite capable of handling. However, in section 4.1 we saw that recent theoretical and empirical studies on growth claim that externalities associated with public

infrastructures have important effects that the standard version of our model does not consider. It was necessary therefore to include in the model endogenous mechanisms such as externalities that will replicate adequately the likely long-run growth effects of CSF expenditures that aim at increasing the stock of infrastructures.

As explained before the basic assumption made was that public infrastructure externalities will increase total factor productivity in the private non-agricultural sector and that by increasing the intrinsic quality of Portuguese goods they will also have a positive effect on exports. The strength of the externality effect is defined as a fraction of the improvement of the stock of infrastructures over and above the baseline projected level. i.e.: $Externality\ effect = (KINF_t / KINF_0)^{\eta}$ where η is the externality elasticity. The choice of the elasticity value was based on empirical studies available only for other countries (see Munnell (1992)). Note that in all simulations the externality effects are phased in gradually over a five year period, reflecting the implementation stages of the CSF programmes.

The stock of productive infrastructures resulting from the CSF expenditures, $KINF_t$, is obtained in the following way:

$$KINF_t = IG_t + (1 - 0.05)KINF_{t-1}$$

where IG is the level of total public investment in productive infrastructures that includes non-CSF public investment plus public CSF investment in productive infrastructures, IGCSF. Finally we assume that IGCSF is determined as follows:

$$IGCSF = (1 + c)IGCSFEC$$

where c is the domestic co-financing ratio and IGCSFEC are those productive infrastructure expenditures directly financed by EU subventions.

4.2.2 Other infrastructure

Other infrastructural expenditures are handled exactly in the same way except that in this case we do not consider that they will give rise to any type of externalities. Therefore here we are only considering a pure demand shock.

4.2.3 Human capital

Human capital expenditures are modelled essentially as an increase in the number of persons on training schemes and in the corresponding number of instructors. Trainees are paid an allowance linked to the minimum wage and instructors receive public sector wage rates. Other related expenditures are treated as overheads.

Here again some authors (see Rebelo (1991) and Lucas (1988)) have stressed that these expenditures will generate important externality effects on growth. To include these effects in the model we assumed that expenditures on education and training improve the skills and the productivity of the labour force implying an increase in total factor productivity. Moreover we also considered a similar positive effect on manufactured exports arising from the observed increase in the existing stock of human capital.

As with productive infrastructure, we assumed that the strength of the externality effect is a function of the improvement in the stock of human

capital over and above its baseline projected level i.e.: $Externality\ effect = KHUMR^{\eta}$ where η is the externality elasticity[10] and with KHUMR defined in the following way:

KHUMR= (KTRAIN0+KTRAINSF)/KTRAIN0

where KTRAIN0 the projected baseline non-CSF stock of trained labour force is calculated as 40 per cent of the labour force and KTRAINSF the extra accumulated stock of Portuguese CSF trainees is computed as follows:

$$KTRAINSF_t = NTRAIN_t + (1 - 0.05)KTRAINSF_{t-1}$$

where NTRAIN is the number of trainees financed by CSF expenditures each year. This number is obtained dividing the total amount of CSF expenditures on human capital, that includes the EU subvention plus the domestic public co-financing counterpart, less overheads expenditures and the amount paid to instructors by the allowance paid to each trainee.

4.2.4 Aids to private investment

Aids to private investment are modelled as an increase in private investment in manufacturing, services, and agriculture. These shocks are assumed to have non-permanent externality effects in production, in the case of agriculture, and in exports in the case of manufacturing. Moreover, for agriculture we also assumed that these externalities imply import

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10 Again the choice of the elasticity value was based on empirical studies available only for other countries (see Callan (1993)).

substitution effects. For the services sector, due to the reduced amount of these investment grants (around 2 per cent of the volume of total investment in this sector) we did not consider any externality effects.

Non-permanent externality effects are modelled in the following way for the traded (T) sector:

$$Non-permanent\ externality\ effect = \left[\frac{IOT}{IOT - TRITEO}\right]^{\eta}$$

and similarly for agriculture. Here η is the externality elasticity, IOT is sector T investment (that already incorporates CSF aids to investment) and TRITEO denotes the value of CSF aids to investment in sector T in constant prices. These effects are temporary as they only operate while the injection of funds is activated.

For this type of public CSF expenditures, EU and domestically financed, it is generally assumed that they will generate private sector responses, and that the payment of these aids will be conditional on these responses. Therefore, when evaluating the effects of these expenditures we will perform two types of simulations: one where only public expenditures are considered and another where public expenditures are augmented by the expected private co-financing response.

Note that we assume that only 90 per cent of these expenditures are spent on investment goods. The remaining 10 per cent are considered as fixed costs of running the selection of investment projects and are therefore treated as overheads.

4.2.5 Urban renewal

These expenditures are modelled as an increase in residential investment with no externalities. Once again, 10 per cent of these expenditures are treated as overheads.

4.2.6 Social cohesion transfers

These expenditures are considered an increase in social benefits. There are no productive externalities involved.

5. Simulation results

We now turn to the presentation of the simulation results. We consider the case of a *permanent* CSF shock, i.e. we assume that CSF expenditures are continued *ad infinitum* and not ended in 1999, the terminal year of the present CSF. Note that we only present separately the impacts associated with expenditures on productive infrastructure, human capital and aids to private investment as the other shocks are less important or their effects more transparent. However, when considering all the effects jointly in the total Portuguese CSF we will include the other types of expenditures as well.

5.1 Infrastructural investment, externalities and growth.

We now present the effects of the CSF infrastructural expenditures programme. The inflow of EU funds considered is 1.08 per cent of GDP in 1992 from 1994 to 2020. National expenditures contributions are obtained applying the rate of participation implied by the CSF programme (54.4%) See Table 4.1.

We will consider two cases: with and without externalities. In the externalities case we set productive externalities for both the traded and the non-traded sector at 0.1 and also considered an export elasticity of 0.1 that affects only exports of the traded (or manufacturing) sector.

To provide a better idea of the magnitude of the shock considered figures 5.1 and 5.2 show, respectively the size of the total injection relatively to GDP for the no-externalities case and the percentage increase in KINFR, the stock of infrastructures relative to the non-CSF baseline.

This injection of funds amounts initially to 1.4 per cent of GDP per annum falling to 1.0 per cent by the end of the simulation period reflecting the observed increase in activity and in prices. The stock of infrastructure increases gradually reaching a percentage difference of 24 per cent by the end of the simulation period. The effects on aggregate GDP at factor costs for both cases - with and without externalities - are shown in Figure 5.3 below.

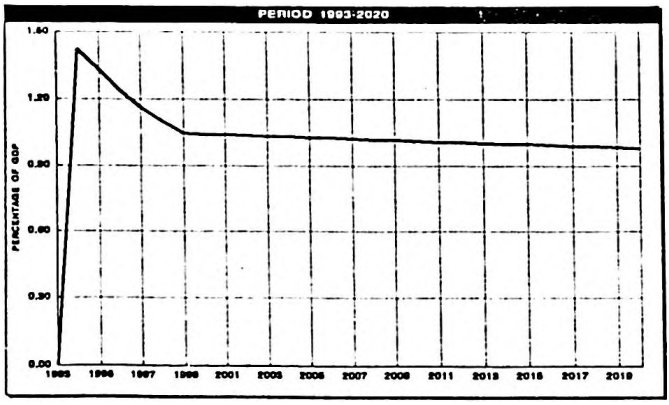

Figure 5.1: Size of CSF Infrastructure Expenditure

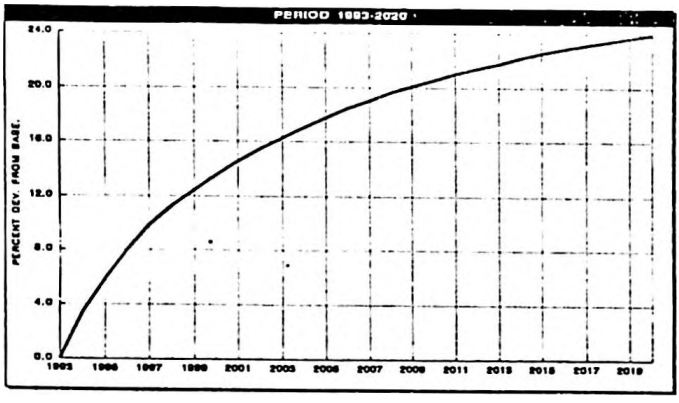

Figure 5.2: Percentage Change in Stock of Infrastructure

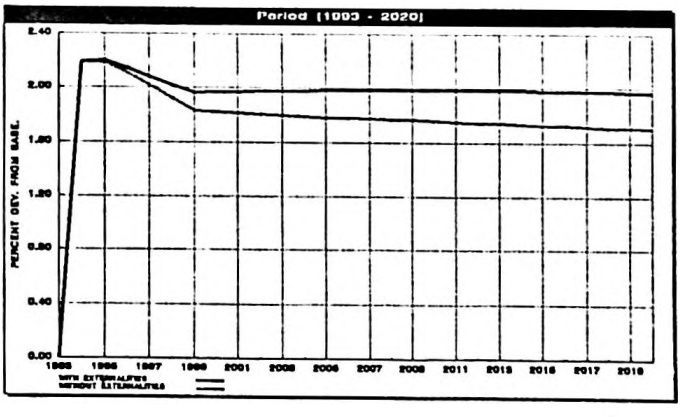

Figure 5.3: Aggregate Effects of CSF Infrastructure Expenditures on GDP

We can see that without externalities GDP at factor costs shows initially an increasing percentage difference from its baseline level that reaches 2.20 per cent and then this increase declines, gradually stabilising at 1.70 per cent by the year 2020. With externalities the percentage increase in GDP is bigger and more sustained, reaching 1.97 per cent by the end of the sample period. This increase is mainly due to the performance of exports, which increase 2.89 per cent relative to the baseline due to the externality effect on manufacturing exports. Without externalities the percentage change in total exports is 0.48 per cent. Note that the introduction of factor productivity externalities in the non agriculture private sectors does not have dramatic effects on GDP but implies important changes in employment. As the production technology becomes more efficient less workers are needed to produce the same output. Therefore in the externalities case, despite the increase in activity, we obtain a decrease in employment relatively to the non-externalities case.

It is also of interest to examine the sectoral output effects of this shock as the improvement in infrastructure implies mainly an increased domestic demand directed to the building and construction sector that in our model is included as a subsector of the non-traded goods sector. In Figure 5.4 we show the percentage changes of output in these two sectors relative to the non-CSF baseline, both for the externalities and no externalities case.

In the no-externalities case, output in the non-traded sector responds strongly and positively as expected, with a long run increase of 3.34 per cent whereas output in the traded sector increases by only 1.07 per cent. Introducing externalities implies a different behaviour of the traded sector because of the export externality. In this case output in the manufacturing

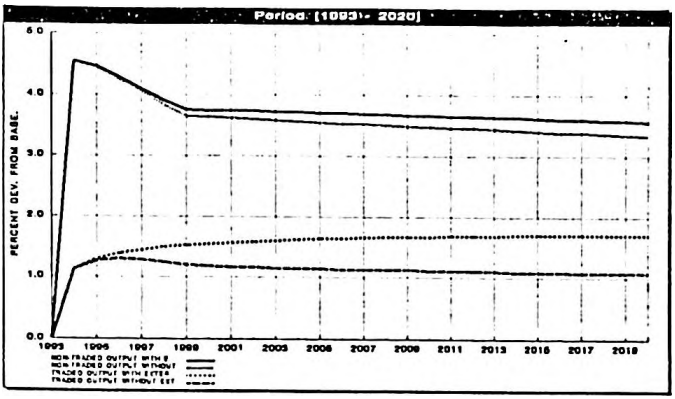

Figure 5.4: Effects of CSF on Traded and Non-traded Output

sector increases by 1.71 per cent by the year 2020 and the non traded goods sector output increases by 3.56 per cent.

Another important effect concerns imports. The Portuguese economy is dramatically dependent on imports and any change in domestic demand implies a massive reaction of imports. Figure 5.5 presents the percentage difference of the volume of imports associated with this shock. In the no-externalities case imports increase 2.26 per cent by the year 2020; this increase is even larger, at 3.06 per cent, when externalities are considered, following the further boost in activity.

The impact on the unemployment rate is negative in both cases and larger without externalities,-0.74 percentage points versus -0.28 percentage points, due to the observed increase in labour productivity when externalities are considered. In both cases prices increase but less in the

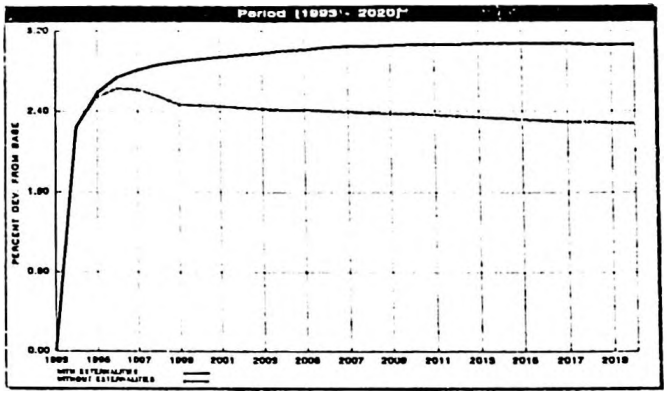

Figure 5.5: Change in Imports due to CSF Infrastructure Expenditures

case with externalities as the pressure on wages due to the tightening in the labour market is smaller in this case.

The CSF infrastructural effects are summarised in Table 5.1 below.

Table 5.1
CSF 1994-99 Infrastructural Effects

Year	CSF shock as % of GDP	GDPfc*- no externalities	GDPfc* - with externalities
1999	1.10	1.83	1.96
2020	1.00	1.70	1.97

* Percentage difference from baseline

5.2 Human capital

We now turn to the effects of expenditures on human capital. The inflow of EC funds considered is 0.56 per cent of GDP in 1992 from 1994 to 2020. National expenditure contributions are obtained applying the rate of participation implied by the CSF programme (33.0%), as reported in Table 4.1 above.

We will also consider two cases: with and without externalities. In the externalities case we set productive externality elasticities for both the traded and non-traded sector at 0.05 and also considered an export elasticity of 0.05 that affects only exports of the manufacturing sector. Again to give an idea of the magnitude of the shock considered we show in Figure 5.6. the size of the total injection relative to GDP for the no-externalities case and in Figure 5.7 we show the percentage increase in KHUMR, the stock of human capital relative to the non-CSF baseline.

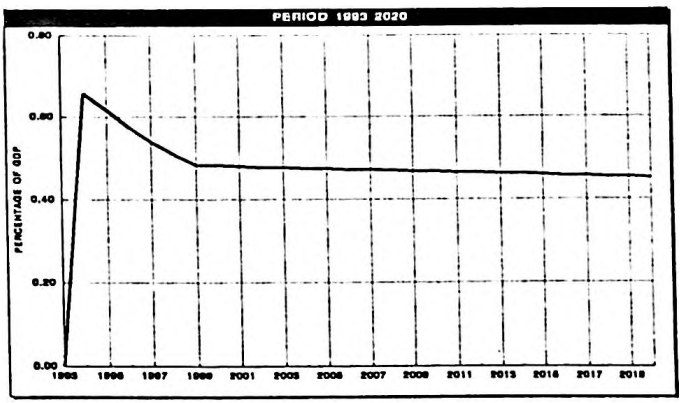

Figure 5.6: Size of CSF Human Capital Expenditure

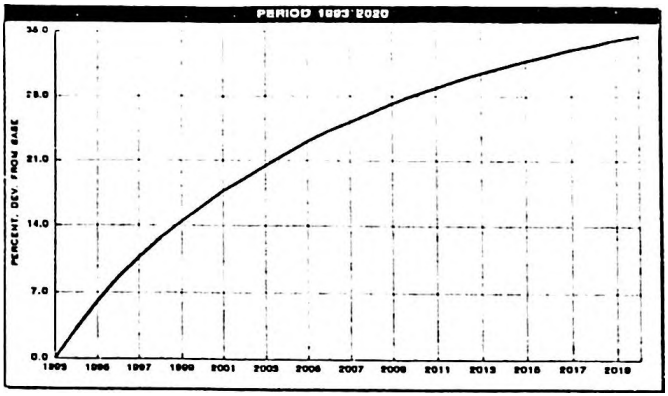

Figure 5.7: Percentage Change in Stock of Human Capital

This injection of funds amounts initially to 0.66 per cent of GDP per annum falling to 0.45 per cent by the end of the simulation period reflecting the observed increase in activity and in prices. The stock of human capital increases gradually reaching a percentage difference of 34.5 per cent by the end of the simulation period.

The effects on aggregate GDP at factor costs for both cases are shown in Figure 5.8 below.

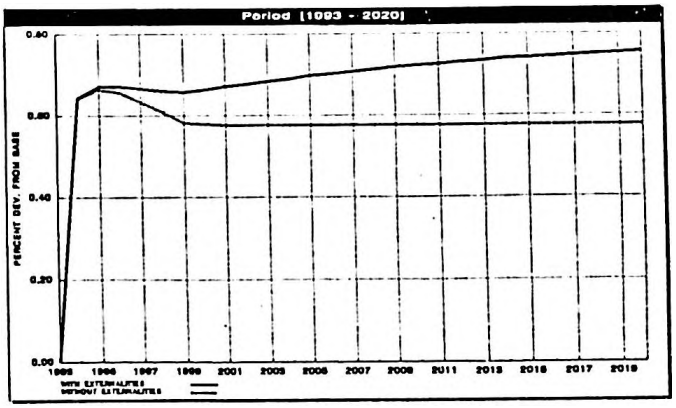

Figure 5.8: Aggregate Effects of CSF Human Capital Expenditures on GDP

The pure no-externalities Keynesian shock increases GDP in a sustained way implying by the end of the simulation period a percentage difference relative to baseline of 0.57 per cent. In the externalities case this effect is magnified and the observed increase in the year 2020 is 0.76 per cent. Again the different performance of GDP between the two simulations is mainly due to the behaviour of exports. Indeed, when the export elasticity for manufactured goods is operating, total exports increase by 1.78 per cent versus an increase of 0.13 per cent for the no-externalities case.

As in the previous case, factor productivity externalities do not cause important GDP effects but imply an increase in productive efficiency that is reflected in labour and capital saving. Therefore employment decreases in the externalities case mainly in the non-traded goods sector.

The boost in activity is again reflected in an increase in imports that reaches 1.26 per cent with externalities and 0.71 in the non externalities case.

The CSF human capital effects are summarised in Table 5.2 below.

Table 5.2
CSF 1994-99 Human Capital Effects

Year	CSF shock as % of GDP	GDPfc*- no externalities	GDPfc* - with externalities
1999	0.48	0.58	0.66
2020	0.45	0.57	0.76

* Percentage difference from baseline

5.3 Aids to private investment

5.3.1 Aids to agriculture investment

The total injection of public funds in this case, as a percentage of GDP, is depicted in Figure 5.9. One can see that it amounts initially to 0.58 per cent of GDP corresponding to 0.40 per cent by the end of the simulation period.

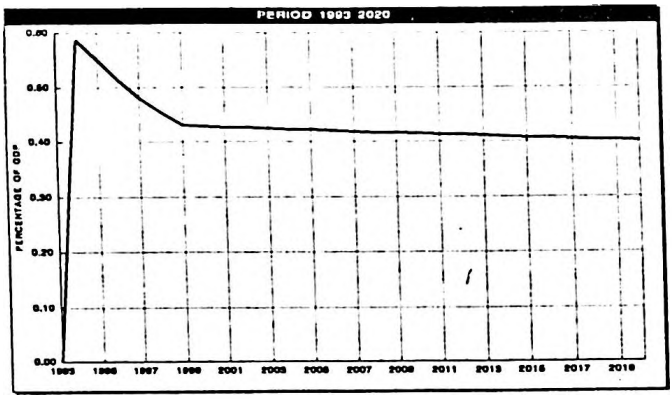

Figure 5.9: Size of CSF Aids to Agriculture Investment Expenditure

The impacts on GDP at factor cost with and without externalities are shown in Figure 5.10. The no-externalities pure Keynesian effect is an increase of 0.29 per cent by the year 2020 whereas when externalities are considered the corresponding increase reaches 0.51 per cent.

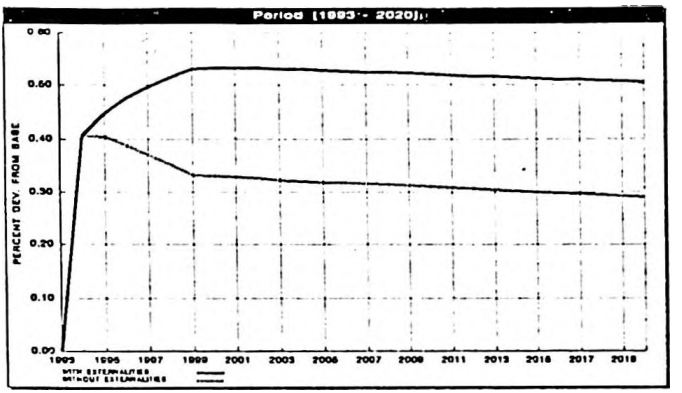

Figure 5.10: Aggregate Effects of CSF Aids to Agriculture Expenditures on GDP

When public expenditures are augmented by an identical private sector co-financing, the total injection of funds increases to 1.20 per cent of GDP initially, ending at 0.79 in 2020. In this case the pure Keynesian effect on GDP reaches 0.52 by 2020. With externalities the impact is 0.92 of per cent by the end of the simulation.

5.3.2 Aids to traded sector investment

The magnitude of the public funds injected in this shock is represented in Figure 5.11. Initially these aids to investment represent 0.55 per cent of GDP declining to 0.37 per cent of GDP in 2020.

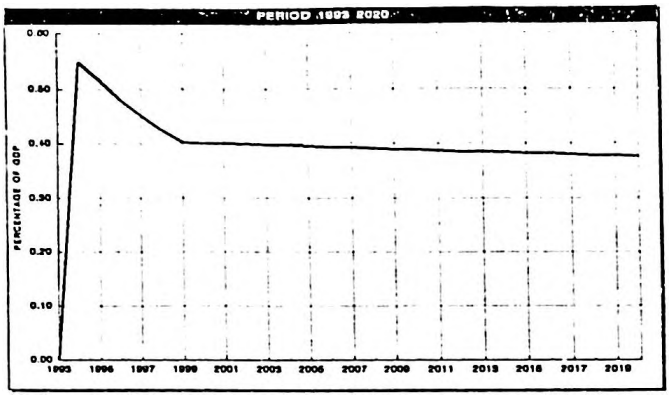

Figure 5.11: Size of CSF Aids to Traded Sector Investment Expenditure

The effects on GDP at factor cost are given in Figure 5.12. Without externalities GDP is increased by 0.22 per cent in the year 2020. The consideration of non-permanent externalities implies a corresponding increase of GDP of 0.28 per cent relative to baseline.

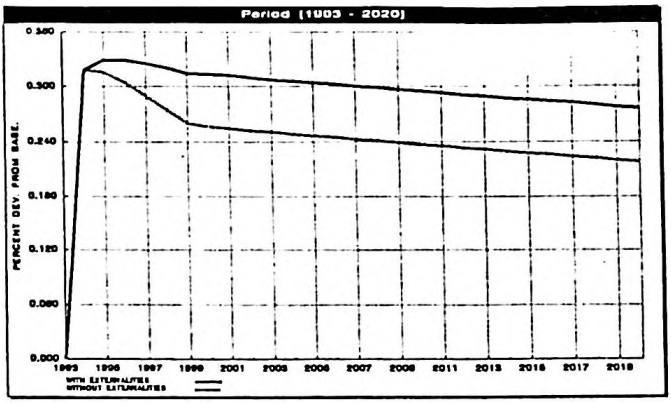

Figure 5.12: Aggregate Effects of CSF Aids to Traded Sector on GDP

When the private co-financement is considered, the total injection of CSF funds increases to 1.09 per cent of GDP initially, ending at 0.74 per cent in the year 2020. In this case the pure Keynesian effect on GDP reaches 0.38 by the year 2020. With externalities the obtained impact is of 0.49 per cent.

5.3.3 Aids to non-traded sector investment

In this case the magnitude of the shock is much smaller, representing roughly 0.14 per cent of GDP when only public expenditures are considered. See Figure 5.13.

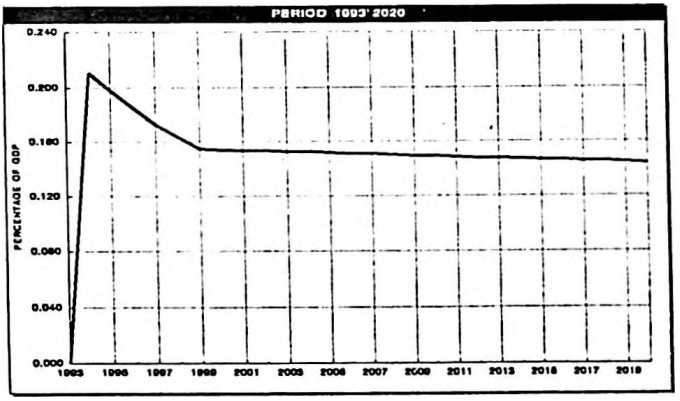

Figure 5.13: Size of CSF Aids to Non-Traded Sector Investment Expenditure

The effect on GDP is represented in Figure 5.14 and amounts to an increase of 0.09 per cent by the year 2020.

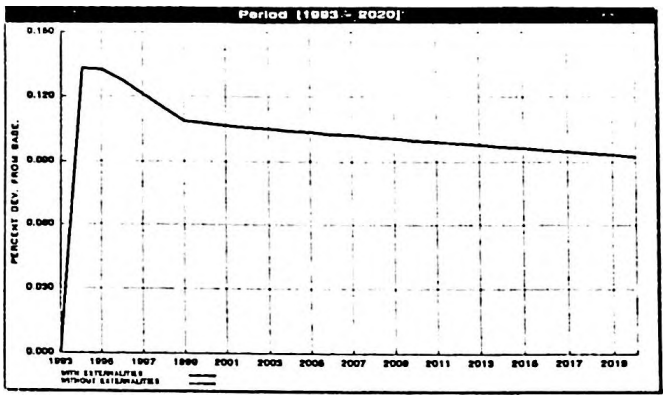

Figure 5.14: Aggregate Effects of CSF Aids to Non-Traded Sector on GDP

If public expenditures are augmented by equivalent private co-financing, the total injection of funds represents 0.29 per cent of GDP by the year 2020. The effect on GDP now rises to 0.16 by the year 2020.

5.4 The full effect of CSF expenditures

This subsection reports the main simulation results obtained when considering the joint effect of all CSF expenditures with and without externalities. We will focus on the case where EU funds and the corresponding national counterpart are supposed to last forever i.e. we will consider the case where the yearly EU subvention inflow and the national contribution will be injected from 1994 to 2020.

The magnitude of this global shock, considering only public expenditures in the case of investment grants, is represented in Figure 5.15.

The total injection of funds in the non externalities case amounts initially to 4.3 per cent of GDP declining gradually to 2.9 per cent by the end of the sample period reflecting the induced boost in activity and in prices.

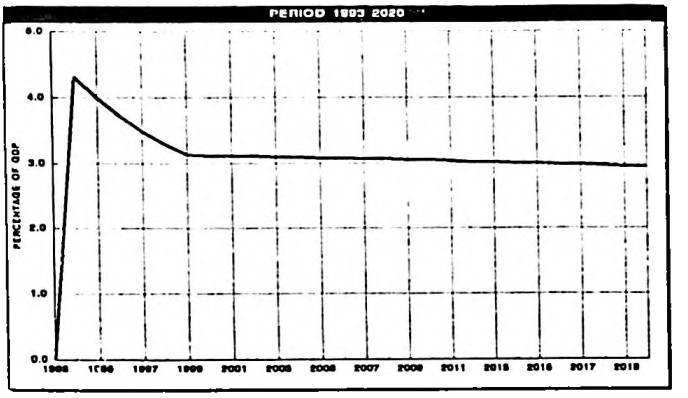

Figure 5.15: Size of Total CSF Public Expenditure

As one of the main objectives of CSF expenditures is to achieve an improvement in the stock of infrastructures and to boost private investment we will start by analysing the effects on investment. Total investment as a percentage of GDP in constant prices reaches 28 per cent by 2020 in the externalities case whereas in the baseline it represented only 25.8 per cent

The effects on GDP at factor cost with and without externalities are shown in Figure 5.16. GDP increases by 4.16 per cent in the long run in the non-externalities case and this increase reaches 4.85 per cent by the year 2020 when externalities are considered.

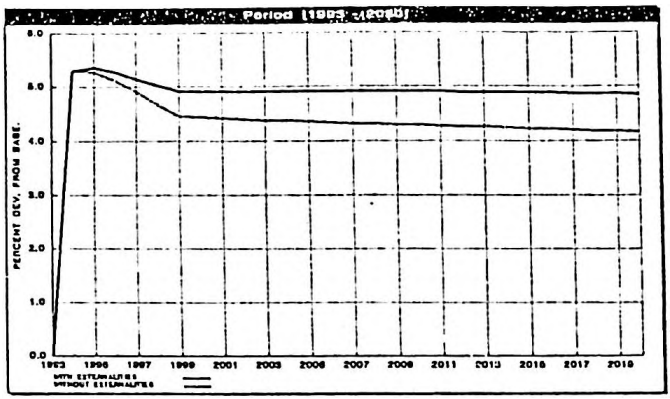

Figure 5.16: Aggregate Effects of Total CSF Public Expenditures on GDP

Again this difference in performance of GDP is mainly due to the behaviour of exports that show an impressive percentual difference of 5.38 relative to the non-CSF baseline when externalities are activated and of 1.27 per cent in the no-externalities case. Imports also react strongly, increasing by 7.65 per cent by the end of the sample period in the externalities case and by 6.07 per cent when externalities are not considered. One obtains therefore a deterioration in the trade balance. The trade deficit as a percentage of GDP exceeds 0.80 per cent in the first years and then improves representing roughly 0.37 per cent of GDP by the year 2020 in the externalities case.

Productive externalities have a positive effect on labour productivity that increases by 6.46 per cent relatively to the non-CSF baseline in the manufacturing sector and by 4.10 per cent in the non traded goods sector by the end of the sample period.

Although the consideration of productive externalities implies, as we have seen, an improvement in labour productivity, total employment is increased by 45 000 jobs by the year 2020. Nevertheless, this global picture corresponds to a different sectorial behaviour of employment. In the non traded goods sector 53 000 jobs are created while in the manufacturing sector 17 000 jobs are eliminated trough factor productivity increases.

In terms of production, for the externalities case, and despite the observed increase in exports, the non traded sector is also the one that reacts more vigorously. Output in this sector increases by 7.67 per cent responding to the boost in domestic demand that is mainly directed to the building and construction sub-sector. In the manufacturing sector output also increases but not so impressively (4.18 per cent).

Following the increase in labour productivity and the reduction in unemployment, nominal wages go up by 8.03 per cent in the traded goods sector and by 10.97 per cent in the non-traded services and construction sector. Prices therefore go up in the services and in the public sector implying an increase in the consumer price of 4.03 per cent and of 4.95 in the GDP deflator.

Despite the huge inflow of EU funds, current and capital public expenditures increase dramatically since the domestic counterpart of CSF funds still represents an important expenditure item. Nevertheless, we also obtain a huge increase of public revenues due to the induced increases in activity and in prices. Therefore, there is no deterioration in the public accounts with this type of permanent shock. However, had the inflow of

EU funds been stopped after 1999 and replaced by Portuguese financing, the picture would have been completely different.

We summarise the total CSF effects in Table 5.3 below for the case that excludes the private sector co-finance of sectoral investment.

Table 5.3
CSF 1994-99 Total Effects (excluding private-sector co-finance)

Year	CSF shock as % of GDP	GDPfc*- no externalities	GDPfc* - with externalities
1999	3.10	4.46	4.90
2020	2.90	4.16	4.85

* Percentage difference from baseline

When public aids to private investment are assumed to be matched by an identical private co-financement, the shock of the total CSF is bigger and represents initially 5.00 per cent of GDP, declining to 3.70 per cent by the year 2020. In this case the effects obtained are bigger but the main conclusions are similar.

Real GDP is increased by 4.60 per cent in the long run in the no-externalities case and by 5.51 per cent when externalities are considered. In this case, total investment reaches 29 per cent of GDP by the year 2020.

The effects on exports and imports are also bigger, but we still obtain an even bigger deterioration in the trade balance. In the no-externalities case exports increase by 1.54 and imports by 7.26 per cent. With externalities the increase in exports is again impressive at 5.88 per cent but the increase is imports rises to 9.11 per cent. The trade deficit as a

percentage of GDP increases by 1.16 per cent in the initial years and then improves, amounting to 0.56 per cent of GDP in the year 2020 in the externalities case.

Employment effects are again similar but quantitatively bigger. Total employment increases by 59 000 jobs by the year 2020 when externalities are considered. Employment creation in the non traded goods sector is now of 64 000 jobs but in manufacturing 19 000 jobs are lost.

Sectorial output responses are again of the same type but larger, reflecting the further boost to the economy. Output in the non-traded sector increases by 8.46 per cent in the externalities case while manufacturing output rises by 5.05 per cent. Labour productivity is further boosted: a 7.64 per cent increase in the manufacturing sector and a 4.19 per cent increase in the non traded goods sector in the externalities case by the end of the sample period.

Wage and price increases are therefore bigger. Nominal wages rise by 9.78 per cent over the non-CSF baseline level in the traded goods sector and by 13.1 per cent in the services and construction sector. Consumer prices rise by 4.96 per cent, while the GDP deflator rises by 6.25 per cent.

In this case public expenditures remain virtually unchanged relative to the previous case, but there is a further boost to tax revenue due to the bigger growth and price impacts. Therefore public accounts improve relative to the case where the private co-financement of aids to investment was not considered.

We summarise the total CSF effects in Table 5.4 below for the case that includes the private sector co-finance of sectoral investment.

Table 5.4
CSF 1994-99 Total Effects (including private-sector co-finance)

Year	CSF shock as % of GDP	GDPfc*- no externalities	GDPfc* - with externalities
1999	3.90	4.99	5.64
2020	3.70	4.60	5.51

* Percentage difference from baseline

6. Concluding remarks

We conclude this paper with a summary of our findings from the HERMIN-based evaluation of CSF 1994-99 for Portugal. Our analysis shows that the CSF 1994-99 package has potentially important effects on the Portuguese economy. Representing an injection of public expenditures that amounts to 3 per cent of GDP per year, we find that these structural funds induce, in the long run and in the case where only demand effects are considered, a boost of about 4.16 per cent in the level of GDP. See Table 5.3. When externality effects are also taken into account we obtain an even bigger effect. In this case, in the long run, the level of GDP would exceed by 4.85 per cent the level that would have been observed without the CSF. (See also Table 5.3).

These results must however be interpreted with some care. What our work suggests is that, all other things being equal and mainly when externality mechanisms are considered, the injection of the CSF funds could trigger a response pattern that would increase the level of GDP by more than the amount injected. The reader should not be misled by the precise quantification of the impact: there is in fact considerable

uncertainty surrounding the figures presented. We analysed the macroeconomic effects of the CSF using an estimated macroeconomic model. Therefore the values obtained are both conditional on the macroeconomic structure assumed and on the values of the parameters obtained, that in some cases have not been very precisely estimated. What this means is that the validity of the conclusions emerging from the simulation of a macro model is strongly dependent both on the assumptions underlying the model and also on the hypothesis chosen for the description of the relevant economic environment. For example, in all the simulations performed we considered a situation of fixed exchange and interest rates. This means that the macroeconomic effects of the CSF might be less positive in reality than in simulation because interest and exchange rates are likely to increase, with unfavourable consequences for economic growth.

Moreover, our quantification of the supply effects of the CSF must be seen as exploratory in nature. To our knowledge this project[11] was the first that attempted to explicitly model externality effects within a macroeconometric model. The best way to capture structural changes within our framework is to calibrate the production side of the model with parameters previously computed from other evidence. However, the necessary information to quantify precisely the likely supply-side impact of expenditures in the area of infrastructure, human resources and investment aids is not available. Indeed for Portugal, there is no macroeconomic, microeconomic or sectoral evidence concerning the magnitude of the elasticities associated with the externality effects that drive the supply-side

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11 We mean the complete HERMIN project involving teams from Ireland, Greece, Portugal and Spain.

responses. Therefore we used values taken from studies for other countries hoping that they could also reflect the Portuguese reality.

Finally we must stress that our framework of analysis is only well suited to make predictions about long run outcomes. Indeed we are not trying to forecast the likely evolution of the Portuguese economy over the next six years under the CSF package. Instead our goal is simply to identify the main channels trough which the CSF operate and quantify its effects over a stylised benchmark path assumed for the Portuguese economy in the absence of structural funds.

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