

Gábor Békés and Péter Harasztosi

# Tax credit, exports and regional disparity: micro-evidence from Hungary

EFIGE working paper 56  
August 2012

Funded under the  
Socio-economic  
Sciences and  
Humanities  
Programme of the  
Seventh  
Framework  
Programme of the  
European Union.

LEGAL NOTICE: The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 225551. The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.



The EFIGE project is coordinated by Bruegel and involves the following partner organisations: Universidad Carlos III de Madrid, Centre for Economic Policy Research (CEPR), Institute of Economics Hungarian Academy of Sciences (IEHAS), Institut für Angewandte Wirtschaftsforschung (IAW), Centro Studi Luca D'Agliano (Ld'A), Unitcredit Group, Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

The EFIGE partners also work together with the following associate partners: Banque de France, Banco de España, Banca d'Italia, Deutsche Bundesbank, National Bank of Belgium, OECD Economics Department.

# Tax credit, exports and regional disparity: micro-evidence from Hungary<sup>☆</sup>

Gábor Békés<sup>a,\*</sup>, Péter Harasztosi<sup>b</sup>

<sup>a</sup>*Institute of Economics, CERS - Hungarian Academy of Sciences*

<sup>b</sup>*Central European University and Magyar Nemzeti Bank*

---

## Abstract

Hungary applied a generous corporate tax credit scheme for the 1998-2000 period. Over 40% of all manufacturing firms received subsidy by applying a deduction from its payable corporate tax. As the tax credit was related to investment, firms could use these funds to expand into foreign markets. Using a new firm level data from Hungary, with direct information on tax credit use, we investigate how this tax credit affected entry into exporting. We find that a firm is about 4% more likely to start exporting if it had received a tax credit. In terms of the policy's regional impact, we find that the impact of tax credit regarding export market entry is not strongly dependent on regional disparity.

*Keywords:* Keywords:

Tax credit, export entry, public policy, regional disparity JEL classification: F10, H25, R12, R53

---

---

<sup>☆</sup>This paper was produced within European Firms in a Global Economy: Internal policies for external competitiveness (EFIGE), a collaborative project funded by the European Commission's Seventh Framework Programme (contract number 225551). The entire responsibility for errors and omissions remains on us. We thank the excellent research assistance of Zsuzsa Holler and István Ilyés.

\*Corresponding author: mail: bekes@econ.core.hu, Institute of Economics, CERS-HAS, Budaörsi út 45, Budapest, Hungary, 1112.

## 1. Introduction and motivation

National governments have applied a variety of tax incentives to boost performance and assist in foreign expansion. Hungary applied a generous corporate tax credit scheme for the 1998-2000 period when 40% of all manufacturing firms received could apply deductions from payable corporate tax. As the tax credit was related to investment, firms could use these funds to expand and upgrade production facilities.

For small and open economies such as Hungary, one channel of improving export performance of the economy is to assist more firms to engage in trade. As several studies<sup>1</sup> have shown trade liberalization often improves the intensive margin, making existing exporters increase volume and enter new markets. However, this is not enough as the impact on the extensive margin is very limited. This is why additional government policies have been applied in many countries to help new firms enter exporting.

At the same time, several broad investment supporting programmes were introduced to assist firms in improving production capacity, and upgrading their technology. While these measures are not directly aimed at export promotion, these investments may lead to higher productivity which in turn would lead to firms self-selecting into export participation (Melitz, 2003). Hence, these policies may be actually more effective. As the government offers tax incentives for firms to invest, this may turn to increase their productivity and hence, help them finance the fixed costs of entering into the export market.

Unlike most public economics studies (such as Girma et al. (2009a)), this paper does not use a direct subsidy program but considers a more general corporate tax package offering tax credits in return for investments. A tax credit is an amount of money deducted from the total amount a tax payable by firms or individuals. Being a neutral form of policy instrument, many countries replaced direct subsidies gradually with indirect policy instruments like tax credit. Indeed, providing tax credit instead of grants in order to achieve a policy goal might have several advantages. Most importantly, unlike subsidies, it is not directly subject to corruption and does not require extra administrative costs. On the other hand it has serious disadvantages. Due to its neutral nature, tax credit is rarely able to correct market failures directly. While subsidies can be distributed based on firm size, activity and industry or on living circumstances of a given individual, tax credits cannot. However, information asymmetries between the distributing agencies and the beneficiaries of grants make it very hard to determine the proper distribution of subsidies thus this property of subsidies can easily turn into their major disadvantage.

Tax credit is a frequently used form of subsidies for personal income taxation but is also offered to firms. One of the most frequently used forms of tax credit is the R&D tax credit. It aims at boosting investment into innovative activity and at the same time it eliminates the gap between the social and private benefit of research and innovation.

Another extensively examined type of tax credit is investment tax credit. Despite

---

<sup>1</sup>See, for instance, Bernard and Jensen (2004), Roberts and Tybout (1997), Eaton et al. (2011)

the fact that empirical evidence on their effectiveness investment promoting tax incentives is ambiguous, they are considered as important tools for stabilizing the economy. While economic theory suggests that the cost of capital influences the demand for capital several studies find that tax policy and the cost of capital have only modest effect on investment decisions (e.g. Chirinko and Eisner (1983)). Empirical works incorporating capital adjustment costs also suggest very small effect of permanent investment incentives (see Summers (1981), Fazzari et al. (1988)).

Unlike several empirical papers (e.g. Mansfield (1986), Hall (1994) or Hall and Van Reenen (2000) on R&D credits), we do not investigate a cost-benefit analysis. The main reason for this is that the tax credit scheme we analyze was aimed at assisting capital formation and this paper looks at a particular indirect consequence for export market entry.

This paper will focus on the impact of tax credit on exporting behavior of firms. Despite the fact that direct export subsidization is banned under World Trade Organization (WTO) rules most countries promote exports indirectly. These promotions may include favorable tax schemes, export promoting agencies and direct production subsidies. Production-related subsidies might substantially affect the export behavior of firms and whilst being in line with WTO regulations. Such subsidies might lower production costs of firms through increased efficiency (R&D subsidies, investment support) thus help firms to overcome entry barriers and makes them more competitive on the global market.

Empirical evidence on the effectiveness of export subsidies is rather mixed. Görg et al. (2008) analyze panel data on manufacturing firms in Ireland over the period 1983-2002 and conclude that grants intend to increase investment in technology, training, and physical capital are effective in increasing total exports of already exporting firms but not in encouraging new firms to start exporting. Similar results are found for China by Girma et al. (2009a), for Portugal by Afonso and Silva (2012) and for Germany by Girma et al. (2009b). Note that some measures in some companies will affect the intensive margin though. Furthermore, even if some positive effect is found, its effectiveness is dubious. For instance Hoffmaister (1992) finds a positive effect of a tax credit scheme in Costa Rica on exports, but points out that, from a cost-benefit point of view, export subsidies have been a disproportionately costly way of achieving the rise in exports.

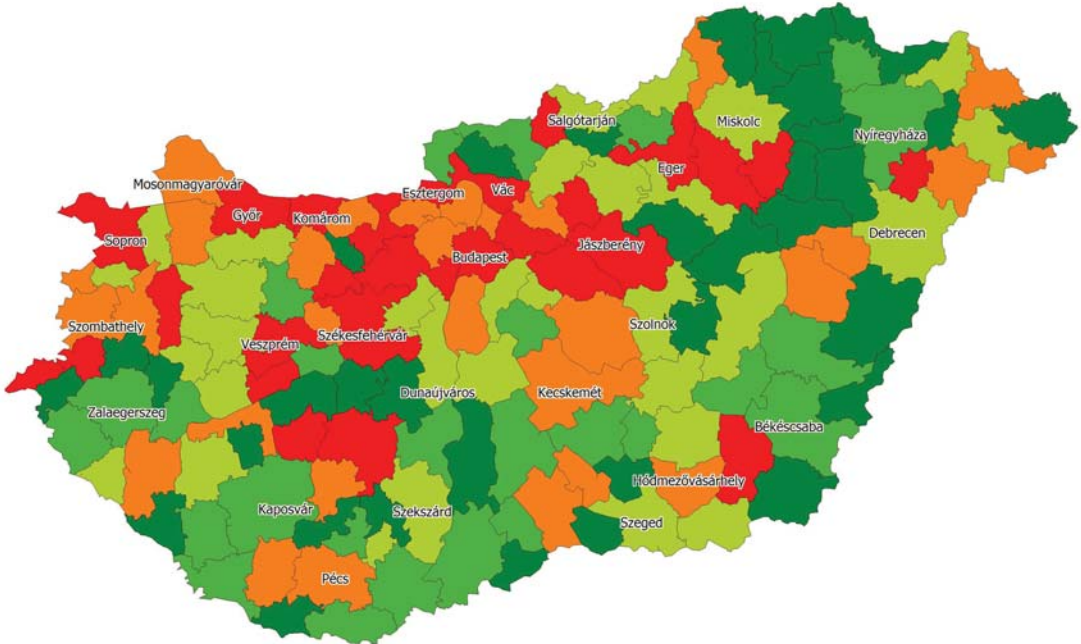
Most empirical studies suggest that the imposed policies did not succeed in achieving their goal. Bernard and Jensen (2004) investigate the effect of government export promotion expenditures on the probability of entry into exporting in the United States using firm level data and they do not find noticeable effect on exporting. Helmers and Trofimenko (2010) find that subsidies have a positive impact on the intensive margin of export using firm level data on Columbian manufacturing plants. A key deviation from most of the literature is that in our case the tax credit use is rather broad and not directly targeted to exporters and hence, we consider it as a potential by-product of the tax credit policy.

Export performance of firms is key determinant of growth prospects at the regional level. Spatial inequality has been rather high in Hungary, with some Western regions

reaching three times the poorest North-East. This is reflected in export participation as well as suggested by the graph below. Hence, comparing regional aspects of tax credit helps understand if regional inequality were ever reduced by the scheme.

Figure 1: GDP per capita by NUTS4 regions in 2001

Values increase from dark green towards red



The potential impact of policy at the regional level comes from two sources. First, firms in lagging and rural regions are more in need for state support given the lack of market options such as bank and venture capital finance, proximity to international supply chains and strong local labor markets. At the same time, exactly because of these missing the necessary labor market and business service supply, firms in these regions will have lower absorptive capacity to make use of state funds. This is true in innovation policy (on this paradox, see for instance Oughton et al. (2002) ), export promotion and other areas of subsidies. As a result, investigating the regional outcome may be the result of such opposing forces with empirical outcome showing which force is stronger.

Regarding spatial consequences, there is evidence that subsidies may affect firms in less developed areas more positively and hence, reduce disparity. At the same time regional GDP may directly affect the use of tax credit. There is ample evidence of spatial spillovers, the knowledge on the existence of such schemes may be spread locally (Glaeser and Gottlieb, 2008). Furthermore, firms need to be close to services, offered in denser regions. Tokila et al. (2008) find that the likelihood that investment subsidy induce additional

investment is greater for projects in distant regions of Finland than in central areas. Girma et al. (2009a) also study the regional differences in the effect of production subsidies on export performance in China. Their results suggest that firms in the less-developed non-coastal regions benefit more from subsidies.

For our case, we will use 150 administrative micro regions to study how export start may be differently affected by the tax credit program.

In this paper, data as well as details of credit tax program will be first presented. In section three, we will first measure the national impact of the tax credit program on export market entry followed by the a more detailed look at the outcome at a regional level in section four. The final section concludes.

## **2. Data and the tax credit program**

In this paper, we use Hungarian firm level data to investigate the effect of a tax credit scheme applied en masse in 1998-2000. We look at export entry following in the first three years after the treatment.

### *2.1. The Hungarian tax credit program*

There has always been a set of investment promotion related tax credit policies in place in Hungary. However, during the 1998-2000 period, a large set of policies allowed 40% of manufacturing firms to enjoy the benefits of tax credits. The first impact came in 1997 when the the corporate tax law of Hungary was generally reorganized, and one of the changes affected the tax credit system.

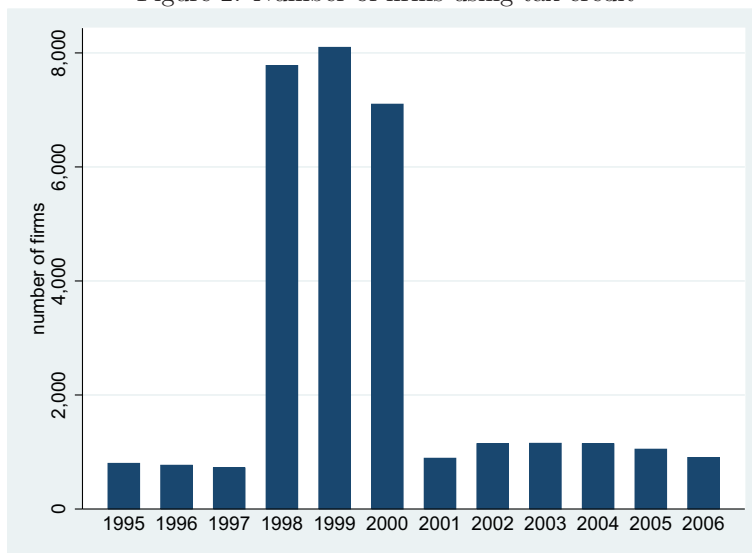
While previously only specific foreign investments and financing schemes were granted tax credit, the new law defined three broad areas. First, in the new scheme, firms which undertook investments above certain thresholds, 1 billion HUF, were allowed to write off 50 percent of their corporate taxes due. Second, in favored micro regions firms could deduct the full amount of the investment from their taxes. Third, also in favored micro regions, six percent of the value of infrastructure investment put into operation was made deductible from corporate taxes payable. Measures were targeted regions where local unemployment in past years were above 15 percent.

In 2000, the Parliament modified the tax credit legislation once again. The allowance in the favored regions were abolished, instead a program helping the small and medium sized enterprised were introduced. This allowed part of the interest on capital services to be deduced from taxes. The tax credit promoting large developments (with a now much larger minimum investment and or employment criteria) were still available.

Overall, the generous changes in the corporate tax code concerning the tax credit resulted in a sharp rise in the number of firms being able to benefit from low effective taxes for a few years. The number of firms applying tax credit rocketed in 1998 and remained high until the next legislative change in 2000. Figure 2 shows that from number

of firms with tax credit rose from 720 in 1997 to over 7000 in just one year only to fall back to below 1000 in 2001.

Figure 2: Number of firms using tax credit



In our analysis we use data from the Hungarian Tax and Customs Office (NAV). The data contains information on balance sheets, income statements and tax reports of double book-keeping manufacturing firms. As our data is based on tax files, it includes income statements of firms. Corporate income tax is a percentage of the pre-tax profits which can be reduced by the tax credit. In addition to providing information on the pre-tax profit and paid taxes, a company will note if it had used tax credit in the given year. Thus, our variable of interest is explicit in income statements and hence, in our data.

We cannot see from the data what exact article of the law firms relied on to use the tax credit scheme. However, we looked at what specific change in the law might have resulted in the jump in the number of eligible firms. Before 1998, it was mainly used for large investments. While several measures were introduced at once, it was the simplified easy to use tax credit scheme that helped so many firms. Adding the specific regional requirement has hardly affected the regional distribution of users. In 2000, new changes reduced availability by raising the minimum limit and basically shifting firms into using interest rate subsidy - which we cannot track in the data.

## 2.2. Data

In our analysis we use data from the Hungarian Tax and Customs Office (NAV). The data contains information on balance sheets, income statements and tax reports of double book-keeping manufacturing firms.



Our sample in this paper contains all the firms who are either non-exporters for the 1997-2002 period or were not exporters in 1997-98 but started to export sometime in the 2000-2002 period. We dropped firms who exported before 2000 as export switching could not be considered for them. The sample includes both firms who did and did not use tax credit in the 2000-2002 period. This left 7150 firms in the sample out which balance sheet data for TFP estimation was available for 5230 firms. Out of this, only 153 are foreign firms, so we focused on domestic firm only.<sup>2</sup> Foreign firms usually start exporting soon after entering the market and hence, post tax credit export switching is rare to be observed. Overall, this leaves us 5077 firms - this is our baseline sample.

The NAV data allows for an evaluation of firm performance in terms of productivity, employment, sales and export sales. Given the information on the share of sales from exports is provided we can define exporting firms as firms with positive export sales. On average 20-24 percent of the firms engage in exporting activity. These firms are on average larger, pay higher wages, are more capital intensive and are more productive. When comparing it to other countries Hungary can be considered a quite open, internationalized economy (Békés et al., 2011).

The location on the firms is obtained from the Central Statistical Office's Corporate Registry. The data allows us to pinpoint the location of the headquarters of the firm.<sup>3</sup> Consequently, firms immediate environment can be examined at larger administrative scales as well, like micro-regions or counties. Table 3 provides a description on Hungarian spatial zoning.

As the graph below suggests, there is substantial spatial variation with larger share of firms in North-Western and Southern micro regions using tax credit than in the center of the country. For example, in Budapest, only 35 percent of the firms used the tax credit scheme in 1998 to 2000. In contrast, more than 55 percent of firms near Pécs (South) make use of the credit.

Table 1: *Summary of Hungarian administrative spatial zoning*

EU level units	Hungarian equivalent	number	avg. size $km^2$
NUTS2	EU administrative region	7	13861
NUTS3	20 regions (megye)	20	4651
NUTS4	micro regions (kistérség)	150	620
NUTS5	municipalities	3125	30

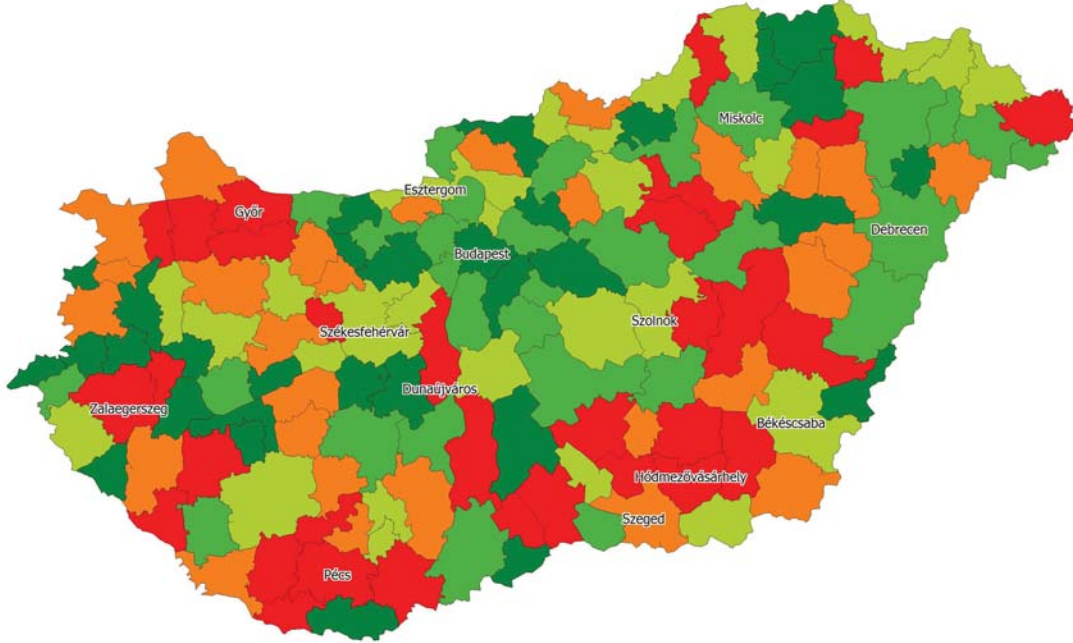
<sup>2</sup>except for column one in Table 2

<sup>3</sup>Previous investigations on the location of Hungarian firms reveal that over 90-95 percent of the manufacturing firms are single plant firms. See Békés and Harasztosi (2010)



Figure 3: Share of firms in 2001 using taxcredit in 1998-2000

Values increase from dark green towards red



### 3. National effect

#### 3.1. Estimation Strategy

To estimate the relationship between tax credits and export entry we estimate a probit model comparing the probability of treated and non-treated firms, asking if firms that received tax credit start exporting with a higher probability.

To formulate our question more precisely, we make two restrictions regarding the sample. First, to investigate the effects of the tax credit being in effect for the years 1998-2000 we focus on one cross section of firms in 2001. Second, we look at firms that existed already before the tax credit was introduced and did not export before 2001. That is, we leave out firms that might have been established just to make use of the tax credit scheme. We focus on existing firms. Excluding firms that made positive exports before 2001 makes sure that when we look into the probability of exports after the tax credit years, we actually consider the firms decision about starting to trade.

For firm  $i$ , we estimate:

$$Pr(EXP_{i,t+1} = 1 | \cdot) = \Phi(\alpha TCRED_{i,t} + \beta CTRLS_{i,t-1}) \quad (1)$$

This is a cross-section exercise with period  $t = 1998 - 2000$ ,  $t - 1 = 1997$  and  $t + 1 = 2000 - 2002$ . Where  $EXP$  is a dummy variable that takes up the value of one if the firm exports in  $t$  or exports anytime in the following two years.  $TCRED$  is a dummy variable that takes up the value of one if firm  $i$  has used the tax credit program to reduce corporate taxes due in any of the three years before  $t$ .

In equation 1 parameter  $\alpha$  will show the difference between tax-credit beneficiaries and other non-trading firms.

We introduce additional control variables that can be both correlated with export performance. In particular, as suggested by the empirical trade literature, e.g. Bernard and Jensen (1999), Bernard et al. (2007) or Mayer and Ottaviano (2008), we control for the firms productivity TFP. In this paper we use TFP estimation as proposed by Levinsohn and Petrin (2000). The method is a control function approach that uses intermediate inputs of the firm as instruments to estimate the coefficients of a Cobb-Douglas production function. We use value added production function with two inputs: capital and labor. The latter is the average annual workforce, while the former is generated by perpetual inventory method.<sup>4</sup> We also include the firms age. Corporate tax literature suggest a correlation between a firms age and the amount of taxes they have to pay (see, e.g., Creedy and Gemmell (2009) or Ahmed (2004)). One of the reasons for this is that firms get to know their own income and cost structure and are better in optimizing for a lower tax. Also age may matter for exports as developing a product line that can successfully meet international competition can take time.

While  $TCRED$  variable is not influenced by contemporaneous trade related shocks, controls such as TFP or a foreign takeover can be possibly endogenous. To attend to this we use lagged values of the control variables,  $CTRLS_{i,t-1}$ . Note that we use the same sample even without control variables. Our main results are presented with TFP and age as well as industry and macro-region controls, with results with firm size as additional control, shown in the Appendix.

### 3.2. Results and extensions

Results are presented in Table 2. The first two columns present results from the probit model with the taxcredit variable (full sample and domestic firms only<sup>5</sup>), the third column shows the extended probit with (lagged) control variables. The tax credit has a significant impact on firms' probability to start exporting. As expected from the trade literature, controlling for productivity and ownership (as well as size and age), reduces the effect. Taken at the mean, a firm is about 4% more likely to start exporting if it had received a

---

<sup>4</sup>Necessary deflators, e.g. for value-added, materials, investments are obtained from Central Statistical Office's national accounts at the 2 digit NACE level.

<sup>5</sup>It turns out that there is only 153 foreign owned firms who match the sample criteria. Hence, except for the first column, we restricted our sample to domestic firms only.

tax credit.

Table 2: Baseline results

Dep. Var: Dummy for any exports in 2001-2003					
	[1]	[2]	[3]	[4]	[5]
sample:	all firms	domestic firms	dom.firms	dom.firms	dom.firms
model:	Probit	Probit	Probit	Probit	Probit IV
restrictions:	no	no	no	pos. past tax	no
TCREDIT	0.348*** [0.0620]	0.363*** [0.0643]	0.253*** [0.0689]	0.225*** [0.0790]	0.347** [0.150]
firm age			-0.0317** [0.0143]	-0.0316** [0.0151]	-0.0330** [0.0144]
TFP			0.188*** [0.0364]	0.198*** [0.0383]	0.176*** [0.0392]
dummy: sector	yes	yes	yes	yes	yes
dummy: county	yes	yes	yes	yes	yes
Constant	-1.777*** [0.0531]	-1.807*** [0.0553]	-2.603*** [0.198]	-2.590*** [0.215]	-2.594*** [0.198]
Observations	5230	5077	5077	4326	5077
Pseudo R <sup>2</sup>	0.0137	0.0148	0.051	0.044	
Wald Chi <sup>2</sup>					110

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

\* instrument: positive taxbase in 1997-2000

In case of the evaluation of governmental subsidy or tax credit program endogenous selection arises as a serious concern. Most likely firms applying tax credit are systematically different from firms not receiving. Moreover, characteristics affecting the probability of receiving governmental support are often related to the outcome variable.

First, there is a basic selection on taxable income; for firms who are loss-making throughout the period (have no positive tax liabilities that can be reduced with the credit), the investment tax credit is not option. It is possible that any effect we measure is only a profitability proxy. Hence, we dropped firms who were always loss-making in the period 1997-2000 period. Given large scale tax evasion, we think that non-taxable income may be a sign of either tax evasion or continued investments and hence, we consider this as robustness check rather than main result. As for the restricted sample (column four), the restriction shuts out not profitable firms and hence, marginally reduces the coefficient.

Second, one can instrument the tax credit variable. It is very difficult to find a good instrument that would be correlated with the ability to use tax credit but not affect export market entry. We used the profitability variable for instrumenting tax credit use that indicates positive tax base whenever tax credit was available. We name this variable *POSTAX*. It shows a partial correlation 0.76 with variable *TCRED*, and only a 3 percent correlation with the dependent variable.

We estimate an instrumented version of Eq. 1:

$$\begin{aligned}
 Pr(EXP_{i,t+1} = 1|.) &= \Phi(\alpha TCRED_{i,t} + \beta CTRLS_{i,t-1}) \\
 E(TCRED_{i,t}|.) &= \theta POSTAX_{i,t}
 \end{aligned}
 \tag{2}$$

The probit IV model (column five) suggests a similar effect and the Wald test of the instrument cannot reject exogeneity suggesting a valid IV.<sup>6</sup>

#### 4. Regional aspects

A key idea behind the scheme has been to help firms with less financing capacity to grow. One dimension of inequality is regional given large discrepancies in Hungary. Given a large amount of firms with financing difficulties in poorer regions, the scheme should have implicitly affected them. Furthermore, some articles of the law made additional eligibility criteria available for firms in poorer micro regions. Our data does not allow us to explicitly see what criterion has been used, so we investigate several regional disparity measures.

##### 4.1. Estimation methods

We employ a set of variables to look into regional variation in the effects of tax credit on exporting activity. We consider several approaches analyzing the effect of local income, urbanization, local export experience and favored regions. Graphs for these variables are available in the Appendix.

First, to capture the economic potential in the immediate locality of firms, we use a calculated proxy of GDP per capita over (NUTS4 level) 150 micro regions (see earlier graph). In the lack of public data at such disaggregated level, we calculated it from value added of manufacturing firms. This is the broadest measure and should proxy spillovers as well as local absorptive capacity within manufacturing (Aitken et al., 1997).

Second, to capture the possible advantages of urbanization, the increased variety of inputs, the heterogeneity in services, higher skills of the workforce we introduce a CITY dummy. The variable takes on the value of one for cities that are the administrative centers of (NUTS 3 level) counties with the addition of three cities that are adjacent to Budapest and are consequently attractive locations of firm headquarters.<sup>7</sup>

Third, we focus our attention on local exporting experience. The propensity to start exporting also depends on the amount of firms already exporting in the vicinity of the firm. Recent international trade literature showed specific export spillovers as trading firms learn from each other on markets and trade technology (Koenig et al., 2010). To account for this variation, we use the share of exporting firms in 2000 in the 150 (NUTS4 level) micro regions and define the variable EXPSHARE as a dummy which equals one of percentage of firms with non-zero exports compared to all manufacturing firms are above its mean, and zero if it is below.

---

<sup>6</sup>Other methods include propensity score matching, see Girma et al. (2009a) and Afonso and Silva (2012) or Czarnitzki et al. (2011) and Heckman two-step estimation procedure, see Hussinger (2003).

<sup>7</sup>Vác, Törökbálint and Érd.

In a further specification, we use a simple control for the remoteness from Hungary’s main export partner, Western Europe. The EAST dummy takes on the value one if the location of the firm is east from the north-south section of the Danube river. The dummy practically cuts the country into half vertically.

Finally, we consider the regional specification discussed in the law. The idea is that in backward micro regions with high unemployment, firms can use further deductions. We denote the locations, where firms were additionally eligible for deductions. We define FAVOR as a dummy with FAVOR=1 if a micro region is defined as backward by the government.<sup>8</sup>

The table below presents key statistics for values of our variables:

Table 3: *Summary statistics of main controls*

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP (logs)	7150	0.003	0.022	0.00011	1.66
CITY	7150	0.567	0.496	0	1
EXPSHARE	7150	0.528	0.499	0	1
EAST	7150	0.357	0.479	0	1
FAVOR	7150	0.216	0.411	0	1

In this context, we extend our baseline specification with  $REG_{i \in r}$ , a regional disparity variable defined at micro-region  $r = 1 \dots 150$  level, and a cross term:

$$Pr(EXP_{i,t+1} = 1 | \cdot) = \Phi(\alpha TCRED_{it} + \beta REG_{i \in r} + \gamma REG \times TCRED_{it} + \delta CTRLS_{i,t-1}) \quad (3)$$

where for  $REG$  we can substitute any of the following variables:  $GDP$ ,  $CITY$ ,  $EAST$ ,  $EXPSHARE$ ,  $FAVOR$ . Results presented come with robust standard errors clustered at the micro-regional level.

#### 4.2. Results

Let us look at results, presented in Table 4. Columns 1 to 3 show results with our basic regional disparity indicators, east-west division, GDP (manufacturing value added) and urbanization (city dummy). True, the probability of export switching depends on these variables<sup>9</sup> as in higher GDP areas, more firms start exports. However, when adding cross terms (as in Table 4), both the regional variable and the cross term becomes insignificant.

<sup>8</sup>The variable is based on the supplement to the corporate income tax law issued jointly by the Ministry of Finance, the Statistical Office and National Employment Service for years 1998-2000.

<sup>9</sup>Results without the cross term are available on request.

This suggests that tax subsidy will not significantly differently affect less developed regions in terms of starting to export.

Table 4: Regional results

Dep. Var: EXPORT	[1]	[2]	[3]	[4]	[5]
TCREDIT	0.276*** [0.0608]	0.256*** [0.0643]	0.224** [0.0922]	0.506** [0.213]	0.258*** [0.0599]
firm age	-0.0326** [0.0130]	-0.0338*** [0.0131]	-0.0323** [0.0129]	-0.0316** [0.0131]	-0.0325** [0.0129]
TFP (LP)	0.190*** [0.0325]	0.196*** [0.0324]	0.195*** [0.0322]	0.190*** [0.0323]	0.191*** [0.0323]
EAST	-0.0196 [0.113]				
TCREDIT $\times$ EAST	-0.0499 [0.128]				
GDP		13.42* [7.027]			
TCREDIT $\times$ GDP		-1.232 [6.982]			
CITY			-0.116 [0.109]		
TCREDIT $\times$ CITY			0.0557 [0.111]		
EXPSHARE				0.0768 [0.194]	
TCREDIT $\times$ EXPSHARE				-0.291 [0.220]	
FAVOR					-0.00682 [0.191]
TCREDIT $\times$ FAVOR					-0.00861 [0.235]
dummy: sector	-2.516*** [0.184]	-2.636*** [0.174]	-2.511*** [0.185]	-2.614*** [0.260]	-2.536*** [0.174]
Constant	[0.196]	[0.195]	[0.200]	[0.257]	[0.191]
Observations	5 077	5 077	5 077	5 077	5 077
Pseudo R <sup>2</sup>	0.0457	0.0501	0.046	0.0476	0.0453

Standard errors in brackets are clustered by NUTS4 region  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Given our focus on exporting and knowledge spillovers related to exporting per se, we created the EXPSHARE, a dummy variable that measured the low vs high intensity of other exporters in the micro-region. Results, shown in column 4, suggest similar evidence, given the insignificance of the cross-term despite a larger then previous value.

It is possible that in high export intensity micro-regions, TFP is also higher due to spillover. To investigate this, we separated the sample by low and high intensity allowing control variable coefficients to differ. Results presented in Table 6 of the Appendix show that while there indeed seem to be a large difference between coefficients tax credit affect firms more in micro-regions with low intensity, statistical difference is rejected by an F-test. Dividing the sample allowed for using or instrument as well. Columns 3 and 4 in Table 6 show a similar picture, but large standard errors once again prevent statistically significant results.

Finally, we test the effect of favored micro-regions – these are defined by a state agency and shown in Figure 5 of the Appendix. In this case, there are legal reasons to think that tax credit may have been more effective – the law set a different set of eligibility criteria and hence, using firms may be different in these regions. Results, presented in column 5 reject this notion as well.

Overall, our results looking at disparities at the micro-regional level found that while firms in micro-regions with less export experience may have benefitted more from tax credits, the difference is not statistically significant.

## 5. Conclusion

Hungary applied a generous corporate tax credit scheme for the 1998-2000 period. Over 40% of all manufacturing firms received subsidy by applying a deduction from its payable corporate tax. Investment subsidy such as this may help firms to prepare for external markets and hence, increase the likelihood of starting to export. We found that a firm is about 4% more likely to start exporting if it had received a tax credit. The result is robust to various specification including instrumenting tax credit receipt.

A key idea behind the scheme has been to help firms with less financing capacity to grow. One dimension of inequality is regional given large discrepancies in Hungary. Given a large amount of firms with financing difficulties in poorer regions, the scheme should have implicitly affected them. We found that that in general, firms in more backward areas did not benefit more or less than in advanced regions. While firms in micro-regions with less export experience may have benefitted more from tax credits, the difference is not statistically significant.

We have not carried out a cost-benefit analysis, and hence, cannot argue for or against such measures. What this paper shown instead is that massive tax credit programs targeting investments in general, may have an additional benefit, helping firms enter foreign markets. At the same time, we could not find statistically strong evidence regarding effects of reducing spatial disparities in terms of exporting frequency.



## References

- Afonso, O., Silva, A., 2012. Non-scale endogenous growth effects of subsidies for exporters. *Economic Modelling* 29 (4), 1248–1257.
- Ahmed, S., 2004. Modelling corporate tax liabilities using company accounts: a new framework. Cambridge Working Papers in Economics 0412, Faculty of Economics, University of Cambridge.
- Aitken, B., Hanson, G. H., Harrison, A. E., 1997. Spillovers, foreign investment, and export behavior. *Journal of International Economics* 43 (1-2), 103–132.
- Békés, G., Harasztosi, P., 2010. Agglomeration premium and trading activity of firms. CeFiG Working Papers 11, Center for Firms in the Global Economy.
- Békés, G., Muraközy, B., Harasztosi, P., 2011. Firms and products in international trade: Evidence from Hungary. *Economic Systems* 35 (1), 4 – 24.
- Bernard, A., Jensen, B., 1999. Exceptional exporter performance: cause, effect, or both? *Journal of International Economics* 47 (1), 1–25.
- Bernard, A. B., Jensen, J. B., 2004. Why some firms export. *The Review of Economics and Statistics* 86 (2), 561–569.
- Bernard, A. B., Jensen, J. B., Redding, S. J., Schott, P. K., 2007. Firms in international trade. *Journal of Economic Perspectives* 21 (3), 105–130.
- Chirinko, R. S., Eisner, R., 1983. Tax policy and investment in major U.S. macroeconomic econometric models. *Journal of Public Economics* 20 (2), 139–166.
- Creedy, J., Gemmell, N., 2009. Corporation tax revenue growth in the uk: A microsimulation analysis. *Economic Modelling* 26 (3), 614–625.
- Czarnitzki, D., Hanel, P., Rosa, J. M., 2011. Evaluating the impact of R&D tax credits on innovation: A microeconomic study on canadian firms. *Research Policy* 40 (2), 217–229.
- Eaton, J., Kortum, S., Kramarz, F., 2011. An anatomy of international trade: Evidence from French firms. *Econometrica* 79 (5), 1453–1498.
- Fazzari, S. M., Hubbard, R. G., Petersen, B. C., Blinder, A. S., Poterba, J. M., 1988. Financing constraints and corporate investment. *Brookings Papers on Economic Activity* 1988 (1), pp. 141–206.
- Girma, S., Gong, Y., Görg, H., Yu, Z., 2009a. Can production subsidies explain China’s export performance? Evidence from firm-level data. *Scandinavian Journal of Economics* 111 (4), 863–891.

- Girma, S., Görg, H., Wagner, J., 2009b. Subsidies and exports in Germany. First evidence from enterprise panel data. *Applied Economics Quarterly* (formerly: *Konjunkturpolitik*) 55 (3), 179–198.
- Glaeser, E. L., Gottlieb, J. D., 2008. The economics of place-making policies. *Brookings Papers on Economic Activity* 39 (1), 155–253.
- Görg, H., Henry, M., Strobl, E., 2008. Grant support and exporting activity. *The Review of Economics and Statistics* 90 (1), 168–174.
- Hall, B., 1994. R&D tax policy during the eighties: Success or failure? NBER Working Papers 4240, National Bureau of Economic Research, Inc.
- Hall, B., Van Reenen, J., 2000. How effective are fiscal incentives for R&D? a review of the evidence. *Research Policy* 29 (4-5), 449–469.
- Helmets, C., Trofimenko, N., 2010. Export subsidies in a heterogeneous firms framework: Evidence from Colombia. CSAE Working Paper Series 2010-26, Centre for the Study of African Economies, University of Oxford.
- Hoffmaister, A., 1992. The cost of export subsidies: Evidence from Costa Rica. *IMF Staff Papers* 39 (1), 148–174.
- Hussinger, K., 2003. R&D and subsidies at the firm level: An application of parametric and semi-parametric two-step selection models. ZEW Discussion Papers 03-63, ZEW - Zentrum für Europäische Wirtschaftsforschung.
- Koenig, P., Mayneris, F., Poncet, S., 2010. Local export spillovers in France. *European Economic Review* 54 (4), 622–641.
- Levinsohn, J., Petrin, A., 2000. Estimating production functions using inputs to control for unobservables. NBER Working Papers 7819, National Bureau of Economic Research, Inc.
- Mansfield, E., 1986. The R&D tax credit and other technology policy issues. *American Economic Review* 76 (2), 190–94.
- Mayer, T., Ottaviano, G., 2008. The Happy Few: The internationalisation of European firms. *Intereconomics: Review of European Economic Policy* 43 (3), 135–148.
- Melitz, M. J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica* 71 (6), 1695–1725.
- Oughton, C., Landabaso, M., Morgan, K., 2002. The regional innovation paradox: Innovation policy and industrial policy. *The Journal of Technology Transfer* 27 (1), 97–110.

- Roberts, M. J., Tybout, J. R., 1997. The decision to export in colombia: An empirical model of entry with sunk costs. *American Economic Review* 87 (4), 545–64.
- Summers, L. H., 1981. Taxation and corporate investment: A q-theory approach. *Brookings Papers on Economic Activity* 12 (1), 67–140.
- Tokila, A., Haapanen, M., Ritsila, J., 2008. Evaluation of investment subsidies: when is deadweight zero? *International Review of Applied Economics* 22 (5), 585–600.

## 6. Appendix

Table 5: Baseline results with firm size controls

Dep. Var: Dummy for any exports in 2001-2003					
	[1]	[2]	[3]	[4]	[5]
sample:	all firms	domestic firms	dom.firms	dom.firms	dom.firms
model:	Probit	Probit	Probit	Probit	Probit IV
restrictions:	no	no	no	pos. past tax	no
TCREDIT	0.348*** [0.0620]	0.363*** [0.0643]	0.219*** [0.0705]	0.202** [0.0812]	0.274* [0.155]
firm age			-0.0508*** [0.0149]	-0.0503*** [0.0158]	-0.0513*** [0.0150]
TFP (LP)			0.104*** [0.0369]	0.118*** [0.0393]	0.0977** [0.0383]
firm size			0.229*** [0.0295]	0.226*** [0.0310]	0.227*** [0.0299]
dummy: sector	yes	yes	yes	yes	yes
dummy: county	yes	yes	yes	yes	yes
Constant	-1.777*** [0.0531]	-1.807*** [0.0553]	-2.632*** [0.196]	-2.653*** [0.208]	-2.628*** [0.196]
Observations	5 230	5 077	5 077	4 326	5 077
Pseudo R <sup>2</sup>	0.0137	0.0148	0.08	0.0722	
Wald Chi <sup>2</sup>					165.7

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

\* instrument: positive taxbase in 1997-2000

Table 6: Regional results: Share of exporters

METHOD	PROBIT	PROBIT	IV POS TAX	IV POS TAX
EXPSHARE	low	high	low	high
SAMPLE	domestic	domestic	domestic	domestic
TCREDIT	0.364*** [0.0980]	0.158* [0.0944]	0.486* [0.250]	0.214 [0.193]
Firm age	-0.0154 [0.0207]	-0.0461** [0.0198]	-0.0167 [0.0121]	-0.0471** [0.0228]
TFP	0.169*** [0.0490]	0.207*** [0.0551]	0.155*** [0.0316]	0.199*** [0.0590]
Constant	-2.789*** [0.290]	-2.389*** [0.264]	-2.790*** [0.184]	-2.384*** [0.264]
Observations	2 406	2 639	2 406	2 639
Pseudo R <sup>2</sup>	0.0652	0.0398		
Wald Chi <sup>2</sup>			62.07	46.82

Moulton corrected standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Figure 4: The distribution of CITY variable

The highlighted regions are considered containing urban areas

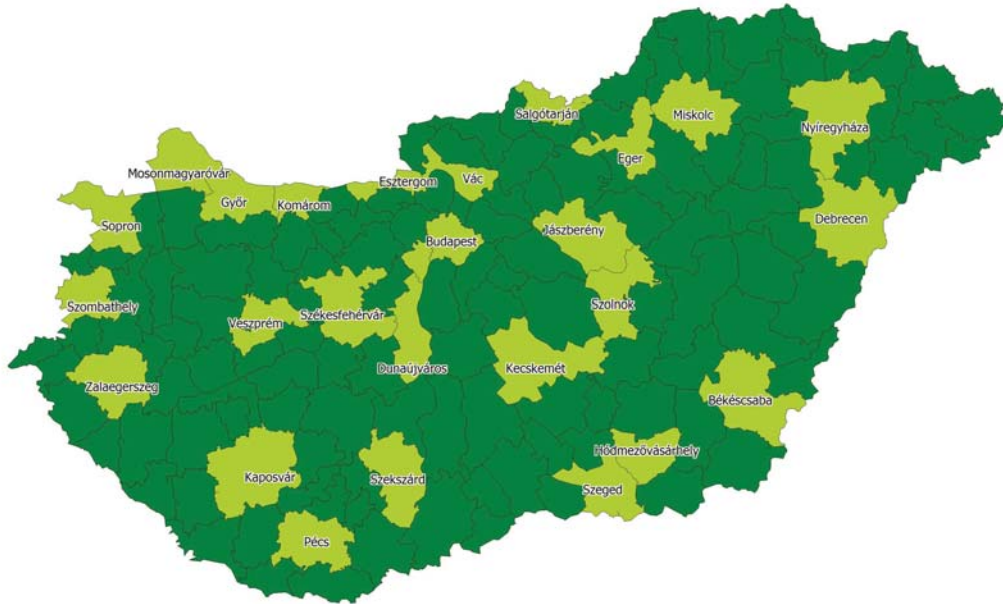


Figure 5: Share of exporting manufacturing firms by NUTS4 regions in 2001

Values increase from dark green towards red

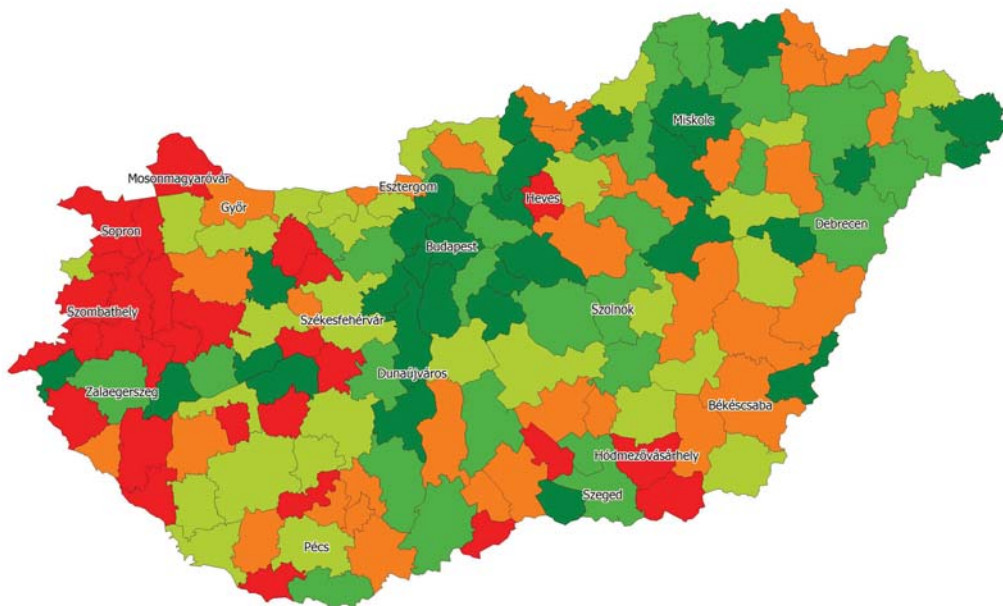


Figure 6: The regions favored by tax credit program

The highlighted regions are the favored regions

