

# The Growth Effects of EU Transfers: An Empirical Investigation

Katalin Szilágyi - Béla Szörfi

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## Abstract

In this paper we examine the effects of EU's structural, cohesion and pre-accession funds on the growth performance of the recipient countries. We show that the meager and controversial literature in the topic is due to the choice of the sample and methodology used. We find that the partial effect of a unit of EU support on growth appears to be higher in countries with good institutions, and this finding is robust with respect to different measures of institutional quality. However, the conditional effectiveness result, as well as the relative optimistic view of the European cohesion policy, is largely explained by the experience of a single, but extremely successful country, Ireland. Also, country-specific factors other than institutions and the standard explanatory variables of an endogenous growth regression, play a role in explaining the convergence of the EU-countries, rather than the EU-funds. As a unique view in the literature, we simulate the "rates of return" of the funds based on the empirical estimations. The result calls for a caution in interpreting the pure numbers, and raises doubt about the future prospects of the EU funding.

# 1 Introduction

## 1.1 Motivation

In this paper we examine the effects of the structural, cohesion and pre-accession funds of the EU - the most important tools for enhancing convergence within the EU - on the growth performance of the recipient countries. The practical relevance of the topic in a country that has newly become eligible for a potentially long-lasting stream of EU transfers is obvious. Moreover, if the effects are found to be conditional on some specific factors, it would be good to know if economic policy can have an influence on them. However, the study of transfer-augmented growth regressions can be of academic importance as well. Namely, as it is highlighted in the literature review, previous studies are divided and the literature is far from conclusive. Specifically, depending on the sample period, the funds considered, the recipients covered or the methodology used, virtually any result is presented in previous studies.

In this paper, we seek answers to three interrelated questions:

1. What is the growth effect of the EU funds? Our interest in the issue is mostly practical: EU funds are pouring into the country at unprecedented scale - we should be curious about the experiences of other countries.
2. Is the effect conditional on something that economic policy is able to influence? From a normative point of view, the question is whether we have the opportunity to improve on our absorbing capacities and escape the well-known traps related to the emergence of new resources.
3. Should we care about EU funds? We ask this from the modeler's point of view: do the funds make enough difference in the behavior of the economy to have to bother with them when trying to model economic growth or convergence of the Hungarian economy?

Our approach contributes to the literature on the effectiveness of EU funds in three ways. First, we make use of an extended dataset, comprising also the new member states and their most recent experiences with and without EU support. Second, we thoroughly examine the conditional effectiveness hypothesis, i.e. the idea that foreign funds only foster economic growth if the recipient country fulfills certain criteria related to the quality of institutions. Third, we calculate the direct and indirect effects of the funds, the former working through direct demand-side effects and improvement in TFP, while the latter through the more extensive use of productive resources (labor and capital). By adding up all the effects, we arrive to an effect also cumulated in time, and an implied rate of return, that compares the higher income to the amount of funds received. We consider this latter being important from the point of view of the representative structural policy maker of the EU: if the additional income is not higher than the amount of funding, it casts doubt on the system of structural and cohesion policy.

## 1.2 Main results

As for the main results, we find that the partial effect of a unit of EU support on growth appears to be significantly higher in countries with good institutions, and this finding is robust with respect to different measures of institutional quality. However, at the country level, the predicted effects are dramatically diverse and controversial with different measures, which casts some doubts on the choice of a single proxy, and in particular of openness, as the proxy for institutional quality. Another troubling result is that conditional effectiveness, as well as the relatively optimistic view of the European cohesion policy, is largely explained by the experience of a single, but extremely successful country, Ireland. Also, country-specific factors other than institutions and the standard explanatory variables of an endogenous growth regression, play a role in explaining the convergence of the EU-countries, rather than the EU-funds. This calls for caution in interpreting the promising numbers, and – given that Ireland is no more eligible to important sources – raises doubts about the future prospects of EU funding.

## 1.3 Structure of the paper

Our paper is structured as follows. In the next section we review the related literature. It turns out that the literature is highly inconclusive, and different methods result in diverging results. We then give a short overview of the institutional setup of EU funding, and present some stylized facts on the growth performance of the main beneficiaries over the last two decades. It turns out that recipient countries followed largely different strategies in terms of the allocation of funds between possible uses with Ireland focusing more on human capital formation, while other 'cohesion countries' spending more heavily on infrastructure development.

We present our estimation results in Section 4.

## 2 Related literature

The literature on the effectiveness of EU structural policy is surprisingly meagre and controversial.<sup>1</sup> Meagre compared to the size and duration of the redistribution practices, and controversial as any kind of result is documented and supported by devoted proponents. The differences become more understandable if we take into account the institutional and methodological biases of different studies. First, the view of the European Commission is clearly positive and optimistic, while outsider commentators (especially those with strict anti-interventionist convictions) take a much gloomier view. Second, the method of investigation also seems to bring biases to the results. Namely, econometric studies and model simulations tend to arrive to systematically different conclusions, as the "impact elasticities"<sup>2</sup> of model simulations turn out to be significantly

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<sup>1</sup>In this section we rely on the meta-analysis by Ederveen et al. (2003).

<sup>2</sup>'Impact elasticity' is a common measure introduced by Ederveen et al. to evaluate transfers of various magnitude and duration. It is defined as the additional cumulated economic growth

higher than those of econometric studies. The reason for this being that model simulations typically assume funds are used efficiently, and all spending directly augment productive resources, whereas econometric studies implicitly take into account all possible sources of inefficiency, like crowding out, rent seeking, and other phenomena that subdue the effectiveness of cohesion policy. The existing body of literature suggests that there is a significant gap between the two.

As our approach is relatively atheoretical and we follow an econometric analysis, we focus on preceding studies of econometric evaluation. Beugelsdijk-Eijffinger (2005) find that EU transfers are unconditionally and significantly effective, while Ederveen et al. (2002, 2003) conclude that they are only conditionally effective: support only fosters economic growth in countries that are sufficiently open. The reasoning behind is that openness disciplines governments, and disciplined governments are essential for the efficient spending of the support and for minimizing the gap between the actual and potential effects. Cappelen et al. (2003) also argue for conditional effectiveness.

Boldrin-Canova (2001) take a more pessimistic view by stating that differences in and evolution of total factor productivity between regions is not related to EU transfers. Falk-Sinabell (2008) draw similar conclusions: regions that receive the most of funds tended to grow faster, but solely due to regional characteristics. Dall’Erba - Le Gallo in a series of studies between 2002 and 2007 find that the effects of funds on growth are rather small, rarely significant, and can even be negative.

### **3 Some stylized facts on EU funding and convergence**

#### **3.1 Institutional setup of the funds**

The first and largest group of EU funding is the Structural Funds (SF). There has been a continuous change in the number, and to a less extent, in the purpose of the Objectives of the SF. In the first programming period after the 1988 reform of the funds, in 1989-1993, six Objectives were defined, and one more was added in 1995.

- Objective 1, representing about 2/3 of the total SFs, was aiming at promoting the development and structural adjustment of lagging regions. NUTS-2 regions, which GDP per capita level was below 75% of the EU average, were eligible to receive funding under the Objective. The main beneficiaries were Greece, Spain, Portugal, Ireland, Southern-Italy and the former East-Germany. The sources of funding were: ERDF, ESF, EAGGF-Guidance, FIG.
- Objective 2, with a share of 11% of the total SFs, was supposed to convert the regions seriously affected by industrial decline. Mostly NUTS-3 regions

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per unit of cohesion support (calculated in percentage of GDP/GNI).

were eligible, where the unemployment level and the percentage share of industrial employment were above the EU average, while the employment level of the industry has been declining. Sources of funding: ERDF, ESF.

- Objective 3 was for combating long-term unemployment and facilitating integration into working life. Mostly NUTS-3 regions were eligible; the Objective represented almost 10% of the total funding. The source of funding was the ESF.
- Objective 4 was aiming at adapting the workforce to industrial changes. Most often, both NUTS-2 and NUTS-3 regions were eligible. The Objective represented 1.6% of the total funding. The source of funding was the ESF.
- Objective 5a and 5b were created to promote rural development. For the latter, the eligibility was the low level of socio-economic development (basically measured by GDP per capita), and two of the following: high share of agricultural employment, low level of agricultural income, low population density and/or significant depopulation trend. For the former, there was no geographical eligibility criteria. The units of funding were smaller than NUTS-3 regions. The two Objectives represented about 5% of the total funding; the main beneficiaries were France, Germany, Austria and Finland. The source of funding were: EAGGF-Guidance and FIFG in case of Objective 5a and ERDF, ESF and EAGGF-Guidance in case of Objective 5b.
- Objective 6 was worked out parallel with the accession of Finland and Sweden, for regions with an extremely low population density (max. 8 inhabitants per sqkm). The source of funding were: ERDF, ESF and EAGGF-Guidance.

In the period 2000-2006, the seven Objectives were re-grouped into three new Objectives. These were:

- Objective 1: Supporting development in the less prosperous regions. This Objective covered the previous Objective 1 and Objective 6 areas.
- Objective 2: Revitalising areas facing structural difficulties. The Objective covered the previous Objective 2 and Objective 5b areas, i.e. those undergoing economic change, declining rural areas, depressed areas dependent on fisheries and urban areas in difficulty.
- Objective 3: Supporting the adaptation and modernisation of education, training and employment policies and systems in regions not eligible under Objective 1. The Objective gathered the former Objective 3 and 4.

Besides the Objectives, so called Community Initiatives focusing on specific problems are financed by the Structural Funds. The 1999 change in regulations decreased the number of these initiatives from 13 to 4, these being:

- EQUAL: to combat all forms of discrimination and inequality as regards access to the labor market.
- LEADER +:to promote rural development through the initiatives of local action groups.
- URBAN II:to encourage the economic and social regeneration of towns, cities and suburbs in crisis.
- INTERREG III:to stimulate cross-border, trans-national, and inter-regional cooperation.

There are four Structural Funds connected to the Objectives and Initiatives, each fulfilling a specific role:

- The European Regional Development Fund (ERDF) is expected to reduce the regional imbalances.
- The European Social Fund (ESF) funds training, vocational retraining and job creation measures.
- The Financial Instrument for Fisheries Guidance (FIFG) contributes to achieve the objectives of the common fisheries policy.
- European Agricultural Guidance and Guarantee Fund (EAGGF) funds expenditure arising from the common organisation of the markets and agricultural prices, rural development measures accompanying market support and rural measures outside Objective 1 regions, expenditure on certain veterinary measures and information measures relating to the CAP (Guarantee Section); and other rural development expenditure not funded by the Guarantee Section, including the LEADER+ Initiative. (Guidance Section).

In 1993, the Maastricht Treaty has created the Cohesion Fund, the second group of funding, in order to help the Member States to diminish economic and social disparities and stabilize their economies. Eligible are the countries whose GNI per capita is below 90% of the EU average. In the 1994-1999 period, Ireland, Spain, Portugal and Greece were eligible for the Cohesion Fund. During the 2000-2006 period, several changes occurred: Ireland was deemed as ineligible as of 2004, while all New Member States become eligible from May 2004<sup>3</sup> on. A special feature of the Cohesion Fund is that the support is conditional: if a country is running an excessive deficit defined under the Maastricht Treaty and the Stabilization and Growth Pact (i.e. a general government deficit above 3% of its GDP), the funding might be suspended. However, this have not happened yet.

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<sup>3</sup>In the 2007-2014 planning period, Bulgaria and Romania also become eligible for the CF. However, Spain is only eligible for the so called phase-out fund, as its GNI per capita exceeds 90% of the EU-27 average, but does not reach 100%.

The third group of funding under examination is the Pre-Accession Funds, available for countries standing before the accession. These funds finance the adoption of the Community law and development in general. During the period under review, both the countries joined in 2004<sup>4</sup>, and those joined in 2007 received money from these Funds. In this period, three pre-accession funds were available:

- PHARE: It was created in 1989 to assist the transition of Poland and Hungary. However, until 2000, 10 of the 12 new members as well as the five Western Balkan countries were entitled for drawing funding from the PHARE. Since 2000, these latter countries receive funds under the CARDS program.
- ISPA: The Instrument for Structural Policies for Pre-Accession was created in 2000 to enhance economic and social cohesion in the applicant countries.
- SAPARD: The Special Accession Programme for Agriculture and Rural Development also came into life in 2000, to help the applicant countries to deal with the problems of the structural adjustment in their agricultural sectors and rural areas, as well as in the implementation of the *acquis communautaire* concerning the Common Agricultural Policy.

### 3.2 An overview by countries

The data for the amount of EU funding stem from the 'EU budget 2007 Financial Report'. We used the entries „Structural Actions” including the Structural and the Cohesion Funds and „Pre-Accession Strategy” including the Pre-Accession Funds. We expect that among the total expenditure, only the above Funds might have any growth effect; however, it is worth to mention that these represent only the third of the total expenditure side of the budget. During the 2000-2006 planning period, 48% of the total expenditure was spent to agriculture (in form of direct aid, export refunds, storage, rural development and other spending), 7% for internal policies, 6% for administration, 5% for external policies and 1% for compensation. Besides, countries also contribute to the common budget, so one has to be cautious when talking about the effectiveness of the EU transfers. For example in 2006, Hungary received an amount of 1.0% of its GNI from the Structural, Cohesion and Pre-Accession Funds; however, the total amount of inward EU transfers was 2.2%, while the net budgetary balance was 1.34%.

We have examined the effectiveness of the funds both with yearly and period data. We constructed three periods according to the EU planning periods: 1989-1993; 1994-1999 and 2000-2006. It is usual that a country does not spend all the amount devoted for a particular period by the end of that period. The reason is that project applications can be submitted until the end of a period,

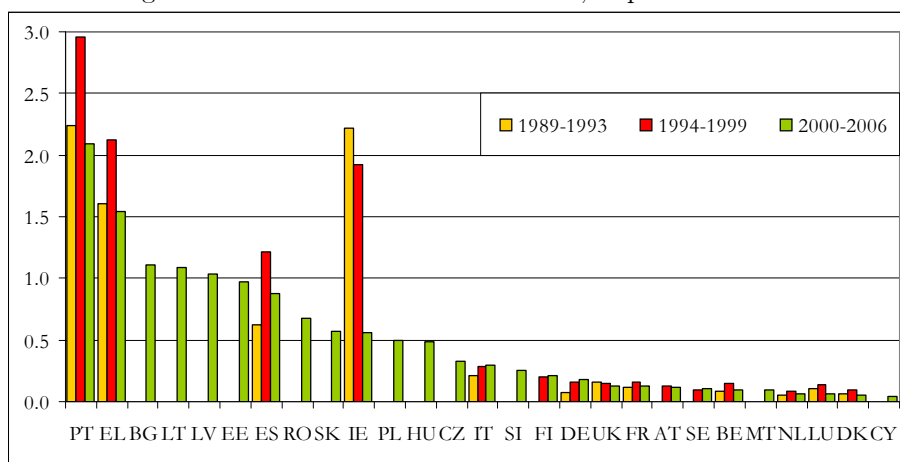
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<sup>4</sup>With the exception of Malta and Cyprus.

thus these project represent development preferences of the particular period. However, they will be undertaken and paid out in the next period<sup>5</sup>. We cannot account for these overlapping periods, so each periods data represent the amount actually paid out in that period.

Figure 1 shows the funds received in percent of the Gross National Income (GNI). On average, Portugal received the most, above 2% of the GNI in each period. Ireland also used about 2% in the first two periods, however as they reached and exceeded the average development level of the EU, they received only a fraction of the previous amount. The other two cohesion countries, Greece and Spain obtained funds between 1 and 2% of their GNI. Among the 12 new member states, Bulgaria attained more than 1% from the pre-accession funds in the 2000-2006 period, which is the double of what the four Visegrad countries<sup>6</sup> received. The developed old EU countries obviously did not benefit that much from the funds, having received less that 0.3% of their GNI.

Figure 1: The amount of funds received, in percent of GNI

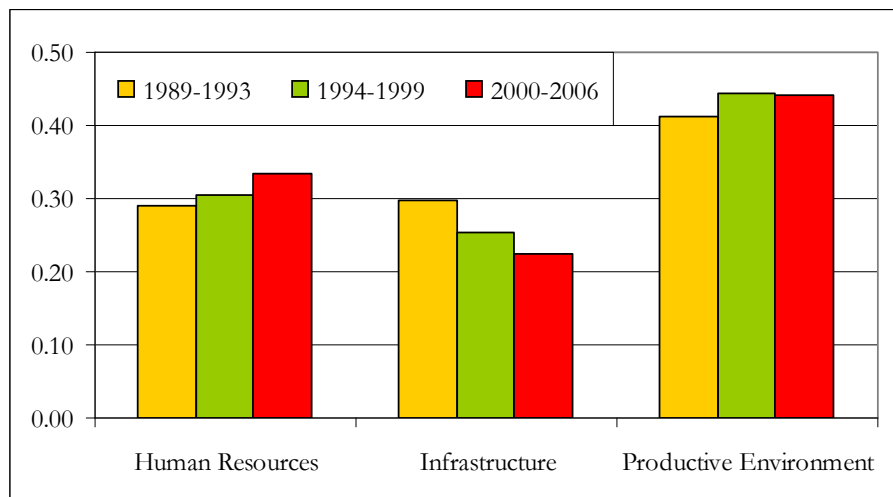


The amount of funding can be spent on three main purposes. On average, 40% was devoted to productive environment, the ratio being rather stable over the examined period. An increasing share was spent on human resources development, while spending on infrastructure decreased from 30% in the first period to about 20% in the third period. In ex ante evaluations, investment in human resources and infrastructure are considered effective, while spending on productive environment is taken as consumption of the recipient, and thus being ineffective. We want to test the appropriateness of this assumption by

<sup>5</sup> At the beginning of each programming period, annual financial allocations are prepared each Programme. Programmes are then required (or, are allowed) to spend funds by the end of the second year following the year in which they are allocated. This is called the N+2 rule.

<sup>6</sup> These are: the Czech Republic, Hungary, Poland and Slovakia.

Figure 2: The distribution of funds (total = 1)



separating the funds due to the purpose of spending.

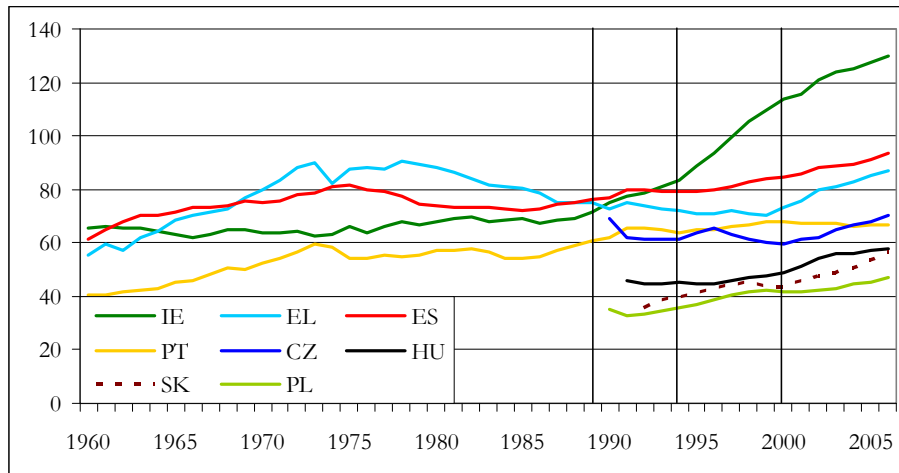
Behind the averages reviewed above, there are considerable differences among the individual countries. Three of the cohesion countries, Spain, Greece and Portugal allocated significantly more to infrastructural development, about 40-50% of the total funding, while they spent less on human resources. Ireland as a contrast, favored the improvement of human resources, allocating more than one third of the funds to that purpose. In the 2000-2006 period, most of the new member states spent more than average on productive environment (Hungary, Poland and the Czech Republic well above 50%) and less on the other two purpose. The exemptions are the Baltic states and Slovakia, which preferred infrastructural development (about 40% of the total expenditure). The more developed EU members allocated more to productive environment and the least to infrastructure, which is usual, since they already had a more developed infrastructure. Besides, less regions were entitled to receive funds for Objective 1, which covers most of the infrastructural investments.

### 3.3 Convergence of the beneficiaries

As mentioned before, the structural funds were reformed in the eighties, and more money was allocated for cohesion and convergence. On Figure 3., we depicted the convergence path of the cohesion countries and some new member states, to see if there was any change in the trend of convergence.

The outstanding example is Ireland. The country was practically stagnating in the 60's to 80's period and its GDP per capita stood at 70% of the EU. From the late 80's, the miracle have started: Ireland reached the average development

Figure 3: Convergence of selected countries (EU15 =100)



level of the EU by the late 90's and exceeded it by 30% by 2006. We are aware though that this excessive pace of growth cannot be solely dedicated to the funds. Ireland went through a series of beneficial shocks and reforms in the second half of the 80's. According to Barry (2003), these were the new fiscal strategy allowing tax reductions, the development of the social partnership model of wage determination, a huge inflow of FDI, and the doubling of the Structural and Cohesion funds. The fiscal strategy included cuts in expenditures rather than increasing incomes, which was the base of the previous consolidation attempts. A favorable external effect was the boost in the UK economy, which attained the domestically unemployed Irish workforce, this way reducing social expenditures. A consequence of these changes was not only a fast growth, but also a drop in inflation and unemployment, and a significant increase in employment.

As a contrast, Greece was even diverging in the 80's and 90's. Most probably the reason was the instable macroeconomic environment, the lack of transparent fiscal policy and as a consequence, the ineffectiveness of investments. Also the forced disinflation of 90's might have hindered convergence. Reforms (including that of state owned companies and healthcare) only started in the late 90's, which seem to have a positive effect: in the last decade, the pace of catching up exceeded that of the Visegrad countries and was close to that of Ireland.

Portugal and Spain converged at about the same slow pace in the nineties; however, the former country's relative development came to a halt in the new millennium. Portugal experienced an expansion in domestic demand in the nineties as a consequence of decreasing interest rates and cheap credits. However, after the introduction of the euro, fiscal policy remained undisciplined with structural reforms being ineffective. Fast wage growth fuelled domestic de-

mand further; however, production shifted towards non-tradables. As a result, consumption became fed by high imports and growth slowed down. Boosting Spanish convergence since the second half of the nineties can be attributed to the significant labor market reforms reducing the unemployment rate; low interest rates and moderate wage increases.

Looking at the way the four countries used the funds, underlying differences can be noticed. In Ireland, national co-financing had an outstanding role.

**TO BE COMPLETED!**

## 4 Estimation results

### 4.1 Data

At first, we constructed three time periods corresponding to the planning periods of the EU. These are: 1989-1993;1994-1999; 2000-2006. The reason behind choosing 1989 as the starting point is that the Structural Funds were reformed in 1988, and as Cappelen et al. (2003) finds, the reform brought a change in the effectiveness of the funds. Unfortunately, we do not have data (either on funds, on macroeconomic variables, or both) for all the current EU countries for all the periods. Germany is left out in the first period because of the unification, which resulted in inconsistency in the data. Austria, Sweden and Finland joined the EU in 1995, thus they are taken into account only in the second sub-period, assuming that they received no funding in the first period. The ten countries that joined the EU in 2004, are only considered in the third sub-period. They have received funding prior to the year 2000 from the pre-accession funds, however, this was not a significant amount.<sup>7</sup> In spite of that, we included Bulgaria and Romania in the third period, because they received even more funding than the NMS-10 countries. The following table presents the list of the countries used in the different sub-periods.

Table 1: The sample used

Period	List of countries	Number of observations
1989-1993	EU-12 less Germany	11
1994-1999	EU-15	15
2000-2006	EU-27	27
1989-2006		53

### 4.2 Methodology

First we estimated a convergence equation standard in the literature (see Barro(year), Mankiw-Romer-Weil(1995?)):

$$g_{i,t} = \alpha_0 + \alpha_1 \log(GDP_{i,0}) + \sum_{j=2}^4 \alpha_j X_{it} + \varepsilon_{i,t} \quad (1)$$

, where the matrix  $X$  contains the log of the investment rate ( $\log invest_{it}$ ), the log of the human capital ( $\log human_{it}$ ) and the change in the employment

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<sup>7</sup>The entry "Pre-accession strategy" appeared only in 2000 in the EU budget, thus we were unable to collect country-level data prior to 2000. However, from the data on 1999 and 2000, it can be estimated that the 10 new member states altogether received an amount equivalent of less than 5% of the structural funds, or between 0.0 and 0.3% of their GNI.

rate ( $dempl_{it}$ )<sup>8</sup>. Then we included the amount of funding in percent of GNI into equation 1:

$$g_{i,t} = \alpha_0 + \alpha_1 \log(GDP_{i,0}) + \sum_{j=2}^4 \alpha_j X_{it} + \alpha_5 fund_{it} + \varepsilon_{i,t} \quad (2)$$

In order to examine the conditional effectiveness of the funds (i.e. that their effect depends on institutional quality), we included an interaction term into equation 2:

$$g_{i,t} = \alpha_0 + \alpha_1 \log(GDP_{i,0}) + \sum_{j=2}^4 \alpha_j X_{it} + \alpha_5 fund_{it} + \alpha_6 fund_{it} \times inst_{it} + \varepsilon_{i,t} \quad (3)$$

The interpretation of  $\alpha_5$  and  $\alpha_6$  needs a little explanation. If  $\alpha_5$  is positive and significant, it means that the funds are effective, no matter what institutional quality a country has. However, if  $\alpha_5$  is either negative or statistically indifferent from zero, the funds are either completely ineffective, or their effect depends on the institutions. The size and significance of  $\alpha_6$  does not tell much in itself since the partial effect of the funds is as follows:

$$\frac{\partial g}{\partial funds} = \alpha_5 + \alpha_6 \times institutions \quad (4)$$

In order to get a picture about the conditional effectiveness of the funds, we evaluated the partial effects at different levels of the institutional indicators. We used the mean, median, minimum and maximum level, as well as values of some selected countries. We used the Wald test to decide if 4 significantly differs from zero.

As it is familiarized by e.g. Mauro (1995) and Acemoglu et al. (2001), institutions are likely to be endogenous in growth regressions. In order to overcome this problem, we also estimated 3 with Two Stage Least Squares. Our institutional variables were corruption, the quality of public institutions and openness, using the distance to equator and the period being independent as instruments<sup>9</sup>. The sources and construction of these indicators are presented in the Appendix.

<sup>8</sup>In most of the convergence equations, population growth plus depreciation is used, however, this variable did not prove to have any explanatory power in our equations. In spite of that, we suspected that we face omitted variable bias if we leave out the change in employment variable.

<sup>9</sup>The idea behind the chosen instruments is that Northern countries have better institutions, and countries that became independent earlier, have more experience in developing and running suitable institutions. We used the natural logarithm of the years being independent. This is indicated by intuition that the institutions of countries being "older" is already developed and changes very slowly; however, countries gaining "new" independence improve their originally weak institutions faster, since they are able to adopt good practices.

Both instruments proved to be strong, thus appropriate to use.

To deal with possible small sample size problems and to check robustness, we reproduced the estimations using yearly data. The specification of the equations slightly differ: we also used the lagged growth and in case of the initial GDP, we took the GDP per capita data lagged by one.

### 4.3 Regressions on period means

In the basic regression, all the variables were significant at 5%, indicating a speed of convergence of 2.6% per year. In equation 2., the coefficient on fund is 0.47 and significant, which means that a one percentage point increase in the amount of funding enhanced growth by almost half a percentage points in the sample. However, if we reestimate equation 2 with leaving out Ireland from the sample,  $\alpha_5$  becomes much smaller and does not differ significantly from zero. In order to get an intuition about the role of institutions and about the possible explanation for the difference between the 'including Ireland' and 'excluding Ireland' results, we split the sample into two, one subsample containing countries with worse than average institutions, and the other with good institutions. The results clearly differ in the two subsamples: in the "bad institutions" subsample, the coefficient on funds is insignificant, while in the "good institutions" regression it is significant and high (1.41). It is worth noting that among the countries receiving the most funding, i.e. the cohesion countries, only Ireland belongs to the "good institutions" group. It is also interesting that no convergence shows among this latter group; however, the sample is really small consisting only 24 observations.

In case of the regressions containing the corruption and political institutions variables, both the coefficient on the funds and on the interaction term are significant in the TSLS estimations, at least at 10%. The calculation of the partial effects shows that in countries with better than average corruption and institutions (e.g. in Ireland), the funds are effective; however, in countries with more corruption or worse institutional structure (especially Greece and the new member states), the funds have no growth effect<sup>10</sup>. The openness regression shows similar effects, with the difference that the NMSs are "too open", compared to their institutions. The calculation of partial effects thus shows a positive growth effect of the funds in these countries.

In the panel regressions, we decomposed the amount of funding according to the purpose of spending. In these, the effect of spending on infrastructure is very small (0.19) and statistically not different from zero. Spending on human resources and productive environment increase growth (the coefficients are 1.61 and 1.84, respectively), however, if we take out Ireland of the sample, the coefficients become insignificant, in accordance with the previous results.

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<sup>10</sup>We do not think that the funds might affect growth negatively, not even in case of the most corrupt countries.

## 4.4 Panel regressions

In the panel regressions, we estimated each equation both by Panel OLS and by Least Squares Dummy Variables (LSDV). This latter includes cross-section and period fixed effects; the appropriateness of use is confirmed by the redundant fixed effect and the Hausmann test.

First we experimented with different lag structures of the fund. The strongest explanatory power showed at the second lag, however, the first three lags were also jointly significant. The POLS estimations basically produced the same result as the pooled regressions (an effect between 0.4 and 0.5); however, in case of the LSDV estimations the coefficient on the funds was only significant at 10%. In order to be able to use the same interaction terms as before, we constructed a moving average of the fund series, i.e. in each year we took the average amount of the current and the previous two years. The estimation with this variable showed a significant effect of 0.43, however, the significance disappeared when using the LSDV model. If we excluded Ireland from the sample, both the POLS and the LSDV estimations produced insignificant coefficients. If we splitted the sample into "bad institutions" and "good institutions" subsamples, the effect was smaller in the former subsample in both estimations; however, the coefficient on funds was not significant in the LSDV estimation.

In the estimations containing the interactions terms we get significant results; however, the use of fixed effect is misleading here, since the institutional variables have little time variation and they serve as quasi cross-country fixed variables. Using different values of the institutional variables, the partial effects have the same sign as in the pooled estimation, however, their size is smaller. Nevertheless, it seems that the funds contributed positively in Ireland (and in more developed countries with better institutions), however, they did not have any effect in the other cohesion countries and in the new member states.

## 4.5 Indirect effects of the funds

Up to this point, the effect reported were the direct effect of the funds on growth. However, it can be expected that the funds also have an effect through employment and investment. Thus we estimated a simple Vector Autoregression model, where growth, employment and investment are endogenous variables, while funds, initial income, and human capital are taken as exogenous. With the estimated coefficients, we simulated the path of the endogenous variables in case a country receives funding equal to one percent of its GNI for seven consecutive years, and then receives nothing. It is important to note, that the interaction between the funds and institutions do not appear in the VAR, and country-specific effects (i.e. cross-country dummies) are also not controlled for, thus the following simulations are consistent with an impact elasticity of 0.4 as well as 0.2 (but insignificant), including as well as excluding Ireland, respectively. The results of the simulations are presented in the following figures<sup>11</sup>.

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<sup>11</sup>It is important to note, that these simulations do not involve the estimated effects of institutions or country-specific effects.

Table 2: Estimated partial effect of the funds

Partial effects	Corruption	Institutions	Openness	
	TOLS	TOLS	POLS	LSDV
Mean	0.62***	0.46*	0.60***	0.10
Median	0.70***	0.61**	0.42**	-0.17
Maximum	2.64***	3.57***	2.24***	2.60***
Minimum	-2.13***	-2.72***	-0.09	-0.93
IE	1.19***	1.19***	1.12***	0.90**
ES	0.04	-0.27	0.08	-0.68
EL	-0.75*	-0.72*	-0.04	-0.86
PT	0.27	0.37	0.28	-0.37
HU	-0.62*	-0.12	1.27***	1.12***
CZ	-1.11**	-0.95**	1.31***	1.19***
SK	-1.18**	-0.96**	1.60***	1.62***
PL	-1.46**	-1.84**	0.42**	-0.17
RO	-1.97***	-2.20**	0.57***	0.06
BG	-1.23**	-1.39**	0.97***	0.67*

\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

First of all, there is a considerable difference between the growth rates if we estimate the VAR with or without Ireland in the sample. In the former case, the additional growth goes up to 1.3 percentage point by the 7th year, while in the latter, the highest extra growth is 0.9 percentage point (Figure ??). The former result corresponds to the HERMIN estimation of the Spanish growth impact of the 1994-1999 funding, when Spain received 1.2% funding of its GNI (EC 2003).

There is not much difference between the two estimations in case of the employment rate and investment rate. The investment rate increases by about 12-14%, i.e. a 20% investment rate goes up to 22.5% (Figure ??). The employment rate goes up by half a percentage point by the end of the seven-year period, and the effect dies out in three years (Figure ??). The effect on investment is more persistent, than in case of the other two endogenous variables.

Figure A.4 shows the additional income level due to the funding. The 100% horizontal axis represents a baseline growth path with no funding; compared to that, the income level increases by 8-10 percentage in the long run.

Finally, we calculated the "return of the funds", as presented on Figure A.4. This means, in each year we compared the cumulative increase of the GDP to the cumulative amount of the funding. If we take all countries, the return is negative in the first five years; roughly spoken, a country receives more money than it makes out of it. From the sixth year on, the return increases steeply to a maximum of about 3.5 percentage points. However, taking the VAR estimations without Ireland in the sample, the return is negative in the first 12 years and reaches only one percentage point in the long run.

OR

Finally, we calculated the "average yearly net return of the funds", as presented on Figure A.4. This means, in each year we compared the cumulative increase of the GDP to the cumulative amount of the funding, divided by the number of years the funds have been flowing in. If we take all countries, the return is negative in the first five years; roughly spoken, a country receives more money than it makes out of it. From the sixth year on, the return increases steeply to a maximum of a 0.3 percentage points on average. However, taking the VAR estimations without Ireland in the sample, the return is negative in the first 12 years and practically remains zero after.

HERE COMES THE REMAINING PART, WHERE A SIMPLE MODEL **INCLUDING INSTITUTIONS** IS USED FOR SIMULATING THE FUTURE GROWTH EFFECTS OF THE FUNDS.

Distinction from the VAR:

- institutions (maybe corruption) included as exogenous
- contemporary endogenous variables also included
- scenarios can be built: stable, but weak institutions; improving institutions

## 5 Conclusions

### References

- [1] Capellen
- [2] Ederveen
- [3] Mankiw-Romer-Weil
- [4] etc

## A Appendix

### A.1 Description of the variables

gdph	GDP per capita in constant purchasing power parities. Source: AMECO database.
growth	Yearly growth of GDP per capita, defined as $(\log(gdph_t) - \log(gdph_{t-k}))/k$ , where $k=5,6$ and $7$ in the pooled estimations and $k=1$ in the panel estimations. Source: calculated from the AMECO database.
invest	Gross fixed capital formation in percent of the GDP, period average. Source: AMECO.
human	Percentage of the population aged 25 to 64 having completed at least upper secondary education. Source: Eurostat.
d(empl)	Yearly change in the employment rate. Source: AMECO.
fund	The amount of funding under the EU budget entry "Structural actions", divided by GNI. Source: EU Budget, 2007 Financial Report.
corrupt	Corruption Perception Index. A value of 1 indicates the most corruption, a value of 10 the least. Source: Transparency International.
inst	Quality of public institutions. Source: World Economic Forum. A relative value was composed from the original values (1: worst, 10: best), where the average of EU-15 equals 1.
open	Openness, defines as the sum of exports plus imports divided by the GDP. Source: Eurostat.
distance	Distance to equator. Source: Google Earth; <a href="http://jan.ucc.nau.edu/~cvm/latlongdist.html">http://jan.ucc.nau.edu/~cvm/latlongdist.html</a>
indep	The logarithm of the years a country has been independent. Source: Democracy Time-Series Data Codebook.

## A.2 Regressions on period means

Table 3: Basic specifications and the role of institutions

Basic specifications	Basic	Funds only	Excluding Ireland	"Bad" institutions	"Good" institutions
<i>c</i>	7.201 (1.311)***	4.179 (2.499)	7.249 (1.779)***	11.514 (1.900)***	-5.261 (5.536)
<i>log(gdpb)</i>	-2.615 (0.390)***	-2.285 (0.629)***	-2.491 (0.624)***	-3.831 (0.316)***	1.853 (0.811)**
<i>log(invest)</i>	2.398 (1.140)**	2.216 (1.044)**	3.315 (1.063)***	3.690 (0.962)***	-2.949 (0.571)***
<i>log(human)</i>	1.564 (0.467)***	1.956 (0.231)***	1.826 (0.303)***	1.766 (0.192)***	-0.929 (0.767)
<i>d(empl)</i>	1.480 (0.647)**	1.355 (0.629)**	0.935 (0.513)*	0.800 (0.637)	1.862 (0.206)***
<i>funds</i>		0.469 (0.178)**	0.086 (0.200)	-0.011 (0.276)	1.408 (0.159)***
Number of observations	53	53	50	29	24
R-squared	0.627	0.639	0.645	0.845	0.763
Adjusted R-squared	0.596	0.600	0.604	0.811	0.697
F-statistic	20.163***	16.627***	15.962***	25.089***	11.559***

Note: Heteroskedasticity robust standard errors in parenthesis.  
\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

Role of institutions	Corruption		Institutions		Openness	Fedtype
	OLS	TSLs	OLS	TSLs	OLS	OLS
<i>c</i>	6.032 (1.019)***	16.901 (5.185)***	5.177 (2.098)**	12.331 (5.800)**	5.397 (2.281)**	0.075 (0.027)***
<i>log(gdpb)</i>	-2.643 (0.456)***	-4.740 (1.657)***	-2.484 (0.595)***	-3.906 (1.608)**	-1.891 (0.495)***	-0.020 (0.004)***
<i>log(invest)</i>	2.669 (0.818)***	5.327 (2.320)**	2.426 (0.997)**	3.931 (2.103)*	2.503 (1.352)*	0.033 (0.013)**
<i>log(human)</i>	1.955 (0.294)***	1.948 (0.733)**	1.948 (0.251)***	1.888 (0.442)***	1.492 (0.298)***	0.014 (0.001)***
<i>d(empl)</i>	1.242 (0.505)**	0.575 (0.628)	1.312 (0.573)**	1.002 (0.581)*	0.925 (0.547)*	1.349 (0.651)**
<i>funds</i>	-1.097 (0.830)	-10.285 (4.419)**	-1.334 (0.480)***	-14.264 (7.535)*	-1.002 (0.279)***	-0.002 (0.004)
<i>interaction</i>	0.237 (0.144)	1.627 (0.711)**	1.884 (0.722)**	15.396 (8.005)*	2.530 (0.185)***	0.010 (0.005)*
Number of observations	53	53	53	53	53	53
R-squared	0.650	0.278	0.645	0.317	0.711	0.669
Adjusted R-squared	0.604	0.184	0.599	0.228	0.673	0.626
F-statistic	14.215***	21.476***	13.943***	20.418***	18.868***	15.503***
Funds and interaction joint significance	1.563	5.447**	3.821*	1.204	24.013***	14.989***

Note: Heteroskedasticity robust standard errors in parenthesis.  
\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

Table 4: Partial effect of the funds in countries with different institutions

Partial effects	Corruption	Institutions	Openness
Mean	0.76	0.38	0.81***
Median	1.07*	0.67	0.48*
Maximum	5.68**	6.49*	3.20***
Minimum	-5.61**	-4.92*	-0.32
IE	2.27**	1.82	1.65***
ES	-0.65*	-1.17	-0.09
EL	-2.41**	-2.10	-0.24
PT	-0.20	0.36	0.28
HU	-2.10**	-0.56	1.98***
CZ	-3.52**	-2.41	1.93***
SK	-3.88**	-2.10	2.39***
PL	-4.15**	-3.47	0.41
RO	-5.6**	-4.15*	0.73**
BG	-3.92**	-3.02	1.40***

\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

Table 5: The effects of the funds spent on different purposes

Purpose of spending	Infrastructure	Human Resources	Productive Environment
$c$	6.475 (1.916)***	4.493 (2.449)*	2.530 (2.792)
$\log(gdpb)$	-2.890 (0.794)***	-2.554 (1.016)**	-2.270 (1.008)**
$\log(invest)$	1.699 (0.627)***	1.971 (0.622)***	1.648 (0.706)**
$\log(human)$	1.645 (0.357)***	1.966 (0.202)***	2.090 (0.244)***
$d(empl)$	1.759 (0.457)***	1.563 (0.373)***	1.607 (0.429)***
$funds$	0.189 (0.363)	1.611 (0.733)**	1.838 (0.683)***
Number of observations	51	51	51
R-squared	0.615	0.631	0.635
Adjusted R-squared	0.572	0.590	0.594
F-statistic	14.379	15.406	15.651

Note: Heteroskedasticity robust standard errors in parenthesis.

\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

### A.3 Regressions on years

Table 6: results1

	Basic		Funds, regr. 1		Funds, regr. 2		Funds, regr. 3	
	POLS	LSDV	POLS	LSDV	POLS	LSDV	POLS	LSDV
$c$	3.080 (1.364)**	15.033 (5.919)**	1.000 (1.751)	14.215 (7.204)**	-0.316 (1.784)	7.226 (6.785)	0.143 (1.877)	10.266 (8.741)
$growth(-1)$	0.473 (0.061)***	0.298 (0.086)***	0.445 (0.070)***	0.288 (0.091)***	0.485 (0.077)***	0.240 (0.073)***	0.474 (0.081)***	0.223 (0.078)***
$log(gdp/b)$	-1.540 (0.301)***	-4.350 (1.801)**	-1.345 (0.258)***	-4.146 (1.847)**	-1.022 (0.321)***	-2.779 (1.404)**	-1.098 (0.319)***	-3.119 (2.023)
$log(finnet)$	1.398 (0.592)**	1.797 (1.317)	1.390 (0.598)**	1.823 (1.262)	0.882 (0.700)	1.091 (1.125)	1.183 (0.698)*	1.749 (1.251)
$log(buman)$	1.229 (0.263)***	0.554 (0.959)	1.573 (0.299)***	0.607 (1.048)	1.420 (0.316)***	1.076 (1.347)	1.497 (0.344)***	0.849 (1.437)
$d(empl)$	0.549 (0.136)***	0.452 (0.133)***	0.551 (0.141)***	0.454 (0.145)***	0.543 (0.137)***	0.499 (0.154)***	0.544 (0.124)***	0.445 (0.166)***
$funds(0)$			0.336 (0.217)	0.135 (0.367)			-0.113 (0.496)	0.086 (0.435)
$funds(-1)$							-0.048 (0.681)	-0.500 (0.592)
$funds(-2)$					0.438 (0.152)***	0.525 (0.310)*	0.584 (0.527)	0.869 (0.497)*
<i>Joint significance of the lags</i>							0.423 (0.173)**	0.456 (0.469)
Number of observations	317	317	321	321	306	306	280	280
R-squared	0.644	0.826	0.637	0.816	0.689	0.848	0.672	0.846
Adjusted R-squared	0.638	0.796	0.630	0.784	0.683	0.819	0.662	0.814
F-statistic	112.562***	27.258***	91.718***	25.193***	110.287***	29.846***	69.454***	25.880***

Note:  
POLS: Panel OLS  
LSDV: Least Squares Dummy Variables (cross-country and period fixed effects)  
Heteroskedasticity robust standard errors in parenthesis.  
\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

Table 7: results1

	Funds only		Excluding Ireland		Bad institutions		Good institutions	
	POLS	LSDV	POLS	LSDV	POLS	LSDV	POLS	LSDV
$\epsilon$	-0.109 (1.832)	11.334 (9.150)	1.926 (2.057)	11.882 (11.513)	3.708 (2.995)	16.304 (13.408)	-5.320 (3.377)	5.174 (13.527)
$growth(-1)$	0.468 (0.083)***	0.215 (0.076)***	0.453 (0.101)***	0.187 (0.074)**	0.472 (0.110)***	0.287 (0.132)**	0.349 (0.106)***	0.169 (0.107)
$log(g^{\beta}b^{\beta})$	-1.014 (0.334)***	-3.113 (2.106)	-1.157 (0.383)***	-3.756 (3.130)	-1.525 (0.587)**	-2.124 (2.906)	0.508 (0.733)	-3.920 (2.954)
$log(invest)$	1.220 (0.689)*	2.020 (1.415)	1.825 (0.621)***	1.676 (1.232)	2.451 (0.838)***	3.797 (2.255)*	-0.154 (1.435)	2.244 (2.540)
$log(human)$	1.507 (0.325)***	0.693 (1.401)	1.378 (0.349)***	0.918 (1.421)	1.397 (0.287)***	-0.617 (1.855)	1.088 (0.720)	2.962 (2.275)
$d(empt)$	0.586 (0.145)***	0.487 (0.157)***	0.541 (0.149)***	0.477 (0.103)***	0.338 (0.133)**	0.217 (0.209)	1.001 (0.263)***	0.876 (0.392)**
$funds$	0.431 (0.176)**	0.380 (0.462)	0.205 (0.146)	0.127 (0.514)	0.332 (0.166)**	-0.012 (0.672)	0.776 (0.326)**	0.614 (0.824)
Number of observations	280	280	264	264	124	124	156	156
R-squared	0.670	0.842	0.665	0.853	0.782	0.902	0.547	0.785
Adjusted R-squared	0.662	0.810	0.657	0.822	0.771	0.856	0.529	0.722
F-statistic	92.205***	26.362***	84.903***	27.411***	69.941***	19.786***	29.973	12.490

Note:

POLS: Panel OLS

LSDV: Least Squares Dummy Variables (cross-country and period fixed effects)

Heteroskedasticity robust standard errors in parenthesis.

\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

Table 8: results1

	Corruption		Institutions		Openness	
	TSL	TSLSDV	TSL	TSLSDV	POLS	TSLSDV
$c$	4.653 (2.71)*	20.253 (11.687)*	4.832 (2.886)*	19.337 (10.644)*	1.699 (2.016)	9.757 (8.682)
$growth(-1)$	0.421 (0.089)***	0.215 (0.099)**	0.407 (0.091)***	0.214 (0.086)**	0.371 (0.093)***	0.165 (0.079)**
$log(gdp/b)$	-2.034 (0.493)***	-6.711 (2.984)**	-1.959 (0.513)***	-9.531 (4.264)**	-1.054 (0.323)***	-2.780 (1.736)
$log(invest)$	2.500 (0.781)***	2.949 (2.008)	2.774 (0.881)***	0.308 (1.461)	1.637 (0.676)**	1.960 (1.287)
$log(human)$	1.648 (0.326)***	1.309 (1.435)	1.665 (0.326)***	2.561 (1.960)	1.309 (0.317)***	0.917 (1.486)
$d(empl)$	0.505 (0.152)***	0.364 (0.125)***	0.541 (0.158)***	0.744 (0.137)***	0.545 (0.143)***	0.432 (0.137)***
$fundz$	-3.818 (1.241)***	6.048 (1.970)***	-7.342 (2.533)***	15.086 (6.466)**	-0.490 (0.259)*	-1.546 (0.887)*
$interaction$	0.646 (0.186)***	-0.792 (0.277)***	9.018 (2.981)***	-17.093 (7.377)**	1.511 (0.388)***	2.293 (0.785)***
Number of observations	280	280	280	280	280	280
R-squared	0.619	0.818	0.586	0.779	0.692	0.851
Adjusted R-squared	0.609	0.781	0.576	0.733	0.684	0.820
F-statistic	84.965	26.066	85.345***	26.066***	87.330	27.470

Note:

TSL: Two Stages Least Squares

TSLSDV: TSL with cross-section and period fixed effects

POLS: Panel OLS

LSDV: Least Squares Dummy Variables (cross-country and period fixed effects)

Heteroskedasticity robust standard errors in parenthesis.

\*, \*\*, \*\*\*: significance at 10%, 5% and 1%, respectively

## A.4 Simulation results

