TI 2002-096/3
Tinbergen Institute Discussion Paper

Fertile Soil for Structural Funds?

Sjef Ederveen[a]
Henri L.F. de Groot[b]
Richard Nahuis[a]

[a] *CPB Netherlands Bureau for Economic Policy Analysis, The Hague,*
[b] *Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam, and Tinbergen Institute.*

Tinbergen Institute
The Tinbergen Institute is the institute for economic research of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam, and Vrije Universiteit Amsterdam.

Tinbergen Institute Amsterdam
Roetersstraat 31
1018 WB Amsterdam
The Netherlands
Tel.: +31(0)20 551 3500
Fax: +31(0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Amsterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Please send questions and/or remarks of non-scientific nature to wdriessen@few.eur.nl.
Most TI discussion papers can be downloaded at http://www.tinbergen.nl.

Fertile soil for Structural Funds?

A panel data analysis of the conditional effectiveness of European cohesion policy

Sjef Ederveen[a], Henri L.F. de Groot[b] and Richard Nahuis[c1]

[a] CPB Netherlands Bureau for Economic Policy Analysis
P.O. Box 80510, 2508 GM The Hague, The Netherlands

[b] Dept. of Spatial Economics, Vrije Universiteit and Tinbergen Institute
De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands

[c] CPB Netherlands Bureau for Economic Policy Analysis and Utrecht School of Economics
P.O. Box 80510, 2508 GM The Hague, The Netherlands

Abstract
Structural funds are the most intensively used policy instrument by the European Union to promote economic growth in its member states and to speed up the process of convergence. This paper empirically explores the effectiveness of European Structural Funds by means of a panel data analysis for 13 countries in the European Union. We show that – on average – Structural Funds are ineffective. For countries with high-quality institutions, however, Structural Funds are effective. This result is obtained for several proxies for institutional quality and is robust for different estimation techniques (OLS, period- and country-specific fixed effects and dynamic panel data models).

JEL codes: F35, F36, O11, O40, O52, R58
Keywords: European Cohesion Policy, policy effectiveness, economic growth, European Union

[1] Corresponding author: Henri L.F. de Groot, Dept. of Spatial Economics, Vrije Universiteit, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands, tel.: +31 20 444 6168, fax: +31 20 444 6004, E-mail: hgroot@feweb.vu.nl. We acknowledge Rob Alessie, Casper van Ewijk, Raymond Florax, Harry Garretsen, Joeri Gorter, Theo van de Klundert, Ruud de Mooij and Miguel Portela for useful comments and discussion. Henri de Groot is grateful to NWO for financial support.

1. Introduction

Structural Funds are the most important policy instrument used by the European Union (EU) to promote regional development of its member states and to speed up the process of convergence. It covers about a third of the total EU budget. An important question is how effective these funds are in promoting economic growth and reducing welfare differences in the EU. In the light of the upcoming enlargement of the EU this question becomes even more pressing. This paper aims at empirically investigating this question.

This paper relates to a large literature that evaluates the effectiveness of the European cohesion policy. Basically, three evaluation methods are used: model simulation, case studies and econometric evaluation. For a recent review of the different economic evaluation methods, we refer to Ederveen et al. (2002). The econometric evaluations, to which this study belongs, consist of analyses of regional economic growth (see, for example, Boldrin and Canova, 2001; Dall'erba and Le Gallo, 2003) or studies that examine the impact of cohesion policy within one specific country (see, for example, De la Fuente and Vives, 1995, on Spain). This paper complements the class of econometric evaluations by performing a cross-country panel data analysis.[2]

The country-level analysis has important merits. First – in contrast to regional growth regressions – the analysis is not sensitive to leakage or spillover effects. Spillover effects occur, for example, when a backward region improves its infrastructure, while as a consequence a construction firm in a wealthy neighbouring region experiences a positive demand shock. Second, the allocation of funds across regions might be sensitive to crowding out (national government change the allocation of their support to backward regions in response to receipts from the EU). The analysis on the effectiveness of the EU support on a regional level is troubled by such a mechanism; the country-level analysis on the contrary is insensitive for this. Third, a country level analysis allows to control for variables that are unavailable at the regional level. Obvious examples are educational attainment rates, which are only reliable on a country level, and institutional quality variables, which are not available on a regional level. Fourth, regional growth analyses suffer from severe selection problems. A country-level analysis substantially lessens this problem. As Structural Funds are allocated to regions in a non-random way – the funds are allocated to regions that are relatively poor –

[2] The only other paper using pooled cross-section analysis that we are aware of is Beugelsdijk and Eijffinger (2003). Compared to our study, their analysis covers a shorter time span and lacks a clear link with theoretically based econometric growth studies.

the regional growth analysis suffers from an endogeneity problem. Given that all countries have regions that are relatively poor, even from a European point of view, this endogeneity problem (which is otherwise hard to solve) is much less of a problem.

In its approach, this paper bears close similarity with Burnside and Dollar (2000). They assess the effectiveness of aid on growth with a focus on less developed countries. Their major result is that aid is at best conditionally effective: only countries with relatively solid domestic policies are positively affected by aid. They measure good policies by an openness variable capturing among others the black-market premium, inflation and the budget deficit (cf. Sachs and Warner, 1995). In a related paper, Gallup et al. (1999) show that locational factors are relevant in explaining growth differences. Their basic argument is that landlocked regions are more vulnerable to policy-induced inefficient allocations of scarce resources as opposed to open regions.

Building on these ideas, this paper aims to assess whether Structural Funds are effective, and what conditions affect the effectiveness. The paper has two major results. First, we show that Structural Funds as such do not explain growth differentials among the Member States. Second, however, Structural Funds allocated to the most open economies and/or to economies with 'good' institutions are effective. The quality of institutions will – in the context of this study – be proxied by several quantitative measures, including corruption, inflation, openness, etc. Hence, EU support is conditionally effective.

Apart from assessing the (conditional) effectiveness of Structural Funds and the type of conditions that are important, this paper contributes to the literature on growth more generally. Especially, by focussing on support to countries in the European Union, the paper adds to the literature on the conditionality of aid that has so far focussed on aid to less developed countries instead of developed countries (see Burnside and Dollar, 2000).[3]

We proceed as follows. Section 2 presents the theoretical background of the model that we estimate. Section 3 presents the basic regression results, whereas section 4 explores a wide variety of institutional variables. Section 5 examines the robustness of the results. The conclusions are contained in Section 6.

[3] In addition, we find that the augmented neoclassical model – the Mankiw, Romer and Weil (1992; hereinafter MRW) version – is well suited to describe European growth. In establishing this result, we make use of the new data on human capital constructed by Doménech and De la Fuente (2000).

2. Theoretical Considerations

The aim of this section is to provide the theoretical background for the empirical analysis that will follow. In doing so, we avoid developing a full-fledged theoretical model. For such a model, we refer to Burnside and Dollar (1997) who have shown how aid can straightforwardly be incorporated in an otherwise standard neoclassical growth model.

The major variable of interest for this study is the amount of Structural Funds (*SF*) received by a country. In analysing the effectiveness of these Structural Funds in stimulating growth, it is important to realise (i) that the Structural Funds can be seen as an income transfer, (ii) the Structural Funds have to be co-funded by the receiving country, and (iii) that the funds often have to be spent on pre-specified projects. Given these characteristics, it is impossible to formulate an unambiguous hypothesis on the expected effect of Structural Funds on economic growth. Depending on the circumstances, the effect can be positive, negative or zero. If aid by means of the provision of Structural Funds would be seen as an unconditional transfer, GDP of an economy that is located on the production frontier would not be affected and the expected coefficient is zero.[4] We can rule this out, however, as the EU requires the Structural Funds to be invested. The basic hypothesis in a neoclassical framework would hence be that the Structural Funds would foster economic growth as they increase the rate of investments. Three important reservations have to be made, however. First, the funds are often required to be invested in specific projects. These projects need not be growth promoting, but might – for example – enhance cultural or environmental values. Furthermore, these projects can absorb complementary factors such as human capital that would otherwise be allocated towards potentially more attractive activities in terms of growth. Second, the Structural Funds have to be co-funded by domestic tax revenues. In case taxation is highly distortionary, the net growth effect may well be negative. Third, corruption may take funds away from productive activities.

The bottom line of this discussion is that the Structural Funds are at best conditionally effective. These conditions determine the type of project that is financed by means of the Structural Funds, the distortions resulting from the required co-funding, and the potential distortions in the allocation of production factors. In operationalising these ideas, we assume that the effectiveness of investments depends on the 'institutional quality' of the receiving country. Though the literature on growth convincingly argues that 'institutions matter', the

[4] GNP is affected immediately.

operationalisation of the concept is more controversial. The details of our operalisation can be found in the data appendix, but in this section we discuss the theoretical considerations behind the indicators.

In assuming the Structural Funds to be conditionally effective, the basic idea is that resources can be allocated either toward productive activities or to 'rent-seeking' activities and that the set of rules and institutions in a country determines this allocation. The effectiveness of Structural Funds might thus depend on this allocation and the Structural Funds might even affect this allocation. Let us give three concrete examples of how this could work. First, Structural Funds could provide attractive, profitable options for public officials to obtain private benefits, in case of a lack of accountability. Murphy et al. (1991) show that increased opportunities for rent seeking might induce an allocation of talent that is harmful to economic growth. Second, barriers to international trade cause an inefficient allocation of resources and can provide ample opportunities for diversion activities; extracting part of the duty payments might, for example, raise the net benefit of a customhouse official (see Hall and Jones, 1997).[5] Alternatively, less open economies typically experience less policy-competition on politicians and they might therefore be induced to listen 'better' to interest groups. Therefore closed economies' institutional quality tends to be worse. Third, for the allocation of the Structural Funds between productive and unproductive projects, more efficient transactions in the market support productive activities. For efficient market transactions, contract enforcement is crucial. Corruption and low bureaucratic quality undermine this. Alternatively, as Knack and Keefer (1997) argue, trust is important to overcome contractual incompleteness. Building on these theoretical ideas, we will select several proxies that we use as conditionality factors to analyse the effectiveness of Structural Funds in promoting economic growth and convergence.

3. Regression results

Given the aspects that we have argued to be relevant in analysing the effectiveness of Structural Funds, we estimate the following pooled cross-section regression equation:

$$g_{it} = c + \beta_1 y_{it} + \beta_2 \ln(s_{k,it}) + \beta_3 \ln(s_{h,it}) + \beta_4 \ln(n_{it} + g_A + \delta) + \beta_5 SF_{it} + \beta_6 COND_{it} SF_{it} + \varepsilon_{it},$$

[5] Though it can be optimal to set a positive tariff if a country has market power, setting a tariff could create lucrative opportunities for rent seeking.

where the dependent variable g_{it} is the average annual growth rate of real GDP per capita over the period under consideration.[6] Like in the standard MRW-framework, we include as explanatory variables initial GDP per capita in constant 1995 dollars (y_{it}), the average gross domestic savings rate ($s_{k,it}$), the rate of human capital accumulation ($s_{h,it}$), the population growth rate (n_i), the exogenous rate of technological progress (g_A), and the rate of depreciation (δ). Most of these variables are taken from the World Development Indicators (World Bank, 2000). Our proxy for human capital is taken from Doménech and De la Fuente (2000). A more detailed discussion of sources and definitions of all the data is relegated to Appendix A. In measuring European aid, we restrict attention to the European Regional Development Fund (ERDF). This is by far the most important of the funds and especially meant to help relatively poor EU members. In the regression equation, we use the natural logarithm of 1 plus the amount of Structural Funds as a fraction of GDP,[7] indicated by the variable SF_i. Finally, $COND_i$ denotes a conditionality factor capturing the institutional quality of the country. We will specify this variable later in this section in greater detail.

We use data for thirteen EU countries[8] (Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom). Our panel data set covers seven five-year periods from 1960–1965 through 1990–1995. Following Islam (1995), an observation in our data set is thus capturing a country's performance averaged over a five-year period.

As is standard in the growth literature, we take $g_A+\delta$ to be equal to 5% for all countries and time periods (see, e.g., MRW). Note that by putting $\beta_5=\beta_6=0$, we have the standard neoclassical growth model as introduced and empirically estimated in a cross-country context by MRW (1992) and later extended to a panel-data context by Islam (1995).[9] As a point of reference, we first estimate this basic MRW-model. The results are presented in

[6] For a period of T years starting at $t=t_0$, we define the growth rate of a variable x as $g_{t0} = [\ \ln(x_{to+T}) - \ln(x_{to})\ ] /T$.
[7] We add 1 to the share of Structural Funds as a fraction of GDP because this share can be zero and we want to include the natural logarithm of structural funds in the regression equation.
[8] We do not include Germany, because of the structural break in the data due to unification, and Luxembourg, because human capital data are unavailable.
[9] In most of our regression analysis, we do not use country- and period specific fixed effects for two reasons: first, we use institutional variables that have no – or at best very limited – time-series variation and, second, fixed effects do not 'explain' growth economically but only statistically, and thereby essentially capture 'the measure of our ignorance'. However, in order to check for the robustness of the results that we present, we have performed the analyses including country- and period specific effects. The results are presented and discussed in Section 5. Similarly, we report the results obtained by application of the dynamic panel data model estimation techniques as developed by Arrelano and Bond (1991) and Blundell and Bond (1998).

the first column of Table 3.1 and are consistent with theoretical predictions.[10] Furthermore, the null hypothesis that the parameters for s_k and s_h sum to the negative of the parameter for the population growth is not rejected. Therefore, in the second column we show the results of the restricted regression. From these results, we can infer the rate of convergence and the production elasticities of physical and human capital (corresponding to the respective capital income shares). These values are 0.027, 0.292 and 0.292.[11] The rate of convergence is slightly higher than the OECD estimates obtained by MRW. The capital income share of 0.29 is fairly close to the common sense value of one-third. The results thus support the validity of the augmented neoclassical growth model in explaining economic growth in EU countries.

To assess the effectiveness of European cohesion policy, we start by including the variable SF in the basic regression. The other parameters are hardly influenced by this, as can be seen from the results in the third column of Table 3.1. The impact of the Structural Funds itself is not significant. If anything, Structural Funds are found to have a negative impact on economic growth.

Table 3.1. Regression results

	Basic	Restricted	Basic with SF	SF and Institutional Quality
Initial GDP per capita	–0.028 (5.3)	–0.026 (5.5)	–0.028 (5.4)	–0.028 (5.5)
Log of investments	0.020 (2.1)	0.018 (2.0)	0.018 (1.9)	0.020 (2.2)
Log of human capital	0.023 (1.9)	0.018 (1.7)	0.023 (1.9)	0.022 (1.8)
Log of population growth + 0.05	–0.023 (1.2)		–0.030 (1.4)	–0.024 (1.2)
Structural Funds			–0.015 (1.2)	–0.141 (3.2)
Structural Funds * Institutional Quality				0.018 (2.6)
Constant	0.202 (3.6)	0.158 (4.9)	0.190 (3.3)	0.208 (3.6)
R^2-adj.	0.44	0.45	0.46	0.51
# panel observations	91	91	91	91

White heteroskedasticity-consistent t-statistics (in absolute values) are reported between parentheses

Next, we explore the question of conditionality. As explained in Section 2, our basic idea is that Structural Funds may only be beneficial, if the recipient country uses them in productive projects. However, if they are used to continue intrinsic loss-making activities, they

[10] We also performed regressions with the Barro-Lee human capital data, but the results were less satisfactory in terms of statistical significance and goodness of fit. We take this as evidence for the superior quality of the data by Doménech and De la Fuente.

[11] λ is solved from $-0.026*5 = -(1-e^{-5\lambda})$. Solving for α and β requires using the first three estimated coefficients (see Islam, 1995).

obviously will not have a positive effect. We use a measure for institutional quality to control for this (the appendix provides the details of this measure).

Including the interaction term of *SF* and institutional quality, the results get markedly different, as can be seen from comparing the last two columns in Table 3.1. The measure for Structural Funds remains negative and becomes significant, whereas the interaction of Structural Funds with institutional quality is significantly positive. This suggests that economies with good institutional quality benefit from the funds whereas those with bad institutions lower their growth performance. That Structural Funds are only conditionally effective is our basic result. In the next section we will perform a robustness check on our results by using a wide range of alternative measures to proxy for 'institutional quality'.

4. Different measures for institutional quality

The empirical growth literature is frequently plagued by the criticism that 'everything can be shown, provided that 'good' proxies are used'. To avoid this kind of critique this section presents regression results with different variables that proxy for 'institutional quality'. By using a wide range of proxies, we intend to provide a fair, complete and reliable view on the conditional effectiveness of Structural Funds.

We distinguish three broad groups of institutional quality variables. First, there are variables directly related to the outcomes of government policy: inflation and the government savings. Although admittedly crude, inflation can be seen as an indication for the degree to which governments give in to certain pressures. Central government savings indicates the extent to which governments absorb financial resources available in a country. Second, we have variables that can be summarized as indicating social cohesion: trust, norms of civic cooperation and the degree of ethnolinguistic fractionalization. The first two proxies are also used by, for example, Knack and Keefer (1997), whereas the last one is also used in related work by Mauro (1995) and Easterly and Levine (1997). The third group of indicators tries to measure institutional quality directly by using a corruption perception index, openness or an institutional quality index. The data appendix discusses the sources and definitions of these indicators in more detail.

Table 4.1 reports the estimation results when different indicators are used for the conditionality factor $COND_i$ in the basic regression equation (results for other proxies are available in Appendix B).

Table 4.1 Regression results with different measures for institutional quality

	SF and Inflation	SF and Trust[a]	SF and Openness	SF and Corruption
Initial GDP per capita	–0.027 (5.3)	–0.024 (4.8)	–0.025 (4.9)	–0.027 (5.3)
Log of investments	0.024 (2.5)	0.024 (2.4)	0.020 (2.3)	0.020 (2.3)
Log of human capital	0.018 (1.5)	0.016 (1.3)	0.014 (1.2)	0.019 (1.6)
Log of population growth + 0.05	–0.037 (1.9)	–0.025 (1.3)	–0.034 (1.8)	–0.028 (1.4)
Structural Funds	–0.184 (1.9)	–0.047 (1.4)	–0.285 (3.5)	–0.112 (3.4)
SF * Cond (see column header)	0.109 (1.6)	0.002 (1.2)	0.064 (3.1)	0.016 (2.5)
Constant	0.170 (3.0)	0.187 (3.3)	0.165 (3.1)	0.193 (3.4)
R^2-adj.	0.49	0.44	0.53	0.51
# panel observations	91	84	91	91

White heteroskedasticity-consistent t-statistics (in absolute values) are reported between parentheses.
[a] The 'trust-variable' is not available for Greece

A first general remark is that the regression results as far as the effects of savings in physical and human capital and (conditional) convergence are concerned are hardly affected by the use of different proxies for institutional quality.

In the first column we report the conditionality of SF aid on inflation.[12] The interaction term is borderline significant at the 10% level. Hence, the soil for SF aid is more fertile if inflation is low. For the governmental budget (detailed results can be found in Appendix B) we cannot draw an analogous conclusion; budget deficits are not significantly affecting the effectiveness of SF. Of the measures for social cohesion we report only the trust variable (the others basically tell the same story). Although the estimated coefficients have the same signs as with the other indicators, the impact of social cohesion variables for enhancing the effectiveness of SF aid is not significant.

A different proxy for institutional quality is the degree of openness of a country, i.e. the degree in which a country faces foreign competition. Openness is defined as the natural logarithm of exports plus imports divided by GDP.[13] The basic idea is that this openness variable captures the pressure on countries to efficiently use the Structural Funds. Openness is – at best – an imperfect proxy,[14] but we focus also on this specification because of its greater

[12] For comparability with the other institutional variables we use four minus the log of average inflation. In that case the resulting variable is positive and a higher value reflects higher institutional quality.
[13] We could alternatively use imports (or exports) divided by GDP, but these measures are highly correlated and the results are hardly affected by the choice for a particular proxy.
[14] Openess is a 'catchall' variable, because openness also depends on the size of the country. To assess its validity in a simple way, we have determined the correlation of our openness variable with the more generally accepted openness variable that was constructed by Sachs and Warner (1995) for a much more extensive cross-section of countries (we did not use the Sachs and Warner index itself, because then almost all EU-countries would be labeled as open). The correlation between these two measures of openness is obtained from a simple linear regression equation and equals 0.28 (p-value=0.0019). Details are available upon request.

data availability for the accession countries. Openness seems to be a good proxy, as it gives results comparable to the institutional quality measure in Table 3.1.[15]

The last two column reports the results for another fairly direct measure of institutional quality, viz. corruption. This also gives rise to a roughly similar and highly significant result. The same conclusions are reached when we use the Governance Indicators constructed by Kaufmann et al. (2002). The results for some of these regressions are relegated to Appendix B as these indicators are less widely used than the ones we discuss here. The evidence therefore clearly suggests that SF aid is more effective in countries with high-quality institutions or with a low perceived corruption.

We consider the specifications with institutional quality and corruption as our preferred specifications. As said before, we also use openness as the data availability is better. For these three specifications Table 4.2 reports the implied semi-elasticity of the SF for different countries discussed above. These semi-elasticities are defined as the derivative of the growth rate with respect to the natural logarithm of the Structural Funds (*SF*). They thus measure the increase in the growth rate in response to a 1% increase in the share of Structural Funds in GDP. The countries are ordered by the size of the elasticity.[16] A few results stand out. First, in Greece and Portugal the elasticity is negative in all specifications. Second, the Southern EU members tend to be clustered around the low and negative values of the elasticity whereas the Northern EU members are clustered around the high and positive elasticities, representing relatively aid-conducive institutions.[17] Third, the current allocation of the ERDF is largely focussed on the countries with negative elasticities.[18]

[15] All three selected specifications have both a significant coefficient for SF as well as for the conditional term.
[16] The elasticities are calculated for all EU countries. We use the observations for the last 5-year period for the conditioning variables to calculate the elasticity. The elasticity that is reported in the table is the calculated elasticity multiplied by 100.
[17] The annual growth effect of the actually received amount of Structural Funds is, for example, for Ireland 0.31%-points and for The Netherlands 0.03%-points (derived from the regression equation using institutional quality as the conditioning variable). Details on growth effects for all countries and conditioning variables are available upon request.
[18] Ederveen et al. (2002) provide an overview of the allocation of the ERDF.

Table 4.2 Implied semi-elasticities for three specifications

SF and institutional quality		SF and corruption		SF and openness	
Greece	–1.58	Greece	–1.56	Italy	–2.90
Spain	–0.31	Italy	–1.43	France	–2.84
Portugal	–0.16	Belgium	–0.33	Germany	–2.55
Italy	0.20	Portugal	–0.31	Spain	–2.25
Ireland	0.24	France	–0.21	United Kingdom	–2.16
France	1.49	Spain	0.08	Finland	–1.90
United Kingdom	1.58	Ireland	0.44	Greece	–1.55
Austria	1.71	Germany	0.56	Sweden	–1.49
Germany	1.87	Austria	1.01	Denmark	–1.04
Sweden	1.96	United Kingdom	1.56	Portugal	–0.45
Finland	1.98	Luxembourg	1.95	Austria	–0.40
Denmark	2.01	The Netherlands	2.14	The Netherlands	0.76
Belgium	2.03	Sweden	2.35	Ireland	0.93
The Netherlands	2.17	Denmark	2.93	Belgium	1.84
Luxembourg	2.30	Finland	3.32	Luxembourg	3.53

In order to assess the implications of these results for the countries that intend to enter the European Union in the (near) future, we have calculated the implied semi-elasticities for these countries (note that for institutional quality and corruption, we do not have data for all accession countries). In interpreting these results, one of course has to keep in mind that these results are based on out-of-sample predictions. Care is therefore required in the interpretation. The results are presented in Table 4.3. Based on the semi-elasticities for the institutional indicators, one has to conclude that the prospects for effective use of structural funds in the accession countries are limited. This reflects the fact that the institutional quality and perceived corruption in most of these countries are worse than in Greece, which featured the lowest values among the EU countries included in our analysis (see Table 4.2). When considering the semi-elasticities based on openness, the picture is slightly more positive. However, here we have to take into account that openness catches more than the institutional quality only. It is well known that small countries tend to be more open; hence the relative size of the countries affects the results, as is clear from Table 4.3.

Table 4.3 Implied semi-elasticities for accession countries

SF and institutional quality		SF and corruption		SF and openness	
Malta	–3.85	Romania	–4.62	Turkey	–4.08
Turkey	–3.35	Latvia	–3.95	Poland	–2.76
Cyprus	–2.49	Turkey	–3.72	Romania	–2.32
		Slovak Republic	–3.61	Hungary	–1.28
		Bulgaria	–3.38	Bulgaria	0.09
		Czech Republic	–3.38	Lithuania	0.76
		Poland	–3.16	Czech Republic	0.86
		Lithuania	–2.37	Cyprus	0.91
		Slovenia	–1.91	Latvia	1.05
		Hungary	–1.80	Slovak Republic	1.27
		Estonia	–1.46	Slovenia	1.87
				Estonia	2.41
				Malta	3.72

5. Robustness analysis

The results presented so far strongly suggest that the Structural Funds are only conditionally effective. However, it may be institutional quality as such, instead of the interaction with structural funds that enhances growth. Or the results might simply reflect the extraordinary economic performance of Ireland. This section deals with a number of these issues by performing an extensive robustness analysis.

We start from the basic equation with Structural Funds conditioned on institutional quality. The results are repeated in the first column of Table 5.1. For this specification we add different variables, change the sample, use different data sources and account for country- and period-specific fixed effects. The results reveal that our major result – Structural Funds are conditionality effective – is robust to these changes. Furthermore, this conclusion is not affected by using different conditionality factors. This is shown in Appendix B, where the analysis of this section is repeated with openness instead of institutional quality as the conditionality variable.

The first variation that we consider is the inclusion of the conditioning variable itself as it is possible that institutional quality as such is the driving force behind growth. The results, reported in the second column of the table, clearly show that it is not institutional quality itself that matters. The estimated coefficient is not statistically significant. The other coefficients do still support the hypothesis of conditional effectiveness of Structural Funds (though the conditionality term is just insignificant at the 5% level).

Second, we analyse whether the exceptional growth record of Ireland is driving the results. This is investigated in the third column in Table 5.1 by leaving out Ireland. Again the results are not very sensitive for this change.

Third, we disentangle the influence of joining the EU and the receipt of cohesion support. Therefore we construct a period dummy variable that equals one when a country was a member of the EU in that period, and zero otherwise. Including this dummy variable does not weaken the strength of the conditional effectiveness, but nevertheless shows that European integration itself tends to contribute to growth (though the estimate is not significant). This result suggests that two separate effects are at stake (see Crespo-Cuaresma, 2001, for a more detailed discussion and empirical analysis of the returns to EU-membership).

Fourth, we test whether the results are driven either by the distinct performance of some of the countries under consideration or by different behaviour in different periods of our sample, for example because of business cycle effects. These options are tested by including country- and period-specific fixed effects in the fifth and sixth column of Table 5.1, respectively. The results further reinforce the idea of the Structural Funds being only conditionally effective. In the specification with country-specific fixed effects, we see that the coefficient of the log of investments becomes smaller and statistically insignificant. This reflects the fact that variation over time of investments is limited. The effect of investments is therefore mainly picked up by the fixed effects. For human capital the coefficient remains stable but is no longer significant. In the specification with period-specific fixed effects, we see, however, that the coefficient of the log of human capital becomes very small (though insignificant). This reflects the fact that human capital develops similarly in all the countries in the sample over time. The effect is therefore picked up by the period-specific fixed effects.[19]

Fifth, we analyse the sensitivity of the results for the period used in the regression analysis. For most countries, the Structural Funds only started to be obtained in the late 1970s. In the years before, we have set the Structural Funds at zero in our dataset. To check the sensitivity of our results for this, we have restricted the time span to 1975-1995. The

[19] These results obtained by including country- and period specific fixed effects basically illustrate that the variation in investments and human capital over time and across countries in the sample of countries that we consider in this study is too limited to obtain statistically significant results for investments in physical and human capital when including period- and country specific fixed effects.

results are reported in the seventh column of Table 5.1. Apart from the reduced statistical significance of investments, both the qualitative as well as the quantitative results are hardly affected.[20]

Sixth, we re-estimate our basic regression equation with data from the Penn World Tables (Mark 6.1) that became recently available (instead of using the data from the World Development Indicators). The results again confirm our major result: Structural Funds as such are not effective in enhancing growth, but they are if they are seeded in fertile soil.

Finally, the last two specifications are based on the application of recently developed GMM estimators (Arellano and Bond, 1991 and Blundell and Bond, 1998).[21] We refer to Bond et al. (2001) for an application to the estimation of empirical growth models and a discussion of the various estimation techniques. In the Arellano-Bond approach, the regression equation is written in the form of a dynamic model. By taking first-differences, time-invariant country specific effects are removed. The right-hand-side variables in the first-differenced equation are instrumented. In doing so, one solves the problem of omitted variable biases that are constant over time, parameters are estimated consistently despite the endogeneity of right-hand-side variables and it allows for consistent estimation in the presence of measurement error. This approach was subsequently refined by Blundell and Bond (1998). They introduced a system GMM estimator that is highly recommended for empirical growth research (cf. Bond et al., 2001). Both the Arellano-Bond-specification and the Blundell-Bond-specification are reported in Table 5.1. The results reveal the well-known fact that the estimated speed of convergence is substantially larger in the GMM estimates. The effect of structural funds becomes statistically less significant, but remains similar in quantitative terms.[22]

[20] We have done the entire analysis in this paper for both the period 1975-1995 as well as 1980-1995. Both qualitative as well as quantitative results are reasonably robust for changes in the time period. Details are available upon request from the authors.

[21] All the GMM estimations were performed with OX version 3.30 and the DPD package version 1.2 (available as freeware at www.nuff.ox.ac.uk/Users/Doornik).

[22] The implied semi-elasticities range from –1.02 (–1.70) for Greece to 4.96 (2.23) for Luxembourg in the Arrelano-Bond (Blundell-Bond) specification.

Table 5.1 Regression results: Robustness with institutional quality as conditioning variable.

	Basic: SF and Institut. Quality	Institut. Quality as such	Excluding Ireland	With EU-dummy	Country Specific Fixed Effects	Period Specific Fixed Effects	Period 1975-1995	With PWT data	Arellano Bond	Blundell Bond
Log of Initial GDP per capita	–0.028	–0.029	–0.029	–0.030	–0.052	–0.013	–0.025	–0.032	–0.076	–0.069
	(5.7)	(5.8)	(5.8)	(5.9)	(4.8)	(2.4)	(2.7)	(4.6)	(2.5)	(4.3)
Log of investments	0.020	0.020	0.020	0.023	–0.002	0.013	0.013	0.029	0.006	0.006
	(2.3)	(2.4)	(2.4)	(2.6)	(0.1)	(1.6)	(1.1)	(3.4)	(0.2)	(0.4)
Log of human capital	0.022	0.017	0.017	0.024	0.026	0.002	0.034	0.000	0.051	0.101
	(2.0)	(1.5)	(1.5)	(2.2)	(0.7)	(0.2)	(2.1)	(0.0)	(0.9)	(2.5)
Log of pop. growth + 0.05	–0.024	–0.024	–0.024	–0.027	–0.026	–0.028	–0.053	–0.036	–0.039	–0.046
	(1.2)	(1.2)	(1.2)	(1.3)	(1.2)	(1.6)	(1.9)	(1.6)	(2.2)	(1.7)
Structural Funds	–0.141	–0.109	–0.109	–0.140	–0.196	–0.133	–0.124	–0.168	–0.155	–0.139
	(3.3)	(2.2)	(2.2)	(3.3)	(4.1)	(3.8)	(3.0)	(3.5)	(1.5)	(1.8)
Structural Funds * instit. quality	0.018	0.014	0.014	0.017	0.029	0.019	0.017	0.023	0.023	0.017
	(3.0)	(2.2)	(2.2)	(2.9)	(4.4)	(4.0)	(3.0)	(3.4)	(1.7)	(1.8)
Institutional Quality itself		0.002								
		(1.2)								
EU dummy				0.004						
				(1.4)						
Constant	0.208	0.212	0.212	0.214			0.056	0.266		
	(3.5)	(3.6)	(3.6)	(3.6)			(0.7)	(3.7)		
R^2-adj.	0.51	0.51	0.51	0.51	0.64	0.68	0.27	0.45		
# panel observations	91	91	91	91	91	91	52	91	78	91

Note: White heteroskedasticity-consistent t-statistics (in absolute values) are reported between parentheses. The results of the last two specifications are based on a regression equation with the natural logarithm of GDP per capita as dependent variable and are subsequently transformed for reasons of comparability using the fact that the growth rate in all specifications in this paper is defined as the dlog divided by five. We report the two-step GMM estimates. Instruments used in the Arellano-Bond approach are the log of initial income two periods lagged. All other righ-hand-side variables are assumed to be exogenous and are instrumented with their own value. The additional instrument used in the Blundell-Bond approach is the dlog of initial income one period lagged. The Sargan test does not reject the null-hypothesis of a valid specification. Further details are available upon request.

6. Conclusions

How effective are Structural Funds in promoting economic growth and convergence in the Member States of the European Union? Building on a standard neoclassical growth framework, we find that European support as such did not improve the countries' growth performance. However, we find evidence that it enhances growth in countries with the 'right' institutions. This conclusion is in line with the recent empirical findings on the effectiveness of aid to less developed countries by Burnside and Dollar (2000).

The analysis reveals which type of institution matters, as institutions are measured in several ways. Social cohesion is not an important conditioning factor. The government policy indicators are not significant at the 5% level in determining the effectiveness of the Structural Funds. However, when conditioning for openness and the direct measures for institutional quality, we find robust and significant conditional effectiveness of the Structural Funds. So, the European policy to promote regional growth is only conditionally effective. This finding bears considerable consequences for the (re-)design of the EU cohesion policy in light of the enlargement of the EU: the funds are to be allocated toward institution building in the first instance! Once the institutions are of a sufficient quality, the funds may be effective in stimulating (catching-up) growth.

References

Arrelano, M. and S. Bond (1991), Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *Review of Economic Studies*, 58, pp. 277–297.

Beugelsdijk, M. and S.C.W. Eijffinger (2003), *The Effectiveness of Structural Policy in the European Union: An Empirical Analysis for the EU-15 During the Period 1995-2001*, CEPR Discussion Paper, no. 3879, London.

Blundell, R. and S. Bond (1998), Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics*, 87 (1), pp. 115–143.

Boldrin, M. and F. Canova (2001), Inequality and Convergence in Europe's Regions: Reconsidering European Regional Policies, *Economic Policy*, 32, pp. 205–245.

Bond, S., A. Hoeffler and J. Temple (2001), *GMM Estimation of Empirical Growth Models*, Discussion Paper, no. 2001-W21, Nuffield College, University of Oxford.

Burnside, C. and D. Dollar (1997), *Aid, Policies, and Growth*, World Bank Working Paper, no. 1777, Washington D.C.

Burnside, C. and D. Dollar (2000), Aid, Policies and Growth, *American Economic Review*, 90 (4), pp. 847–868.

Crespo-Cuaresma, J., M.A. Dimitz and D. Ritzberger-Grünwald (2001): *Growth, Convergence and EU-membership*, unpublished manuscript, Vienna.

Dall'erba, S. and J. Le Gallo (2003): *Regional Convergence and the Impact of European Structural Funds over 1989-1999: A Spatial Econometric Analysis*, REAL Discussion Paper 03-T-14, Urbana, IL.

De la Fuente, A. and X. Vives (1995), Infrastructure and Education as Instruments of Regional Policy: Evidence from Spain, *Economic Policy*, 20, pp. 11–40.

De la Fuente, A. and R. Doménech (2000), Human Capital in Growth Regressions: How Much Difference does Data Quality Make?, available at fuster.iei.uv.es/~rdomenec/human.html

De la Fuente, A. and R. Doménech (2001), Schooling Data, Technological Diffusion and the Neoclasical Model, *American Economic Review*, 91 (2), pp. 323–327.

Doménech, R., A. Maudes and J. Varela (2000), Fiscal Flows in Europe: The Redistributive Effects of the EU Budget, *Weltwirtschaftliches Archiv*, 136 (4), pp. 631–656.

Easterly, W. and R. Levine (1997), Africa's Growth Tragedy: Policies and Ethnic Divisions, *Quarterly Journal of Economics*, 112 (4), pp. 1203–1250.

Ederveen, S., J. Gorter, R. de Mooij and R. Nahuis (2002), *Funds and Games: The Economics of European Cohesion Policy*, CPB Netherlands Bureau for Economic Policy Analysis, The Hague.

Gallup J.L., J.D. Sachs and A.D. Mellinger (1999), Geography and Economic Development *International Regional Science Review*, 22, pp. 179–232.

Hall, R.E. and C.I. Jones (1997), Levels of Economic Activity Across Countries, *American Economic Review*, 87 (2), pp. 173–177.

Islam, N. (1995), Growth Empirics: a Panel Data Approach, *Quarterly Journal of Economics*, 110 (4), pp. 1127–1170.

Kaufmann, D., A. Kraay and P. Zoido-Lobaton (2002), *Governance Matters II: Updated Indicators for 2000/01*, World Bank Policy Research Department Working Paper, Washington D.C., available (with data) at www.worldbank.org/wbi/governance/wp-governance.htm

Knack, S. and P. Keefer (1997), Does Social Capital have an Economic Payoff? A Cross-Country Investigation, *Quarterly Journal of Economics*, 112 (4), pp. 1252–1288.

Lambsdorff, J.G. (2001), *How Precise are Perceived Levels of Corruption*, background paper to the 2001 Corruption Perceptions Index, Transparency International, available (with the data) at www.transparency.org/cpi/index.html

Mankiw, N.G., D. Romer and D.N. Weil (1992), A Contribution to the Empirics of Economic Growth, *Quarterly Journal of Economics*, 107 (2), pp. 407–437.

Mauro, P. (1995), Corruption and Growth, *Quarterly Journal of Economics*, 110 (3), pp. 681–712.

Murphy, K.M., A. Shleifer and R.W. Vishny (1991), The Allocation of Talent: Implications for Growth, *Quarterly Journal of Economics*, 106 (2), pp. 503–530.

Pelkmans, J. (1997), *European Integration. Methods and Economic Analysis*. Longman, Harlow UK.

Sachs, J.D. and A.M. Warner (1995), Economic Reform and the Process of Global Integration, *Brookings Papers on Economic Activity*, 1, pp. 1–95.

Taylor, C.L. and M.C. Hudson (1972), *World Handbook of Political and Social Indicators*. 2nd Edition, New Haven: Yale University Press.

Vanhove, N. (1999), Regional Disparities in the European Union, in: Vanhove, N., *Regional Policy: A European Approach*, Third edition, Chapter 2, Aldershot, U.K.; Brookfield, Vt. and Sydney: Ashgate.

World Bank (2000), *World Development Indicators 2000*, CD-Rom, Washington, D.C.

Appendix A: Data[23]

Data in the basic regression

- The average annual growth rate of GDP per capita over the respective 5-year interval (the dependent variable) is taken from the World Development Indicators (World Bank, 2000, CD-Rom). Recently, the newest versio of the Penn World Table – Mark 6.1 – has become available, in which a different method is used to construct purchasing power parities. We report a robustness check with these data in Section 5.
- Initial GDP per capita (in constant 1995 dollars) is taken from the World Development Indicators.
- Average gross domestic savings is taken from the World Development Indicators.
- The human capital variable is taken from De la Fuente and Doménech (2000) and is available via the Internet. For a discussion on the quality of these data, see De la Fuente and Doménech (2001). We have also experimented with the more commonly used proxies provided by Barro and Lee. Details are available upon request.
- Population growth is taken from the World Development Indicators.
- Openness is derived from variables in the World Development Indicators. It is defined as exports plus imports divided by GDP. In the regressions, we use the natural logarithm of openness. To assess its validity as a proxy for institutional quality, we have confronted this openness variable with the openness variable from Sachs and Warner (1995) for a more extensive set of countries (see footnote 14).
- In measuring European aid, we restrict attention to the European Regional Development Fund (ERDF). This is by far the most important of the funds and especially meant to help relatively poor EU members. Up to 1986, we rely on Vanhove (1999) for ERDF data (source: Official Journal of the EC). For the period 1986 onwards, we use data from the Commission Accounting System (SINCOM).[24] We divided the amount of SF aid by the level of GDP in the country. Furthermore, we added one to this share before taking the natural logarithm to avoid negative numbers and to avoid problems with countries that received no structural funds. We treated the period before countries entered the EU as if they did not receive any cohesion support.[25]
- The EU dummy equals one if the country is a EU-member, and zero otherwise. For countries that entered during the period under consideration, the dummy represents the fraction of the time that the country was a member. The years of entry are based on Pelkmans (1997, p. 27).

[23] The dataset is available at www.henridegroot.net/downloads
[24] See Doménech et al. (2000). We are grateful to Rafael Doménech for making them available to us.
[25] The results presented in the main text are not sensitive for this. Details are available upon request.

We use data for thirteen EU countries (Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom) for the period from 1960–1995. Table A.1 shows summary statistics for some of the main variables of interest in the study.

Table A.1. Summary statistics of the most important data

	Per Capita GDP in 1960 (1995 US $)	Per Capita GDP growth (% per year)	Structural Funds (1990; % of GDP)	Openness (export plus import as % of GDP)
Mean	8623	2.9	0.32	60
Median	9587	2.7	0.04	53
Standard Deviation	3830	1.7	0.51	27

Alternative proxies for institutional quality

- The corruption perception index (CPI) is constructed by Transparency International and documented in a background paper (Lambsdorff, 2001).
- Sachs and Warner (1995) provide the institutional quality index (ICRG) used in Section 4.
- The inflation rate that we use in the same section is from Sachs and Warner (1995). It measures the average inflation rate over the period 1965–1990.
- Central government savings (measured as current revenues minus current expenditures of the central government as a fraction of GDP) (CGB) are taken from World Data CD-ROM, 1995. We added 10 to this variable to ensure positive values and comparable outcomes in our regressions.
- The variable trust measures the percentage of people that replies 'most people can be trusted' to the question 'Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?'. This proxy is used by, for example, Knack and Keefer (1997) and derived from the World Value Survey.
- The norms of civic cooperation are measured by membership of associations or societies and is also used by Knack and Keefer (1997).
- The variable ethnolinguistic fractionalization is based on Taylor and Hudson (1972) and used in, among others, Mauro (1995).
- We used a number of Governance Indicators from the World Bank's Composite Indicator Dataset Research Project by Kaufmann et al. (2002). These indicators refer to Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption and are measured in units ranging from about –2.5 to 2.5, with higher values corresponding to better governance outcomes.

Appendix B: Alternative specifications and test for robustness

In Table B.1 we provide results for alternative measures of institutional quality. The first regression complements the first specification in Table 4.1. The latter three specifications use WorldBank Governance Indicators to condition for institutional quality. These specifications confirm that SF are conditionally effective and illustrate the robustness of the results reported in the main text.

Table B.1 Regression results with different measures for institutional quality

	SF and government budget	SF and WorldBank Governance Indicator 'Political Stability'	SF and WorldBank Governance Indicator 'Government Effectiveness'	SF and WorldBank Governance Indicator 'Rule of Law'
Initial GDP per capita	–0.029 (5.4)	–0.028 (5.2)	–0.026 (5.0)	–0.025 (5.1)
Log of investments	0.019 (2.0)	0.016 (1.6)	0.022 (2.5)	0.022 (2.5)
Log of human capital	0.024 (1.9)	0.022 (1.8)	0.016 (1.3)	0.015 (1.3)
Log of population growth + 0.05	–0.026 (1.2)	–0.024 (1.2)	–0.036 (1.8)	–0.034 (1.8)
Structural Funds	0.008 (0.3)	–0.088 (3.1)	–0.064 (3.6)	–0.078 (3.7)
Structural Funds*cond (see column header)	0.007 (0.9)	0.064 (2.0)	0.044 (2.2)	0.063 (2.4)
Constant	0.203 (3.5)	0.203 (3.6)	0.167 (3.0)	0.169 (3.1)
R^2-adj.	0.46	0.49	0.51	0.51
# panel observations	91	91	91	91

White heteroskedasticity-consistent t-statistics (in absolute values) are reported between parentheses

In Table B.2, we repeat the robustness analysis performed in Section 5, but now with openness as the conditioning variable instead of institutional quality. The results confirm our main conclusions.

Table B.2 Regression results: robustness analysis

	Basic: SF and Openness	Including Openness separately	Excluding Ireland	With EU-dummy	Country Fixed Effects	Period Fixed Effects	Period 1975-1995	With PWT data	Arellano Bond	Blundell Bond
Initial GDP per capita	–0.025	–0.025	–0.025	–0.027	–0.060	–0.010	–0.020	–0.027	–0.079	–0.067
	(5.1)	(5.1)	(5.1)	(5.4)	(5.6)	(2.0)	(2.1)	(3.8)	(2.6)	(4.2)
Log of investments	0.020	0.018	0.018	0.023	0.006	0.015	0.014	0.027	0.008	0.006
	(2.4)	(2.3)	(2.3)	(2.8)	(0.6)	(2.0)	(1.2)	(3.2)	(0.3)	(0.3)
Log of human capital	0.014	0.020	0.020	0.017	0.064	–0.006	0.020	–0.007	0.068	0.098
	(1.3)	(1.8)	(1.8)	(1.6)	(1.8)	(0.6)	(1.2)	(0.7)	(1.1)	(2.3)
Log of pop. growth + 0.05	–0.034	–0.038	–0.038	–0.038	–0.043	–0.041	–0.068	–0.047	–0.042	–0.055
	(1.7)	(1.9)	(1.9)	(1.9)	(2.1)	(2.5)	(2.5)	(2.0)	(2.4)	(2.1)
Structural Funds	–0.285	–0.336	–0.336	–0.296	–0.416	–0.285	–0.253	–0.290	–0.346	–0.278
	(3.9)	(4.3)	(4.3)	(4.1)	(4.9)	(4.8)	(3.4)	(3.4)	(1.7)	(0.9)
Structural Funds * Openness	0.064	0.077	0.077	0.065	0.102	0.068	0.060	0.068	0.086	0.063
	(3.7)	(4.2)	(4.2)	(3.8)	(5.1)	(4.9)	(3.4)	(3.4)	(1.8)	(0.9)
Openness itself		-0.007								
		(1.8)								
EU dummy				0.005						
				(1.9)						
Constant	0.165	0.165	0.165	0.173			-0.008	0.201		
	(2.9)	(2.9)	(2.9)	(3.0)			(0.1)	(2.8)		
R^2-adj.	0.53	0.54	0.54	0.54	0.67	0.7	0.31	0.44		
# panel observations	91	91	91	91	91	91	52	91	78	91

See Table 5.1 for notes.