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Growth and project finance in the least developed countries

Lisbeth F. la Cour¹ and Jennifer Müller²

Abstract

This article examines the effects of project finance on economic growth in the least developed countries (LDC). Inspired by the neoclassical growth model we set up an econometric model to estimate the effects of project finance for a sample consisting of 38 of the least developed countries using data from the period 1994-2007. The results of our study suggest, that project finance has a significant positive effect on economic growth and therefore constitute an important source of financing in the selected set of countries. Additionally, the project sheds light on other factors of importance for economic growth in LDCs. We find that a higher regulatory quality, lower government consumption and a higher level of education helps increase growth. The significance of these variables are, however, not as consistently robust as the results for project finance.

Keywords: Project Finance, Economic Growth, Least Developed Countries, Foreign Direct Investment

JEL Classification: F43, G15, O16

1. Introduction and Motivation

Worldwide, a growing portion of infrastructure and natural resource projects, are funded by project finance. Even though most of the project finance is invested in developed countries, project finance funds constitute an important and growing portion of foreign investment to developing and even the Least Developed Countries (LDCs). The United Nations (United Nations, 2010) refers to three criteria to identify a country as LDC: low income, human resource weakness and economic vulnerability. To be categorized as a LDC all three criteria have to be fulfilled. With financing being particularly scarce in LDCs, project finance helped to fund major infrastructure and natural resource projects. Many projects were made possible only because of the use of project finance. The potential of project finance as a development tool for developing countries is also recognized by

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development organizations like the World Bank, the International Finance Corporation (IFC), the African Development Bank or the European Investment Bank, which are often key investors and warrantor in project finance deals in the LDCs.

Despite the growing volumes of project finance in LDCs and the commitment of the IFC and other developing banks to project finance as a developing tool, the effect of project finance on economic growth in LDCs or even developing countries in general remains surprisingly under-explored. This paper responds by quantitatively examining the importance of project finance for economic development in LDCs.

On theoretical grounds there are two key reasons why project finance is an especially suitable candidate of long-term capital for LDCs and why it can support economic growth in LDCs.

First, project finance has a very unique financing structure. In contrast to corporate loans, project finance is mostly non-recourse or limited-recourse debt for stand-alone projects. Project financing schemes are characterized by a high level of debt and extensive long-term contracting to guarantee an effective risk distribution. Due to its unique characteristics project finance is often better able to mitigate risk and reduce transaction costs than other forms of foreign direct investment or commercial loans. In addition it is not dependent on local financial markets. Thereby project finance enables investors to enter economically and politically less stable countries like the LDCs. Due to their underdeveloped to basically non-existing local financial markets, LDCs are more dependent on capital from abroad than other countries. Hence, project finance in LDCs can provide the desired capital for investments and helps LDCs to unlock their natural resources.

Second, project finance not only enables economic growth by creating revenue through taxes, jobs and royalties, but it also creates revenues and spill-over effects by setting up strategically important assets like power plants, harbors and other infrastructure ventures. There is a general consensus that infrastructure investments are a strong driver of economic growth and that the lack of infrastructure is a main source of disincentives to invest (Estache, 2005). Despite the substantial inflow of official development assistance (ODA) into LDCs, investment demands for public services and infrastructure in LDCs by far exceed government and donor resources. Therefore, LDCs are dependent on private capital inflows to develop the needed infrastructure. However, infrastructure assets are particularly prone to creeping expropriation by hostile home governments. Consequently, investors are generally reluctant to invest in infrastructure assets in politically unstable countries. Again, due to its unique characteristics, project finance can mitigate these risks and it is therefore suitable for infrastructure investments even in politically unstable countries. To summarize, project finance can provide the desired private capital for infrastructure investment without increasing the debt burden of the LDCs.

On theoretical grounds there are strong arguments that project finance is particularly suitable for LDCs and that there should be a relationship between project finance and economic growth in LDCs. This is supported by case studies and investigations by the World Bank, which generally reveal a positive economic and social effect of project finance in developing countries (Ahmed, 1999). Somewhat surprising though, the World Bank and

other development banks have not, to the best of our knowledge, empirically investigated the effect of project finance on growth in developing countries. Therefore, we believe that our empirical study can add to the limited research done on project finance in developing countries and can help to shed light on the importance of project finance for LDCs .

In the light of the still ongoing financial crisis, our results are particularly relevant. Due to the financial crisis, project finance volumes dropped considerably in the LDCs. With liquidity drying up, many banks refrain from long-term investments like project finance. Due to the reduced supply of project finance loans, project finance costs increased considerably and risky projects like those in LDCs are affected the most. As a result, more project finance deals in developing countries are seeing delays or even cancellation.

As this study shows, project finance can have a significant positive effect on economic growth in LDCs. Therefore, in case project finance volumes continue to decline or remain low in the aftermath of the financial crisis, this development can pose a new threat to economic growth and recovery in the LDCs (Leigland and Russell, 2009).

In order to substitute for the declining project finance loans issued by commercial banks, the World Bank, the IFC and other development banks have to commit themselves even stronger to project finance by increasing their loan volumes and guarantees in LDCs and by giving assistance and advice in project finance deals.

In section two of the paper we review some of the literature on project finance both theoretically and empirically. In section 3 we present our model and methodology and we discuss our data. Section 4 contains our empirical results and discussions of these results, section 5 reports results of robustness checks while section 6 concludes.

2. Review and Theoretical Extension

This section reviews and extends the theoretical and empirical literature on project finance and economic growth in LDCs.

2.1 Importance of Capital

Investigating the economic growth effect of project finance in LDCs is strongly linked to the finance growth nexus. The interaction between financial markets and growth has been studied extensively in the finance growth literature and the results generally reveal that financial development stimulates growth. By increasing innovation, human capital and physical capital, financial capital triggers and supports economic growth (Kleimeier and Versteeg, 2010). The finance growth nexus thus implies that developing countries and especially LDCs are at a disadvantage. Given their virtually non-existing financial markets, they are particularly dependent on capital from abroad, like foreign direct investment (FDI) and ODA. However the empirical evidence on the growth enhancing effects of FDI and ODA on economic growth in developing countries is rather ambiguous (Alfaro, 2003). Some researchers find that the positive attributes of FDI only materialize if a certain threshold of development, for example in capital (Borensztein et al., 2004), financial institutions

(Durham, 2004) and financial market development (Alfaro et al., 2004) is already reached¹. Accordingly, Kleimeier and Versteeg (2010) argue that in countries with underdeveloped financial markets not only the quantity of the capital inflow but the quality of the capital inflow matters. They further argue that, given its unique characteristics, project finance can substitute the lack of institutional and financial development.

2.2 Unique Characteristics of Project Finance

In a project finance scheme a so called sponsor, usually a very large multinational company, operating in the relevant sector, sets up a legally independent project company with a limited life (Special Purpose Vehicle). A project finance scheme is further characterized by non- or limited recourse debt, high debt levels and a detailed, long-term contracting.

In the following we address the unique characteristics of project finance and elaborate, why project finance is particularly suitable for the least developing countries. First, project financing schemes help reduce *transaction costs* arising from asymmetric information and it can increase efficient capital allocation.

Managers might be inclined to undertake projects with negative NPV if these projects yield management perquisites. However, the need to raise substantial bank debt in project financing can reduce the risk of funding negative NPV projects (Esty, 2002). Banks are only willing to invest in a high leveraged asset, if they can be sure that the asset will generate sufficient cash flows to service the debt (Finnerty, 2006).

Furthermore, the concentrated equity ownership in project financing gives a stronger incentive for shareholder to control management behavior (Esty, 2002). At the same time the high leverage induces the participating banks to monitor the project performance carefully. In case more banks are involved in financing the project, one bank, mostly the so called lead arranger, will undertake the general monitoring. Given that most projects are large in size, it is not unusual that more than one bank is involved in the financing. Project financing can therefore generate economies of scale in control and reduces monitoring costs. Additionally, the separation of the project from the sponsor in combination with project financing features like covenants², debt service reserve account³, sinking funds⁴ and the finite life of the project makes it easier for shareholder to monitor the investment.

¹ According to a study by Blomström et al. (1992), FDI does not stimulate growth in low-income developing countries.

² Covenants are generally financial ratios that the project entity is not allowed to exceed or resp. to fall short of. A very common covenants in project financing is the Debt Service Coverage Ratio (= CF available for debt service/ debt service). Often covenants in project financing are more extensive than they are in conventional financing. In case a covenant is broken the debt contract will be renegotiated (Finnerty, 2006)

³ If a project performs better than anticipated, the additional cash is transferred to a sinking fund. The sinking fund can be used as an additional source for debt service financing, in case the projects falls short of cash flows later in the project life and works as a buffer (Navigator, 2010).

⁴ Additional cash is set aside to retire back bank debt earlier (Finnerty, 2006).

Generally it is easier to structure a debt contract for a particular project than it is for an entire company (Finnerty, 2006).

Second, project financing can reduce *leverage-induced underinvestment*, arising when a leveraged firm experiences trouble financing attractive projects because of debt overhang at the company level. By using project financing a highly leveraged project structure, with all its advantages, can be achieved, while at the same time a debt overhang problem at the sponsor level can be avoided due to the limited to non-recourse nature of project finance. Project financing can so to say preserve the sponsor's corporate debt capacity as it eradicate all recourse back to the sponsor (Esty, 2002).

Third, project financing enhances *risk allocation and risk management*. The contractual structure of the project entity reduces uncertainty and thereby the cost of capital, by allocating the different risk factors to the project participant that is best able to bear them (Finnerty, 2006). A typical project finance transaction involves 15 parties and on average 40 contractual agreements. Usually there are at least four contracts that manage the supply of input, output, construction and operation. The extensive contracting reduces opportunistic behavior by related parties, like an increase [decrease] in the price of an input [output], once the investment is undertaken. Often crucial off-taker or suppliers are integrated in the ownership group (Esty, 2002).

Also political risks like expropriation can be reduced by using project financing. In developing countries the local government is often part of the project finance agreement, by providing guarantees, own equity and financial or other assurances. Additionally, in developing countries multilateral lending agencies such as the World Bank or the European Bank for Reconstruction are often part of the project company. Their political importance further reduces the risk of expropriation or other political hostile actions against the project. The ability to reducing risk makes project finance an ideal solution for risky projects. Unsurprisingly, a study by Hainz (2002) reveals that project finance is often used for projects with high political risk.

Reducing the risk of expropriation is particularly important for infrastructure investments. Infrastructure investments are tangible and often very capital-intensive investments, which have high location specificity. They cannot easily be moved in case of political or economic distress. Often they require high initial investments and generate a steady cash flow over the project life. Once established the infrastructure asset requires only moderate managerial skills. This makes infrastructure investments especially prone to creeping expropriation and hostile actions by host governments. In his study on project finance and corporate-financed investments in the oil, gas and petrochemical industries, Sawant (2010) only finds limited empirical support that project finance mitigates creeping expropriation. However, he finds empirical evidence that project finance reduces transaction costs arising from concentrated buyer and/or supplier and that project finance reduces the risk arising from large infrastructure investments for multinational enterprises.

2.3 Project Finance in LDCs

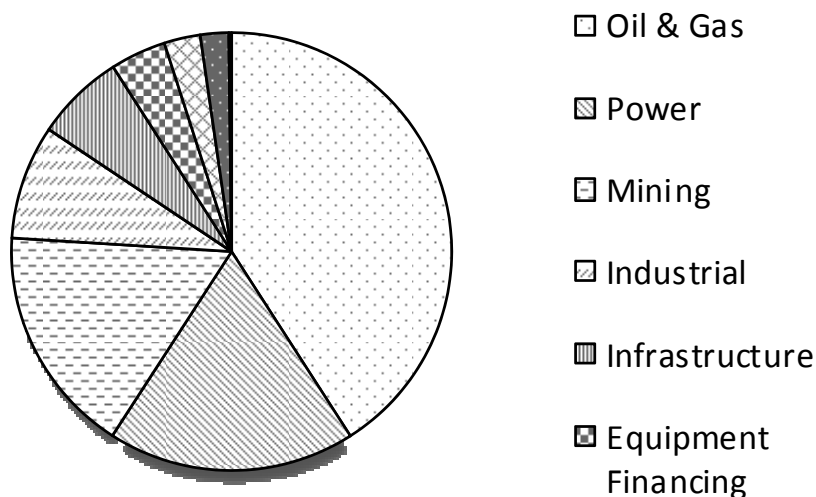
Compared to worldwide project finance volumes, LDCs only attracted comparably little project financing. This is largely due to the fact that LDC exhibit higher country risk and therefore investment risks as compared to developed countries, but also as compared to developing or low income countries⁵. Political unrest, macroeconomic instability, corruption as well as the risk of expropriation are especially prevalent in LDCs. This makes LDCs comparably less attractive for investors. However, compared to other forms of investments, project finance is nevertheless an attractive and especially suitable solution for LDCs, due to its risk mitigation characteristics. As stated earlier, in LDCs local governments are often part of the project finance agreement by providing guarantees or own equity and thereby reduce the political risk and risk of expropriation. Further, according to Dealogic, in nearly half of the project finance projects between 1980 to 2009 multilateral, bilateral and regional agencies, like the IFC or Development Bank of South Africa, were involved in the project finance agreements. The participation of development agencies can reduce political risk and improve the credibility of the project, whereby the project is attractive to commercial lenders even if the project is in a politically unstable LDC. Finally, project finance can reduce the risk of corruption and inefficient capital allocation, which are especially prevalent in LDCs. Due to the high leverage, banks and international companies are only willing to invest in positive NPV projects that will generate sufficient cash to service debt. Therefore, with project financing market mechanisms guide economic activities. Also the involvement of private international companies and banks can effectively reduce corruption ‘within’ the project. To summarize, because of above average country risks in LDCs, project financing, with its unique risk mitigation characteristics, can be a particularly suitable solution for LDCs.

As displayed in Figure 1, project financing in LDCs is primarily applied in oil & gas, power and the mining sector. Given the severe danger of exchange rate fluctuation in LDCs, these sectors are more suitable as their output is priced in hard currencies. Not surprisingly, project financing is less common in the infrastructure sector. Infrastructure projects only generate revenues in local currencies and with substantial foreign currency financing, currency fluctuation impose a major threat.

But even though project finance in road infrastructure is rare in LDCs, a lot of the project finance deals in natural resources induced the construction of supplementary roads for transport. Take for example the Mozal Project in Mozambique in 1998: for the USD 1.4 billion aluminum smelter, Alusaf, a South African natural resource company, the Mozambican government and Eskom, a South African power utility company teamed up. As the aluminum production is energy-intensive, Eskom rebuild some of Mozambique’s damaged electricity infrastructure and produced inexpensive hydroelectric capacity from

⁵ The low income category of countries comes from a classification by the World Bank (2010). There is not a one-to-one correspondence between LDC and low income countries although there is an overlap.

Figure 1: Project finance in our sample by industry



Note: Only the six largest slices are labelled.

the river Zambezi. Today, the Mozal Project provides Mozambique with new electrical and industrial infrastructure. Due to its very successful operation the Mozal Project even saw an expansion in 2001 (Esty, 2004). Another project in Mozambique, the Maputo Port Concession Project Finance deal in 2003, also reveals the spillover effect of project finance. Due to increased freight traffic, which was besides other the result of the Mozal Project, the port was modernized and transport connections by road and rail to neighboring countries were build. The concession improved efficiency and handling volumes doubled (World Bank, 2008).

By helping to unlock LDCs' natural resources, project finance further helps to generate government revenues through royalties and income tax, which can be used to promote further economic development. In project finance deals, where road infrastructure investments are necessary for operation, the government is often part of the project finance agreement and guarantees to provide the necessary transport connections. Even if the government is responsible for supplying the required infrastructure and not the project financing investor, this arrangement makes sure that at least some of the royalties the government receives from a mining or oil project finance deal are used for transportation investments and does not land in the pockets of government representatives or is used for military spending.

In a wider meaning the word infrastructure not only entails roads and ports, but also telecommunication, power generation and water supply. In the LDCs four-fifths of the total energy supply is provided by traditional fuels such as wood fuel. Yet the supply of wood fuel in Africa is only limited and its use causes desertification and environmental degradation. Also, about one-quarter of Africa's hard currency is used to buy petroleum

products from other parts of the world. Given the extensive oil and gas resources of many of the African LDCs, own petroleum production could reduce balance of payments problems and potentially increase electricity supply (Bono, 1992). Another alternative source for energy in Africa is hydro power. From 1980 to 2009 there have been seven hydro power project finance deals worth more than 2.3 billion USD in debt value in the LDCs (Dealogic – Loan Analytic Database).

Hence even though only a small share of the project finance deals of our sample is classified as infrastructure projects there may be hidden infrastructure improvements in many of the other projects as well such that the link from project finance to infrastructure improvements can still be considered a natural channel for ultimate increases in economic growth.

2.4 Project Finance and Economic Growth

As mentioned before, the literature around project finance is still limited. To the best of our knowledge there is only one article so far that quantitatively investigates the effect of project finance on economic growth. In this article by Kleimeier and Versteeg (2010) the authors investigate project finance data from 90 countries. When accounting for the income level of the countries the authors find a significant positive effect of project finance on economic growth in low income countries. For middle and high income countries however, the growth effect is not significant. The authors argue that project finance is especially beneficial to the least developed countries as it “compensates for a lack of domestic financial development”. Inspired by Kleimeier and Versteeg (2010) we focus exclusively on a sample of LDC’s which we see as a natural extension: 1) In their theoretical section Kleimeier and Versteeg argue strongly for effects of project finance in LDC while they end up estimating effects for low income countries and not LDCs. There is an overlap between the two groups of countries but they are certainly not the same. In fact out of the 90 countries Kleimeier and Versteeg (2010) employ in their analysis, only 16 are from our group of LDCs. 2) The low income countries is the only group of countries in their study where they consistently find significant effects of project finance. Hence extending their study, as we do, by exclusively focusing on LDC seems natural. 3) Kleimeier and Versteeg (2010) incorporate a Sub-Saharan dummy, which has a significant negative coefficient in their study. The negative coefficient implies that the Sub-Saharan countries exhibit, on average, a lower GDP growth than the rest of the sample and that this lower growth cannot be explained by the other variables in the regression⁶. The Sub-Saharan dummy captures 12 out of their LDCs⁷. In our study we do not need a dummy to capture special features of the Sub-Saharan countries, which we see as an indication that our model to a larger extent

⁶ The dummy does not imply that the Sub-Saharan countries ‘drop out’ of the sample. GDP growth in the Sub-Saharan countries is affected to the same extent by changes in project finance as the other countries in the sample.

⁷ According to a classification of Sub-Saharan countries by the UNESCO Institute of Statistics (2010).

is able to capture the properties of the countries in our sample. 4) Finally, as our study only looks at LDCs, the coefficients of the control variables can reveal interesting information about the importance of certain variables for growth in LDCs. In the study by Kleimeier and Versteeg's (2010) the control variables' effect apply to a more general context of developing as well as developed countries. It might be that some control variables, which are of importance in a general context of developing and developed countries, end up trivial in a LDC context, and vice versa. Therefore, besides of investigating the growth-effect of project finance in LDCs, our study will also contribute to the limited research that has been done so far on LDCs and growth in general. In our study we employ data for 38 LDC's. For a list of these countries, see Appendix 1. The set of control variables in the study generally follows Kleimeier and Versteeg (2010) and include variables commonly used in the literature. However, due to the focus on LDCs the additional control variable ODA grants was included in the regression, while the control variable 'black market premium' was dropped⁸ due to limited data. Contrary to Kleimeier and Versteeg (2010) we also include a war dummy amongst our controls. Further, some variables (education, regulatory quality and FDI) were drawn from different sources than those used by Kleimeier and Versteeg (2010), because of better data coverage. And finally, for this study marginally longer and more recent periods than those studied by Kleimeier and Versteeg (2010) are used⁹.

3 Data and Econometric Models

3.1 The Models

As the purpose of the empirical analysis is to examine if project finance contributes to economic growth in LDCs, we base the methodology of this study on Kleimeier and Versteeg (2010) and Alfaro et al. (2004). Following the study by Kleimeier and Versteeg (2010), a neo-classical growth framework¹⁰ is assumed, in which countries converge towards their GDP per capita equilibrium. Therefore, a country's GDP growth is a function of its initial GDP (actually the log of initial GDP), project finance (PF) and a set of control variables:

$$\text{GROWTH}_i = \beta_0 + \beta_1 \text{INITIAL GDP}_i + \beta_2 \text{PF}_i + \sum \gamma_j \text{CONTROL}_{ji} + v_i \quad (1)$$

Equation (1) will be estimated by OLS and also by IV methods due to the possible endogeneity of project finance. We have also investigated the model using panel data methods (country fixed effects) on the two sub periods. In general we will keep a pragmatic

⁸ The data on the black market premium used by Kleimeier and Versteeg (2010) are from the New York University's Global Development Network Growth Database. Unfortunately the database runs just until 1999 and has only limited records for LDCs.

⁹ Kleimeier and Versteeg (2010) look at three 5-year periods (1991-1995, 1996-2000, 2001-2005)

¹⁰ The neo-classical framework was first developed in the Swan-Solow and Ramsey-Cass-Koopmans model.

attitude towards model building looking at different models and estimation methods for as long as it is possible to see how this affects our results (Granger, 2009).

The CONTROLS comprise inflation, population growth, regulatory quality, openness, FDI, ODA grants, government consumption and education. A time dummy is incorporated when possible to account for a potential time effect or structural change between the two investigated periods. Finally we include a dummy for war.

In order to reduce the noise of annual data and to mitigate business cycles we use a panel of two 7-year periods from 1994 to 2000 and 2001 to 2007. This procedure is chosen due to the many zeros in the project finance series if analyzed on a yearly basis. The observations start with the year 1994, as for most variables data is available from 1994 onwards. Generally, an observation is included in the regression if at least four out of seven data points are available in the respective period. An observation constitutes the average over the 7-year period. For the period between 1994 and 2000 the source for regulatory quality only provides data for the years 2000, 1998 and 1996. Therefore, an observation is used as long as there are all three data points on regulatory quality available. PF, FDI and ODA are calculated as cumulated shares of the respective variables to GDP. This procedure is quite similar to the procedure used in Kleimeier and Versteeg (2010)¹¹. Due to missing data points, the initial GDP, ODA and FDI in 1994 for the Maldives are estimated by linear extrapolation. Finally, FDI data points for Bhutan (1994, 1998) and Eritrea (1994, 1995) were estimated by linear inter- and extrapolation. Contrary to the other control variables, an observation for education is used as long as there is at least one data point available in the 7-year period. A country's education data does not vary considerably over the years and thus, a single data point for education can still be considered a reasonably good estimate for the average over the 7-year period.

For the regressions 72 observations are used. The observations for Haiti (2001-2007), Laos (1994-2000), Tanzania (2001-2007) and Yemen (2001-2007), drop out because of limited data on one or more of the explanatory variables. Even though formally belonging to the list of LCDs we have excluded Equatorial Guinea from our sample. Equatorial Guinea enjoyed a growth rate of on average 20.29% and in the period 1994-2000 the country surprised with an average growth rate of even 24.02%. The dramatic economic growth in Equatorial Guinea is thanks to the discovery and exploitation of large off-shore oil reserves. In the last decade Equatorial Guinea has become Sub-Saharan Africa's third largest exporter, even though by size it is one of the smallest countries in Africa with only around 700,000 inhabitants. According to the United Nations, Equatorial Guinea enjoys the fourth highest per capita income in the world, after Luxembourg, Bermuda and Jersey. Interestingly, despite the economic growth the living standards of the population only increased marginally. Also Equatorial Guinea is plagued by high corruption, with government officials and their families owning most businesses. The World Bank and the IMF even cut their aid programs due to government corruption and mismanagement (United Nations OHRILLS, 2012). As we can find good economic reasons for this country

¹¹ They, however, use periods of 5 years of duration instead of our 7 years.

and periods to behave differently from the bulk of observations we believe that excluding this country can easily be defended.

3.2 The Data and Descriptive Statistics

The data sources and their definitions are found in Appendix 2. Table 1 displays the descriptive statistics for the dependent and independent variables over the two 7-year periods. The table shows a considerable cross-country variation. Looking at the sample of the OLS regression of equation (1), the mean per capita growth rate over the two 7-year periods is 1.62% with a standard deviation of 2.83. The maximum growth was enjoyed by Sierra Leone (8.07%) in the period 2001-2007, while the Democratic Republic of Congo suffered a growth rate of -5.65% during the first sub period.

Table 1: Descriptive statistics on our variables. Based on the 72 ‘full sample’ observations

Variable	Mean	Std Dev	Minimum	Maximum
Project finance cum. (%)	3.59	9.73	0.00	51.58
FDI cum. (%)	21.67	27.71	-11.59	171.85
ODA cum. (%)	105.87	66.27	9.94	278.41
GDP growth (%)	1.62	2.83	-5.65	8.07
Log og initial GDP p.c.	5.69	0.67	4.39	7.79
Inflation (%)	68.42	487.83	1.01	4149.12
Population Growth (%)	2.55	0.70	0.65	4.23
Openness (% of GDP)	67.40	31.78	21.43	165.86
Regulatory Quality	-0.68	0.52	-2.44	0.61
Gov. Consumption	14.80	8.27	4.48	46.91
Education (%)	24.28	12.45	5.73	72.48
War dummy	0.25	0.44	0.00	1.00

The mean inflation is 68.42% combined with a striking standard deviation of 487.83. The Democratic Republic of Congo has experienced an inflation rate as high as 4149.12% in the period 1994-2000, revealing the macroeconomic problems prevalent in many of the LDCs. Moreover, regulatory quality is low in most of the LDCs, with an average mean of -0.68, implying rather unfavorable business conditions. Cumulative inflow (e.g. stock) of FDI to GDP amount to 21.67%, with a standard deviation of 27.71, revealing that FDI, like project finance, is selective and does not flow to every country equally. The maximum

cumulative FDI inflow was experienced by Chad in the period 2001-2007 with 171.85%. In studies with both developing and developed countries, FDI per annum is generally around 1-2% of GDP¹². The somewhat higher FDI/GDP ratio in this sample, of on average 3.10% in the two 7-year periods, might be due to the comparably lower GDP of LDCs, combined with FDI inflows for mainly rather costly oil operations. The cumulative inflow of project finance over the two 7-year periods in the baseline regression is 3.59% to GDP, which implies an average of about 0.51% per year. Kleimeier and Versteeg (2010), who investigate both developing and developed countries, find that in most years project finance deals account for no more than 0.01% of GDP. Again, the higher project finance to GDP ratio in our sample might be due to the overall lower level of GDP in LDCs. Similar to FDI, project finance inflows exhibit considerable variation, with a standard deviation of 9.73%. There are a lot of countries that experienced no project finance inflows at all, while others, like Chad had cumulative project finance inflows to GDP of as much as 51.58% during the period 2001-2007. Finally, average cumulative inflow of ODA grants is as much as 105.87% of GDP in the two 7-year periods. ODA appears to be an important source for capital in the LDCs. Especially, as ODA grants only constitute part of the total ODA flows. Given the substantial size of ODA disbursements, it is very surprising that most studies cannot find a significant effect of ODA on economic growth. Similar to project finance and FDI, there is considerable variation in the cumulative ODA inflows to GDP across countries. Bangladesh (cumulative ODA/GDP of 9.94% between 2001-2007) had the lowest cumulative ODA inflows to GDP in the sample. Guinea-Bissau experienced the highest inflow of ODA grants relative to GDP in the two 7-year periods, with 278.41% in 1994-2000 and 273.11% in 2001-2007. Government consumption is on average 14.80% of GDP per year in the LDCs. The findings are in line with the average government consumption (15%) reported by Carkovic and Levine (2003) in their study of developing countries and somewhat lower than the average government consumption (around 24%) reported by Kleimeier and Versteeg (2010) in their study of both developing and developed countries. With 4.48% of GDP in 2001-2007, Cambodia has the lowest government consumption in the sample, while government consumption in Eritrea is as high as 46.91% of GDP in the period 1994-2000. Average enrollment in secondary education relative to the population of the age group that officially corresponds to the level of secondary education in the LDCs is 24.28% in the two 7-year periods. Again, there is considerable cross-country variation. The Maldives have the highest enrollment rate with 72.48% in 2001-2007. The lowest rate of enrollment can be found in Tanzania in the period 1994-2000 (5.73%). But also Burundi, Mozambique and Niger have enrollment rates of less than 7% in the period 1994-2000. However, in all three countries the enrollment rate increased by 2-7 percentage points in the subsequent period 2001-2007. As comparison, the enrollment rate in developed countries like the USA or UK is around 95% to 100%.

¹² Alfaro et al. (2004) have a FDI/GDP of 1% in their sample, Carkovic and Levine (2003) show a FDI/GDP ratio of 1.1% and Kleimeier and Versteeg (2010) suggest that FDI is typically between 1% and 5% of GDP.

The descriptive statistics reveal that, even though all the countries in the sample belong to the group of LDCs, there is considerable variation between the countries in terms of social and macroeconomic conditions.

4. Results

The purpose of the empirical analysis is to examine if project finance has a positive effect on economic development in the LDCs. Table 2 presents the results of the OLS estimation of equation (1) on the pooled data set consisting of the two 7-year periods 2001-2007 and 1994-2000. In Table 2, columns one through 3, a robust standard error is provided below each coefficient estimate. Notice, however, that we find no indication of heteroscedasticity in any of the regressions (results of heteroscedasticity test are available upon request). A limitation of the analysis is that a rather small time frame is investigated. Even though it is common in the literature on ODA and FDI to use 4-year growth regressions, Rajan and Subramanian (2008) advise to use longer term periods. They argue that short-term regressions are prone to cyclical factors and possibly overlook long-run effects. Unfortunately, our sample does not allow for a long-term econometric analysis. First, project finance was not popular until the beginning of the 1990s and especially in the LDCs there were hardly any project finance deals before 1990. Second, as we concentrate only on LDCs the sample size is limited. If we had investigated one 14-year period instead of two 7-year periods, half of the observations would have been lost due to limited data and the degrees of freedom of the model would have severely decreased. In addition to the pooled sample results we also show results for the two sub samples individually. This allows the reader to look for changes from the first sub period to the next. Also the results of the second sub sample will be more comparable to the results of the SUR estimation in Table 2 and the IV and panel estimations in Table 4. Finally, Table 2 contains estimation results based on a SUR approach. This approach is not the classical SUR of a panel data set as that would imply separate regressions for each country taking correlation amongst countries into account. Instead we allow for correlation amongst the two sub periods in our SUR results (a kind of correction for autocorrelation).

The OLS estimation results of equation (1) in column one are used as our starting point. They are in line with prior expectations and match evidence from other studies on economic growth. First, consider the parameter estimates for the control variables. The coefficient of initial GDP is not significant. This might be due to a lower variation in the initial GDP of the LDCs, compared to a sample of both developing and developed countries. Ghosh and Wang (2009) argue that in a sample with countries of similar economic development, country-specific fixed effects might actually be more important for changes in economic growth than the countries' initial conditions. Also, various studies argue that there has been no tendency of low income countries to catch up with developed countries (Sachs and Warner, 1995). Next, inflation exhibits a significant negative impact on growth¹³.

¹³ Notice however that the significance disappears if data for the democratic republic of Congo is

Table 2: Results of OLS and SUR estimations of growth in LCDs

				SUR	
	Full sample	1994-2000	2001-2007	1994-2000	2001-2007
Intercept	0.014 (0.031)	0.034 (0.036)	-0.034 (0.056)	0.024 (0.051)	-0.033 (0.063)
Project finance	0.077*** (0.022)	0.161*** (0.056)	0.054** (0.024)	0.145 (0.093)	0.060 (0.047)
FDI	-0.005 (0.008)	-0.004 (0.031)	-0.007 (0.009)	-0.007 (0.033)	-0.004 (0.016)
ODA	-0.002 (0.004)	-0.004 (0.004)	0.001 (0.008)	-0.002 (0.007)	0.004 (0.007)
Log init. GDP	0.000 (0.005)	-0.006 (0.006)	0.011 (0.008)	-0.005 (0.009)	0.010 (0.010)
Inflation	-0.001*** (0.000)	-0.002** (0.001)	-0.038 (0.037)	-0.001* (0.001)	-0.038 (0.042)
Population	-0.002 (0.387)	0.332 (0.483)	-0.132 (0.513)	0.439 (0.558)	-0.189 (0.809)
Openness	0.014 (0.013)	0.006 (0.017)	0.024 (0.020)	0.004 (0.024)	0.020 (0.020)
Reg. quality	0.027*** (0.005)	0.029*** (0.007)	0.014 (0.010)	0.030*** (0.009)	0.016 (0.011)
Gov. Consump.	-0.090** (0.037)	-0.040 (0.047)	-0.165** (0.063)	-0.043 (0.059)	-0.161** (0.065)
Education	0.052** (0.025)	0.080** (0.030)	0.034 (0.033)	0.088 (0.053)	0.045 (0.049)
Period dummy	0.012** (0.005)	-	-	-	-
War dummy	0.031*** (0.007)	0.022*** (0.007)	0.045*** (0.009)	0.023** (0.010)	0.045*** (0.011)
Adj R ²	0.52	0.50	0.41	0.62 ^a	0.62 ^a
No. Obs.	72	37	35	68 ^a	68 ^a

Notes: Values in parentheses are robust standard errors for the first 3 specifications and standard errors for the SUR equations. Significance: *** at 1% level, ** at 5% level and * at 10% level. The superscript ‘a’ refers to system values.

Inflation is a proxy for macroeconomic stability, so we would expect a negative coefficient. Kleimeier and Versteeg (2010) also find that inflation has a significant negative effect on growth.

Our estimate of the coefficient of population growth is negative and insignificant. Studies that investigate the effect of population growth on economic development yield only inconclusive results. This might be because population growth has a different impact on economic growth in developing countries vs. developed countries. In developed countries low population growth threatens the supply of (skilled) workers, whereas in developing countries population growth is blamed to trigger economic stagnation with underemployment, low wages and sluggish market demand (Crenshaw et al., 1997). The estimate for population growth in column 1 has a negative sign, but it is far from being significant. Kleimeier and Versteeg (2010) find a significant negative coefficient of population growth, but only in their extended regression. The difference in their results on population growth compared to ours might be because their sample includes both developing and developed countries. Openness to international trade exhibits an insignificant positive effect on economic growth. In theory, openness to international trade increases competition and triggers gains in efficiencies. Countries that specialize according to their comparative advantage ultimately achieve a higher output. Waczjarg (1998) finds that openness triggers economic growth mainly through the increasing accumulation of physical capital. And Sachs and Warner (1995) argue that the lack of trade is the reason for the sluggish convergence of low income countries. In the study by Kleimeier and Versteeg (2010) openness exhibits a positive coefficient, but it is not significant. In line with prior expectations regulatory quality shows a significant positive effect on growth. Regulatory quality has a coefficient estimate of 0.027, implying that an increase in regulatory quality by one unit increases growth by 2.7%. An approximately one unit increase would occur if for example The Democratic Republic of Congo, with an average regulatory quality of -1.58 (2001-1007), moves to the same level of regulatory quality as Nepal or Zambia, with an average regulatory quality of -0.58 (2001-2007). Regulatory quality captures the ability of the country's government to employ sound policies and regulations in order to promote private sector development. In the study by Kleimeier and Versteeg (2010) the law variable has a positive coefficient, but it is not consistently significant. The coefficient of government consumption is negative and significant at the 5% level. Empirical evidence suggests that government consumption generally has a negative effect on growth. Excessive government consumption often causes inflation and an increase in interest rates. This is however not true for public investment expenditures in education or healthcare, which generally trigger a positive effect on economic growth (Saleh, 2003). Kleimeier and Versteeg (2010) find no significant effect of government consumption on growth. Next, secondary education

neutralized. This country experienced a very atypical period of extremely high inflation during our sample period. Due to this sensitivity of our estimation results towards data from one specific country we ask the reader not to put too much emphasis on this coefficient estimate. The estimates of the other coefficients are however barely affected and their significance not at all affected if a dummy for this country is included.

shows a significant positive effect on economic growth, which is again in line with prior expectations and other studies (Haldar and Mallik, 2010, Kleimeier and Versteeg, 2010). However Kleimeier and Versteeg (2010) only find a significant positive effect of education on growth in their baseline regression. Our study suggests, that an increase in the secondary education enrollment rate from 0.25% to 0.5% increase growth by 1.30% ($=0.052*0.25$). The coefficients of ODA and FDI exhibit negative signs. They are however insignificant. The negative sign possibly indicates that the negative effects of ODA, like inflationary pressure and crowding out of private (foreign) investment, prevail in LDCs. But we have to be careful with our interpretation, as the negative sign could be caused by inverse causality. Countries that experience war and natural disaster receive more ODA, while at the same time their GDP often decreases. The coefficient of the time dummy exhibits a significant positive sign, indicating that the average GDP growth per capita was higher in the period 2001-2007 than in the period 1994-2000, while it cannot be explained by the other control variables. The war-coefficient is consistently positive and significant¹⁴.

Finally, turning to project finance, a significant positive effect of project finance on economic growth in LDCs is found. The quantitative impact of project finance on growth in the LDCs is substantial. Recall that on average the LDCs have a ratio of 3.59% project finance to GDP over the two 7-year periods. Further, project finance shows a coefficient estimate of 0.077. A country that currently does not use project finance can increase its average growth by 0.28% ($=0.0359*0.077$), if it moves to the average level of project finance. As another example let us take Ethiopia¹⁵, as one of the countries that currently does not employ project finance. If Ethiopia increases its average cumulative project finance to GDP over the two 7-year periods to one of the countries that have a high level of project finance to GDP¹⁶, like Mozambique with 26.16% (2001-2007), Ethiopia would increase growth by as much as 2.01% ($=0.2616*0.077$) annually. Kleimeier and Versteeg (2010) find a somewhat stronger effect of project finance on economic growth¹⁷. In their study, a county that currently does not employ any project finance can increase its annual growth by 0.56% if it moves to the average level in the sample of 0.014% project finance to GDP.

¹⁴ This latter result is a bit puzzling as most empirical evidence points towards either insignificance or negative effects (see e.g. Koubi (2005)). There are however theoretical explanations in support for a positive effect especially when analyzing average data over a period of time. The main argument is that growth increases in the periods just after the end of a war. Taking a look of our data it turns out that our war effect is mainly driven by only six countries so another possibility is that special factors were actually present for those countries. We have not investigated this topic further as the war variable is not one of our variables of main interest but we leave it in the model now that it has actually turned out significant.

¹⁵ Ethiopia is used for illustrative purpose. Any other country with no project finance over the two 7-year periods could be used.

¹⁶ Other countries with high average cumulative project finance to GDP over the two 7-year periods are for example Djibouti (18.82%) and Chad (25.79%). Laos has a value of 31.9% but due to missing values only observations for the second sub period can be used for this country.

¹⁷ In their study Kleimeier and Versteeg (2010) use a log-linear model. Therefore, one cannot directly compare the coefficients of their study to those in this study.

As pointed out by Kleimeier and Versteeg (2010), it is not clear if the positive growth-effects of project finance are triggered by benefits unique to project finance or due to general benefits of foreign capital. Therefore, FDI is included in the equation as an additional variable. However, including FDI together with project finance in one regression is not without risk. Depending on the composition of the equity part, project finance can be a form of FDI. Recall that a project finance deal commonly consists of around 30% equity. For deals in LDCs the equity part is most often provided by foreign investors. Note also that an investment is classified as FDI if at least 10% of the equity is contributed by an investor from abroad. Given this definition, some of the project finance deals are likely included in the FDI data as well¹⁸. Nevertheless, equation (1) can provide an impression of the different growth-effects of project finance vs. FDI. Even with FDI in the model, project finance is still significant. This indicates that the growth-effect of project finance is unique and not due to the effect of foreign capital in general. FDI is as stated earlier not significant and even has a negative sign.

The estimation results shown in column two are results based on OLS but only using the observations for sub period one. In column three the results for sub period two are found. As the two sub periods cover seven years each there may be a reason to believe that maybe the results have changed from the first to the second sub period. Hence based on a comparison between columns two and three the issue of model stability can be discussed. Also later in the robustness section we report results of estimations using alternative modelling approaches that in our case only work for the second sub sample and then column three will provide a more “fair” comparison for e.g. the IV estimation results. Due to the use of lagged PF as an instrument when using IV methods, we can only get results for the second sub period in this case. Focusing on the estimate of PF, we see that this coefficient is positive and significant for both sub periods although it is somewhat smaller for the most recent sub sample. The coefficient of inflation is negative in both sub periods but only significant in the first. For the first sub period regulatory quality is significant while government consumption is significant only for the second sub sample. For both of these explanatory factors the signs are the same for both sub periods. The coefficient of education turns out insignificant for the second sub sample but again has the same sign. We run a Chow type test for a structural break in equation one with respect to the two sub periods. Results from this test are: F-stat = 0.99 with p-value = 0.468 (and in the version of the tests that uses heteroscedasticity-corrected standard errors: Q-stat = 21.4 and the p-value = 0.045 for a Chi Square distribution with 12 degrees of freedom). The hypothesis is accepted based on the F-version of the test and borderline rejected at the 5% level for the Chi square version of the test. Hence we do not see this as a major problem for stability of the model although of course one has to keep in mind that the relative importance of the explanatory factors may change somewhat as time passes.

Finally, in columns four and five we report the results of the SUR estimation. As can

¹⁸ Surprisingly, the correlation between project finance and FDI is 0.23 and hardly significantly different from zero.

be seen from the table the signs and sizes of the coefficients do not change much compared to the OLS sub sample values. In general the standard errors in the SUR case are larger than for OLS, and therefore more coefficients appear insignificant. This is probably due to the relatively small number of observations in our study.

To sum up: in none of the regressions the coefficient of project finance exhibits a negative sign, irrespectively of the estimation method used. We consistently find a positive effect of project finance on growth in the LDCs. The size of the effect varies somewhat by sub period but in all cases it seems to contribute significantly to the growth in the LDC's. In addition, for the first sub period regulatory quality and educational level seem to be important for growth while government consumption seems more important during the second sub period.

5. Robustness Checks

5.1 The Issue of Data Quality

In this sub section we report results of OLS regressions for pooled data from both of our sub periods but with different selections of countries or observations excluded. Sub sets are excluded based on data quality considerations and hence this exercise can be seen as a robustness check of the data quality. The results are reported in Table 3.

For comparisons reasons, the first column of Table 3 is just repeating the full sample results of Table 2. In the second column we report results of a sample that only includes observations where the education variable is based on more than one year from each 7-year period. If a country has missing values for the education variable, then a hypothesis can be, that also the quality of the remaining data for that country is questionable.

In the third column we exclude the Maldives, Bhutan and Eritrea, all countries for which we have performed linear extrapolations to obtain information for all explanatory factors. Finally, in column four we report results from a sample without Haiti, Laos, Tanzania and Yemen, the four countries where only the observation from one of the sub periods can be used. In all of these cases almost all of the previously significant coefficients are still significant, of the same sign and of approximately the same size. Hence, we find no strong indications that our results are in general sensitive to the data quality as investigated by exclusion of sub groups of countries or specific observations of countries.

5.2 Alternative Models and Estimation Methods

The results reported in Table 4 contain estimates from a panel data country fixed effect model and also from a 2 SLS IV estimation of equation (1). The first column of Table 4 is repeating the OLS results of the second sub sample for comparison reasons as the panel estimation basically relies on the differences in variable values between the two sub periods and the IV estimation relies on lagged project finance (from the first sub period for the data of the second sub period) as the instrument.

Table 3: Results of robustness checks for growth in LDCs with sub sets of countries and/or observations excluded

Variables	Full sample and OLS ^a (from table 2 for comparison)	Only observations with the education variable based on more than one year ^b	Sample without Maldives, Bhutan and Eritrea (countries with linear extrapolations)	Sample without countries with data for just one sub period (Haiti, Laos, Tanzania and Yemen dropped)
Intercept	0.014 (0.031)	0.041 (0.028)	0.016 (0.033)	0.013 (0.032)
Project finance	0.077*** (0.022)	0.066*** (0.020)	0.077*** (0.022)	0.074** (0.031)
FDI	-0.005 (0.008)	-0.003 (0.007)	-0.006 (0.009)	-0.003 (0.009)
ODA	-0.002 (0.004)	0.002 (0.005)	-0.005 (0.004)	-0.002 (0.004)
Log init. GDP	0.000 (0.005)	-0.002 (0.004)	-0.002 (0.005)	0.001 (0.005)
Inflation	-0.001*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)
Population	-0.002 (0.387)	-0.710 (0.323)	0.337 (0.400)	-0.050 (0.429)
Openness	0.014 (0.013)	0.015 (0.012)	0.015 (0.016)	0.012 (0.014)
Reg. quality	0.027*** (0.005)	0.023*** (0.005)	0.022*** (0.005)	0.027*** (0.005)
Gov. Consump.	-0.090** (0.037)	-0.097*** (0.034)	-0.095 (0.058)	-0.092** (0.036)
Education	0.052** (0.025)	0.044* (0.025)	0.042 (0.028)	0.053* (0.028)
Period dummy	0.012** (0.005)	0.009* (0.005)	0.015*** (0.005)	0.011** (0.005)
War dummy	0.031*** (0.007)	0.031*** (0.006)	0.028*** (0.007)	0.031*** (0.007)
Adj R ²	0.52	0.53	0.50	0.50
No. Obs.	72	66	66	68

Note: Values in parentheses are robust standard errors. Significance: *** at 1% level, ** at 5% level and * at 10% level. Superscript 'a': A version of this model extended by a Sub-Saharan dummy shows no significance of this dummy. These results are available from the authors upon request. Superscript 'b': in this case first period observations for Burundi, Central African Republic, Madagascar, Sierra Leone are dropped, and for Guinea-Bissau both sub periods are excluded.

In column 2 of Table 4 we report results of a panel country fixed effects estimation of equation (1). For the panel estimation each time period is one of our 7-year periods so the panel just consists of two observations in the time dimension. Yet this is enough to remove firm specific heterogeneity with respect to the intercept term of the model. We consider this a great advantage as the LDCs of our sample are very different¹⁹. In the panel estimations we are not able to use IV methods at the same time. The results in column 2 show that the coefficient of project finance is significant and somewhat larger than the OLS estimate. In addition ODA, openness, regulatory quality and education are significant and have the expected signs. Hence, our results also seem robust when the data are analyzed in this way.

As mentioned previously there may be a problem of adverse causality in equation (1). Initially, in the OLS estimations, we would argue that using averages or cumulative values over the 7 year periods we are trying to avoid this potential reverse causality. As pointed out in the literature on FDI and project finance, it is likely that foreign capital is invested in countries that experience high growth rates. If this is the case, the OLS regression will overstate the effect of project finance on economic growth. Instead of using averages and cumulative values for fairly long sub periods, another way of solving the potential endogeneity problem is by means of IV estimation. As usual the finding of an appropriate instrument is challenging. In the present study we follow the idea of Kleimeier and Versteeg (2010) and use lagged project finance as our instrument. Their argument for this choice of instrument is that flows of capital are fairly persistent over time. Due to the length of the sub periods, and the fact that lagged project finance (in addition to the other explanatory variables) significantly contributes to the explanation of the present project finance, see column four of Table 4, we will argue that lagged project finance is a valid instrument²⁰.

The results of the IV/2SLS estimation are shown in the third column of Table 4. The coefficient of project finance is still significant and has about the same size as in the panel approach case. Government consumption is significant and of the expected sign in the IV case as well. Overall, the results continue to support the findings that project finance promotes economic growth in the LDCs. In their study, Kleimeier and Versteeg (2010) also find an increase in the coefficient of project finance in the IV regressions, compared to the original OLS. The increase might result from a measurement error where the OLS results are biased towards zero. The instrumental variables estimation corrects for this measurement error.

¹⁹ In the panel regression we do not use initial GDP as a regressor as that would complicate the model by adding a dynamic element that may bias the coefficient estimates. We choose this simple solution to the problem as initial GDP is never close to being significant in any of our models and estimations.

²⁰ In the literature it is also proposed to use the real exchange rate as an instrument. This instrument was, however, not a valid one for our study. As suggested by an anonymous referee, we have also tried to use lagged values of FDI, ODA and initial GDP as instruments. Again none of these variables qualifies as a valid instrument in our case. Finally, we have also investigated the possibility of using measures of mineral and oil reserves in the LDC as instruments. Also this approach proved unsuccessful.

Table 4: Results of robustness checks using alternative estimation methods for growth in LDCs. (The dependent variable is growth in column one to three and project finance in column four)

Variables	OLS 2001-2007 (from table 2 for comparison)	Panel data approach. Country fixed effects.	IV estimation Lagged PF used as the instrument.	IV first step: PF regressed on lagged PF and the other explanatory variables.
Intercept	-0.034 (0.056)	-0.069*** (0.020)	-0.031 (0.056)	0.004 (0.093)
Project finance	0.054** (0.024)	0.124*** (0.015)	0.117** (0.045)	-
FDI	-0.007 (0.009)	-0.004 (0.005)	-0.018 (0.012)	0.222*** (0.078)
ODA	0.001 (0.008)	0.015** (0.006)	0.003 (0.008)	-0.020 (0.023)
Log init. GDP	0.011 (0.008)	-	0.009 (0.008)	0.000 (0.000)
Inflation	-0.038 (0.037)	-0.001 (0.000)	-0.034 (0.038)	-0.315** (0.123)
Population	-0.132 (0.513)	0.064 (0.334)	-0.120 (0.575)	0.366 (2.979)
Openness	0.024 (0.020)	0.028* (0.015)	0.021 (0.024)	-0.010 (0.068)
Reg. quality	0.014 (0.010)	0.039*** (0.008)	0.018 (0.012)	-0.045 (0.037)
Gov. Consump.	-0.165 (0.063)	-0.072 (0.084)	-0.148* (0.074)	-0.048 (0.277)
Education	0.034 (0.033)	0.143*** (0.029)	0.048 (0.039)	-0.160 (0.176)
War dummy	0.045*** (0.009)	0.052** (0.020)	0.045*** (0.010)	0.017 (0.033)
Lagged PF	-	-	-	1.241*** (0.262)
Adj R ²	0.41	0.73 ^a	0.33	0.47
No. Obs.	35	34	35	35

Notes: Values in parentheses are robust standard errors. Significance: *** at 1% level, ** at 5% level and * at 10% level. Superscript ‘a’: this R² is artificially high due to the country fixed effects.

6. Conclusion

In this study we have analyzed the effect of project finance on economic development in a sample of the least developed countries. To our knowledge we are the first ones to focus this kind of study specifically on this group of countries. As the group of least developed countries is the group of countries that may benefit the most from this type of investments we believe that our results will be of high interest. Following the tradition in the field, our empirical model is inspired by the neoclassical growth model. Trying to exploit our data as much as possible econometrically, we offer results based on both OLS and IV estimation and we also use panel data techniques. Irrespectively of the model or method used, we find a significant positive effect of project finance on economic growth.

Also, apart from the significant effects of project finance we are able to identify an additional group of variables that helps explain growth in the LDC: higher regulatory quality, lower government consumption and a higher level of education seems to be of importance for economic growth. The significance of these variables are, however, not as consistently robust as the results for project finance. Finally, from a policy perspective, our results are of interest as they may suggest that lenders, especially international development organizations like the World Bank, the International Finance Corporation (IFC) and the African Development Bank, should not cut back on project finance to LDC countries in times of a financial crisis. This is a general suggestion due to the quite robust finding of a positive impact of project finance on economic growth in these countries.

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Appendix 1

Countries included in the analysis

Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti (only 1st sub period), Laos (only 2nd sub period), Lesotho, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Solomon Islands, Sudan, Tanzania (only 1st sub period), Togo, Uganda, Vanuatu, Yemen (only 1st sub period), Zambia.

Appendix 2

The data

Growth	Measured as real GDP per capita growth in constant 2000 USD. Retrieved from the World Development Indicators Online from the World Bank (2010).
Initial GDP	Initial level of GDP for each sub period. Retrieved from the World Development Indicators Online from the World Bank (2010).
Inflation	Measured as the percentage change in the GDP deflator, which is the ratio of GDP in current local currency to GDP in constant local currency. Inflation is a proxy for macroeconomic stability. The data are retrieved from the World Development Indicators Online from the World Bank (2010).
Population growth	Measured as the annual percentage population growth. Retrieved from the World Development Indicators Online from the World Bank (2010).
Openness	Measured as the sum of exports plus imports relative to total GDP (output). This should proxy the openness of the country to international trade. The data are retrieved from the World Development Indicators Online from the World Bank (2010).
Regulatory Quality	Captures perceptions of the ability of a country's government to employ sound policies and regulations that help promote private sector development. The indicator is estimated by surveys from a large number of enterprises, citizens and experts of both developing and developed countries. The indicator range from about -2.5 to +2.5, with higher values indicating better governance. Data is retrieved from Kaufmann et al. (2009).

Government Consumption	Measured as the general government final consumption expenditure to GDP. The general government consumption expenditures also include most expenditure on national defense and security. The data are retrieved from the World Development Indicators Online from the World Bank (2010).
Education	Measured as the ratio of total enrollment (regardless of age) in secondary education relative to the population of the age group that officially corresponds to the level of secondary education. As stated by the World Bank, after secondary education, the basic education is completed, and a foundation for lifelong learning is developed. Retrieved from the World Development Indicators Online from the World Bank (2010).
FDI	Measured as the inflow of FDI as percentage of GDP (the sum of these ratios over each 7 year period). FDI is a long-term investment in which a foreign investor (a resident from another country) owns at least ten percent of the equity. The data are retrieved as USD at current prices and current exchange rates in millions from the Beyond 20/20 Web Data Server from the UNCTAD, World Investment Report (2009). The data is then converted to real dollar values using the US GDP deflator provided by the World Development Indicators Online from the World Bank (2010)
ODA Grants	Measured as real disbursements of ODA grants relative to the country's GDP (the sum of these ratios over each 7 year period). Data on disbursements are preferred over ODA commitment, as growth is more likely to be affected by actual money transfers. ODA grants are chosen instead of total ODA (The OECD's Creditor Reporting System differentiates between ODA grants, grants-like ODA, ODA loan and ODA equity), since including ODA loan would risk accounting double for some of the money that has flowed into the country. This is because several of the PF deals were financed partially by the World Bank and therefore are possibly reflected in ODA loans. The data are retrieved from the OECD's Creditor Reporting System in current USD million and converted to real dollar values using the US GDP deflator provided by the World Development Indicators Online from the World Bank (2010).

PF	Measured in real USD million relative to GDP (the sum of these ratios over each 7 year period). The data are retrieved from the Dealogic – Loan Analytic Database (This database covers more than 120.000 loan transactions, including project finance loans, since 1980. The deal signing date is used as reference date for the yearly data. All deals in currencies other than US\$ were converted at the exchange rate at signing date. The reported deal volumes only reflect the debt financing part and not the total deal volume, which further includes an equity part of on average 10%-30%.) in current USD and converted to real dollar values using the US GDP deflator provided by the World Development Indicators Online from the World Bank (2010)
War dummy	This dummy takes the value 1 if the country were at war in the time period and zero otherwise. UCDP/PRIO Armed Conflict Dataset Gleditsch et al. (2002).
Time Dummy	Dummy that indicates all observation from the period 2001 to 2007