On export composition and growth*

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Abstract

The effect of exports with different technological intensity on economic growth is estimated using a generalization of the model put forward by Feder (1983, "On Exports and Economic Growth", *Journal of Development Economics* 12, 59-73). The hypothesis that exports in technology-intensive industries have a higher potential for positive externalities coupled with higher productivity levels (due to higher rates of capitalisation) is tested using a comprehensive and detailed data set, covering 45 industrialised and developing countries and including exports of 33 industries over the time period 1981 to 1997. The estimation results, using a random effects model and employing an instrumental variables estimator, support the hypothesis of qualitative differences between high and low tech exports with respect to output growth. The superior performance of high tech exports stems from their positive productivity differential to the domestic sector, while the externality effect is not significant at any meaningful level of significance. The positive productivity differential is only significant for the subsample of developing countries. No significant effects were found to be present in the subsample of OECD member countries.

Keywords: Economic growth, exports, export composition, externalities

JEL Classification: O41, O50, C23

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1 Introduction

Being a component of GDP, exports contribute directly to national income growth. However, there are a number of reasons why the impact of exports should be greater than the pure volume change. Indirect growth promoting effects may occur due to economies of scale, increased capacity utilization, productivity gains, greater product variety and the like. Furthermore, greater exposure to the world market may induce competitive pressures that lead to technological upgrading, efficiency gains in production as well as in management procedures, etc. All these trade related aspects are not new and have been put forward in the literature more than two decades ago (Feder, 1983, Bhagwati and Srinivasan, 1978, Krueger, 1980). More recent contributions put special emphasis on the role of trade in spurring innovation and facilitiating the international transmission of knowledge and technology (see the seminal book by Grossman and Helpman, 1991). Thus, the qualitative distinction between the export sector and domestic production with respect to its influence on the path and prospects of economic development is well founded in the theoretical literature.

The empirical literature which tests the hypothesis that exports stimulate growth (the so-called export-led growth hypothesis) is equally extensive. Most authors include either export growth (e.g. Balassa, 1978, 1984, Jung and Marshall, 1985) or a measure of openess (e.g. Michaely, 1977, Levine and Renelt, 1992, Greenaway and Sapsford, 1994, Sala-i-Martin, 1997) in an empirical growth model and find a significant positive relationship, although some are cautious when assigning the direction of causality (Jung and Marshall, 1985).

All the studies cited above do not explicitly investigate indirect effects from trade on growth. To our knowledge, Feder (1983) is the first to explicitly describe such indirect effects and develop an analytical framework that allows to test for productivity differentials and externalities between the export and the non-export sector. In the present paper we use this framework and extend it to include various export sectors that differ in the technology intensity of their production processes.

Thus, we refine the export-led growth hypothesis using a Ricardian argument. We postulate that not exports *per se* matter for growth, but that the composition of exports is also crucial. Our hypothesis rests on the same arguments concerning indirect effects between exports and growth as outlined above. However, we shift attention to a lower level of aggregation and look at the meso-structure of the economy. In analogy to Feder (1983) we postulate and explicitly test the hypothesis that trade in more technology-intensive industries implies a greater potential for productivity gains (due to efficieny gains, economies of scale, etc.) and positive externalities (like technology and knowledge spillovers) than trade in less sophisticated activities. Consequently, the structure of trade has a decisive influence on growth.

The impact of exports or trade composition on growth has been researched considerably less than the relationship between exports or trade and growth in general. Fosu (1990) studies the effect of manufacturing exports on growth for development countries as compared to primary sector exports, and reaches the conclusion that there is a differential positive impact by the manufacturing export sector. Greenaway et al. (1999) is one of the few existing contributions that directly studies the growth effect of disaggregated exports. In Greenaway et al. (1999), certain industries (fuel, metals and textiles) are identified as having a special importance for developing countries' growth performance. Amable (2000), Laursen (2000), and Peneder (2002) investigate the effect of trade specialisation (in relation to all other countries) in specific industries. All three studies find evidence for an impact of trade specialisation on growth. Amable (2000) identifies specialisation as such to be growth enhancing, but especially specialisation in electronics. Laursen (2000) arrives at similar results, reporting that specialisation in fast growing sectors (which correspond in general to high-tech sectors) is related to GDP. Peneder (2002) finds that specialisation in services represents a burden to future growth whereas exports of technology driven and high skill intensive industries have positive effects on aggregate growth. The last two contributions refer to OECD countries while Greenaway et al. (1999) restrict their analysis to developing countries. The coverage of present analysis is similar to the study by Amable (2000). We also adopt a global view and include a large set of industrialized and semi-industrialized countries.

The aim of this paper is to shed light on the relative importance of exports with different technological content on GDP growth. Using a panel of 45 industrialized and semi-industrialized countries and the theoretical framework offered by a simple generalization of Feder (1983)'s model, we find evidence that there is a significant difference in the growth effect of exports when these are disaggregated according to their technological intensity. We also present evidence that the better performance of high-tech exports is due to their productivity differential with respect to the domestic sector. The effect appears to be of relevance for developing countries.

The paper is structured as follows. Section two presents a simple generalization of Feder (1983)'s model to allow for different export sectors. Section three presents the data and the estimation methodology. Section four examines the results and section five concludes.

2 The theoretical framework

This section presents a straightforward generalization of the model proposed by Feder (1983) in order to study the effects of exports in economic growth. Let total production in the economy ($Y(t)$) be composed of exports ($X(t)$) and non-export production ($N(t)$), and assume that there are S different exporting sectors (for the moment the characteristic that defines the division into sectors is irrelevant, it could be technological content or skill requirements, for instance), so that $X(t) = \sum_{i=1}^{S} X_i(t)$. Let production in the non-export sector be affected by the volume of exports produced, and let such dependence be asymmetric in the sense that exports from different sectors may affect non-export production differently. Assume a generic production function for the non-export sector including externality effects from the different export sectors,

$$N(t) = F(K_N(t), L_N(t), X_1(t), X_2(t), \dots, X_S(t)), \tag{1}$$

where $K_N(t)$ and $L_N(t)$ are the stocks of capital and labour used in the non-export sector, respectively.[1] Let export production in sector i be given by

$$X_i(t) = G_i(K_i(t), L_i(t)) \qquad i = 1, \ldots, S, \tag{2}$$

where $K_i(t)$ and $L_i(t)$ are the stocks of capital and labour used in the production of exports from sector i, respectively. Assume furthermore that factor productivities differ between the non-export sector and each one of the export sectors by some sector-specific factor $\delta_i > -1$,[2]

$$\frac{\partial G_i/\partial K_i}{\partial F/\partial K_N} = \frac{\partial G_i/\partial L_i}{\partial F/\partial L_N} = 1 + \delta_i \qquad i = 1, \ldots, S. \tag{3}$$

Using the fact that

$$\frac{dN}{dt} = \frac{\partial F}{\partial K_N}\frac{dK_N}{dt} + \frac{\partial F}{\partial L_N}\frac{dL_N}{dt} + \sum_{i=1}^{S}\frac{\partial F}{\partial X_i}\frac{dX_i}{dt}, \tag{4}$$

and the identity $Y = N + \sum_{i=1}^{S} X_i$, after some manipulation it is possible to write

$$\frac{dY/dt}{Y} = \frac{\partial F}{\partial K_N}\frac{dK/dt}{Y} + \frac{\partial F}{\partial L_N}\frac{dL/dt}{Y} + \sum_{i=1}^{S}\left(\frac{\partial F}{\partial X_i} + \frac{\delta_i}{1+\delta_i}\right)\frac{dX_i/dt}{X_i}\frac{X_i}{Y}, \tag{5}$$

where $K = K_N + \sum_{i=1}^{S} K_i$ and $L = L_N + \sum_{i=1}^{S} L_i$.

If, as in Feder (1983), we make use of the assumption that there is a linear relationship between marginal productivity of labour and average output per worker so that $\frac{\partial F}{\partial L_N} = \gamma(\frac{Y}{L})$, equation (5) can be rewritten as

$$\frac{dY/dt}{Y} = \beta\frac{dK/dt}{Y} + \gamma\frac{dL/dt}{L} + \sum_{i=1}^{S}\left(\frac{\partial F}{\partial X_i} + \frac{\delta_i}{1+\delta_i}\right)\frac{dX_i/dt}{X_i}\frac{X_i}{Y}, \tag{6}$$

where β is the marginal productivity of capital in the non-export sector, assumed constant.

Although the specification given by equation (6) can be used to assess empirically whether exports from different sectors have a different effect on growth, the externality effect (given by $\frac{\partial F}{\partial X_i}$) and productivity differential effect ($\frac{\delta_i}{1+\delta_i}$) cannot be empirically identified. A specification which is more adequate for applied work can be however attained if, in the spirit of Feder (1982), the production function for the non-export sector is parametrized as

$$N = F(K_N, L_N, X_1, X_2, \ldots, X_S) = \left(\prod_{i=1}^{S} X_i^{\psi_i}\right)\tilde{F}(K_N, L_N), \tag{7}$$

[1] Notice that the assumption of unidirectional externality effects needs to be imposed in order to allow for the identification of the parameters in the model. We thus abstract from modelling externalities of the domestic sector in the export sectors.

[2] Henceforth, time dependency is dropped for the sake of notational ease.

for parameters $\psi_i \in I\!R$, $i = 1, \ldots, S$. This parametrization implies that

$$\frac{\partial F}{\partial X_i} = \psi_i \frac{N}{X_i}, \qquad (8)$$

and thus equation (6) can be written as

$$\frac{dY/dt}{Y} = \beta\frac{dK/dt}{Y} + \gamma\frac{dL/dt}{L} + \sum_{i=1}^{S}\left[\psi_i\frac{dX_i/dt}{X_i}\left(1 - \frac{\sum_{i=1}^{S} X_i}{Y}\right) + \frac{\delta_i}{1+\delta_i}\frac{dX_i/dt}{X_i}\frac{X_i}{Y}\right], \qquad (9)$$

a specification which allows estimates of ψ_i and δ_i for $i = 1, \ldots, S$ to be obtained empirically. This specification will be used in order to extract estimates of δ_i and ψ_i for different groups of exports aggregated in terms of technological content.

3 Data description

For the purpose of this paper we combined two data sources. Aggregate data for GDP, investment, population, exports, imports, exchange rates and the GDP-deflator were taken from the IMF's International Financial Statistics database. Data for exports of manufactures at the industrial level were taken from UNIDO.[3] We have grouped manufacturing industries into two broad groups, low and high technology intensive activities, based on the classification by Hatzichronoglou (1997). This classification is based on R&D intensity in a specific industry taking into account purchases of intermediates and capital goods from other sectors. A list of all industries and their assigned technology intensity is given in Table 1. Although divisions in more export sectors according to technological intensity were tried out, the results were plagued with multicollinearity and proved to be useless to establish sound conclusions on the effects of exports on growth at a finer level of disaggregation.[4]

The data set covers 45 countries over the time period from 1981 to 1997, subject to availability across countries and industries. Countries are grouped according to geographic region into five distinct classes: OECD North and South, East and South Asia and Latin America (for a listing of countries in each individual group see Table 2). Thus, the sample is very heterogenous, including all industrialized countries and many developing countries around the world with the exception of the two groups of transition and least developed (mostly African) countries where data was not available. The OECD group refers to all member countries prior to 1994. Inside this group we distinguish between catching-up countries (OECD South, including Greece, Portugal, Spain and Turkey) and advanced countries (OECD North).

Given the long-run scope of the analysis pursued, the observation period was divided into three subperiods (1981-1986, 1987-1992, 1993-1997) and variables were averaged over these subperiods. Growth rates were calculated as the logarithmic trend of the respective variable over the respective subperiod.

[3]UNIDO Demand and Supply Balance Database 2000; the data are recorded at the 3-digit and 4-digit level of ISIC (Revision 2).

[4]The results for finer groups of export aggregates are available from the authors upon request.

4 Results

Given the analytical framework described in section two and without making any assumption on the functional form of the externality effect of sectoral exports, we arrive at the following discretized version of equation (6) that allows us to test for an overall differential impact of various export sectors on output growth:

$$\frac{\Delta Y_{it}}{Y_{it}} = \alpha + \beta \frac{\Delta K_{it}}{Y_{it}} + \gamma \frac{\Delta L_{it}}{L_{it}} + \sum_{k=1}^{3} \phi_k \frac{\Delta X_{k,it}}{X_{k,it}} \frac{X_{k,it}}{Y_{it}} + \varepsilon_{it}, \tag{10}$$

where $\frac{\Delta Y_{it}}{Y_{it}}$ is the period-average annual growth of real GDP for country i in period t, $\frac{\Delta K_{it}}{Y_{it}}$ will be proxied by the period-average share of investment in GDP and $\frac{\Delta L_{it}}{L_{it}}$ will be approximated using period-average population growth. $\frac{\Delta X_{k,it}}{X_{k,it}} \frac{X_{k,it}}{Y_{it}}$ is the growth rate times the share in output of the respective exporting sector k, averaged for each period. In our case, we identified three export sectors: X_1 are non-manufacturing exports, X_2 refers to low-tech exports and X_3 stands for technology intensive exports. In this first specification, we jointly test for the effects of increased productivity in these export sectors together with positive externalities (i.e. spillovers) from exports on the domestic sector. The presence of either one or both of these two indirect effects will be captured by the ϕ-coefficients in specification (10).

The error term, ϵ_{it}, is assumed to be composed by a country specific effect and a general white noise disturbance, so that $\epsilon_{it} = \mu_i + \nu_{it}, \nu_{it} \sim IID(0, \sigma_\nu^2)$. The individual effects will be modelled as realizations of a random variable, so that $\mu_i \sim IID(0, \sigma_\mu^2)$, where μ_i is independent of ν_{it}. The results of both Breusch-Pagan and Hausman tests justify the use of random effects over simple OLS and fixed effects specifications.

The results of the GLS estimation for the specification given by (10) are given in the first column of Table 3. The classic driving forces of economic growth - capital and labour, which are approximated by investment and population growth - turn out to have the expected positive and significant effect on GDP growth. Non-manufacturing and high technology intensive exports also show a significant positive impact on output growth, whereas low tech exports do not have a significant impact.

A usual criticism to the GLS estimation of growth equations such as (10) relies on the fact that some explanatory variables could be endogenous in the specification, and therefore correlated with the error term, thus leading to biased parameter estimates. In order to account for endogeneity of our explanatory variables we decided to instrument for investment and all the variables involving export growth on the right hand side of (10) by using initial subperiod levels of investment and disaggregated export shares, as well as time and group dummies (corresponding to the groups in table 2). The estimation was carried out using Baltagi (1981)'s EC2SLS estimator, which improves upon the usual Balestra-Varadharajan-Krishnakumar (1987) 2SLS estimator by using a broader set of transformations of the instruments spanning those used by the latter. The results of the Durbin-Wu-Hausman test support the use of instruments to account for the endogeneity of the variables mentioned above.

Regression output from this more appropriate estimation are given in the second column of Table 3. The results differ with respect to our variables of interest. Investment and growth of the labour force show again the significant positive correlation with output growth that was observed previously. Also, the effect of the aggregate export sector (i.e. the sum of all γ_s) does not significantly differ from the results of the previous estimation. The conclusions for non-manufacturing exports are qualitatively unchanged. In contrast, low technology intensive exports now exhibit a negative correlation with output growth. The positive indirect impact of high tech exports remains.

In the present specification, we cannot disentangle between the two channels that may be responsible for this influence. High tech exports may be characterised by a higher productivity as compared to the domestic sector, thus increasing output disproportionately, they may also provide the domestic sector with positive externalities, such as knowledge and technology spillovers. The following specification, a discretized version of (9), allows us to isolate these two mechanisms empirically,

$$\frac{\Delta Y_{it}}{Y_{it}} = \alpha + \beta \frac{\Delta K_{it}}{Y_{it}} + \gamma \frac{\Delta L_{it}}{L_{it}} + \sum_{k=1}^{3} \rho_k \frac{\Delta X_{k,it}}{X_{k,it}} \left(1 - \frac{\sum_k X_{k,it}}{Y_{it}}\right) + \\ + \sum_{k=1}^{3} \pi_k \frac{\Delta X_{k,it}}{X_{k,it}} \frac{X_{k,it}}{Y_{it}} + \varepsilon_{it}, \tag{11}$$

where

$$\pi_k = \frac{\delta_k}{1+\delta_k}$$

represents the productivity differential between the specific export sector k (i.e. non-manufacturing, low tech, and high tech exports) and the domestic sector of the economy. ρ_s is the externality spilling over from this sector on the domestic sector. The results, using again Baltagi (1981)'s EC2SLS panel estimator assuming random effects and instrumenting for investment and all six export variables, are reported in Table 4.

Investment and population growth exhibit the expected positive influence on growth. The non-manufacturing export sector has a higher productivity than the domestic sector while there are negative externalities from this sector on the domestic economy. These two opposite effects are of equal magnitude at the 5%-significance level. The role of non-manufacturing exports for the economy remains ambiguous, at least in our heterogeneous sample. This is not very surprising, as this sector includes a great variety of exporting activities ranging from agricultural exports and primary commodities to service exports.[5] In the export oriented service sector, we would expect to observe a lower productivity than in the domestic sector on average, whereas we would expect a higher productivity in the primary sector and in utilities. Conversely, opposite effects are to be expected with respect to externalities. All these countervailing effects are likely to cancel out in the present heterogeneous sample,

[5]Furthermore, due to our calculations this sector also picks up non-systematic statistical discrepancies between the two data sources, as non-manufacturing exports are calculated as the residual between all manufacturing exports (low and high tech) taken from UNIDO and total exports as reported by the IMF.

where services may play a greater role in some countries and commodities and primary resources in others. We shall shed some light on this issue below, when we stratify the sample into OECD and non-OECD countries.

Low technology intensive exports are characterised by a significantly lower level of productivity as compared to the non-export sector. The positive coefficient on the externality term for this export sector is not statistically significant. Consequently, the previously observed negative impact on growth stems from the relatively inefficient use of factor inputs when compared to domestic production.

Equivalently, the growth enhancing effect of technology intensive exports hinges on their positive productivity differential to the domestic sector. The externality effect is close to zero and not significant at any meaningful level of significance.

The results so far indicate that exports contribute to growth mainly through increased productivity and not via external effects, like knowledge or technology spillovers. This seems plausible and supports the view formalised by Grossman and Helpman (1991) that competitive pressure on international markets improves efficieny in production and management procedures. The transfer of embodied knowledge and technology, which is another channel of indirect, dynamic gains from trade, is likely to be of greater importance with respect to imports rather than exports. Given the supply side oriented character of our analysis we are unable to test for these differences between exports and imports. We can say from our empirical results that there is no big role for spillovers arising from exports on the domestic economy.

An interesting picture emerges when the sample is stratified into OECD and non-OECD countries (see Table 5). No significant effects from exports are observed for the group of industrialised countries. The positive productivity differential between exports and domestic production, which was observed for technology intensive and non-manufacturing exports, arises solely from the group of less developed countries. For this subset of countries, the positive productivity differential of the non-manufacturing and high tech export sectors with respect to the domestic sector implied a positive growth effect. Again, no growth enhancing externalities arose from any of the export sectors. The negative externality of the non-manufacturing export sector, which has been observed for the total sample, could not be discerned in any of the two subsamples. Further, the negative productivity differential of low tech exports disappears when looking at the two subsamples individually.

As a general remark, Feder (1983)'s model performs considerably worse when applied to OECD countries as compared to non-OECD economies, which is reflected in the overall R^2 statistics reported in the last line of Table 5.

5 Conclusion

The empirical evidence presented in this paper allows to draw some inference on the mechanism via which exports impact on growth. Given the comparably weak performance of the model when it was applied to industrialised countries we refrain from extending the following conclusions to this subset of countries explicitly. Thus, we conclude that countries, and in particular developing countries, gain from increased openness on the export side primarily via improved resource allocation as a result of their exposure to international competition. This leads to a more efficient use of available resources and thus increases productivity in the export sector above the productivity level in the domestic sector. Learning effects and other positive externalities were not found to be influential for the superior growth performance of the non-domestic sector.

Also the productivity differential cannot be observed in all export sectors. There are significant differences between various types of export sectors. Whereas the technology intensive export sector and the non-manufacturing export sector (which unfortunately in this analysis contains information on all remaining sectors of the economy: primary commodities, utilities, and services) are characterised by such a positive productivity differential, the low tech export sector exhibits a significantly lower relative productivity.

This latter observation does not hold when stratifying the sample into industrialised and developing countries. In both subsamples, no distinction between the low tech and the domestic sector was found to be present. This still implies that no additional growth impetus from low tech exports could be observed in contrast to the two other export sectors. Thus, the hypothesis of a differential impact on growth depending on the technology intensity of the respective export industry finds support. The dynamic gains from high tech exports surpass the gains from low tech exports.

Consequently, industrial policy and trade policy should aim at promoting exports in sophisticated industries (in sense of R&D intensity), even when existing comparative advantages, stemming from low labour costs, abundance of certain resources, etc. would imply specialisation in less technology intensive, labour intensive activities. It seems to be important - as the example of sucessfully developing East Asian countries has shown - to direct resources to industries, where they are used most efficiently. These industries can be identified first as being outward oriented (export) industries and second as being technology intensive in their use of inputs.

This is not to say that current comparative advantages should not be exploited. Especially in the context of developing countries, export revenues are an important source of foreign exchange and thus of financial inflows into the economy. As the establishment and promotion of new, technology intensive industries requires financial funds, often public funds, in order to set up a respective environment (i.e. training of the labour force, fostering investments, etc.). these revenues are important in financing restructuring towards more growth promoting export specialisation.

We would conclude that the evidence in this paper supports the view that restructuring towards more technology intensive export patterns is crucial for a country's long term growth prospects.

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Code	Definition	Tech	Group
311	Food products	1	
313	Beverages	1	
314	Tobacco	1	
321	Textiles	1	
322	Wearing apparel, except footwear	1	
323	Leather products	1	
324	Footwear, except rubber or plastic	1	Low-Tech
331	Wood products, except furniture	1	
332	Furniture, except metal	1	
341	Paper and products	1	
342	Printing and publishing	1	
355	Rubber products	2	
356	Plastic products	2	
361	Pottery, china, earthenware	2	
362	Glass and products	2	
369	Other non-metallic mineral products	2	
371	Iron and steel	2	Low-Tech
372	Non-ferrous metals	2	
381	Fabricated metal products	2	
390	Other manufactured products	2	
3841	Ship building and repairing	2	
351	Industrial chemicals	3	
385	Professional and scientific equipment	3	
352d	Other chemicals	3	
382d	Machinery, except electrical	3	High-Tech
383d	Machinery, electric	3	
384d	Transport equipment	3	
3522	Man. of Drugs and Medicine	4	
3825	Man. Of Office, Computing and Accounting Machinery	4	High-Tech
3832	Man. of Radio, TV, and Communication equipment and apparatus	4	
3845	Man. Of Aircraft	4	

Table 1: Industries and groupings

Country	**Name**	**Group**
AUS	Australia	1
AUT	Austria	1
CAN	Canada	1
DNK	Denmark	1
FIN	Finland	1
FRA	France	1
GER	Germany	1
ITA	Italy	1
ICE	Iceland	1
JPN	Japan	1
NLD	Netherlands	1
NZL	New Zealand	1
NOR	Norway	1
SWE	Sweden	1
GBR	UK	1
USA	USA	1
GRC	Greece	2
PRT	Portugal	2
ESP	Spain	2
TUR	Turkey	2
HKG	Hongkong	3
IDN	Indonesia	3
KOR	Republic of Korea	3
MYS	Malaysia	3
PHL	Philippines	3
SGP	Singapore	3
THA	Thailand	3
ARG	Argentina	4
BOL	Bolivia	4
CHL	Chile	4
COL	Colombia	4
ECU	Ecuador	4
SLV	El Salvador	4
GTM	Guatemala	4
MEX	Mexiko	4
NIC	Nicaragua	4
PAN	Panama	4
PER	Peru	4
URY	Uruguay	4
VEN	Venezuela	4
BGD	Bangladesh	5
IND	India	5
NPL	Nepal	5
PAK	Pakistan	5
SRL	Sri Lanka	5

1: OECD North; 2: OECD South; 3: East Asia; 4: Latin America; 5: South Asia

Table 2: Countries and groupings

Variable	GLS	EC2SLS
Constant	0.006 (0.007)	-0.005 (0.009)
$\frac{\Delta K_{it}}{Y_{it}}$	0.061^{**} (0.031)	0.081^{*} (0.043)
$\frac{\Delta L_{it}}{L_{it}}$	0.503^{**} (0.200)	0.667^{***} (0.230)
$\frac{\Delta X_{1,it}}{X_{1,it}} \frac{X_{1,it}}{Y_{it}}$	0.303^{***} (0.100)	0.474^{**} (0.192)
$\frac{\Delta X_{2,it}}{X_{2,it}} \frac{X_{2,it}}{Y_{it}}$	0.007 (0.126)	-0.504^{**} (0.245)
$\frac{\Delta X_{3,it}}{X_{3,it}} \frac{X_{3,it}}{Y_{it}}$	0.359^{***} (0.112)	1.031^{***} (0.287)
Observations	131	131
Countries	45	45
Durbin-Wu-Hausman test	8.88 (p-value: 0.03)	–
R^2_{adj}	0.21	0.16

Standard errors in parenthesis. *(**)[***] stands for significance at the 10% (5%) [1%] significance level. X_1 refers to non manufactured exports, X_2 refers to low-tech exports and X_3 refers to high-tech exports (see text for definition). Instruments used: Time and group dummies, initial investment shares, initial export shares.

Table 3: Simple Feder estimates

Variable	GLS	EC2SLS
Constant	0.006 (0.007)	-0.001 (0.009)
$\frac{\Delta K_{it}}{Y_{it}}$	0.064**(0.032)	0.086** (0.035)
$\frac{\Delta L_{it}}{L_{it}}$	0.488**(0.203)	0.533** (0.225)
$\frac{\Delta X_{1,it}}{X_{1,it}} \frac{X_{1,it}}{Y_{it}}$	0.336*** (0.119)	0.325* (0.177)
$\frac{\Delta X_{2,it}}{X_{2,it}} \frac{X_{2,it}}{Y_{it}}$	-0.032 (0.173)	-0.533* (0.297)
$\frac{\Delta X_{3,it}}{X_{3,it}} \frac{X_{3,it}}{Y_{it}}$	0.407*** (0.128)	0.853*** (0.241)
$\frac{\Delta X_{1,it}}{X_{1,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	-0.016 (0.013)	-0.073* (0.043)
$\frac{\Delta X_{2,it}}{X_{2,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	0.005 (0.013)	0.024 (0.025)
$\frac{\Delta X_{3,it}}{X_{3,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	-0.002 (0.008)	0.001 (0.019)
Implied $(\delta_1, \delta_2, \delta_3)$	(0.506, 0, 0.686)	(0.481, -0.348, 5.803)
Observations	131	131
Countries	45	45
Durbin-Wu-Hausman test	19.69 (p-value: 0.01)	–
R^2_{adj}	0.23	0.15

Standard errors in parenthesis. *(**)[***] stands for significance at the 10% (5%) [1%] significance level. X_1 refers to non manufactured exports, X_2 refers to low-tech exports and X_3 refers to high-tech exports (see text for definition). Instruments used: Time and group dummies, initial investment shares, initial export shares.

Table 4: Feder estimates with parametrized externality effect

Variable	OECD	NON-OECD
Constant	0.019 (0.008)	0.009 (0.015)
$\frac{\Delta K_{it}}{Y_{it}}$	-0.010 (0.035)	0.106* (0.054)
$\frac{\Delta L_{it}}{L_{it}}$	0.582***(0.210)	-0.471 (0.527)
$\frac{\Delta X_{1,it}}{X_{1,it}} \frac{X_{1,it}}{Y_{it}}$	0.339 (0.342)	0.539** (0.222)
$\frac{\Delta X_{2,it}}{X_{2,it}} \frac{X_{2,it}}{Y_{it}}$	0.001 (0.545)	-0.405 (0.398)
$\frac{\Delta X_{3,it}}{X_{3,it}} \frac{X_{3,it}}{Y_{it}}$	0.176 (0.179)	0.977*** (0.346)
$\frac{\Delta X_{1,it}}{X_{1,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	0.003 (0.029)	0.028 (0.081)
$\frac{\Delta X_{2,it}}{X_{2,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	-0.050 (0.072)	-0.010 (0.042)
$\frac{\Delta X_{3,it}}{X_{3,it}} \left(1 - \frac{\Sigma X_{k,it}}{Y_{it}}\right)$	0.176 (0.179)	0.003 (0.026)
Implied $(\delta_1, \delta_2, \delta_3)$	(0.513, 0.001, 0.214)	(1.169, -0.288, 42.478)
Observations	58	58
Countries	20	20
R^2_{adj}	0.11	0.31

Standard errors in parenthesis. *(**)[***] stands for significance at the 10% (5%) [1%] significance level. X_1 refers to non manufactured exports, X_2 refers to low-tech exports and X_3 refers to high-tech exports (see text for definition). Instruments used: Time and group dummies, initial investment shares, initial export shares.

Table 5: Feder estimates with parametrized externality effect for OECD and non-OECD countries