5. Specialize rightly or decline*

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5.1. INTRODUCTION

This chapter addresses the long-run relation between trade specialization and growth in a cross-country empirical framework. The theoretical literature on both the supply and demand side suggests the relevance of the nature of the goods produced and exported to a country's long-run growth success or decline.

In the Keynesian tradition (Thirlwall, 1979), growth is driven by the income elasticities of exports and imports and cumulative causation forces. Thirlwall's final growth equation (Thirlwall's law) is:

$$\frac{\dot{y}}{y} = \frac{1}{\pi}\varepsilon\left(\frac{\dot{Y}}{Y}\right) \tag{5.1}$$

National growth $\dot{y}/y$ depends on world demand growth $\dot{Y}/Y$, given the export and import elasticities ε and π which are thought to depend on countries' model of specialization.[1]

More recently, the static theory of international trade has evolved along interesting lines with models of endogenous growth (Romer, 1990; Grossman and Helpman, 1991; Lucas, 1988; Young, 1991) in which supply-side factors play a dominant role.

Lucas (1988) proposes a model where sector-specific self-reinforcing learning-by-doing processes are at the core of his analysis: two final goods are produced according to a Ricardian production technology and the key assumption of the model refers to the accumulation of human capital h in sector s:

$$\dot{h}_s = h_s \delta_s u_s \tag{5.2}$$

h_s can be interpreted as the outcome of a learning-by-doing process: the growth of h_s depends on the effort u_s and learning-by-doing is assumed to be sector-specific, as indicated by the parameter δ_s.

If countries differ in the distribution of sectoral human capital relative levels h_s they will specialize on the basis of comparative advantage, the latter being the effect of differences in the sectoral distribution of human capital. The main result of the model is that countries exhibit constant endogenously determined rates of growth, although the growth rates themselves differ among countries, because (under certain conditions) they specialize in the production of goods with different intensities of learning-by-doing. Lucas shows that the model predicts a very stable structure of specialization, analogously to the Thirlwall case, originating from initial conditions and local feedbacks.

Grossman and Helpman (1991) distinguish some extreme cases, comparing differences in the rates of growth between countries in complete isolation or in a free trade regime, and with dynamic comparative advantage resulting from local accumulation of knowledge or international spillovers of technical information. The main conclusion is that economic growth and international specialization are connected, and the second has an influence on the first.[2]

Nevertheless, there are many mechanisms and channels linking trade and growth, through international specialization, and, as Grossman and Helpman themselves underline, in the real world we find more mixed and less neat situations, and outcomes will be even less clearly identifiable. Indeed, the composition of demand changes with the evolution of the economy, and technical progress always introduces new goods and new production processes, again differentiating sectoral evolutions.

Taking into account this last perspective, both in the Keynesian and in the endogenous growth traditions, some models allow for appreciable mobility of the economic (and trade) structures (Fiorillo, 2001; Grossman and Helpman, 1991), but outcomes of these models are less neat in terms of the specialization–growth nexus.

In short, the theoretical literature suggests that specialization can be a limit or a push for growth. Nevertheless, specialization can also change and this ability to change may well be a fundamental characteristic for growth. The overall dynamics depends on exogenous (nature of spillovers, degree of world integration, and so on) and endogenous factors ('social capability', institutional framework, and so on)

No definitive answers to the previous theoretical questions can be found in the empirical literature on trade and growth, which provides mixed results. Part of this outcome is probably due to the mis-measurement of openness: as suggested by the above theoretical literature, rather than openness or exports 'tout-court', it might be the type of goods exported that can determine a country's success. What we propose here, then, is a re-statement of the empirical relation between trade and growth in terms of the 'quality' of country specialization. Following the recent work by Hausmann et al. (2006), we set out to assess whether 'what you export matters for growth'. Moving some steps ahead, we propose various indicators to detect the key factors of success for exports which make a country's long-run fortune or decline. Our indicators are intended to identify supply and demand side factors contained in countries' exports. These countries' specialization indicators are then tested within the empirical framework of growth regressions. In particular, two different panel data specifications are estimated respectively on annual and five-year-averaged data, making use of the most suitable estimation techniques concerned.

5.1.1. Describing the Nature of Specialization

On the empirical side, this issue surprisingly has not been investigated in depth. A few authors look at the relation between growth and specialization from a general point of view, and others focus more on specific sectors (and areas). While Dalum et al. (1999) confirm the theoretical link between specialization and growth without specifying the nature of specialization, Fagerberg (1999) reports that specializing in electronics has a positive effect on productivity, and Amable (2000) shows that countries with comparative advantage in the electronics and ICT sectors achieve greater growth rates. Focusing on Ireland, Salavisa (2001) finds that an industrial structure focused on high-tech sectors is one of the main factors responsible for its rapid economic growth.

As regards more general approaches, Laursen (1998) studies the relationship between specialization and growth in a Constant Market Share (CMS) analysis and, isolating the importance of the initial specialization pattern and of structural changes towards sectors with higher growth rates, he confirms that the growth rate of the economy is positively influenced by the Adaptive Effect, which measures the extent to which a country changes its productive structure towards high-demand growth sectors. This implies that a certain dynamics of the productive structure is necessary for sustained economic growth. The same conclusion is reached by Bensidoun et al. (2001) who build an *ad hoc* measure, called GSIM, that is the rate of growth of per capita income of countries with a similar specialization. This is not a measure of specialization: in practice they regress the growth rate of countries on the growth rate of similar countries expecting a positive relationship between the two.[3] A recent study (Worz, 2004) stresses that trade specialization in skill-intensive sectors has a long-term positive effect on economic growth. Worz shows that in the OECD countries both the initial specialization pattern and the capacity to reduce production in low-growth sectors have a positive effect on the growth rate.

Very recently, Hausmann et al. (2006) formally demonstrated that in the presence of local cost of discovery generating knowledge spillovers, the mix of goods that a country produces can have important implications for economic growth. They built up an indirect index of the productivity level (content) of a country's export basket and showed that it predicts subsequent economic growth. What should the previous productivity content capture? Following indications deriving from the theory of endogenous growth, the first candidate for this content is some kind of human capital and/or technology proxy: the general idea is that a structure with a large share of goods with high levels of technology/human capital should foster the rate of growth. Unfortunately, there are few data relative to technological progress or human capital at the sector level and for a large set of countries. As a consequence, for each country *c*, they simply proxy those aspects only indirectly, measuring how much technology/human capital is contained in the economic structure (the export basket), building a variable measuring the 'productivity content' in the following way:

$$SP_{ha_c} = \sum_{s=1}^{S} \frac{x_{cs}}{X_c} \times PRODY_s \tag{5.3}$$

with x_{cs} and X_c respectively measuring sector *s* of country *c* and total exports, and $PRODY_s$ responds to the following formula

$$PRODY_s = \frac{\sum_{c=1}^{N} \frac{x_{cs}}{X_c} y_c}{\sum_{c=1}^{N} \frac{x_{cs}}{X_c}} \tag{5.4}$$

and measures, for each product *s,* the average productivity of its exporting countries. For each country $c = 1,..., N$, y_c represents the per capita income level and for each product *s* a weighted average is obtained using weights equal to $\left(x_{cs} \big/ \sum_{c=1}^{N} x_{cs}\right)$. [4]

Summing up, for each product the content of technology level is calculated by averaging the per capita income of exporters; then, for each country, it is possible to get the average level of technology of its trade composition.[5] The analysis proceeds by heavily relying on the idea that most advanced sectors (in a technical sense) necessarily engender higher growth. Lall et al. (2005) demonstrate that this can be partially erroneous and interpret this measure in a broader sense. While Hausmann et al. (2006) take it as a narrow indicator of the technological/human capital level, the former recognize that many factors can be captured by the index: not only technology but also variables depending on marketing, infrastructure, fragmentability, and so on. Furthermore, Lall et al. also descriptively show that there is no strict linkage between growth and their measure, while Hausmann et al. get partially different results from panel growth estimations over the period 1992–2003 and 1962–2000: the nature of specialization proves significant in most of their estimations. Sharing the belief that the productivity content of exports as calculated by Hausman et al. is too broad a measure to identify what causes some export structures to be preferable to others, we propose a different ranking of export sectors more specifically based on their 'skilled labour' content where the non-production workers' compensation share is taken as a proxy for human capital at the sector level.

The index is calculated according to the following formula:

$$SP_{sk_c} = \sum_{s=1}^{S} \frac{x_{cs}}{X_c} \times SKILLCONT_s \qquad (5.5)$$

The average content of human capital in export sectors is obtained according to $SKILLCONT_s$, that is the share of non-production workers' compensations, and then for each country the average skills content of its exports is calculated using its sectoral export shares x_{cs}/X_c as weights. In order to overcome the shortage of sectoral data on human capital for several countries, we use information on the skill composition of the labour force in the US industrial sectors as the benchmark for our ranking of products. The idea is that although industrial activities are not performed equally across nations the relative position of sectors in terms of skill content should be the same all over the world and especially for traded goods in a globalized environment.[6] We think that this index provides a refinement of Hausmann, et al.'s index since it seeks to identify the role of a specific key factor for growth, that is human capital.

Furthermore, we propose an alternative indicator which can be related to the demand side literature mentioned in the introduction. This is meant to be directly connected to export growth and is calculated according to the following formula:

$$SP_{gr_c} = \sum_{s=1}^{S} \frac{x_{cs}}{X_c} \times EXPGROWTH_s \qquad (5.6)$$

where $EXPGROWTH_s$ is the average rate of growth of world exports, between the initial and the final year, for sector *s*. When the country export structure is completely concentrated, the lower and upper bounds are defined by the lowest and highest sector growth rate of world exports.

As stated in the introduction, although economic structures change slowly, we seek to investigate the possibility that the ability to change the trade structure, following demand and/or technological evolution at the world level, could be one of the reasons for a country's success. We also build some indexes on the basis of the static indexes outlined above. The dynamic version of Hausmann et al.'s index is

$$DSP_{ha_c} = [SP_{ha_c}]^{t=T} - [SP_{ha_c}]^{t=0} \quad (5.7)$$

This formulation measures the difference in the productivity content of the trade structure of countries between the end and the beginning of the period under analysis. A positive value means that in the final year the structure has moved to more advanced sectors; note that these sectors are not necessarily the same as in the initial year.

The dynamic version of SP_{sk} is the following:

$$DSP_{sk_c} = [SP_{sk_c}]^{t=T} - [SP_{sk_c}]^{t=0} \quad (5.8)$$

Instead, in the case of equation SP_{gr} the dynamic version is

$$DSP_{gr_c} = \sum_{s=1}^{S}\left(\frac{x_{cs}}{X_c}\right)^{t=T} \times EXPGROWTH_s - \sum_{s=1}^{S}\left(\frac{x_{cs}}{X_c}\right)^{t=0} \times EXPGROWTH_s \quad (5.9)$$

In this case, a positive value means a change in export structure toward more dynamic sectors in terms of the world demand growth, while a negative value would mean the opposite. Fast- (or slow-)growing sectors remain unchanged between the initial and final period.

5.2. DESCRIPTION OF THE DATA

5.2.1. Data Set Sources and Construction

The specialization indicators used in the present work were obtained by combining countries' trade and income data. The data on exports come from the COMTRADE data base and the disaggregation is at the 4 digit SITC revision 1. The original data set contains information on 623 products for a maximum of 211 countries and 44 years. The use of more disaggregated data and newer revisions is possible, although this would limit analysis to a very short time span, thus hampering the chance of analysing long-run growth paths. As previously mentioned, for the calculation of the SP_{sk_i} index we used the information of non-production workers' compensation over total workers' compensation in US industrial activities from 'The NBER-CES Manufacturing Industry Database (1958–1996)' available at http://www.nber.org. The classification of industrial activities does not concern primary products, which is why we dropped those products for which there is no correspondence in the US classification of industrial activities, ending up with 490 products. We also dropped many countries whose total exports sum to 0 in some years, thus ending with 177 countries and a total of 1,747,123 observations from the original 2,638,049.

The information on countries' macroeconomic variables and productivity for the computation of the SP_{ha_i} index and the specifications of the growth empirical model was retrieved from the Penn World Tables (PWT 6.2) containing data on 188 countries between 1960 and 2004 and available at http://pwt.econ.upenn.edu.

Merging the data on trade with the data on real GDP per worker from PWT 6.2 leaves us with 148 countries and 490 products for the period 1962–2003. Once the specialization indexes were calculated, we decided to focus the empirical part of the work on a balanced panel of 46 countries at different stages of development; this balanced panel is limited to the 1970–2003 period, ending up with a total of 1564 yearly observations. Table 5A.2 in the Appendix shows descriptive statistics for the specialization indexes and the other variables used in the empirical analysis below.

5.2.2. Description of the Specialization Indexes

Table 5.1 presents a comparison among the ranking of products according to productivity content, skill content and world demand dynamics, respectively. The three columns in the upper part of the table display the ten products with the lowest $PRODY$, $SKILLCON$ and $EXPGROWTH$, respectively. The lower part of the table, instead, shows the ten products with the highest values of the indexes. A certain similarity can be found between the ranking obtained by means of average productivity content and average skill content: the products ranking in the highest positions are similar. Different results are obtained when the average growth rate of world exports is used to rank export products. In general, Hausmann et al.'s method to recover the technological content of exports and our method based on human capital actually position some higher technology products in the highest positions.[7] Table 5.2 shows the five lowest and highest values of the specialization indicators both in their static and dynamic versions.

Again some similarities emerge between the SP_{ha} and the SP_{sk} indexes and also for their dynamic versions, DSP_{ha} and DSP_{sk}, where four out of five nations are the same in the two rankings and actually concern developing countries which experienced a major change in their trade and production structure during the period of analysis.[8]

Finally, a complete list of the countries present in the sample is available in Table 5A.1 in the Appendix, together with their rankings in terms of the above-mentioned specialization indexes.

Table 5.1. Comparison among specialization indexes

Ten lowest	***PRODY***		Skill content		***EXPGROWTH***
Jute fabrics, woven	1767.05	Cotton fabrics, woven, grey, not me	0.138	Cigarette paper in bulk, rolls or s	–0.25
Bags and sacks of textile materials	2540.67	Cotton fabrics, woven, other than g	0.138	Tannic acids-tannins-and derivative	–0.22
Carpets, carpeting and rugs, knotted	2896.06	Sawlogs and veneer logs - conifer	0.139	Railway locomotives-steam- and tend	–0.18
Coffee, green or roasted	2963.73	Glass carboys, bottles, jars, stopp	0.160	Ammoniacal gas liquors produced in	–0.15
Cocoa beans, raw or roasted	3003.72	Glass tableware etc for household h	0.160	Chassis with engs. mntd. for vehicl	–0.15
Edible nuts, fresh or dried	3061.83	Poultry, incl.offals-ex.liver-fresh,	0.179	Fin. structural parts of zinc	–0.13
Leather, nes	3201.27	Tanks,vats and reservoirs for stora	0.184	Expanded metal	–0.12
Groundnut/peanut/oil	3394.55	Silk fabrics, woven	0.185	Typewriters and cheque-writing mach	–0.04
Coconut-copra oil	3436.88	Lumber, sawn, planed, etc. - conife	0.189	Hoop and strip of iron or steel	–0.03
Cotton fabrics, woven, grey, not me	3614.32	Lumber, sawn, planed, etc. - non-co	0.189	High pressure hydro-electric condui	–0.03
Ten highest	***PRODY***		**Skill content**		X_{gr}
Semi-chemical wood pulp	21010.19	Newspapers and periodicals	0.873	Spiegeleisen	0.193
Electron and proton accelerators	19975.62	Fruit juices & vegetable juices, unf	0.684	Invalid carriages	0.188
Orthopaedic appl., hearing aids, artif	19872.16	Non-alcoholic beverages, n.e.s.	0.684	Orthopaedic appl., hearing aids, artif	0.167
Platinum, unworked or partly worked	19688.13	Music, printed or in manuscript	0.678	Statistical machines-cards or tapes	0.155
Bacon, ham & other-dried, salted, smok	19414.7	Printed matter, nes	0.678	Glycosides, glands & extracts, sera, v	0.155
Uranium & thorium & their alloys	19362.26	Electro-medical apparatus	0.659	Thermionic valves and tubes, transi	0.152
Music, printed or in manuscript	19337.75	Electrical insulating equipment	0.597	Non-alcoholic beverages, n.e.s.	0.143
Chemical prods for photography, for	18705.25	Thermionic valves and tubes, transi	0.597	Medicaments	0.141
Electro-medical apparatus	18550.69	Electro-mechanical hand tools	0.597	Binoculars, microscopes & other opt	0.141
Watches, watch movements and cases	18391.29	Electron and proton accelerators	0.597	Optical elements	0.139
		Electrical machinery and apparatus	0.597		

Source: COMTRADE, PWT 6.2. Own calculation.

5.3. THE EMPIRICAL MODEL AND ESTIMATION ISSUES

According to the empirical growth literature, the basic specification of the empirical growth model is the following

$$\Delta y_{it} = -(1-\alpha) y_{it-\tau} + \gamma SP_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{5.10}$$

where y_{it} measures the log of per worker real GDP and SP_{it} the nature of trade specialization measured by the above indexes, τ indicates the panel periodicity, μ_i is the country-specific unobserved heterogeneity, λ_t is a common time effect and ε_{it} represents the idiosyncratic error term.

The choice here is to estimate the empirical model both on yearly observations and five-year averages of the data.

With annual data Equation (5.10) is reformulated as an auto-regressive distributed lag ARDL(1,1) model according to the following specification

$$\tilde{y}_{it} = \alpha \tilde{y}_{it-1} + \gamma_0 \tilde{SP}_{it} + \gamma_1 \tilde{SP}_{it-1} + \mu_i + \varepsilon_{it} \tag{5.11}$$

Here the superscript $\sim$ indicates that for each variable the deviation from the year-specific cross-sectional mean was taken thus controlling for time common effects. Equation (5.11) reformulated as

$$\Delta \tilde{y}_{it} = \gamma_0 \Delta \tilde{SP}_{it} - \phi \tilde{y}_{it-1} + \theta \tilde{SP}_{it-1} + \mu_i + \varepsilon_{it} \tag{5.12}$$

with $\phi = (1-\alpha)$ and $\theta = \gamma_0 + \gamma_1$. The long-run effect of specialization on growth is straightforwardly identified by a non-linear combination $\frac{\theta}{\phi}$ on the model parameters.

When using five-year averages of the data, the empirical model is specified as follows

$$\Delta \tilde{y}_{it} = -\phi \tilde{y}_{it-5} + \gamma \tilde{SP}_{it} + \mu_i + \varepsilon_{it} \tag{5.13}$$

where the long-run effect of specialization on growth can again be identified by the non-linear combination of the model parameters γ / ϕ.

Equations (5.10)–(5.14) represent dynamic panel data models where the lagged dependent variable appears among the right-hand-side variables. The correlation between the unobservable heterogeneity and the regressors in general is not a new issue in the empirical growth literature (see Temple, 1999; Islam, 1995; Knight et al., 1993; Caselli et al., 1996). The unobservable country-specific effects incorporate the countries' different efficiency levels that are likely to be correlated with some of the explanatory variables. This feature makes OLS biased and inconsistent. For the case of a large time span *T*, Nickell (1981) shows that in Within Group estimations the

Table 5.2. Country ranking according to trade specialization

Static indices					
5 Lowest	SP_{ha}		SP_{sk}		SP_{gr}
BOL	5615.39	CHL	0.27	EGY	0.04
HND	5910.08	TUR	0.29	BOL	0.04
PRY	6092.30	ISL	0.29	HND	0.05
SLV	6592.01	NZL	0.30	TTO	0.05
GTM	6640.81	GRC	0.31	CHL	0.05
5 Highest	SP_{ha}		SP_{sk}		SP_{gr}
CHE	14346.39	SGP	0.42	IRL	0.11
SWE	13572.42	ISR	0.42	HKG	0.11
GER	13477.07	CHE	0.41	CHE	0.10
USA	13302.52	USA	0.41	SGP	0.10
FIN	13260.13	IRL	0.40	ISR	0.10
Dynamic indices					
5 Lowest	DSP_{ha}		DSP_{sk}		DSP_{gr}
HND	72.328	TTO	-0.003	ISL	0.007
CHL	101.072	VEN	-0.003	HKG	0.007
PRY	104.496	ECU	-0.002	CHE	0.007
ARG	111.845	BRA	-0.001	DNK	0.008
NZL	117.509	PAN	-0.001	PRT	0.008
5 Highest	DSP_{ha}		DSP_{sk}		DSP_{gr}
SGP	339.938	PHL	0.008	BOL	0.039
MYS	321.865	SGP	0.006	ARG	0.032
PHL	321.245	MYS	0.005	ECU	0.030
IRL	319.721	IRL	0.004	BRA	0.029
KOR	292.927	BOL	0.004	EGY	0.027

Source: COMTRADE, PWT 6.2. Own calculation.

size of the downward bias goes down whenever the panel time span increases.

For the typical small T growth regression on five-year averages of the data the econometric theory has developed a series of dynamic panel data estimators basically aimed at solving the inconsistency of the previous estimators.

When T is small and N, the cross-section size of the panel, is wide, the Arellano and Bond (1991) First Difference GMM estimator provides an improvement with respect to OLS, FE and IV estimators: first differencing the original model wipes out the unobserved heterogeneity, and lagged levels of the endogenous variable are used as instruments for its first difference. This procedure would thus grant a consistent and efficient estimate of the coefficient on the lagged dependent variable provided that lagged levels are good instruments for first differences. If series are highly persistent, though, this no longer applies. For this reason, a second GMM estimator is proposed (Arellano and Bover, 1995; Blundell and Bond, 1998) where lagged levels of the variables are used as instruments for the first differences and lagged differences are used as instruments for the equation in levels. The so-called System GMM represents a useful alternative when the series display a near unit root behaviour because it provides a wider and more robust instrument set.

Thus in light of the above and from availability of 35 yearly observations for each of the 46 countries of the unbalanced panel, the estimates of the empirical model (5.12) on annual data are obtained by means of the Fixed Effects (FE) estimator and compared to the OLS ones.

With five-year averages, the time span of the panel is too short and the First Difference and System GMM estimators are used and compared to OLS and FE ones.

5.4. RESULTS

The next two subsections respectively report results when annual and five-year averages of the data are used. The basic empirical models shown above are in all cases enriched with the inclusion of the population growth rate and the investment share over GDP to control for determinants of the steady state other than trade specialization. In an initial stage we also included several variables relative to the level of human capital and to the degree of openness of countries. These variables in most cases proved insignificant,[9] and we decided to omit them from our presentation.

As previously discussed, the specialization indexes SP_{ha} and SP_{sk} are intended to capture supply-side features of trade specialization and hence they alternate in the empirical specifications. On the other hand, as displayed in Table 5.1, the SP_{gr} indicator deals with another kind of information concerning world demand and thus it is always present in the empirical specifications jointly with one of the other two indicators in turn.

Finally, it is worth noting that SP_{ha} and SP_{sk} enter the specifications in logs while SP_{gr} enters in levels. Their dynamic versions always enter in levels. Furthermore, SP_{ha} and SP_{gr} refer to the value at the beginning of the year/five-year period, while SP_{sk} refers to the year/five-year period average.

5.4.1. Annual Data

Tables 5A.3 and 5A.4 in the Appendix show the complete results for the specification in Equation (5.12). OLS estimates alternate with FE ones. The first table shows results for the static version of the specialization indicators, while Table 5.3 refers to their dynamic versions.

The lower part of the table shows the test for the significance of the lagged value of the specification. From the specification in Equation (5.11), the test is based on the restriction $\gamma_1 = 0$ and this is accepted in most specifications.

From the original estimates, Table 5.3 shows the long-run parameters emerging from model (5.12) for our variables of interest.

Table 5.3. Results on annual data. Lon-run effects (θ/ϕ)

	OLS	*FE*	*OLS*	*FE*
SP_{ha}	1.17*	0.63		
SP_{sk}			1.69**	1.97*
SP_{gr}	3.79**	1.95*	3.74**	1.42*
DSP_{ha}	0.00***	0.00*		
DSP_{sk}			21.31	5.20
DSP_{gr}	–6.36	–1.73	–6.83	–1.63

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

While the dynamic version of the specialization indexes show no significance at all in the long run[10] apart from the DSP_{ha} which is positive and significant although the size of the coefficient is very small, the static versions are particularly interesting since SP_{sk} and SP_{gr}, especially, result positive and significant. The Hausman, Rodrik and Hwang Index, SP_{ha}, instead displays a positive although barely significant long-run elasticity. From the results in Table 5.3 a 1 per cent increase in average human capital content of exports brings about an increase in the steady state level of the real GDP per worker of about 1.7–2 per cent. On the other hand an increase in the growth rate of world demand of 1 per cent causes the steady state level of the real GDP per worker to grow of 0.2–0.3 per cent taking the Within Group estimates as a reference point.[11]

A note should be added at this point. With our data the SP_{ha} proves weakly significant and in few cases, while in the original work it was generally significant. This difference may depend on several aspects that differentiate our data from the original work of Hausmann et al. First of all, our dependent is GDP per worker and not per capita; second, since we opted for a balanced panel, our countries sample is different; besides, as a consequence of this choice (balanced panel) we can calculate *PRODY* for all years, while Hausmann et al., to avoid difficulties due to the presence of non-random distributed missing data, use only the final years. Finally, trade data used in the regressions come from different sources (COMTRADE for us, Feenstra et al. (2005) dataset for Hausmann et al.).

5.4.2. Five-Year Averages

Tables 5A.5 and 5A.6 in the Appendix display results for the estimation of model (5.13) on five-year averages of the data. As previously mentioned, all the estimators are used and compared in order to assess the robustness of the findings. Apart from FE and OLS estimates, both the first and second step estimates of the First Difference and System GMM are shown. For the second step Windmeijer's finite-sample correction for the two-step covariance matrix is applied. A particular advantage of the GMM estimators is that all the endogenous variables can be instrumented by means of past level or differences. Therefore all the variables included in the specifications together with the lag of the dependent variable are considered as endogenous, thus overcoming the typical problem of endogeneity of the growth determinants. Nevertheless, since our results might be sensitive to the number of instruments used in the GMM method, the tables also show results when the set of instruments is reduced to lags 1 to 3 of the endogenous variables.

Finally, First Difference and System GMM estimators rely on the assumption of no first order auto-correlation in the level equation which results in testing for AR(2) in the difference equations. The test p-value is shown in the final columns of the tables together with the Sargan–Hansen test for the over-identifying restrictions and the Difference Sargan to test the validity of the additional moment used when passing from First Difference GMM to System GMM. A general look suggests that the identification of the long-run parameters from System GMM is the most reliable since, unlike the FD GMM results, the lagged dependent variable estimate always stays within the range of the OLS and FE estimates which, in general, are thought of as the upper and lower bound with highly persistent time series.

Table 5.4 in the text summarizes the long-run parameter estimates from model (5.13). Among the static indexes only SP_{sk} proves to be significant across all the specifications and again the effect results in about a 2 per cent increase in the steady state per worker GDP for each 1 per cent increase in the average human capital content of exports. According to the evidence of Table 5.2, were Chile to become Singapore, the human capital contained in its exports would grow by 1/2 and its steady state GDP per worker would nearly double. Comparing Chile and Singapore in the final period, the latter country displays a real GDP per worker which is twice as large as the former.

Table 5.4. Results on five-year averages. Long-run effects (γ/ϕ)

	SP_{ha}	SP_{sk}	SP_{gr}	DSP_{ha}	DSP_{sk}	DSP_{gr}	Instruments
OLS	0.66		0.16	0.00**		–0.07	
FE	0.32		0.23	0.00		0.12	
FD-GMM	0.14		0.11	0.00		–0.04	all lags
FD-GMM2nd	0.21		0.12	0.00		–0.03	all lags
FD-GMM	0.18		0.10	0.00		–0.07	lags 1 to 3
FD-GMM2nd	0.17		0.11	0.00		–0.07	lags 1 to 3
SYS-GMM	0.55		–0.12	0.00*		–0.04	all lags
SYS-GMM2nd	0.58		–0.13	0.00*		–0.05	all lags
SYS-GMM	0.85		–0.14	0.00*		–0.05	lags 1 to 3
SYS-GMM2nd	0.85		–0.10	0.00		–0.06	lags 1 to 3
OLS		1.67**	0.05		7.05	–0.07	
FE		1.18	0.12		0.23	–0.04	
FD-GMM		2.41**	–0.00		–1.60	–0.05	all lags
FD-GMM2nd		2.38**	–0.04		–1.70	–0.05	all lags
FD-GMM		2.18**	–0.02		–2.05	–0.05	lags 1 to 3
FD-GMM2nd		2.19**	–0.02		–2.02	–0.05	lags 1 to 3
SYS-GMM		1.87*	–0.10		5.34	–0.05	all lags
SYS-GMM2nd		2.27*	–0.05		5.50	–0.03	all lags
SYS-GMM		2.24**	–0.09		3.34	–0.07	lags 1 to 3
SYS-GMM2nd		2.29**	–0.07		3.65	–0.06	lags 1 to 3

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

As far as the dynamic version of the specialization indexes are concerned, only DSP_{ha} is significant although the coefficient is really small and implies a 0.1 per cent increase in the steady state real GDP per capita for each 10 per cent increase in DSP_{ha}.

5.4.3. Robustness Checks

A number of robustness checks have been conducted on the previous empirical results and this section is devoted to provide a summary of the main findings. Generally speaking, readers should take into account that our main conclusion, that is the significance of SP_{sk} in growth equations, has already been tested in different ways: it holds with annual and five-year estimations; it holds with different estimation methods; finally, it holds with all or a limited number of lags in the instruments. As an initial step, we rebuilt the data set and indicators excluding export sectors related to primary products, hinging on the suspicion that the share of US non-production workers might not be a valid proxy of skill content for this kind of product.

Then we repeated the estimates on five-year averages of the data on the 46 countries of the balanced panel with this reduced version of the specialization indexes and results do not substantially change, especially with OLS and System GMM.

We also observed that the inclusion of countries with a very concentrated structure of exports generates a flaw in the countries' ranking due to the high weight of the few export sectors in these countries' export structures. For this reason, we have multiplied the average skill content for the Herfindahl index calculated on countries' exports. When repeating the estimates with the adjusted SP_{sk} for the subset of 46 countries of the balanced panel the measure is positive and significant again with OLS and System GMM.. These results in robustness seem to confirm the reliability of the growth specialization linkage, at least when this is measured by an index of human capital.

5.5. CONCLUSION

This chapter addressed the study of the relation between the nature of trade specialization and growth in a panel of countries between 1969 and 2003.

First an attempt to measure the nature of specialization was made by introducing two new indicators, one based on the human capital content of exports and the other reflecting the dynamics of countries' exports according to world demand. A major weakness concerns the fact that our measures of specialization are proxies, above all due to data shortage. Nevertheless, both the index based on human capital and the other on export growth are a step forward over previous studies, providing, we hope, deeper insights on the subject.

We then introduced our specialization indices in an empirical growth model which was estimated both on annual observations and five-year averages of the original data. The results suggest that being specialized in goods with a higher content of human capital helps growth and this result is confirmed in all the specifications of the empirical model and across all the estimation techniques adopted. Furthermore, although world demand dynamics do not prove to be very relevant to country growth, moving the export structure towards more dynamic goods might be important as suggested by the five-year average estimates. Further work still needs to be done in this respect. The lack of an effect for some of the indexes might actually hint at a heterogeneous effect of specialization on growth. The empirical part could be further extended by applying estimators which are generally considered more suitable for the case of heterogeneous parameters.

APPENDIX

Table 5A.1. List of countries and ranking according to specialization

Country	SP_{ha}	SP_{sk}	SP_{gr}	DSP_{ha}	DSP_{sk}	DSP_{gr}
Argentina	17	17	12	4	34	45
Australia	29	16	15	13	29	31
Austria	38	22	36	31	27	6
Barbados	19	35	22	10	20	26
Bolivia	1	20	2	6	42	46
Brazil	16	29	17	39	4	43
Canada	41	7	27	18	24	19
Chile	8	1	5	2	35	24
Colombia	6	40	7	25	7	38
Costa Rica	9	38	16	41	36	23
Denmark	35	26	38	17	30	4
Ecuador	12	18	11	12	3	44
Egypt	13	8	1	22	15	42
El Salvador	4	39	8	19	8	36
Finland	42	13	24	23	41	16
France	37	33	39	27	25	13
Germany	44	32	41	20	16	12
Greece	20	5	25	16	32	20
Guatemala	5	34	6	8	11	27
Honduras	2	21	3	1	21	34
Hong Kong	28	28	45	37	37	2
Iceland	24	3	30	14	12	1
India	10	6	14	33	31	30
Indonesia	22	15	18	34	6	40
Ireland	40	42	46	43	43	11
Israel	34	45	42	40	39	18
Italy	31	24	40	21	19	8
Korea	27	19	35	42	40	21
Malaysia	18	36	20	45	44	37
Mexico	26	27	9	36	23	41
Netherlands	36	37	37	32	38	17
New Zealand	33	4	19	5	26	9
Panama	7	10	21	7	5	33
Paraguay	3	11	10	3	10	28
Philippines	14	30	29	44	46	39
Portugal	23	9	32	29	17	5
Singapore	32	46	43	46	45	25
Spain	30	12	31	35	14	14
Sweden	45	23	33	24	33	10
Switzerland	46	44	44	30	22	3
Trinidad &Tobago	21	31	4	15	1	7
Tunisia	15	14	23	11	9	22
Turkey	11	2	26	38	13	15
United Kingdom	39	41	28	26	28	32
United States	43	43	34	28	18	29
Venezuela	25	25	13	9	2	35

Table 5A.2. Descriptive statistics. Values in logs

		Mean	*St. dev.*	*Max*	*Min*	*Observations*
Y	overall	9.986	0.69	7.86	11.13	N = 1564
	between		0.67	8.27	10.84	n = 46
	within		0.19	9.17	10.72	T = 34
Inv.	overall	2.853	0.48	0.81	3.96	N = 1564
	between		0.43	1.55	3.75	n = 46
	within		0.21	1.27	3.52	T = 34
Pop.gr.	overall	0.014	0.01	–0.01	0.05	N = 1518
	between		0.01	0.00	0.03	n = 46
	within		0.00	–0.01	0.05	T = 33
SP_{ha}	overall	9.201	0.32	8.06	9.84	N = 1564
	between		0.26	8.59	9.56	n = 46
	within		0.20	8.37	9.85	T = 34
SP_{sk}	overall	–1.060	0.12	–1.43	–0.66	N = 1564
	between		0.10	–1.29	–0.87	n = 46
	within		0.07	–1.36	–0.67	T = 34
SP_{gr}	overall	0.082	0.14	–0.72	1.27	N = 1564
	between		0.02	0.04	0.11	n = 46
	within		0.14	–0.69	1.28	T = 34
DSP_{ha}	overall	0.019	0.07	–0.40	0.70	N = 1518
	between		0.01	0.00	0.03	n = 46
	within		0.07	–0.40	0.70	T = 33
DSP_{sk}	overall	0.001	0.01	–0.12	0.11	N = 1564
	between		0.00	0.00	0.01	n = 46
	within		0.01	–0.12	0.10	T = 34
DSP_{gr}	overall	0.017	0.03	–0.10	0.32	N = 1564
	between		0.01	0.01	0.04	n = 46
	within		0.03	–0.09	0.31	T = 34

Table 5A.3. Results on annual data. Static indices

	OLS	*FE*	*OLS*	*FE*
$inv_t -1$	0.02***	0.02***	0.02***	0.03***
$pop.gr._t -1$	–0.22	–0.04	–0.39*	–0.09
$SP_{gr_t -1}$	0.05*	0.05**	0.05*	0.05*
$SP_{ha_t -1}$	0.02	0.02		
$SP_{sk_t -1}$			0.02	0.07
y_{t-1}	–0.01***	–0.03***	–0.01***	–0.03***
Δinv	0.09***	0.09***	0.10***	0.10***
$\Delta pop.gr.$	0.16	0.16	0	0.07
ΔSP_{gr}	0.05***	0.05***	0.05***	0.05***
ΔSP_{ha}	0.09***	0.08**		
ΔSP_{sk}			0.06	0.06
test for				
$\Delta SP_{gr} = SP_{gr_t -1}$				
$\Delta SP_{ha} = SP_{ha_t -1}$	0.013	0.05		
$\Delta SP_{gr} = SP_{gr_t -1}$				
$\Delta SP_{sk} = SP_{sk_t -1}$			0.62	0.00

Table 5A.4. Results on annual data. Dynamic indices

	OLS	*FE*	*OLS*	*FE*
$inv_t -1$	0.02***	0.02**	0.02***	0.03***
$pop.gr._t -1$	–0.32*	–0.05	–0.31	–0.02
$DSP_{gr_t -1}$	–0.07	–0.04	0.08	–0.04
$DSP_{ha_t -1}$	0.00***	0.00**		
$DSP_{sk_t -1}$			0.24	0.13
y_{t-1}	–0.01***	–0.02**	–0.01***	–0.03**
Δinv	0.09***	0.09***	0.10***	0.10***
$\Delta pop.gr.$	0.10	0.15	0.08	0.14
ΔDSP_{gr}	–0.07	–0.05	–0.06	–0.04
ΔDSP_{ha}	0.00***	0.00***		
ΔDSP_{sk}			0.17	0.12
test for				
$\Delta DSP_{gr} = DSP_{gr_t -1}$				
$\Delta DSP_{ha} = DSP_{ha_t -1}$	0.28	0.05		
$\Delta DSP_{gr} = DSP_{gr_t -1}$				
$\Delta DSP_{sk} = DSP_{sk_t -1}$			0.66	0.44

Table 5A.5. Results on 5-year averages. Static indexes

	y_{t-5}	Investment	Population growth	SP_{ha}	SP_{sk}	SP_{gr}	Observations	No. of countries	Hansen	AR2	Diff–Hansen	Instr.[a] lags:
OLS	–0.0139***	0.0214***	–0.10	0.01		0.00	276					
	[0.0027]	[0.0057]	[0.21]	[0.0100]		[0.012]						
FE	–0.0433***	0.0282**	0.43	0.01		0.01	276	46				
	[0.0073]	[0.012]	[0.29]	[0.013]		[0.012]						
FD-GMM	–0.0334***	0.0484***	–0.31	0.00		0.00	230	46	1	0.68		
	[0.010]	[0.014]	[0.46]	[0.011]		[0.012]						
FD-GMM2nd	–0.0324***	0.0486***	–0.39	0.01		0.00	230	46	1	0.66		
	[0.011]	[0.014]	[0.44]	[0.011]		[0.012]						
FD-GMM	–0.0347***	0.0513***	–0.28	0.01		0.00	230	46	0.949	0.68		1–3
	[0.011]	[0.016]	[0.55]	[0.011]		[0.012]						
FD-GMM2nd	–0.0346***	0.0515***	–0.32	0.01		0.00	230	46	0.949	0.69		1–3
	[0.011]	[0.016]	[0.57]	[0.012]		[0.012]						
SYS-GMM	–0.0165***	0.0273***	–0.14	0.01		0.00	276	46	1	0.50	1	
	[0.0039]	[0.0074]	[0.23]	[0.013]		[0.012]						
SYS-GMM2nd	–0.0154***	0.0273***	–0.07	0.01		0.00	276	46	1	0.51		
	[0.0045]	[0.0073]	[0.26]	[0.012]		[0.012]						
SYS-GMM	–0.0163***	0.0264***	0.00	0.01		0.00	276	46	1	0.49	1	1–3
	[0.0047]	[0.0075]	[0.25]	[0.014]		[0.012]						
SYS-GMM2nd	–0.0161***	0.0267***	–0.01	0.01		0.00	276	46	1	0.49		1–3
	[0.0055]	[0.0078]	[0.30]	[0.015]		[0.011]						
OLS	–0.0139***	0.0235***	–0.24		0.0232*	0.00	276					
	[0.0030]	[0.0048]	[0.17]		[0.012]	[0.011]						
FE	–0.0438***	0.0269**	0.32		0.05	0.01	276	46				
	[0.0079]	[0.012]	[0.27]		[0.036]	[0.0098]						
FD-GMM	–0.0422***	0.0417***	–0.18		0.102**	0.00	230	46	1	0.54		
	[0.0092]	[0.011]	[0.47]		[0.042]	[0.0098]						

Table 5A.5. Continued

	y_{t-5}	Investment	Population growth	SP_{ha}	SP_{sk}	SP_{gr}	Observations	No. of countries	Hansen	AR2	Diff-Hansen	Instr.[a] lags:
FD-GMM2nd	–0.0416***	0.0387***	–0.16		0.0992**	0.00	230	46	1	0.51		
	[0.0097]	[0.012]	[0.51]		[0.043]	[0.010]						
FD-GMM	–0.0475***	0.0398***	–0.09		0.104***	0.00	230	46	0.971	0.54		1–3
	[0.011]	[0.013]	[0.63]		[0.039]	[0.0099]						
FD-GMM2nd	–0.0470***	0.0390***	–0.02		0.103**	0.00	230	46	0.971	0.55		1–3
	[0.011]	[0.014]	[0.66]		[0.042]	[0.010]						
SYS-GMM	–0.0172***	0.0260***	–0.417**		0.0320*	0.00	276	46	1	0.44	1	
	[0.0034]	[0.0053]	[0.19]		[0.018]	[0.010]						
SYS-GMM2nd	–0.0173***	0.0267***	–0.35		0.04	0.00	276	46	1	0.46		
	[0.0038]	[0.0059]	[0.24]		[0.024]	[0.011]						
SYS-GMM	–0.0185***	0.0270***	–0.417**		0.0415**	0.00	276	46	1	0.44	1	1–3
	[0.0041]	[0.0058]	[0.21]		[0.019]	[0.010]						
SYS-GMM2nd	–0.0192***	0.0282***	–0.456*		0.0440**	0.00	276	46	1	0.44		1–3
	[0.0046]	[0.0058]	[0.28]		[0.022]	[0.010]						

Notes:

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors in brackets.

SP_{ha} and SP_{sk} enter the specifications in logs, SP_{gr} enters in level. SP_{ha} and SP_{gr} refer to value at the beginning of the five-year period.

SP_{sk} is the average value across the five years.

[a] All right-hand-side variables are treated as endogenous.

5A.6. Results on five-year averages. Dynamic indexes

	y_{t-5}	Investment	Population growth	DSP_{ha}	DSP_{sk}	DSP_{gr}	Observations	No. of countries	Hansen	AR2	Diff–Hansen	Instr.[a] lags:
OLS	–0.0112***	0.0213***	–0.17	0.00000340***	0.00	276						
	[0.0027]	[0.0045]	[0.16]	[0.0000011]		[0.0040]						
FE	–0.0384***	0.0263**	0.46	0.00		0.00	276	46				
	[0.0078]	[0.012]	[0.29]	[0.0000011]		[0.0041]						
FD-GMM	–0.0336***	0.0370***	–0.20	0.00		0.00	230	46	1	0.88		
	[0.010]	[0.012]	[0.47]	[0.0000011]		[0.0036]						
FD-GMM2nd	–0.0363***	0.0348**	–0.22	0.00		0.00	230	46	1	0.87		
	[0.011]	[0.014]	[0.48]	[0.0000011]		[0.0038]						
FD-GMM	–0.0357***	0.0380***	0.01	0.00		0.00	230	46	0.949	0.83		1–3
	[0.011]	[0.013]	[0.59]	[0.0000012]		[0.0034]						
FD-GMM2nd	–0.0356***	0.0382***	–0.04	0.00		0.00	230	46	0.949	0.80		1–3
	[0.012]	[0.013]	[0.62]	[0.0000013]		[0.0033]						
SYS-GMM	–0.0143***	0.0276***	–0.21	0.00000246**	0.00	276	46	1	0.96	1		
	[0.0034]	[0.0056]	[0.20]	[0.0000012]		[0.0045]						
SYS-GMM2nd	–0.0139***	0.0284***	–0.18	0.00000252**	0.00	276	46	1	0.94			
	[0.0037]	[0.0066]	[0.24]	[0.0000012]		[0.0043]						
SYS-GMM	–0.0145***	0.0298***	–0.27	0.00000228**	0.00	276	46	1	0.99	1	1–3	1–3
	[0.0038]	[0.0061]	[0.21]	[0.0000011]		[0.0044]						
SYS-GMM2nd	–0.0147***	0.0319***	–0.23	0.00000229*	0.00	276	46	1	0.97		1–3	1–3
	[0.0041]	[0.0068]	[0.19]	[0.0000012]		[0.0041]						
OLS	–0.0120***	0.0227***	–0.17		0.08	0.00	276					
	[0.0028]	[0.0046]	[0.16]		[0.088]	[0.0039]						
FE	–0.0404***	0.0290**	0.45		0.01	0.00	276	46				
	[0.0079]	[0.013]	[0.29]		[0.090]	[0.0038]						

Table 5A.6. Continued

	y_{t-5}	Investment	Population growth	DSP_{ha}	DSP_{sk}	DSP_{gr}	Observations	No. of countries	Hansen	AR2	Diff-Hansen	Instr.[a] lags:
FD-GMM	–0.0333***	0.0382***	0.21		–0.05	0.00	230	46	1	0.75		
	[0.011]	[0.013]	[0.43]		[0.077]	[0.0034]						
FD-GMM2nd	–0.0348***	0.0365***	0.23		–0.06	0.00	230	46	1	0.77		
	[0.011]	[0.014]	[0.46]		[0.074]	[0.0033]						
FD-GMM	–0.0329**	0.0472***	0.40		–0.07	0.00	230	46	0.969	0.81		1–3
	[0.013]	[0.016]	[0.55]		[0.083]	[0.0035]						
FD-GMM2nd	–0.0329**	0.0466***	0.47		–0.07	0.00	230	46	0.969	0.82		1–3
	[0.014]	[0.017]	[0.56]		[0.087]	[0.0037]						
SYS-GMM	–0.0131***	0.0242***	–0.24		0.07	0.00	276	46	1	0.49	1	
	[0.0036]	[0.0051]	[0.18]		[0.094]	[0.0039]						
SYS-GMM2nd	–0.0136***	0.0253***	–0.27		0.07	0.00	276	46	1	0.50		
	[0.0040]	[0.0072]	[0.22]		[0.094]	[0.0039]						
SYS-GMM	–0.0140***	0.0268***	–0.30		0.05	0.00	276	46	1	0.50	1	1–3
	[0.0044]	[0.0066]	[0.20]		[0.088]	[0.0040]						
SYS-GMM2nd	–0.0140***	0.0270***	–0.30		0.05	0.00	276	46	1	0.51		1–3
	[0.0050]	[0.0068]	[0.23]		[0.091]	[0.0041]						

Notes:

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors in brackets.

SP_{ha} and SP_{sk} enter the specifications in logs, SP_{gr} enters in level. SP_{ha} and SP_{gr} refer to value at the beginning of the five-year period.

SP_{sk} is the average value across the five years.

[a] All right-hand-side variables are treated as endogenous.

NOTES

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1. The idea is that 'if a country gets into balance-of-payments difficulties ... demand must be curtailed; supply is never fully used; investment is discouraged; technological progress is slowed down ... A vicious circle is started' (McCombie and Thirlwall, 1994, p. 233). The same authors, explaining why export and import elasticities differ among countries, wrote that 'this deeper question' may be answered considering that those elasticities are 'primarily associated with the characteristics of goods produced' (p. 244), that is with something that has to do with countries' models of specialization.
2. With national spillovers their findings are in line with those of Lucas while with perfect international spillovers initial conditions matter less.
3. They also use a dynamic index that we will discuss in the next section
4. Weights are represented by a sort of (*ad hoc*) revealed comparative advantage index. World export shares of countries in different sectors would not be suitable, being influenced by country size.
5. In principle, technology level could be measured by variables other than *y*. Since direct technological measures are not easy to find at the sector level, as stated above, researchers propose proxies for them. For example, Kaplinsky and Santos Paulino (2003) propose to use trends in export unit values. This procedure has the disadvantage of requiring sufficiently long time series to get time trends through statistical methods. This limits the usefulness of an otherwise potentially interesting method.
6. We apply USA ratios to world sectors. We recognize that this procedure has its shortcomings: as stated in the text, the same good production is probably performed with different intensities of skills in different countries, especially when high-income and low-income countries are compared. In principle, following the suggestions of Ciccone and Papaioannou (2005), it could be possible to re-scale US sector data taking into account some measure of average human capital at country level. Nevertheless (Temple, 1999), these data usually have serious problems. We tried something in this direction, without obtaining good results. We will try to extend our research efforts in this direction.
7. The strange case is for *Bacon, ham & other dried, salt, smoked* in the ranking based on the average productivity level of exporters.
8. Curiously, four of the five countries with the highest DSP_{gr} are Latin American countries, perhaps testifying to the effort of these countries to move towards more dynamic goods in terms of world demand.
9. This kind of result is not new, as broadly discussed in Temple (1999).
10. And in the short run too as from Table 5.8.
11. Actually the logs of SP_{sk} and SP_{ha} are entered in the specifications, for this reason their coefficients can be interpreted as elasticities. SP_{gr} instead enters the specifications in levels for this the elasticity is obtained as the long-run coefficient times the mean value of the variable taken from Table 5A.2 in the Appendix. Then a long-run coefficient of 3.8 turns into an elasticity of $0.31231668 = 3.8 * 0.0821886$ and a coefficient of 1.42 turns into $0.16572509304 = 1.42 * 0.0821886$.

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