Learning-by-Exporting and Destination Effects: Evidence from African SMEs

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ABSTRACT

Vast empirical evidence underscores that exporting firms are more productive than non-exporters. As governments accordingly pursue export-promoting policies we are interested in the firmness of these conclusions with respect to African small and medium sized enterprises (SMEs) and the influence of the destination of export trade. Using a micro-panel dataset from five African countries we confirm the self-selection. We apply propensity scores to match exporters and use a difference-in-difference methodology to test if African SMEs experience productivity gains because of export participation. Results indicate that African firms significantly learn-by-exporting. Manufacturers obtain significant performance improvements due to internationalization although this effect is moderated by export destination. Firms that export outside Africa become more capital intensive and at the same time hire more workers. In contrast we find evidence that exporters within the African region significantly downsize in capital intensity. Results regarding skill-bias of internationally active firms are mixed, where exporters within the region expand in size and hire more relatively unskilled workers.

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INTRODUCTION

Over the past decade a burgeoning literature based on firm-level analysis has indicated that internationally active firms are more competitive than domestically active counterparts. For this reason many governments try to push domestic firms to operate abroad using export-promotion programs. However, the quest to internationalize is still contentious in the African context due to a serious knowledge gap (Van Biesebroeck, 2003; Greenaway & Kneller, 2007; Wagner, 2007). First, relatively few firm-level studies on exporting activities in Africa have been undertaken. Second, grounds for the presupposed productivity difference between internationally active firms and domestically active firms are still unclear. The self-selection hypothesis holds that only more efficient firms can afford exporting. If internationally active firms are more competitive before entry abroad then in certain respects pushing firms towards internationalization becomes meaningless. Another hypothesis states there is learning-by-exporting. Accordingly, firms acquire knowledge from their experience abroad and obtain foreign technology transfers which boost productivity. The two views are non-contradictory; more efficient firms can self-select to export participation while subsequently learn by exporting. Third, the choice of the export destination itself can affect the extent of learning. Some exporters in developing areas only trade with developing countries whereas others have operations directed to more developed regions. Finally, most African firms are relatively small while most studies so far are based on large firms. The poor growth performance of many African countries makes it even more pressing to increase the understanding of the link between internationalization of the firm and gains in productivity (Collier & Gunning, 1999; Banerjee & Duflo, 2007).

Hence, it is important to study African firms and distinguish between self-selection of strong firms and learning-by-exporting effects, as well as accounting for export destinations and focusing on small and medium sized enterprises (SMEs). These four research areas are the core of this empirical study. We utilize a panel dataset from 1991 to 2003 to study the heterogeneity among exporters and non-exporters from several manufacturing sectors in five African countries: Ghana, Kenya, Nigeria, Tanzania and South Africa. By careful construction of firm productivity our data allows us to test if and why African exporters show exceptional performance. We explore the determinants of export participation and demonstrate that firm size, foreign ownership and human capital positively affect the decision to export. The core of the research lies here in showing the causal impact of internationalization and the specific effects of export destinations on firm productivity using propensity matching and Dif-in-Dif methodology (Girma et al. 2004; De Loecker, 2004).

Our results confirm the selection hypothesis and support the learning-by-exporting hypothesis as African manufacturing firms are more competitive *before* they can internationalize and increase productivity *because of* export participation. African firms that export experience significantly sharper increases in earnings, wages, and employment of (relatively lower skilled) workers than non-exporters. However, there is heterogeneity with respect to export destination on firm performance. Exporting outside Africa leads to more capital intensive production. In contrast firms that export within Africa downsize on relative capital investment and these firm-level adjustments including hiring more (low-skilled) employees at higher wages strongly decrease firm productivity. Next we discuss some background literature. Then we present our data and estimation strategy. Key empirical results are subsequently summarized and discussed, and finally we conclude.

EMPIRICAL LITERATURE ON EXPORTING AND PRODUCTIVITY

In this part we present some central results as stipulated by the economics literature in relationship to exports and productivity. We emphasize empirical findings based on firm-level data and briefly outline the development of this field (see Wagner, 2007). We pay particular attention to the relationship between internationally active firms and competitiveness in emerging markets and African economies where learning-by-exporting seems more relevant. Finally, we draw on recent findings on the effect of export destinations on firm productivity.

Exporters and productivity in developed countries

Exporters are exceptional in two ways. First, only few firms engage in exporting. Second, empirical economic literature indicates that exporting firms are more productive, bigger, more capital intensive, pay higher wages, and survive longer than non-exporting firms (Bernard & Jensen, 1995, 1999, 2004). However, Bernard and Jensen's findings suggest that although exporting firms tend to grow relatively faster, there are no indications that exporting per se results in productivity improvements. Similarly, most scholars confirm superior competitiveness of internationally active firms and the fact that firms do not seem to further improve after entry in foreign markets for developed countries (Aw & Hwang, 1995; Castellani, 2002; Delgado et al. 2002; Wagner, 2002; Hansson & Lundin, 2004). Hence, in rich countries firms self-select into export markets yet do not learn from exporting.[2]

Exporters and productivity in emerging markets

Subsequent studies in emerging markets have challenged the self-selection hypothesis, although evidence remains mixed. Several studies based on Latin-American firms conclude mostly in favour of the self-selection hypothesis. Clerides, Lach and Tybout (1998) argue that self-selection only partially explains the difference between exporters and non-exporters based on data from Colombia and Mexico.[3] Likewise, Isgut (2001) concludes in favour of the self-selection hypothesis when comparing the gains in productivity of new export participants with non-exporters using data from Colombia, although there appears some learning effects with respect to labour productivity. Alvarez and Lopez (2005) apply matching techniques and provide no support for the learning-by-exporting hypothesis in Chile.

Other scholars provide strong evidence for improvements in productivity as a consequence of export participation for firms in emerging markets like South-East Asia and Eastern Europe. According to the learning-by-exporting hypothesis firms acquire knowledge from their experience abroad which boosts their productivity. The lack of evidence for this channel in developed economies is attributed to the fact that the most advanced technologies are already available in the home market. In contrast, in emerging markets and developing countries exporters often trade with relatively more skilled countries where they can benefit e.g. from customer's technical assistance, new managerial practices, market information, information systems and supply chain networks. Moreover, exposure to international market is posed to create competitive pressures which induce upgrading. Finally, tapping international markets allows firms to exploit economies of scale. Within this spirit Kraay (1999) shows Chinese exporters become more competitive after entry in foreign markets, mainly in terms of labour productivity. Similarly, using various techniques Blalock and Gertler (2004) find that Indonesian exporters increase their total factor productivity subsequent to export participation

[2] Based on more elaborate techniques some recent studies in developed countries show promising effects of exporting, supporting learning-by-exporting. For example, Girma and colleagues (2004) use matching techniques and show that UK manufacturing firms self-select and further increases firm productivity upon exporting (see also Bernard et al. 2003; Baldwin & Gu, 2003; Bernard & Jensen, 2004).

[3] Clerides and others (1998) find some weak support for the learning-by-exporting hypothesis in Morocco.

and strongly support the learning-by-exporting hypothesis. Based on data from Slovenia, De Loecker (2004) applies matching techniques and finds large improvements in productivity when comparing exporter and non-exporter performance. Finally, Hagemejer and Kolasa (2008) conclude that Polish firms that start international activities improve their productivity significantly. In an emerging market context the self-selection and learning views are not mutually exclusive as the most productive firms self-select to export markets and (some) subsequently increase their competitiveness as a result of learning experiences from internationalization.

Exporters and productivity in African economies

Recently scholars have actively collected data on African firms (Bigsten & Söderbom, 2006). Although the continent's business environment is characterized by many obstacles, especially in trade, empirical findings offer promising prospects for exporting firms in Africa. Bigsten and others (2004) analyze data from four African countries over the period 1992 to 1995 and find indications that African firms learn from exporting. Interestingly, they do not find support for self-selection, implying that any firm can enter export market regardless of productivity. In contrast, Mengistae and Pattillo (2004) use data from three African economies over a period from 1992 to 1995 and present support for the self-selection hypothesis. They also show higher productivity growth for exporting firms. Finally, Granér and Isaksson (2007) use data on Kenyan firms from 1992 to 1994 and give tentative support for learning effects. Although these studies support learning-by-exporting effects, the limited time-span does not allow for any strong causal interpretation related to the learning hypothesis.

In an extensive study Van Biesebroeck (2003) employs GMM estimations and finds that exporting firms in Sub-Sahara Africa not only self-select, but additionally benefit from internationalization. He finds that exporter's labour productivity and growth are higher for exporting firms. Using a simple probit specification Rankin, Söderbom and Teal (2006) show that firm size, foreign ownership and human capital positively affect the decision to export. Their results do not find strong self-selection effects since productivity is not a key determinants for African manufacturers to start exporting. Moreover, they find no sector composition effects on exporting propensity nor are more capital intensive firms more inclined to export once controlling for firm size dynamics. We aim to augment on these findings by employing more detailed data from more countries and over a longer time-span to again test the extent of learning-by-exporting in African economies.

Export Destination Effects

Implicitly the learning-by-exporting hypothesis is based on the notion that exporting firms trade with technologically more advanced countries and subsequently climbs the technology ladder (which explains why in rich countries there seems little evidence of gains from exporting). Basically, the hypothesis is that if the export destination is to a more developed country, the firm can learn subsequently from trade. De Loecker (2004) shows that Slovenian firms significantly gain from internationalization given that they export to a more advanced country. Using a similar dataset Damijan and colleagues (2004) confirm the importance of export destinations for learning to occur. Granér and Isaksson (2007) provide evidence that Kenyan firms also learn from regional export participation. More specifically, they find no selection effect in regional exporting, implying that ex ante exporters are only different from non-exporters if they go trade outside the continent. They show that exporters are heterogeneous with respect to the destinations they serve, where exporters outside the region are more capital intensive and hold higher human capital levels than exporters within the

region. These findings suggest that African exporters can improve most from regional trade as penetration in these markets requires lower ex ante productivity levels and as they are more productive subsequent to learning-by-exporting (within the region) self-select to technologically more advanced markets occurs. Mengistae and Pattillo (2004:344) also find learning effects of Kenyan exporting firms inside Africa, although they indicate the impact of outside Africa trade is larger. More recently, Eaton and others (2008) study Colombian firms and provide a detailed analysis of the impact of export destinations. The findings suggest firms strongly learn from exporting within the region and exporting to neighbours can be a stepping-stone to tapping into other destinations and enhance growth further by experimentation.

DATA

We use a firm-level (unbalanced) panel dataset which covers (formal) manufacturing firms from Ghana, Kenya, Nigeria, Tanzania and South Africa over the period 1991 to 2003.[4] The sample consists of 10.359 observations based on more than 1000 manufacturing firms. Most firms are small businesses as 80 percent of the firms have less than 100 employees. Table 1 shows the distribution of the data per year and country. The firm surveys were conducted by the World Bank Regional Program on Enterprise Development (RPED) using stratified sampling strategies across location within each country, sector, and according to firm size (see Van Biesebroeck, 2003; Bigsten & Söderbom, 2006;). The survey data provide information on some key variables including productivity measures and internationalization proxies like export status, export intensity, export destination, and foreign ownership. In addition, it includes details about the firm size, age, sector, wages, capital intensity, and human capital levels. We distinguish five broad industries, including food, furniture, garment and textiles, metal and chemicals, and wood.

Table 1: Overview of manufacturing data per country

	Period	No. of years	No. of firms	No. of observations
Ghana	1991-2003	13	274	3390
Kenya	1992-1999	8	405	3240
Nigeria	1998-2003	6	156	700
Tanzania	1992-2000	7	375	2625
South Africa	1997-1998	2	212	404

Descriptive statistics

About 20 percent of the manufacturing firms are exporting a share of their production at some point in time. Half of the exporters trade within the African continent, while 75 percent of exporters does business outside Africa. On average internationally active firms export 33 percent of their output to foreign markets, of which one third is traded within Africa. Of the exporters 35 percent has any foreign ownership, whereas of the non-exporters 13.3 percent has any foreign ownership.[5]

Table 2: Descriptive statistics of non-exporting and exporting firms (mean)

	firm characteristics			*employee characteristics*			
	size	age	capital intensity	wages ($)	education	age	tenure
Non-exporting firms	52	18	7,4%	123	8,5	31	6,6
Exporting firms	240	22	9,2%	297	9,6	36	8,1

[4] Rankin, Söderbom and Teal (2006) use a related dataset which cover the same countries, but a shorter period.
[5] Differences in foreign ownership between exporters given export destination or intensity are negligible.

Table 2 confirms the well-establish distinction between exporters and non-exporters for manufacturers in Sub-Sahara Africa. Exporting firms are bigger, older and more capital intensive. Exporting firms also pay higher wages and employ relatively higher skilled workers in terms of education, age and tenure. As we are interesting in export destination effects in Table 3 we divide exporters by the type of foreign market they serve. Broadly, exporting firms can be active within or outside the African continent. Interestingly, exporters with destinations outside Africa tend to be bigger, more capital intensive and pay higher wages than exporters that only trade within Africa. Note, all presented descriptive statistics are unconditional and are explored in detail later.

Table 3: Firm characteristics and exporting destinations

	firm characteristics			*employee characteristics*			
	size	age	capital intensity	wages ($)	education	age	tenure
within Africa	188	22	8,7%	157	10	37	7,5
outside Africa	239	22	9,3%	391	9,8	35	8,3

Measuring productivity

In order to derive a measure of productivity we start by setting-up a production function:

$Y = f(L,K,M,O,X,C)$

All variables are in logs and for convenience we leave out firm and time subscripts. Y denotes output, L number of workers, K capital stock, M material inputs, O other inputs (indirect costs), X and C capture time-varying and fixed control variables.[6] Taking first-differences removes the firm-specific effects and alleviates many potential endogeneity problems. We obtain the following "growth equation":

$$(1) \qquad \Delta ln Y_{it} = \beta_1 \Delta ln L_{it} + \beta_2 \Delta ln K_{it} + \beta_3 \Delta ln M_{it} + \beta_4 \Delta ln O_{it} + \beta_5 \Delta ln X_{it} + v_{it}$$

Although inference of the production function with micro-level data is often problematic, the obtained estimated productivity growth rates and their determinants as presented in table 4 are straightforward. Moreover, estimates are consistent among various specification methods.[7]

Table 4: Determinants productivity growth rates (Δ output per worker)

	Pooled FGLS				*Fixed effects*	
Δ ln L	-0,36***		-0,15***	-0,06	-0,15***	0,01
Δ ln O/L	0,24***	0,26***	0,11***	0,13***	0,09***	0,10***
Δ ln K/L		0.21***	0,03*	0,11***	0,03	0,14*
Δ ln M/L			0,58***	0,55***	0,60***	0,58***
Δ ln EDUC				0,10***		0,11**

[6] The vector X includes real profits in $ to capital ratio, earnings in $, average workers wage in $, education, tenure and age (to incorporate human capital, in years). Set C covers country and sector fixed effects. Note we use profits and earnings as unconditional proxies of productivity in a later stage.

[7] Following Disney, Haskel and Heden (2003) we assume that one of the time-varying control variables that might be correlated with output growth is in equilibrium, we use the an analogous specification to Harding, Söderbom, and Teal (2004) and obtain comparable results. The major difference is that our dataset is much larger such that we obtain more significant coefficients. We also run a wide range of various specifications. In the presented estimations we do not include time dummy, firm age and foreign ownership (here, fixed) because in none of the specifications they were significant and are therefore removed. Moreover, basic TFP proxies remain the same (Pearson correlation > 0.985) when excluding these X and C subsets. Finally, although first-differencing removes most of the collinearity issues we have employed a wide range of alternative specifications (not shown here, at request) pair-wise excluding sets of variables; results are robust.

Δ ln TENUR				0,03		0,03
Δ ln AGE W				-0,10		-0,10
n	2713	2609	2560	1704	2560	1704

Note: Throughout the paper *,**,*** indicate significance at the 10%, 5%, 1% respectively.

We find that when not controlling for worker characteristics the labour growth rate negatively impacts the productivity growth rate. This could indicate diminishing returns to size in terms of employment (when the workers are of relatively low skill, given their age, education and tenure). Higher capital intensity is associated with increases in productivity growth rates. This may suggests that African manufacturers are below their optimal capital-labour ratio and that there is underinvestment in capital stocks. We obtain strong evidence that more material and other (indirect) inputs boost productivity growth rates, which again might indicate that firms are employing relatively too much labour. As expected, hiring more high skilled workers significantly contributes to higher productivity growth. Moreover, using changes in earning and profits per capital ratio shows these measures are positively associated with our productivity growth estimate, which strengthens the validity. Overall, productivity growth rates determinants are highly robust and intuitive: African manufacturing firms are likely to increase changes in productivity with more capital, material, and indirect inputs, including more highly skilled workers and increased profits to capital ratio.

Table 5: Productivity growth rates for export status, destination and intensity

	fixed effects	*random effects*	*pooled*
non-exporting	1,3%	1,8%	1,0%
exporting	3,3%	3,6%	0,4%
within africa	-1,3%	0,3%	-2,1%
outside	3,7%	2,7%	0,2%

In order to obtain our firm productivity growth proxy we perform a factor analysis using principal components on three ΔTFP estimates derived from pooled FGLS, random and fixed effects estimators including the full set of variables as in equation (1) with profits in X.[8] Table 5 summarizes our main productivity growth rates comparing non-exporters and exporters, export destinations (for countries and sectors, see appendix A.1.). Exporters experience higher productivity growth rates. Interestingly, these positive growth rates are only achieved by firms that export outside Africa. Most worrying is that exporters with destinations within Africa on average experienced productivity decreases. Also, only exporters that are not too intensive in the margin see their productivity rise, whereas firms that mainly focus on exporting witness productivity plummeting.

METHODOLOGY AND ECONOMETRIC RESULTS

There are several commonly used methods to assess if exporting firms are different (e.g. Blalock & Gertler, 2004; Wagner, 2007). In table 5 we already found evidence that exporting firms tend to grow faster in terms of productivity. Bernard and Jensen (1995, 1999) also obtain the 'unconditional' difference in productivity growth rates between exporters and non-exporters. Next, they estimate an *export-premium* from a simple regression with various dependent variables (Y) on export status (EXP) given control variables (X) as follows:

$$(2) \qquad Y_{it} = \alpha + \beta_1 EXP_{it} + \beta_2 X_{it} + e_{it}$$

[8] Our derived measure of productivity growth is highly consistent (Cronbach alpha = 0.91).

This regression is similar to table 2 which unconditionally compares exporters and non-exporters if we drop the conditional set X. Following equation (2) we obtain simple export-premia for various firm characteristics while accounting for country, sector and year effects. Results in table 6 delineate exporters are 35% bigger in terms of employment, pay 28% higher wages, and employ employees with 78%, 6% and 8% higher education, age and tenure, respectively. Two findings stand out: exporters are not older nor use more capital when including a set of controls. Although we see that exporters are 22% older and are 24% more capital intensive, these difference stem from concentration of exports in specific countries, sectors and time. Hence, exporters are exceptional in firm performance and employment characteristics.[9]

Table 6: Simple export-premia

	firm characteristics			*employee characteristics*			
	size	age	capital intensity	wages ($)	education	age	tenure
export premium	35%***	1,50%	0,00%	28%***	78%***	6%***	8%**

Self-selection hypothesis

One important question is if the differences between exporters and non-exporters are the result of exporting (learning-effect) or that internationally active firms are already different before they enter foreign markets (self-selection). Bernard and Jensen (1999:11) compare *ex ante* firm characteristics and growth rates for exporters and non-exporters by selecting a subsample of non-exporting firms at a given moment (0) and contrast their initial levels and growth rates of the dependent variables with future (T) exporting firms.

$$(3) \qquad Y_{i0} = \alpha + \beta_1 EXP_{iT} + \beta_2 X_{it} + e_{it}$$

Using the described methods one gains insights to how ex-ante exporters differ from non-exporters. Following equation (3) we first select all non-exporting firms at a particular point in time to compare the performance of firms that start exporting at the end of the period against the persistent domestically active firms, controlling for country, sector and time effects. We use three-year subsamples with several time-windows to contrast ex ante firm characteristics and growth rates of (newly) exporters and non-exporters.

In table 7 we find that future exporters are bigger and pay higher wages beforehand. The results indicate no significant growth effects, except for 1998-2000. The outcomes for capital intensity are mixed. For the periods 1991-1993, 1994-1996 and 2000-2002 future exporters have relatively more capital prior to the internationalization. However, in 1998-2000 future exporters are relatively less capital intensive and these firms significantly downsize on capital intensity. Future exporting firms are not more capital intensive nor do they alter their capital stock in a different manner from non-exporters. Future exporters pay higher wages. However, relative to firms which stay domestically oriented, future exporting firms seem to negatively adjust average workers' wages prior to exporting. These latter findings might suggest that newly exporting firms consciously prepare for exporting by hiring more workers and pay

[9] If we apply pooled panel data methods (table A.2) to assess the export premia then on average exporting firms are 29% bigger, pay 12% higher wages and, in contrast to table 6, are more capital intensive if one controls for lagged dependent variable effects. The reason for including a lagged dependent variable (AR1) is to ensure that the relationship between our set of performance measures and exports is not mistakenly interpreted as causality running "from exports" when in fact causality may run in the other direction (self-selection). However, it is well known that in micro-panels allowing for a lagged dependent variable can create complications because of correlation between the lagged dependent variable and the (firm-specific) error term which leads to biased estimates, see appendix.

them more competitively wages while downsizing on capital. There is some evidence of self-selection meaning future exporting firms are ex ante bigger and pay higher wages, yet in terms of capital intensity and growth of size we find no significant differences to firms that stay active domestically.

Table 7: Ex ante advantage for future exporters (levels and growth rates)

period	size	Δsize	cap. intens	Δcap. intens	wage	Δwage
1991-1993	79%***	13%	30%**	0%	27%**	-45%*
	(n = 999)	(n = 402)	(n = 959)	(n = 383)	(n = 861)	(n = 317)
1994-1996	59%***	17%	22%*	-16%	78***	
	(n = 542)	(n = 131)	(n = 519)	(n = 123)	(n = 484)	-
1995-1997	57%***	5%	3%	-6%	40%***	4%
	(n = 851)	(n = 263)	(n = 817)	(n = 250)	(n = 734)	(n = 231)
1998-2000	55%***	28%**	-20%*	-43%**	21%*	-43%*
	(n = 1407)	(n = 669)	(n = 1322)	(n = 613)	(n = 1238)	(n = 557)
1999-2001	31%**	-7%	15%	7%	28%	-19%
	(n = 1073)	(n = 471)	(n = 1027)	(n = 453)	(n = 947)	(n = 391)
2000-2002	61%***	-3%	50%**		54%***	-2%
	(n = 782)	(n = 333)	(n = 765)	-	(n = 684)	(n = 274)

Note: Throughout this paper in brackets we denotes the number of observations (n). We apply a random effects GLS model on the natural logarithm of number of employees (size) and real wage per month in $ (wage) and took the percentage of capital to labour inputs, while controlling for country, sector and time fixed effects. We removed all non-transformed wages below unity. Only a limited number of firms are designated as 'future exporters' at the end of the subsample period such that we have relatively little observations (see parentheses).

Table 8 shows that future exporters do not have higher profits per capital ratio. To the contrary, results seem suggestive that when accounting for capital intensity newly exporting firms actually make lower profits, up to (a significant) 39% less (for the period 1998-2000). If one looks at the earnings an sich the opposite holds. Future exporters have significantly higher earnings ex ante, with noteworthy difference between 22% and 58%. In terms of changes we find no significant variation which may refute conscious self-selection.[10]

Table 8: Ex ante advantage for future exporters (levels and growth rates)

period	ln profits to K/L	Δ ln profits to K/L	ln earnings	Δ ln earnings
1991-1993	-37%	-51%	45%***	
	(n = 861)	(n = 329)	(n = 695)	
1994-1996	-37%	64%	18%*	
	(n = 485)	(n = 117)	(n = 422)	
1995-1997	-25%	-20%	28%***	12%
	(n = 738)	(n = 243)	(n = 547)	(n = 215)

[10] It is possible that in equations (2) and (3) we are missing time-invariant firm characteristics that are correlated with the explanatory variables. In order to account for this likely bias we expand the set of explanatory variables (X) given the production function in equation (1) and also control for unobserved firm heterogeneity using firm-level fixed effects. The main results (not shown here) do not change, although this inclusion of other variables is likely hamper estimations due to high correlations among variables. Apart from using fixed-effects we can account for the reverse causality from export participation to productivity by a random effects FGLS estimator which includes an autogressive term for the dependent variable and allows for heteroskedasticity across panels. (Van Biesebroeck, 2003). We also use the "force" option in STATA here because of the irregular year structure for Tanzanian firms (or due to missing values) such that in some cases we skip a year (over our three years time window) and look at the difference in year 0 to year 2 as if it were one year. Results confirm (not presented here) that exporters are ex ante larger, often older, pay higher wages, frequently increase the number of workers, have mostly relatively lower profits per capital ratio and in some cases these also tend to change negatively. In the various specifications for some periods we found that future exporters hold significantly more capital per worker whereas for other periods the opposite was found, so again, results regarding capital intensity remain mixed, more on this later.

1998-2000	-39%*	3%	22%**	-17%
	(n = 1214)	(n = 545)	(n = 866)	(n = 408)
1999-2001	-17%	17%	34%**	
	(n = 962)	(n = 412)	(n = 637)	
2000-2002	-12%	-13%	58%***	-17%
	(n = 738)	(n = 307)	(n= 410)	(n = 163)

In summary, the self-selection hypothesis holds that exporters are different from non-exporters already before they start exporting. With the use of prior established methods, we find evidence that African manufacturing firms seem to self-select into exporting primarily based on size, which confirms the findings by Rankin and colleagues (2006) who also argue that the size effect is independent from productivity, capital intensity or country, sector and other firm-specific effects. Moreover, pre-entry exporting firms pay higher wages. We provide weak support for ex ante higher earnings and increases in employment, yet relative to firms which stay domestically oriented, future exporting firms seem both to negatively adjust average workers' wages and hire more workers prior to exporting, while they become less capital intensive, although beforehand they do not have larger capital stocks, nor do they differ in terms of growth for any of our key variables prior to the exporting experience itself.

Matching techniques

African firms self-select into export markets. Note that if we observe substantial higher productivity growth in exporting firms this does not prove that the causality runs from exporting to productivity gains. If better firms self-select into export participation and given that newly exporting firms are beforehand more productive than non-exporters it is not surprising to see some persistence in this behaviour such that on average exporters would perform better in the future even if they would not start to export today (selection bias).[11] The problem is that we do not observe whether exporters would do so as a consequence of exporting since we have no counterfactuals. Likewise, we cannot identify what could have happened to the firm if it had decided not to export due to identification problems. A way out is to construct a control group in such a way that every exporter is precisely matched to a non-exporter that is similar to the newly exporting firm before internationalization. The calculated differences between the two matched groups based on observable criteria like firm size after the change in export status can then arguably be attributed to the "treatment" (see Heckman et al. 1999).

A few scholars have applied matching techniques in the context of exporting (Wagner, 2002; De Loecker, 2004; Girma et al., 2004). Given our goal to unravel a *causal impact of exporting* on firm performance we can test if the outcomes from exporting (treatment) is different from matched non-exporters based on the *changes* in indicators like productivity, employment, human capital etc. We use the notation of Girma and others (2004:859) and denote an indicator function $EXP_{\text{it}} \in \{0,1\}$ for whether the firm *entered* the export market. Let ΔY^1_{it+s} capture the change in our performance measure at some time *s* after entry and ΔY^0_{it+s} the outcome of the firm "had it not started exporting". Hence, the hypothetical causal impact of exporting is $\Delta Y^1_{it+s} - \Delta Y^0_{it+s}$ since ΔY^0_{it+s} is unobservable: in expectations terms we have the "average treatment effect on the treated" (ATT):

[11] Appendix A.3 shows that firms that start exporting expand by hiring more workers yet relatively downsize on capital intensity and see negative changes in both total factor productivity and profits given capital intensity.

$$(4) \qquad E\left[\Delta Y^{1}_{it+s} - \Delta Y^{0}_{it+s} \mid EXP_{it} = 1\right]$$

Using some expectations operators we can show that if we rely on a counterfactual which shows the (expected) average outcome of the newly exporting firm had it not participated in exporting, such that ATT is:

$$(5) \qquad E\left[\Delta Y^{1}_{it+s} \mid EXP_{it} = 1\right] - E\left[\Delta Y^{0}_{it+s} \mid EXP_{it} = 1\right]$$

Equation (5) uses the law of iterated expectations where the first term expresses the outcome after entry, given that there indeed is entry. The second expectation operator gives the outcome "had it not started exporting" although that we observe entry as given. We will produce a counterfactual by estimating a corresponding average value of firms that have remained non-exporters as follows:

$$(6) \qquad E\left[\Delta Y^{0}_{it+s} \mid EXP_{it} = 0\right]$$

We must specify a control group based on the selection of observables and the pre-entry level of the outcome variable Y_{it-1}. Given our results we know which observable determinants affect productivity growth. Likewise, we can identify a probability function for exporting using a simple probit model. We already categorized a group of variables for which exporters and future exporters differ from non-exporters. Now we follow Rosenbaum and Rubin (1983) and adopt "propensity score matching" techniques:

$$(7) \qquad P\left(EXP_{it} = 1\right) = F(X_{it-1}, C_i)$$

Equation (7) defines the probability that a firm starts exporting based on the arguments of *F* which represents the normal cumulative distribution function. We will use several propensity score "matches" because it is well-known that the results are highly dependent on the quality of the match or the creation of the counterfactual. As before, in the vector X (here: *in lags*) we use combinations of subsets such as employment, capital intensity, firms age, average worker's wages and productivity etc. Moreover, in set C we match on dummies for foreign ownership, sector and country categories (see e.g. Girma et al., 2004; Rankin et al., 2006). Note that it is not our intention to use all these variables because there is a trade-off. Using more observables is likely to increase the quality of the match yet will also require much richer data and as such including more variables can deteriorate the connection between the selected variables of the control and treatment groups.

Based on our propensity score matching from equation (7) we obtain P_{it} which denotes the estimated probability of exporting for which the firm is actually (eventually) exporting. Using this score we can select a non-exporting firm which is "closest" in terms of $P(EXP_{it})$ in terms of observables. We use the selected non-exporter based on various matching techniques, including (a) (traditional) one-to-one, (b) nearest-neighbour, (c) capiler and the Epanechnikov kernel function (see Leuven & Sianesi, 2003).[12]

[12] In this section the propensity score matching techniques are (a) one-to-one, (b) nearest-neighbour and (c) Epanechnikov. Results in tables 10 to 13 show that choosing different matching techniques does not significantly affect our results. Nearest neighbour matches the treated to the non-treated where $\mid p_i - p_j \mid = \min\{p_i - p_k\}$ where k is taken from non-exporters. Capiler estimation is based on the same method and pre-specifies a value δ

Learning-by-exporting

Albeit stronger and more competitive firms are the ones able to participate in foreign markets, we are interested in the question if there are additional learning-effects compared to "had the firm not been exporting". After construction of this control group based on the prior described matching techniques we apply a 'Dif-in-Dif' estimator to isolate the *causal effect* of internationalization on the performance dynamics. We calculate the difference in the average growth rates before and after entry given X_{it} and C_i. Roughly speaking, this captures the change in performance measures after export participation. Still, as Girma and colleagues (2004:861) stipulate, this impact cannot exclusively be attributed to the export decision since the changes after entry may stem from "factors that are contemporaneous with entry" or a "common shock". Therefore in a second stage we again obtain difference in performance but now compared to the before and after difference from our counterfactuals, the control group of matched non-exporters.

Results in table 9 show significantly higher changes in employment, workers' education levels, earnings and profit to capital intensity for exporters relative to their matched non-exporting counterparts. Given several matched counterfactuals scenarios we find consistently faster growth rates in employment for exporting firms with differences up to 15%. Also, two measurements show that average worker's education of exporters increases more than the matched counterfactual at a ten percent significance level, while the impact is insignificant in others (more on this later). Exporters obtain up to 10% faster earnings growth rates than their counterfactuals, while the effect is insignificant in four out of nine specifications. Two outcomes show profits to capital intensity grow significantly faster with differences up to 7% at a ten percent significance level. One specification indicates that exporters experiences relatively slower output per worker growth than their non-exporting counterparts. The results with respect to total factor productivity growth and change in capital intensity, profits to capital ratio and output are mixed. We do not see any effect of exporting on wage changes.

Table 9: Exporters vs. non-exporters (ATT) using Dif-in-Dif with matching techniques

	I (a)	I (b)	II (a)	II (b)	III (a)	III (b)	III (c)
ΔTFP	-0,08	-0,12	0,02	0,18**	-0,07	-0,18*	-0,16*
Δoutput	-0,03	-0,03	-0,04	0,01	-0,02	-0,03	-0,07*
Δsize	0,03	0,05**	-0,01	-0,02	0,06**	0,12***	0,15***
Δcapital	0	-0,06	0,05*	0,08**	-0,04*	-0,09***	-0,11**
Δeducation	-0,01	-0,02	-0,02	-0,04	-0,01	0,03*	0,05*
Δwage	-0,02	-0,03	0	0,05	-0,04	-0,03	-0,09
Δearnings	0,06**	0,05	-0,1	0,05	0,07**	0,09*	0,10**
Δprofit to K/L	-0,02	0,07*	0,05*	-0,15	0,1	0,03	0,05

Note: The propensity score matching techniques are (a) one-to-one, (b) nearest-neighbour and (c) Epanechnikov. Models I(a) and (b) are based on Xit-1(SIZE) and Ci, II(a) and II(b) use Xit-1(K/L, AGE, WAGE) and Ci. Models III(a-c) use Xit-1(TFP, SIZE, WAGE) and Ci. For Model I and II epan results are dropped because they are highly similar to nearest-neighbour. We also applied several random sorting patterns of the data and rerun the analysis to check robustness since ordering can affect results due to similar propensity scores (signs and significance did not change).

Overall, we support the learning-by-exporting hypothesis while controlling for a selection bias. We present significant (positive) learning-by-exporting effects for *changes* in total factor productivity, employment, capital intensity, education levels, earnings and profits to capital

which the match cannot succeed (it must be "within" that bound) otherwise the exporter cannot be matched 'properly' and if left unmatched. The kernel distribution match is based on a smoothed weighted average of the non-exporters in proportion to their closeness within a fixed caliper, using the Epanechnikov kernel function.

intensity although in some cases the outcomes are not robust between specifications, which is why next we further differentiate learning-by-exporting effects by destinations of exports.

Destination effects

African manufacturers self-select into exporting markets and experience significant productivity gains because of internationalization. However, as presented in table 10 there is heterogeneity with respect to the learning effects given export destinations. Most matching specifications clearly indicate that firms that export outside Africa become significantly more capital intensive. We interpret this finding as an indication that goods exported outside the continent require more capital intensive production techniques. To our knowledge we are the first to show evidence that firms that target these advanced markets indeed alter their production process towards more capital intensive production relative to other firms. We suggest that export products outside Africa require high product standards to be competitive that can only be met with capital investments.[13] In a way this contrasts with standard trade theory because it would predict a comparative advantage in labour intensive industries (see Baldwin & Robert-Nicoud, 2010).

Table 10: Dif-in-Dif exporting outside Africa (ATT) using matching techniques

	OUTSIDE AFRICA					*WITHIN AFRICA*				
	I(a)	I(c)	II(a)	II(b)	III(c)	I(a)	I(c)	II(a)	II(b)	III(c)
ΔTFP	-0,18**	-0,01	0,02	-0,07	-0,01	-0,16*	-0,28**	-0,02	-0,11	-0,12
Δoutput	-0,06*	-0,01	0,01	-0,02	0,01	-0,05	-0,07*	-0,01	-0,04	-0,04
Δsize	0,06***	0,03*	-0,02	-0,01	-0,02	0,07***	0,05*	0,03	0	0,02
Δcapital	-0,04	-0,05	0,06*	0,08**	0,07*	-0,07***	-0,07*	0,06	0,04	-0,01
Δeducation	0,01	-0,01	-0,02	-0,04*	0	-0,01	-0,03	-0,02	0,03	-0,11***
Δwage	0	0,06*	0,03	0,02	0,02	0	0,06	0,04	0,01	0
Δearnings	0,04	0,05*	0,07*	0,06	0,02	0,04	0,12***	-0,01	0,02	0,04
Δprofit to K/L	0,08	0,10	0,03	0,06	-0,05	0,03	0,04	-0,05	0	-0,08

The outcomes suggest that exporting firms that trade outside Africa see significant higher increases in earnings and hire more employees accordingly. Given that these exporters become more capital intensive and increase employment these findings suggest that these firms heavily invest in order to serve advanced foreign markets. However, we find no indication that these firms increase their productivity.[14] We show some evidence of a decrease in the average education level of the hired workers while at the same time these exporters are able to increase workers wages more than other firms (although in the majority of the specifications these results are insignificant). Nonetheless, we belief we are the first study to uncover this pattern in firm level data from Africa. These findings are highly relevant for policy makers as it suggest that exporting outside the continent leads firms to heavily invest in capital, increase employment and average wages, but, most importantly, they have no skill-bias towards more educated workers.

In contrast to exporting firms outside of Africa, Table 10 shows that firms that export within the African region are downsizing on capital. In order to export within Africa these firms also hire more workers and we again find strong indications that there is a bias towards employing relatively lower skilled workers. As a consequence, we find significant increases in earnings, however, we present evidence that these firm-level adjustments of local exporters strongly decrease firm productivity measures (TFP and output per worker). In terms of policy we show evidence that export promotion strategies can enhance job security within developing countries as

[13] In constrast, in specification I(c) we find the exporters outside Africa become more labor intensive.

[14] In one specification we have indications for a decrease in productivity based on both TFP and output per worker. One problem is that given the capital investments it can be argued that our one-year period is insufficient to reveal such an impact relative to other firms.

exporting activities create employment, however, exporting within the African region does not stimulate firm productivity enhancements from foreign exposure.[15]

DISCUSSION

Overall, comparing the findings of table 9 - which differentiate between exporter and non-exporter performance – with export destination effects in table 10 shows that our main results are robust. First, exporting firms contribute significant to overall employment. We find a consistent pattern that regardless of the export destination; exporting creates significantly more employment with significant positive adjustments up to 17 percent higher than non-exporters. Next and related, we substantiate that exporting firms are able to increase earnings up to 12 percent faster than non-exporters, regardless of the export destination. Results give micro-level evidence that promotion of more exporting facilities can enhance overall economic growth through job creation and rising income.

Table 9 presents evidence for both intensifying and downsizing capital relative to non-exporters, depending on the matching specification. A more detailed analysis of export destination heterogeneity suggests the following: once we take into account the export destination only firms serving foreign markets outside the continent (or both) increase their relative capital intensity of production up to 8 percent more rapidly, whereas exporters that trade within the region are actually downsizing with significantly negative difference of 7 percent compared to matched counterparts. Export participation both within and outside Africa also leads to capital investments which capital intensity changes up to 17 percent. So, firms that export to more technologically advanced regions outside Africa experience an increase in the their capital to labour ratio, which may be the result of technology transfers, fierce competition or forced product standards. In contrast, promotion of exports within the region may accommodate labour-intensive industries as export participation within the region does not contribute to capital intensive production.

Taking into account the impact of the average education level theory would expect a skill-bias for exporting firms, for which we suggest some weak support in table 9. Controlling for the difference in destinations we again do not find any support for the "highly skilled bias" among exporters. It even seems that exporters within or outside of Africa or both not only create more

[15] It is possible that an exporting firms serves *both markets* within and outside of Africa. We rerun 80 separate difference in difference estimators based on the prior outlined propensity score models. We do not present these outcomes here because they are based on a relatively small sample of "double exporters", with a treatment group ranging from 67 to 175, which explains first of all why many of the results are insignificant (and go unmentioned) and secondly strengthen the importance of the results given here, since findings 'significant effects' in small matched samples is difficult (Heckman et al., 1999). Measurements from I(b) and I(c) confirm weakly significant negative adjustments in educational attainment levels of workers, with a difference of 0,06 compared to matched counterparts that do not participate with exports in and outside Africa. In specification II(a) we find a weakly significant positive difference of 0,18 in changes in total factor productivity, 0,07 in change in output per worker, 0,05 in change in capital intensity, and 0,10 in wage adjustment for firms that export to both 'destinations' compared to matched counterparts. In II(c) we again find significant positive changes in productivity, now a difference of 0,27. Findings based on II(b) show weakly significant positive changes in total factor productivity, average worker wages and profits with a difference of 0,27, 0,10 and 0,09 with the control group. In model III(a) the change in output per worker of 0,15 is highly significant for exporters that trade both within and outside of Africa. The specification III(b) and III(c) presents highly significant and positive adjustments in the capital intensity with changes of 0,17 for exporters that serve both markets compared to matched controls. Overall, exporting firms that participate in trade both within and outside of Africa lower their average worker skills, yet they do not seem to lower wages more than counterparts (rather, we find weak evidence of the opposite, namely more positive wage adjustment). Moreover, these 'double' exporters experience relative increases in capital intensity and at the same time do better in changes in total factor productivity, output per worker and profits.

jobs, but they significantly hire relatively lower educated workers and also adjust wages up to 8 percent higher compared to their counterparts.

Encouragingly, export participation does not cause negative wage corrections as we find no (but significantly positive) effects of exporting on the change in average workers wages. A wide range of studies indicates that multinational firms pay higher wages and we have already corroborated on these findings. Nonetheless, we are the first study to present preliminary evidence that African exporting firms active outside of the continent are able to *increase wages* compared to other firms, while exporting within the region or at a very high intensity have no direct effect on wage changes. Again, we suggest one possible explanation for this wage increase and that is the intensification of the capital ratio of these firms. Related to this results Feenstra and Gordon (2001) suggest that international trade has increased the "wage gap" because it has boosted outsourcing strategies. One the one hand, it seems that our report shows that exporters indeed hire overall more educated workers, which can increase inequality. However, as explained above and given that production sharing techniques are less popular in the African continent it is not surprising that a more detailed analysis reveals no such skill-bias. Exporting firms, especially within the region hire more workers and with relatively lower skills. We could also explain this by the lack of educated workers available and that exporting firms which are expanding in size are constrained in their human resource policies and face a different set of choices in terms of hire of skilled workers than for example South-East Asian firms.

In relationship to trade liberalization and poverty, Winters, McCulloch and McKay (2004) have raised concerns whether exporting firms provide benefits to the poor. One limitation of our firm-level study is that we can only give a partial account of the impact of exporting activities on poverty and we cannot provide conclusive answers as to whether exporting firms can help people out of poverty. We could think of both positive and negative arguments. There are benefits from larger economies of scale and competition effects. Exporters tend to be formally active and contribute taxes. Others have argued that openness may decrease government corruption or that exporting firms are at the gateway of technology transfers. One the negative side we like to pay attention to the selection effect as pointed out by Melitz (2003). As exporting firms will increase market competition, it is likely that small subsistence farmers and other self-employed poor people will tend to lose their respective markets to the 'big' firms, as the former are unable to comply with reduced prices and high productivity. These reallocations can be so strong that exporting activity can raise poverty levels while benefiting only a group of inclusive few. On the other hand, if these price effects are indeed negative (or, if product quality is raised) locals can actually directly benefit from this as well as they find employment elsewhere at higher wages and as such can increase their respective consumption bundle. A standard Hechscher-Ohlin (HO) model predicts that as African economies open up to trade, the reform will boost demand for labour-intensive products, such that wages and employment of unskilled-workers increase. However, as Winters and colleagues (2004:75) emphasize the dichotomy between unskilled and skilled workers does not hold. When semi-skilled labour demand increases as a results of more exporting activities, poverty is "possibly worsened". African countries hold many agricultural resources and mineral endowments such that HO theory suggests a stimulation for these sectors rather than the labour-intensive ones. Moreover, if unskilled workers are mostly active in the non-tradable sector and exporting firms demand semi-skilled employees, trade liberalization could fuel a depreciation of the real exchange rate, which may hurt the poor.

Finally, our findings with respect to the changes in productivity of exporting firms seems less encouraging than other studies have suggested. For instance, the effect of exporting on total factor productivity is mixed (table 9). Especially firms that export within Africa experience drops in productivity, which might be explained by both their downsizing on capital and the increased hiring of relatively low-skilled workers. Finally, we find that firms that export to

several destination (within and outside Africa) are the ones able to reap most of the "export" fruits. "Double exporting" causes faster productivity growth rates up to 27 percent and results in better output per worker rates with difference up to 15 percent and while controlling for capital intensity we even suggest weak evidence of positive changes in profits compared to the control group.

CONCLUSIONS

In this paper we employ a micro-panel dataset with more than 10.000 observations of firms in African countries to investigate the determinants and effects of exporting and their respective destinations. Internationally active firms are different *before and because of* export participation and there is significant heterogeneity in firm performance given the export destinations. Promotion of exporting activities could translate into poverty alleviation via job creation at higher wages, technology upgrading (capital) and as such open the gateway to better economic performance.

First, we provide evidence in favor of the self-selection hypothesis. Larger size, higher productivity, profits to capital intensity and more capital, material and indirect production inputs (including higher skilled workers) to labour all contribute to the propensity to export, as well as foreign ownership. Ex ante, future exporting firms are bigger, have larger earnings and pay higher wages. In contrast to other studies, beforehand, future exporters earn lower profits, experience negative profit changes and results with respect to their capital intensity are mixed. The results seem to suggest that newly exporting firms consciously prepare exporting activities by hiring more workers and pay them more competitively wages while relatively downsizing on capital.

Second, given the subsequent selection bias that "to be" exporters are different from "not to be" exporters we apply propensity score matching and Dif-in-Dif estimation to carefully test the learning-by-exporting hypothesis. Exporting firms perform better after internationalization relative to matched counterfactuals (had the firm decided not to export). Export participation of African manufacturers 'causes' significantly better firm performance in terms of growth in employment, earnings, profits given capital intensity and workers educational attainments. We find mixed evidence for adjustments in capital intensity and changes in total factor productivity as a result of internationalization.

Our study also uncovers important heterogeneous effects of internationalization given export destination which are relevant to policy makers. The competitiveness improvements of internationally active firms (post-entry) can be enhanced via various channels. If firms traded outside Africa or utilize various destinations then growth rates are higher, stipulating that destination effects are real and should be managed. Firms that export outside Africa become more capital intensive, while firms that export within Africa are downsizing on capital which can decrease productivity. Although exporters experience quicker productivity growth, these changes seem less promising once these firms are precisely matched with comparable non-exporters. Especially firms that export within Africa experience 'relative' drops in productivity, which might be due to the downsizing on capital and increased hiring of relatively low-skilled workers, which is even more worrying given our suggestive evidence that African manufacturer's production is too much labor-intensive.

Knowledge transfers and technology upgrading require absorptive capacities which the relatively more capital intensive and productive exporters seem to have particularly when complemented with foreign ownership. Finally, exporters' human resource departments show

no bias in terms of hiring more skilled or educated workers than non-exporters, which is in contrast with the skill-bias literature but fits into the standard HO framework as we find preliminary evidence that exporters increase average wages, especially when they trade outside of Africa, which we explain by the change in capital intensity of these firms, which contrasts the HO model.

The bottom line is that export promotion seems a promising path for growth of Africa's private sector. Export promotion could increase employment and alleviate poverty since exporters expand rapidly and upwardly adjust wages creating higher income growth without skill-bias. Policies that help firms experiment with exporting small shares of output towards more advanced markets accommodate both capital enhancement and employment against higher wages. A burdensome prerequisite seems that exporters self-select, such that newly exporting firms are already exceptionally productive. This may call for policies that nourish and stimulate national superstars to expand activities abroad.

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APPENDIX

A.1. Productivity growth rates per country and sector

	fixed effects	*random effects*	*pooled*
Ghana	0,6%	0,7%	0,1%
Tanzania	4,1%	5,3%	6,2%
Kenya	8,3%	8,6%	2,8%
Wood	2,8%	1,2%	1,3%
Food	3,4%	2,4%	-4,3%
Metal/Chemical	3,1%	3,2%	3,8%
Garment	-1,5%	1,4%	2,7%
Textile	6,6%	2,9%	7,5%
Furniture	2,4%	3,5%	-1,2%

A.2. Export premia from pooled sample specifications

period	size	Δsize	cap. intens	Δcap. intens	wage	Δwage
Pooled FGLS	50%***	3%*	-11%***	1%	21%***	3%
	(n = 4530)	(n = 2920)	(n = 4340)	(n = 2764)	(n = 3991)	(n = 2419)
Pooled	29%***	2%	20%***	0%	12%**	2%
with AR(1)	(n = 1960)	(n = 1124)	(n = 1832)	(n = 1023)	(n = 1178)	(n = 986)

Note: Results are based on population-average panel effects using a pooled FGLS estimator.

A.3. Differences between starters and non-starters of exporting (unconditional)

	Δoutput	Δsize	Δcapital	Δeducation	Δwage	Δearnings	Δprofit to K/L	ΔTFP
starters	0,05	0,12**	-0,07**	-0,01	0	-0,01	-0,13*	-0,14**
non-starters	0,05	0	0,04	0,01	0,05	0,06	-0,05	0