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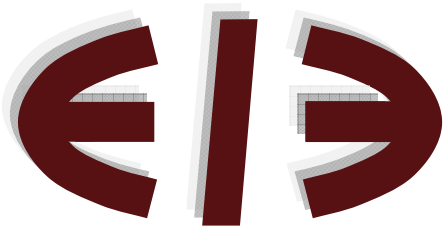

EERI
Economics and Econometrics Research Institute
Avenue de Beaulieu
1160 Brussels
Belgium

Tel: +322 299 3523
Fax: +322 299 3523
www.eeri.eu

The Role of Additionality in the EU Cohesion Policies: An Example of Firm-Level Investment Support[1]

Andries Brandsma[2], Pavel Ciaian[3] and d'Artis Kancs[4]

Abstract: Additionality is one of the key principles driving the functioning of the EU Cohesion Policies (ECP). The present paper studies how additionality affects the impact of firm-level investment support on firm investment behaviour in differently competitive markets. We find that the investment additionality and the level of competition importantly affect the firm investment behaviour. Imposing additionality to the ECP investments in perfectly competitive markets causes distortions in the capital market and leads to lower welfare levels. In contrast, without the enforcement of additionality, the distortions are zero and the investment support fully benefits the firms. In an imperfectly competitive environment the firm-level investment support may increase investment and may be welfare increasing with and without the enforcement of the investment additionality.

Keywords: European policy planning, firm-level investment support, EU Cohesion Policy, investment subsidy, regional development.

JEL classification: F1, O1, R3, R4.

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[2] European Commission (DG JRC). E-mail: andries.brandsma@ec.europa.eu.

[3] European Commission (DG JRC), Catholic University of Leuven (LICOS), and Economics and Econometrics Research Institute (EERI). Correspondence Address: European Commission, DG Joint Research Centre, B-1049 Brussels, Belgium. E-mail: pavel.ciaian@ec.europa.eu.

[4] European Commission (DG JRC), Catholic University of Leuven (LICOS), and Economics and Econometrics Research Institute (EERI). Correspondence Address: European Commission, DG Joint Research Centre, B-1049 Brussels, Belgium. E-mail: d'artis.kancs@ec.europa.eu.

1 Introduction

Support to firms is one of the key priorities of the EU Cohesion Policies (ECP) and an essential component of the Renewed Lisbon Strategy – Europe 2020. During the current programming period 2007-2013 more than 28 billion Euro are used to support firm investment across the Member States. Among others, the ECP grants to firms are used to support private investment to improve the private capital stock (European Commission 2010).

There have been many attempts to measure the impact of public policy support for firms (Rae 2010). Some studies find that firm-level investment support induces additional investment in supported firms (Harris and Trainor 2005; Pellegrini and Centra 2006; Duch, Montolio and Mediavilla 2009; Gadd, Hansson and Månsson 2009). In contrast, other studies do not find positive effects (Bronzini and de Blasio, 2006). Similarly, the employment impact of capital subsidies has been found doubtful (Gabe and Kraybill, 2002), and the effect of firm-level investment support on efficiency and productivity is found to be negligible or even negative (Beason and Weinstein 1996; Lee 1996; Bagella and Becchetti 1998; Bergström 2000; Harris and Robinson 2004; Bernini and Pellegrini 2011). Moreover, there is a considerable variation in the estimated impact of investment support which, among others, reflects differences in circumstances between countries, regions, sectors and firms, differences in the design of policy and delivery (policy implementation details), and differences in the quality of the data and the analytical methods used in the empirical studies.

An important drawback of existing studies, which increases uncertainty about the true ECP impact, is that they do not explicitly consider the policy implementation details, such as additionality, capping rules, maximum co-funding, and the funding gap. However, according to Bergstrom (2000), substitution of private capital by public capital, i.e. non-additionality, is one of the main causes of failures of firm-level investment subsidising efforts. In the presence of inter-temporal substitution firms may bring forward investment projects originally planned for the post-intervention period in order to take advantage of the investment support. In the presence of cross-sectional substitution the subsidised firms may take some of the investment opportunities that unsubsidised firms would have exploited in absence of the investment support.

The objective of the present paper is to analyse under which circumstances the firm investments triggered by the investment support are additional, i.e. when does the firm-level investment support makes investments possible that otherwise would not have been undertaken. In order to answer this question we analyse theoretically how the investment additionality and the co-financing rate affect the firm investment behaviour in differently competitive markets.

We find that the investment additionality and the level of competition importantly affect the firm investment behaviour. Imposing additionality to the ECP investments in perfectly competitive markets causes distortions in the capital market and leads to lower welfare levels. In contrast, without the enforcement of additionality, the distortions are zero and the investment support fully benefits the firms. In an imperfectly competitive environment the firm-level investment support may increase investment and may be welfare increasing with and without the enforcement of the investment additionality. These results are new, as policy implementation details have not been studied in the context of the ECP before.

2 The EU Cohesion Policies

The ultimate objective of the ECP is to promote economic growth and employment and to simultaneously reduce regional disparities, e.g. in terms of regional income per capita and rates of unemployment. Within this ultimate objective, the relevant provisions of law identify the following three derived objectives:[5]

- *Convergence* is concerned with speeding up the convergence of the least developed Member States and regions. This objective focuses in particular on promoting investments in physical infrastructure, human capital, R&D, and aid to productive sectors;
- *Regional competitiveness and employment* covers all the rest of the EU outside the convergence regions which focuses in particular on investing in human resources, R&D, and promoting entrepreneurship and environmental protection;
- *European territorial cooperation* aims at strengthening cross-border cooperation, transnational cooperation, interregional cooperation and exchange of experience.

In order to achieve these objectives,[6] the ECP implements financial instruments relating to investment in specific sectors and areas and with different intensity of aid and within a well-identified programming, which in the current programming period is lasting seven years from 2007 to 2013. Depending on the form of investment (physical capital, human capital, R&D, support to productive sectors), different financial instruments are implemented: the European Social Fund (ESF), the Cohesion Fund (CF), and the European Regional Fund (ERDF). The use of the ECP financial instruments is characterised by: (i) targeting specific sectors of investment in well-identified eligible areas; (ii) modulating the intensity of aid by applying a number of co-funding rules. The eligibility for co-funding within the ECP is defined over two main elements: area and the sector of investment. Moreover, different eligibility rules apply for each of the three financial instruments. The ERDF can finance investment in regions

[5] See Art. 3(2) of the General Regulation.
[6] For an overview of these objectives see European Commission (2007: 10-26).

relating to the three objectives of convergence, regional competitiveness and employment, and European territorial cooperation. Although, the eligible sectors of investment are many, the ERDF finances mainly physical infrastructure, R&D, human capital and aids to productive investments. The ESF finances mainly human capital and labour-market related investments in regions relating to the objective of convergence, and of regional competitiveness and employment. Finally, the CF finances mainly projects in the field of transport, environment, and energy if the investments have beneficial impacts on the environment. The CF may finance investments in countries whose GNI is less than 90 per cent of the EU-27 GNI, or it would have been eligible assuming the same threshold for the EU-15.

According to the provisions of Annex II, Part A, Commission Regulation 1028/2006,[7] the total ECP expenditures are classified in 86 categories of expenditure in the programming period 2007-13. The 86 programmes target sectors such as transportation, renewable energy, environment, research and development, labour market, etc. (Ferrara, Ivanova and Kancs 2010). Around 8% of the total ECP budget (28 billion Euro) is allocated to investment support to both large and small businesses, including productive investment and the provision of business support services. Significant share of these funds is directly or indirectly benefiting the SMEs (European Commission 2010).

The ECP co-funding is subject to several implementation rules. At the National Strategic Reference Framework level, the principle of additionality and the capping rules;[8] at the operational programme level, the maximum co-financing rate for eligible expenditure;[9] at the investment project level, the funding gap given by the difference between the discounted investment costs and the discounted net revenue to identify eligible expenditure.[10] These ECP implementation rules result in using matching grants subject to the principle of additionality, whose total amount and the overall financial leverage depend mainly on the level of GDP, and whose specific matching rates depend on the project's self-financing ratios.[11]

The principle of additionality stipulates that the ECP may not replace the national or equivalent (e.g. project-level, programme-level) expenditure by a Member State.[12] According to European Commission (2006), additionality would be achieved where the ECP generates

[7] www.cc.cec/dgintranet/regio/documents/20072013/a_sf_reg2007_2013/corrigendum_commission_reg.pdf

[8] See Art. 15 and Annex II(7) of the General Regulation, respectively.

[9] See Annex III, General Regulation.

[10] See Art. 55(2), General Regulation. It is worth noting that the funding gap does not apply to investment projects whose financing is classified as State aids (see Art. 55(6)).

[11] This ratio is the complement to one of the funding gap and it is given by the ratio of discounted net revenue and discounted investment costs.

[12] European Commission, Article 15 of Regulation (EC) No 1083/2006.

activities or outcomes over and above that which would have occurred in their absence. In the context of the ECP, three types of support additionality can be identified: project-level additionality, programme-level additionality, and MS-level additionality (ECOTEC 2003). Although, additionally is a more general concept and often it is referred to MS public expenditure, its success at MS level or at programme level depends on its enforcement at project level (CSES 2003; ECOTEC 2003). Therefore, in this paper we explicitly study ECP's additionality at firm level. However, the results are more general and apply similarly to any other implementation level of the ECP.

The principle of additionality is verified at national level by the Commission, in cooperation with Member States, for the regions covered by the Convergence objective. At the ex-ante stage, the Commission and the Member States decide the level of eligible public or equivalent spending to be maintained all over the programming period. For each Member State concerned the Commission verify the compliance with the principle of additionality at the mid-term of the programming period, in 2011, and at the end of this period, in 2016. The objective of additionality is to set realistic but sufficiently ambitious targets for structural public expenditure, in order to ensure the additional trait of the ECP intervention. As a general rule, the average annual level of expenditure in real terms shall be at least equal to the level attained in the previous programming period (European Commission 2010).

3 Previous studies

The size of the ECP expenditure's share in the total EU budget (over 50%) has generated a large interest between policy makers, taxpayers and academics (Stryczynski 2009). Whereas some studies suggest that firm-level investment support induces additional investment in supported firms (Harris and Trainor 2005; Pellegrini and Centra 2006; Duch, Montolio and Mediavilla 2009; Gadd, Hansson and Månsson 2009); others do not find positive effects (Bronzini and de Blasio, 2006). Similarly, the employment impact of capital subsidies has been found doubtful (Gabe and Kraybill, 2002), and the effect of firm-level investment support on efficiency and productivity is found to be negligible or even negative (Beason and Weinstein 1996; Lee 1996; Bagella and Becchetti 1998; Bergström 2000; Harris and Robinson 2004; Bernini and Pellegrini 2011).

3.1 Positive evidence of firm-level investment support

Harris and Trainor (2005) estimate a linear static production function model with a set of explanatory variables, time variables to control for business cycle effects and a binary dummy variable for SFA capturing different types of firm-level investment support. The model is estimated for Northern Ireland and accounts for possible endogeneity of capital,

employment, intermediate inputs and the SFA.[13] The results of Harris and Trainor suggest that the total factor productivity would have been 7-10% lower if the Northern Ireland firms had not received SFA. By comparing different types of firm-level investment support, Harris and Trainor find that capital grants are more likely to have a positive impact on the total-factor productivity (TFP) compared with other forms of firm-level investment support, and that the impact of the SFA was stronger towards the end of the sample period from 1990 – 1998. Harris and Trainor also find that SFA reduced the probability of firm closure by 15-24%.

Pellegrini and Centra (2006) use a conditional difference-in-difference estimator as a combination of the standard difference-in-difference estimator and the matching estimator to estimate the impact of firm-level investment support on turnover and employment. These outcome variables are modelled as a function of selected covariates in a panel setting with individual and time-effects and a dummy for being supported or not. Their results for Italy indicate that growth in turnover, employment and fixed assets has been more dynamic in subsidised firms and that such firms have invested more as well as increased the number of employees stronger than firms in the control group.

Employing a difference-in-difference estimator Bronzini and de Blasio (2006) investigate the effect of firm-level investment support on investments of Italian firms. The results of Bronzini and de Blasio suggest that subsidies have a positive effect on private investments. They find that firm-level investment support induces additional investments by the supported firms; however these investments do not trigger faster growth.

Duch, Montolio and Mediavilla (2009) analyse the effect of subsidies on firm performance in Spain by employing a propensity score model. Their results show that, on average, the supported firms recorded a higher value added growth than the non-supported firms. Furthermore, the results point to the fact that firms with low value added grow faster than those, which have already reached a high level of value added. Duch, Montolio and Mediavilla also present evidence that diversified, centrally located, and exporting firms constitute higher growth rates for value added. Finally, Duch, Montolio and Mediavilla do not find significant growth differences between the high technology manufacturing industries and service sectors. Generally, their results suggest that public subsidies have a positive and significant impact on the growth of value added.

[13] From the baseline specification, the SFA-receiving firms are also allowed to interact with explanatory variables in the model through various ways such as: (i) composite dummy effects (multiplication of the SFA-dummy with employment, capital stock, etc.), to investigate whether firms which received SFA might operate using different technologies compared to non-supported firms, (ii) interaction terms between the SFA and firm age and ownership structure, as well as (iii) disaggregation of the SFA into capital grants and all other ECP support.

Gadd, Hansson and Månsson (2009) estimate the effect of firm-level investment support on firm performance by employing a propensity score model. According to their results, both firm characteristics and regional context matter for the probability to receive public policy support. After performing the matching algorithm, Gadd, Hansson and Månsson find a significant positive difference in employment growth, indicating that firms which received the investment subsidy increased the number of employees stronger than their matched pairs in the control group. However, the profitability, measured as differences in return on total assets, does not differ significantly between supported and non-supported firms. Generally, the results of Gadd, Hansson and Månsson, suggest that investment subsidies had some effect on employment, but not on the return on total assets.

3.2 Zero/negative evidence of firm-level investment support

On the other hand, there are many studies which find zero or even negative evidence of firm-level investment support. Beason and Weinstein (1996) use industry-level data for evaluating the effect of firm-level investment support in Japan, and find no evidence of productivity enhancements as a result of firm-level investment support.

Lee (1996) studies the TFP between 1963 and 1983 in South Korea, and finds that firm-level investment support actually lowered the TFP of the supported firms. Lee finds that targeting of low productivity firms amounted to a form of increased protection, which decreased competition and thus efficiency levels. These results suggest that firm-level subsidies can foster further lack of competition and lower efficiency, as firms become over-reliant on "production" subsidies and fail to reorganise their activities and improve their performance to the same extent as non- supported firms that face the same competitive market pressures.

Bagella and Becchetti (1998), studying Italian data, find a set of partly contradictory results. In the short run, subsidies seem to cause a higher level of indebtedness for firms which receive them with non-decreasing costs of debt, so apparently there is no mis-allocation of financial resources. In the long run, subsidised firms exhibit lower levels of productivity when compared to non-subsidised ones, lending support to the idea that this exogenous ”shock” is re-absorbed by the market.

Bergström (2000) finds no significant effect of firm-level investment support on total factor productivity in Sweden. More precisely, Bergström finds that in the first year after having received incentives, the treated firm productivity increases. However, in the following years additional subsidies reduce the TFP growth, which may signal that in the long run subsidies can lead to negative productivity and welfare effects.

Harris and Robinson (2004) find that firm-level investment support in the UK had no effect on productivity by comparing the supported firms to similar firms within the supported area.

Bernini and Pellegrini (2011) study the impact of firm-level investment support in the southern Italian regions over the period 1996–2004. Employing a difference-in-difference matching estimator, and taking selection on observables and non observables into account they find a higher growth in output, employment and fixed assets in subsidised firms but a lesser increase in the TFP than in unsubsidised firms. They conclude that the negative impact on long term productivity and growth reduces the positive temporary effects of regional subsidies.

3.3 Causes of mixed evidence

The results of previous studies provide mixed and inconclusive evidence on whether firm-level investment support increases firm investment and improves firm performance. Bergstrom (2000) identifies two main causes of failures of firm-level investment subsidising efforts, which may be responsible for the mixed evidence. First, investment support may displace private investments (inter-temporal substitution). Second, it may cause crowding out of investment in non-subsidised firms (cross-sectional substitution). This suggests that measuring the impact of firm-level investment support amounts to gauging the extent to which the firm investments triggered by the incentives are *additional*, i.e. does the firm-level investment support makes investments possible that otherwise would not have been undertaken?

First, because of the availability of investment support, firms may have brought forward projects originally planned for the post-intervention period. As shown by Abel (1982), a temporary investment subsidy gives firms a strong incentive to invest while the incentive is in effect. This effect has been extensively studied in the literature on the effects of incentives for investments and purchasing of durable goods (Auerbach and Hines 1988 and Adda and Cooper 2000). Bronzini and de Blasio (2006) show that inter-temporal substitution considerably affects the investment pattern of supported firms in Italy. They find that a potential effect of aid may be to boost investment during the period in which the aid programme is in place, at the cost of reducing investment subsequently. In this case, a positive effect of the subsidies is not a proof of additionality, as without aid the same investment would have been made in the future. Similalry, Cannari, D'Aurizio and de Blasio (2006) find that inter-temporal substitution is significant: 64.2 percent of firms that would have invested less without subsidies declared that they would have postponed the investment. Cannari, D'Aurizio and de Blasio also find that inter-temporal substitution is more widespread among businesses located in the Centre and the North of the country, while lack of profitability and lack of external resources have more effect on southern companies. Finally, their results suggest that inter-temporal substitution is more important for firms in traditional sectors, while the opposite holds true for lack of profitability.

Second, subsidised firms may receive some of the investment opportunities that non subsidised firms would have otherwise had in absence of the investment support. In presence of cross-sectional substitution subsidised firms take some of the investment opportunities that unsubsidised firms would have exploited in absence of the investment support (Harris and Trainor 2005 and Lee 1996). Adopting the difference-in-difference approach, Bronzini and de Blasio (2006) find that supported firms have substantially increased their investments when compared with the pool of firms whose applications have been rejected. A similar crowding out process might also occur because of general equilibrium effects. Firm-level investment support may change the price of capital in a region as a whole if it affects a substantial number of firms. For example, Goolsbee (1998) shows that investment incentives have little impact because much of the benefit does not go so much to investing firms as to suppliers of capital through higher prices. Cross-sectional substitution is particularly important when the market in which the firms compete is small and when the firms are close in their industrial distance (Rosenthal and Strange 2004). Bronzini and de Blasio (2006) find that that cross-sectional substitution is more intensive for firms located in the same area or competing in the same sector.

4 The role of additionality in the EU Cohesion Policies: A theoretical analysis

In order to answer the question under which circumstances the firm investments triggered by the investment support are *additional*, i.e. when the firm-level investment support makes investments possible that otherwise would not have been undertaken, it is necessary to evaluate additionality. In this section we develop a conceptual framework for analysing the impact of additionality on firm investment behaviour. We employ the theoretical model to study how the investment additionality affects the impact of firm-level investment support on firm investment behaviour in differently competitive markets.

4.1 The model

The representative firm's output in a given sector is assumed to be a function of the amount of capital, K. The production function is represented by $f(K)$ with $f_K > 0$ and $f_{KK} < 0$.[14] The capital K is a stock variable which supplies services used by the firm during the production process. For simplicity, we assume that the investment capital, K, is financed from a bank loan, L, at interest rate i, which is assumed to be fixed. The capital good's price is equal to the discounted present value of future rents. The firm's profit function is given as follows:

$$(1) \qquad \Pi = pf(K) - kK$$

[14] f_K and f_{KK} are first and second derivatives of the production function with respect to capital, respectively.

where k is the rental price of capital, $k = R\left(i+\delta\right)$, p is the price of the final product[15], R is the unit price of capital good, and δ is the capital depreciation rate. The firm's capital rental unit costs include interest payments, iR, and the depreciation costs, δR.[16]

The equilibrium conditions are given as follows:

(2) $pf_K = (1+\varphi)k = (1+\varphi)R\left(i+\delta\right)$

(3) $K = S$

(4) $L = RK$

where S is the capital supply function. Equation (2) represents the firm marginal condition for capital services derived from the profit maximisation problem. It represents firm's decision on the optimal quantity of capital use by taking in consideration marginal benefits, pf_K, and marginal costs, $(1+j)k$, adjusted by the market imperfection factor, j. The capital equilibrium condition (2) yields a standard capitalisation formula $R = pf_K \Big/ \left[(1+\varphi)\left(i+\delta\right)\right]$, which implies that the capital good price is equal to the present value of the future capital rents. Parameter φ measures the degree of imperfect competition (defined as the ratio between the marginal profit and the rental price of capital), which could be a result of market imperfection that constrain firms' capital use such as credit constraint or credit rationing. If $\varphi > 0$, then the firm marginal value product of capital exceeds the marginal cost of capital k. Everything else equal, by increasing the investment, the firm could increase its profit. Market imperfections reduce capital use and firm profitability. If $\varphi = 0$, then the firm's equilibrium condition (2) collapses to the competitive market result, where $pf_K = k$, implying that all profitable opportunities of capital are exploited if this equilibrium holds.

Equation (3) represents the equilibrium market clearing condition for the capital good, where capital good supply, S, equals the firm demand for capital, K. To simplify the analysis, we assume a perfectly elastic capital supply, implying that the rental price of capital, k, is fixed.[17]

Implicitly, we assume that capital costs are exclusively financed through bank loans. The total firm loan demand, L, is determined by the capital good's price, R, and the quantity of

[15] For illustrative purpose, we assume that the economy is small and open, which implies that the output price is fixed.

[16] For example if $\delta = 0$ then the capital good is undepreciable such as land.

[17] This is consistent with the short-run modelling of capital market, where firms adjust capital quantities as a response to a policy change. Other effects, such as changes in prices and/or quantities of other inputs will take place in medium to long-run perspective. Usually in firm investment literature variable inputs are assumed to change in the short-run, whereas capital is assumed to change in the long-run. Because our objective is to analyse the effect of investment support, the change in firm capital is a short-run effect of the policy. Then in the long-run, adjustment of other inputs and/or prices follow as a reaction to policy induced capital change. Further, note that when incorporating this partial equilibrium approach into a general equilibrium framework all price and other input effects are accounted for (Kielyte 2008).

capital invested by the firm, K, $L = RK$ (equation (4)). The total firm's interest costs on the loan equal iRK.[18] More precisely, the firm uses loans to purchase capital goods from capital suppliers. In return it pays interest costs to the bank on the borrowed loan.

In summary, this model implies four agents in the capital market: representative firm, loan suppliers (banks), capital suppliers (e.g. machinery/technology suppliers), and the government. The loan suppliers provide loans to firm. The firm uses loan to buy capital goods from the capital suppliers. The firm uses the services of capital goods to produce final products. The government intervenes in the capital market with the investment subsidy (see further).

The capital market is illustrated in Figure 1. Condition (2) determines the firm's demand for capital services and is shown in Figure 1 by curve D_{pc} for the perfectly competitive sector ($\varphi = 0$), and by curve D_{ic} for the imperfectly competitive sector ($\varphi > 0$). The vertical difference between D_{pc} and D_{ic} represents the price mark-up, $[\varphi/(1+\varphi)]pf_K$. The horizontal line S represents the supply of capital services. The intersection between the demand and the supply yields the equilibrium bundle of the rental price and the capital use, (k^*, K_{pc}^*) and (k^*, K_{ic}^*) in the perfect and the imperfect sectors, respectively. The investment is smaller in the imperfectly competitive than in the perfectly competitive sector, $K_{ic}^* < K_{pc}^*$.

4.2 The impact of firm-level investment support

Let α denote the investment co-financing rate of the ECP programmes. The co-financing rate α measures the share of the total value of the supported investment (purchase costs of supported capital investments), which is subsidised from the ECP programme. In line with the ECP co-finding rules, the maximum quantity of capital eligible for support is constrained at $K_{\max}$.[19]

An important factor affecting the impact of firm-level investment support is to what extent the investment additionality is enforced. The objective of the ECP is to increase the quantity or/and the quality of the capital, i.e. to create an additionality effect. In terms of our model this implies that the policy objective is to increase the stock of capital relative to the capital stock used by firms at the prevailing market prices of capital. In order to study the impact of additionality, we analyse two situations: perfect enforcement of additionality and imperfect (no) enforcement of additionality.

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[18] This assumption is not strictly needed to obtain the results. The interest rate i represents the income to capital owners. If one would consider firm-owned capital, then the interest rate i would represent opportunity cost of capital.

[19] This is a more realistic assumption, because the actual budget for the ECP is limited and is subject to competition, implying that not all capital benefits from the support. We assume $K_{\max}$ sufficiently low; less than the equilibrium quantity of investment in the absence of support (see below).

With investment support the firm's profit function (1) changes to:

(5) $\prod = pf(K_{no} + K_s) - k(1-\varphi)K_{no} - \left(k(1+\varphi) - \alpha Ri\right)K_s$

(6) subject to eligibility constraint $K_s \leq K_{\max}$

where K_{no} is the part of capital, which does not benefit from the investment support, and K_S is the part of capital which benefits from the support. We split the total firm capital in K_{no} and K_S in order to allow the possibility that not all firm capital may benefit from the support. This is consistent with the implementation regulation of the ECP. In reality not all firm capital can benefit from the support but there are imposed maximum eligibility thresholds. Note that only the capital K_S benefits from the support in our model.

The value of the ECP support per unit of capital is equal to the capital price multiplied by the co-financing rate, αR. The investment support reduces capital purchase costs. The firm loan demand decreases by an equivalent amount resulting in lower loan interest costs. In terms of our model, the investment subsidy is equivalent to interest rate subsidy. More precisely, the support reduces loan interest costs per unit of supported capital by αRi, i.e. $iR - \alpha iR = \left(R - \alpha R\right)i = \left(1-\alpha\right)iR$. The investment additionality has important implications for firm behaviour particularly in terms of how it affects marginal capital profitability. When we consider the investment support and the issue of the additionally enforcement, the firm equilibrium capital marginal condition (2) changes as follows:[20]

Firm equilibrium conditions if the support affects capital profitability at the margin (additionality enforced or imperfectly competitive sector):

(7) $\partial\Pi / \partial K_{no} = pf_K(K_{no}) - (1+\varphi)k = 0$

(8) $\partial\Pi / \partial K_s = pf_K(K_{no} + K_s) - (1+\varphi)\left(k - \alpha iR\right) - \lambda = 0$

Firm equilibrium conditions if the support does not affect capital profitability at the margin (additionality not *enforced):*

(9) $\partial\Pi / \partial K_s = pf_K(K_s) - (1+\varphi)\left(k - \alpha iR\right) - \lambda = 0$

(10) $\partial\Pi / \partial K_{no} = pf_K(K_s + K_{no}) - (1-\varphi)k = 0$

where λ is shadow price of the eligibility constraint $K_s \leq K_{\max}$.

Profit equation (5) implies that the profitability of capital is higher for the supported capital, K_s, (by αiR) than for the unsupported capital, K_{no}. However, the support improves capital profitability at the margin only in equations (7)-(8) but not in equations (9)-(10). This difference is due to the enforcement of the investment additionality or due to the presence of

[20] We consider the case when the support affects only the firm interest costs. In general, this is consistent with the implementation of the firm-level investment support. The support finances purchase costs of capital. The depreciation costs (δR) are not eligible for the support.

market imperfections (see further). We illustrate this in Figure 2 for the perfectly competitive demand, D_{pc}.[21] First, consider equations (7)-(8). Note that the equilibrium without the support is k^*, K_{pc}^*. Up to the equilibrium investment with no support K_{pc}^*, the support has no effect on the marginal capital profitability. Capital K_{pc}^* does not benefit from the support (i.e. $K_{no} = K_{pc}^*$), and the capital demand is given by curve D_{pc} (this follows from equation (7)). For the investment higher than K_{pc}^*, the support increases capital profitability at the margin (by αiR^*) for the quantity of capital up to K_{max}. K_{max} represents the supported capital, $K_s = K_{pcs}^* - K_{pc}^* = K_{max}$ (this follows from equation (8)).[22] This implies a discontinuous firm's capital demand. Starting in the left-hand side of the Figure 2, the capital demand is given by the curve D_{pc}, D_{pcs}, D_{pc}. By assumption, when the investment additionality is enforced, equations (7)-(8) always hold. This is because the additionality makes only additional capital eligible for the support. With the presence of market imperfections, equations (7)-(8) will tend to hold with and without the investment additionality enforced (see further).

Second, consider equations (9)-(10). Up to the investment K_{pc1}, the support increases the profitability of capital at the margin (by αiR^*) up to the maximum quantity allowed K_{max} ($K_s = K_{pc1} = K_{max}$) and capital demand is given by the curve D_{pcs1} (this follows from equation (9)). Beyond K_{pc1} the support does not affect firms' marginal profitability, implying that the capital demand is at D_{pc} (this follows from equation (10)). As above, this implies a discontinuous firm's capital demand. Starting in the left-hand side of the Figure 2, the capital demand is given by curve D_{pcs1}, D_{pc}. Note that at the margin the firm capital profitability is not affected by the support, at investment K_{pc}^*. In the next sections we show that this situation may occur when the additionality is not enforced and with no market imperfections.

4.3 Perfect enforcement of the ECP additionality

A perfect enforcement of investment additionality implies that policy makers are able to enforce that firms increase their investment by the quantity of the supported investment relative to the investment at the prevailing market prices of capital. In other words, only the additional capital which firms invest benefits from the support. The equilibrium bundle of the rental price and capital use without the investment support in place is (k^*, K_{pc}^*) and (k^*, K_{ic}^*) in the perfect and the imperfect competitive sectors, respectively. This implies that under the perfect enforcement of the investment additionality, the capital use K_{pc}^* and K_{ic}^* is

[21] Similar can be shown for the imperfectly competitive demand, D_{ic}.

[22] Note that in the case shown in Figure 2, the eligibility constraint $K_s \leq K_{\max}$ is binding, $\lambda > 0$. This does not hold in general. For sufficiently high maximum eligibility threshold, firm may not exploit the investment support possibility in full.

not eligible for the support, only capital application beyond this levels can be granted investment subsidies.

This is illustrated in Figure 1. The support shifts the equilibrium investment from K_{ic}^{*} to K_{ics}^{*} in the imperfectly competitive sector, and from K_{pc}^{*} to K_{pcs}^{*} in the perfectly competitive sector. In both types of sectors the quantity of capital increases by eligibility threshold, K_{max}. Note that part of the capital, K_{max}, benefits from the investment support, while the rest of the capital used by firm is not eligible for the support. The firm capital use increases only because the additionality is enforced. However, the uptake of the support is voluntary. The firm has incentive is to apply for the investment subsidy because of profit increasing effect (the policy reduces costs for the supported capital).

There are important differences in the firm investment behaviour between perfectly and imperfectly competitive markets. Under the perfect competition, a cohesion policy which supports capital investments is welfare decreasing. On the other hand, in the imperfectly competitive sector the investment support may generate welfare gain. Under the imperfect competition, the additional investments K_{max} generates productivity gain equal to area *ABCE* (Figure 1). The policy costs are equal to area *BC*, implying a net welfare gain equal to area *A* (equal to productivity gain, area *ABCE*, minus the rental costs of capital, area *BCE*)[23]. Firm's gain is equal to area *ABC,* given by the net productivity gain (area *A*) and the gain from the support (area *BC*).[24]

Under the perfect competition, the additional investment K_{max} generates productivity gain equal to area *GH*, which is less than the rental costs of capital (area *FGH*), implying a net welfare loss equal to area *F*. Area *F* is the deadweight loss resulting from the misallocation of capital recourses. Firm benefits part of the support, which is equal to area *G* (equal to productivity gain, area *GH*, plus policy support, area *FG*, minus the rental costs of capital, area *FGH*).

The man intuition of the above results is that under the perfect competition firms are able to exploit all profitable opportunities even without the support. Firm increases capital investments because it is an eligibility requirement for receiving the support. Additional investments lead to distortions on the capital market resulting in welfare losses. Under the imperfect competition, positive mark-up exists, which makes additional investment opportunities profitable. The support shifts the investment closer to the perfect competition situation, i.e. $K_{pc}^{*} - K_{ic}^{*} > K_{pc}^{*} - K_{ics}^{*}$, thus leading to welfare gains.

[23] Note that this is not a general result. If the mark-up is not sufficiently large, then the net effect of the investment support could actually lead to a welfare loss.

[24] Note that in a general equilibrium model tax distortions and other inter-sectoral and inter-regional distortions need to be accounted for to obtain total welfare effects of the investment support.

4.4 Imperfect enforcement of the ECP additionality

Often, however, policy makers cannot enforce investment additionality in reality, because usually there are no available counterfactual data to check the firm investment level with and without the support. Policy makers can observe only capital use with the support. At the same time, firms do not have incentive to reveal their true counterfactual investment intentions. This makes the monitoring of the application of investment additionality costly and thus hard to enforce.

First, consider the perfectly competitive sector (Figure 1). The equilibrium investment without the support is K^*_{pc}. We assume that the maximum eligibility thresholds is $K_{\max}$, where $K_{\max} < K^*_{ic}$.[25] In this case, the equilibrium capital with and without the support is K^*_{pc}, all the support (area FG) benefits firm and the support does not create distortions in the capital market. In equilibrium the firm invests K_{pc1} to claim the support up to the maximum allowed, $K_{pc1} = K_{\max}$ and gains full value of the support, area H (=area FG). However, firm can consider expanding investments by $K_{\max}$ (as shown in the previous section with the perfect enforcement of the investment additionality). In this case the equilibrium investment would shift to K^*_{pcs} and firm's gains would equal to area G. Given that the area H is larger than the area G, due to the decreasing capital productivity, it does not pay-off to increase capital beyond K^*_{pc} if $K_{\max} < K^*_{ic}$.[26] This implies that with perfect markets, private investments are crowded out by subsidised investments. The firm investments would be undertaken even in the absence of the ECP support policy.

Next, consider the imperfectly competitive sector. In the previous section (with perfect enforcement of the investment additionality) we have shown that with the increase of capital by $K_{\max}$ (to K^*_{ics}) firm gains from policy support are equal to area ABC, which is more than the gain (area H) obtained if the capital quantity is kept unchanged at K^*_{ic} (Figure 1). Hence, with imperfect competition it is optimal for firm to increase investment by $K_{\max}$ and the equilibrium capital with and without the enforcement of investment additionality is the same at K^*_{ics}.[27]

The main intuition behind these results is that with perfect markets, the ECP cannot improve the investment opportunities of firms. Firms undertake the same level of capital investments independently of whether the policy is in place. In this case the investment support represents to a large extent a pure income transfer to firms from taxpayers. This is

[25] Note that $K_{\max} < K^*_{ic}$ also implies that $K_{\max} < K^*_{pc}$.

[26] The intuition behind this result is that with perfect competition firms can exploit all profitable investment opportunities even without the support. Providing investment support to firms (such that $K_{\max} < K^*_{ic}$) does not alter investment opportunities available to firms. Firm optimal behaviour is to use the same quantity of capital with and without the support.

[27] Note that this does not hold in general, only for the cases when the mark-up is sufficiently large as shown in Figure 1.

not the case with imperfect markets where the ECP support allows firms to expand investments and thus exploit otherwise unused profitable investment opportunities.

5 Conclusions

Additionality is one of the key principles driving the functioning of the EU Cohesion Policies. The present paper studies how additionality and co-financing affect the firm investment behaviour. Using the example of firm-level investment support we illustrate the impact of additionality in perfectly and imperfectly competitive sectors.

We find that the investment additionality and the level of competition importantly affect the firm investment behaviour. The allocation of the firm-level investment support to a perfectly competitive sector increases investment only, if the investment additionality is enforced. When imposing the principle of additionality, firms are able to exploit all opportunities even without the support. Allocating investment support to such a sector and enforcing the additionality causes distortions in the capital market and leads to lower welfare levels. However, without the enforcement of additionality, the distortions are minimal and the support represents a large extent an income transfer to firms. Only in imperfectly competitive sectors (e.g. due to increasing returns to scale, credit constraint) the firm-level investment support may increase investment and may be welfare increasing with and without the enforcement of the investment additionality. In this case policymakers should not be concerned about the enforcement of additionally.

Our findings suggest that for achieving sensible policy results, not only the amount of support given to the firms is important, but also the way how money is allocated as well as market conditions under which it is granted are highly important. If investment substitution possibilities are not controlled for, i.e. if additionally is not enforced, then profit maximising firms may solely substitute private investment by public investment resulting in policy inefficiencies. An efficient firm-level investment support policy should strictly consider under which market conditions (imperfect versus perfectly functioning markets) the investment support is allocated. The consideration of market situation is as relevant policy objective as the additionality enforcement. If the ECP is targeted on the sectors which are deprived from the access to capital, firms will always have the tendency to increase capital use even if the additionality is not enforced; moreover the ECP will have a welfare increasing effect. Under imperfect market conditions firms have private incentive to increase investments, whereas with additionality enforced firms may increase investment only because it is politically imposed possibly leading to welfare losses.

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Figure 1. Firm investment support and additionality

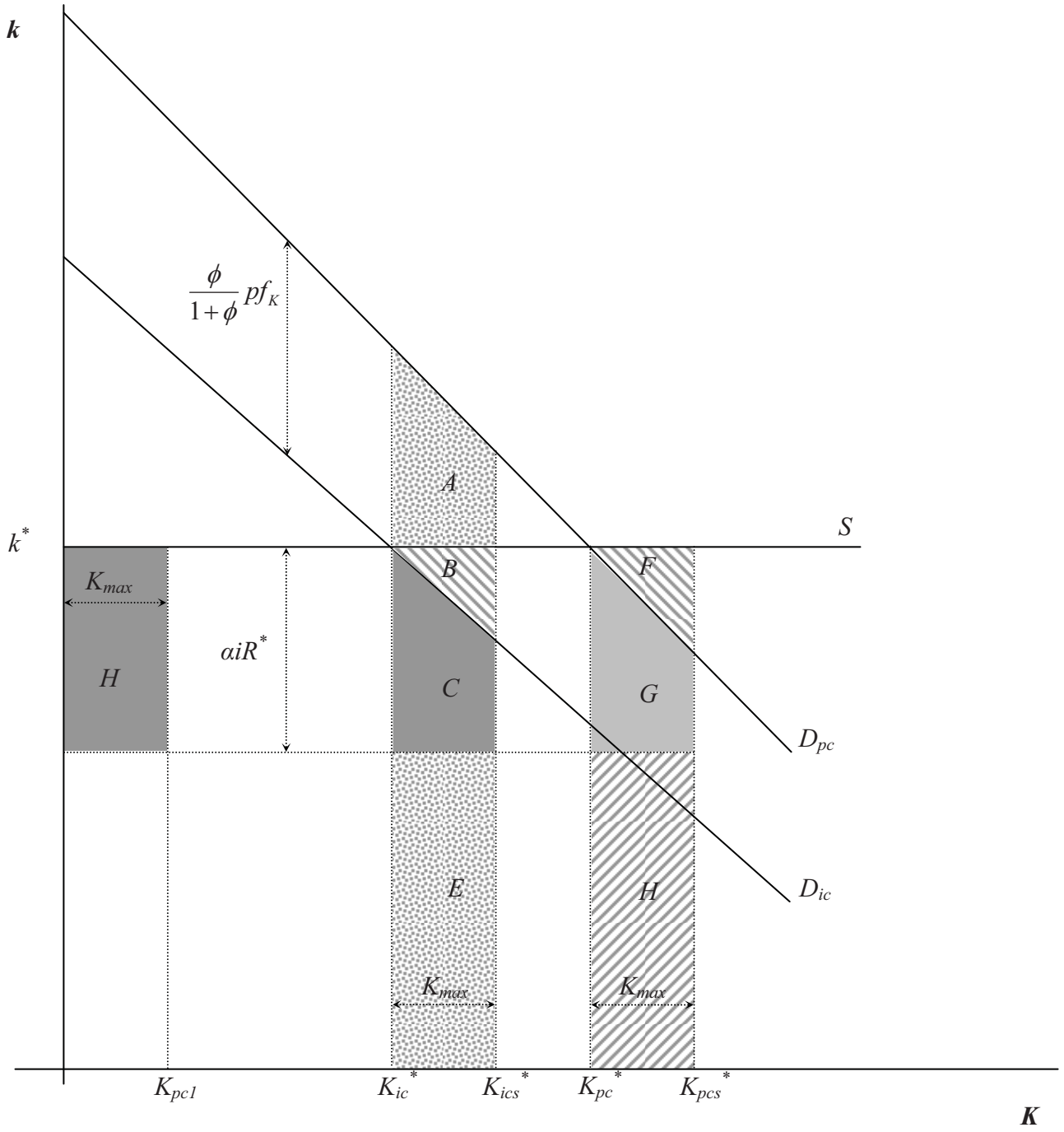

Figure 2. Modelling the firm investment support