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ON NON-LINEARITIES BETWEEN EXPORTS OF MANUFACTURES AND ECONOMIC GROWTH

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Building up human capital and other complementarities may be important in the link between exports of manufactures and economic growth. On the other hand, managerial strategies that push for export promotion may be important, too. Though both may yield non-linearities in the link between exports and growth, the associated patterns differ. In this paper we take an aseptic, empirical view in the link between these two variables and the possible non-linear links. Since direct testing for non-linearities in panel data may yield non-significant results although they may actually be present, we propose a very simple method that may serve as a first approximation to uncover such non-linearities. We also take into consideration endogeneity and reverse causality problems (Arellano and Bover, 1995), and definitional problems in our variable of interest. In fact, we use a panel of 96 countries for the period 1960-1995 and find evidence consistent with the presence of non-linearities. We apply formal sensitivity analysis and confirm the results.

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I. Introduction

The mechanisms by which exports of manufactures may affect growth have been described in previous research in recent years. Increased exports may lead to greater capacity utilization, adoption of efficient technologies, increasing returns to scale, and higher foreign exchange in order to import superior capital goods and raw materials (Levin and Raut, 1997). On the other hand, theoretical research shows that non-linearities may exist in the link between technological development and economic growth. In fact, it has been argued that in exports of goods with relatively high technological content, such as manufactured goods, a certain critical mass of exports may have to be reached first before higher rates of growth can be obtained.[1] This because even though new technologies that help produce exportable manufactures may be readily imported, building up the skills of the labor force and preparing the administrative systems needed in order to optimize the use of such technologies may take considerable time. Complementarities between new technologies and human capital, and other factors may be important. Similarly, the acquisition of new technologies in the form of equipment and machinery may not be translated in the production of exportable goods that are competitive enough in international markets immediately. There may exist a delay, incubation, or adjustment period, between the production of exportable manufactures and the actual increase in the rates of growth. Also, at some point, spillover effects among related technological sectors may occur, which may help increase the rates of growth through the improved production of other exportables, too.[2] In simple terms, this view argues that the linearized

[1] Lucas (1993) poses the idea that East Asian countries managed to grow for a long period of time eluding any decreasing tendency of learning by doing saturation by changing products periodically. To some extent, non-linearities may be understood in such a context, too.

[2] For instance, a new imported technology that was first brought to produce televisions for exporting may be also used to produce computer monitors, too. Spillover effects toward the domestic computer industry may occur. Similarly, a production process to produce

link between manufactured exports and economic growth has two basic segments; in the first the slope is expected to be rather flat while in the second segment, the corresponding slope is expected to be bigger.[3]

However, unlike the above theory, the conventional wisdom is that structural change, or non-linearities, at least in the case of manufactured exports, may follow quite a different pattern. According to this conventional wisdom, structural changes, if any, appear near the end of the life cycle of a product, when returns become more difficult to obtain. In fact initial increases in manufactured exports may be linked with increases in the rates of growth until a critical mass is reached and the good becomes less profitable. At this point the rates of growth become lower and more stable. In this case an observed structural change may be such that initially higher rates of growth may be followed by lower ones, as products stabilize in foreign markets. Unlike the theoretical arguments described previously, this view argues that either the link between manufactured exports and economic growth has a first segment with a relatively large slope and a second segment with a flatter slope, or perhaps even a logarithmic, concave pattern. This view appears to be consistent with the "managerial approach" applied in several East Asian countries in past decades, and in more recent times, in some Latin American countries such as Chile. In these cases policymakers have been made aware of the potential importance of management strategies in the approach to use exports successfully as a tool in order to maximize the growth prospects of a country. Among others, these strategies include international distribution agreements, marketing arrangements, vertical production processes, and aggressive pricing strategies. According to the conventional wisdom the penetration to new foreign markets typically requires this kind of specific international business expertise in order to help increase market share in foreign

motorcycles may also be employed to produce other mass transportation vehicles later. (Azariadis and Drazen, 1990).

[3] There is a distinction between lags in the answer of growth to exports of manufactures and non-linearities. Lags may exist without non-linearity and vice-versa.

markets, sometimes even at the expense of short-run losses.[4]

The interest of this research is to focus on the common link of the above views. That is, we test for possible existence of non-linearities in the relationship between manufactured exports and economic growth but we take an agnostic approach, and do not assume that any one approach will predominate over the other. That is, we do not assume ex-ante that a critical mass of exports is required in order to achieve higher rates of growth, nor do we assume that countries will first achieve high rates of growth and at a critical threshold such rates will experience a structural break or will tend to stabilize. We propose a very simple methodology that gives basic clues on the possible shape of the pattern between manufactured exports and economic growth that could serve as the basis to more in-depth study of such non-linearities, if any. The idea is to use a spline regression approach and estimate a series of conjectured structural breaks in a systematic way and test whether such breaks are statistically significant. To avoid the risk of being over-ambitious the aim of this paper is simply to test whether there *exist* non-linearities in the relationship between exports of manufactures and economic growth, and not to uncover the specific *shape or location* of such non-linearities, if any. As explained below, we view our method as an effective tool that may serve as a stepping stone for more sophisticated methods.

Additionally, we employ recent panel data econometric techniques in order to alleviate for potential endogeneity or reverse causality, and use a sensible empirical definition of manufactured exports. With respect to the first it should be said that in spite of its abundance, most of the existing empirical literature has been criticized on the grounds that not only does exports contribute to economic growth, but also on the fact that growth may very well increase exports. This has been a common concern among researchers that try to test the link between trade measures and economic growth. As described by Rodrik

[4] Frequent claims of dumping from goods produced in developing countries is consistent with the above (Finger, 1993)

(1993), Frankel and Romer (1996), and others, appropriate instruments are extremely hard to come by, which translates in results that may not be credible.[5] More recently, new econometric procedures have been developed in order to deal with this problem and have been applied to an ample array of topics.[6] In this paper we use some of those recent econometric techniques applied to panel data in order to minimize for such problems. In particular, the estimator we use employs jointly the regression equation in both differences and levels, each with its specific set of instrumental variables. (Arellano and Bover, 1995; Blundell and Bond, 1997). The consistency of our Generalized Method of Moments estimator depends on whether the lagged values of the explanatory variables are valid instruments in the regression. To test for this we use a Sargan test of overidentifying restrictions, and a serial correlation test (Arellano and Bond, 1991). Regarding an appropriate definition of manufactures, we focus on goods that embody relatively high levels of technological know-how. If non-linearities exist, it is expected that they would be more clearly observable when more potential complementarities between human capital and technologies may be required. As explained above, it is reasonable to believe that this may occur more clearly in relatively high tech goods. Since we are concerned in studying developing countries as much as developed ones, choosing the more appropriate categories becomes a difficult task. We use a relatively wide array of possible definitions of manufactures with relatively high technological content, by using the SITC classification and follow related work along the same basic lines by Klodt (1990) and Patel and Pavitt (1990).

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[5] Edwards, (1993), Rodrik (1993), Frankel and Romer (1996), Harrison (1996), among others, provide comprehensive literature reviews on the link between exports and growth. Xu (1996) provides empirical support on the causal link between exports and output, and show that the export-led growth hypothesis is supported by more than half of his sample. Frankel and Romer (1999) use geographical variables as instruments in a cross-section of countries.

[6] Among others, some examples are Easterly, Loayza, and Montiel (1997), Loayza, Schmidt-Hebbel, and Serven (1998), and Chong and Zanforlin (1999).

Unlike the recent work of, among others, Rodríguez and Rodrik (1999) who analyze the related issue of consequences of trade *policies* on growth (and find no significant relationship between them), we focus on trade (i.e., exports) *volumes* and growth.[7] Conceptually our work may be seen as somewhat related to that of Frankel and Romer (1999) who use geographical variables as instruments in order to identify the effects of trade volumes on income levels in a simple cross-section of countries. In fact, they find that the former has a moderately significant effect on the latter. However, from a methodological perspective, our research may be seen as somewhat related to that of Harrison (1996) who uses measures of trade policies in a panel of countries. Although she finds that the black market premium, some subjective measures of liberalization, and a measure of tradable to international prices display a significant relationship with growth, this author finds no significant relationship between measures of trade volumes and growth. It has been claimed that one weakness in Harrison's approach lies precisely in the potential endogeneity problems between her trade policy measures and economic growth (Chong and Zanforlin, 1999).

The paper is organized as follows. The next section provides a brief review of the relevant literature. We pay some attention to theoretical research by Azariadis and Drazen (1990). The third section describes the methodology and the data employed. In this section we explain the Generalized Method of Moments panel data methodology employed as well as the simple spline approach used. The fourth section presents sensitivity analysis, and the last section summarizes and concludes. Additionally, Appendix 1 contains a more detailed explanation of our econometric method.

II. Brief Review of the Literature

Azariadis and Drazen (1990) provide some theoretical support for the

[7] As Rodrik (1993) points out, there is no strong reason to expect that trade policies effect on growth will be quantitatively or even qualitatively similar to the consequences of changes in trade volumes.

hypothesis that new technologies will impact output growth once a certain threshold is reached. If an economy reaches a critical mass of technology, rates of growth will accelerate as the economy moves from one locally stable low growth equilibrium to another where the growth rates and the technological stock are higher. The aggregate production possibilities of the economy increase. This argument is based on the existence of increasing social returns to scale that become pronounced when certain economic variables attain a certain critical mass or threshold. Azariadis and Drazen provide a simple illustration in the context of the Diamond (1965) neoclassical model. In particular, they augment Diamond's model to include technological externalities and a threshold property to permit returns to scale to rise rapidly whenever certain variables take on values in a relatively narrow critical mass range. The technological externalities that they consider are typically spillovers from the stocks of capital and increases in labor quality due to training, along the lines of the endogenous growth literature. The existence of threshold effects, gives rise to "radical differences in dynamic behavior" as a result of "local variations in social returns to scale." This arises as a result of technological externalities. In the case of quality of labor, examples are setup costs and preparation time invested prior to the use of new technology, so that the more you invest, the higher the social returns due to the externalities.[8] This leads the economy to shift in a step-wise pattern along a series of locally stable equilibrium.

Levin and Raut (1997) have pursued empirical work along these lines. These researchers show that training is necessary for foreign technology to be efficiently adopted. They explain how this process requires more specialized human capital by using a panel of thirty semi-industrialized developing nations between 1965-84. Levin and Raut find that growth is promoted when investing in human capital and exports in manufactured simultaneously. To do this they assume complementarities between exports and skills. Similarly, Chong and

[8] Azariadis and Drazen cite the example of "time to learn a language in order to study abroad or time to prepare for university" (p. 517).

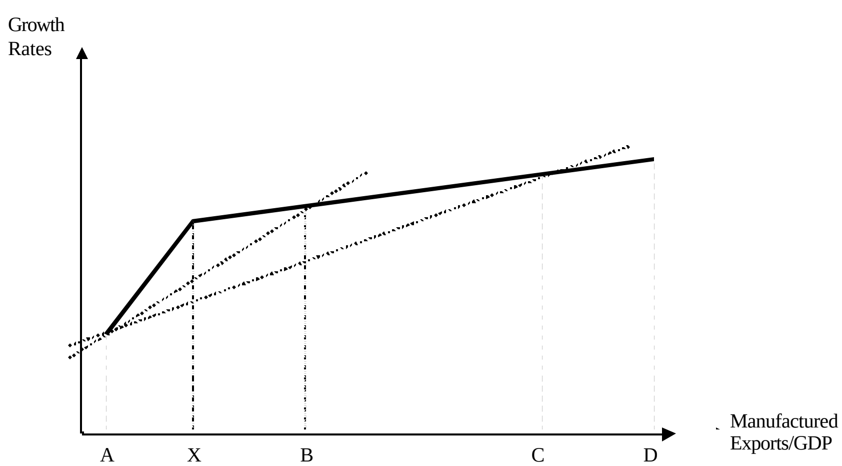
Zanforlin (1999) show that there appears to be a logistic link between imported foreign technology and output when using a panel of 88 countries for the period 1960-1995. In a first stage, new imports of equipment have little or no effect on output and growth rates. Later, the impact of the newly acquired technology becomes more apparent. In a final stage, the marginal benefits of the new technology are fully taken advantage of and the rates of growth stabilize. These researchers explain that the increase in growth rates not only as a result of higher productivity due to the introduction of technology, but also because of potential domestic spillovers that are produced, since the mastering of one specific technology may also benefit other domestic industries.

III. Methodology

We apply a simple empirical methodology to explore for non-linearities in our variable of interest, manufactured exports. Using a standard growth specification we run a spline regression using a dummy variable which we place arbitrarily along the values of our variable of interest, exports of manufactures as a percentage of gross domestic product. Applying this simple method yields two slopes, one that covers the range from the origin to the conjectured location of the threshold, the other from such a point to the highest value of our variable of interest. If the difference of these two slopes is statistically significant we will have evidence of the presence of a non-linearity in the form of a structural change. We repeat this exercise by systematically moving the dummy variable, representing a different conjectured structural break, along a wide range of values of our variable of interest. A pattern will emerge. Thus, the resulting path of slopes of this repeated estimation of growth equations gives an idea on the shape of the link between the exports of manufactures and growth.

Figure 1 illustrates a purely hypothetical case when there is a structural change in X, in exports of manufactures. When we assume an arbitrary conjectured structural break in B, regardless of whether it is the 'true' structural break or not, the dummy variable in the growth regression may yield an statistically significant difference in slopes AB and BD. Notice that although a non-linearity has been identified in the link between exports of manufactures and growth, such is not the "true" structural break. Moving the conjecture to the right of B will yield decreasing measures of the first slope while moving the conjecture break to the left of B will yield increasing measures of the first slope. Thus, this methodology provides clues on the, in fact, concave shape of the non-linear link between the variables. We believe this method has some advantages. First, it is simple. Second, as mentioned, it allows to take an agnostic approach to uncover possible non-linear shapes between the variable of interest and the dependent variable, but it does not require an a-priori knowledge of the location of any inflection points. The information gained using this method, serves as a first step in order to use more sophisticated approaches as it may help provide clues on the vicinity of possible inflection points.

Figure 1. Structural Change in Exports of Manufactures and Growth



IV. Data and Estimation Methods

We use log-linear growth regressions for the period 1960-1995 along the lines of standard Barro-type specifications (Barro and Lee, 1993). We construct five-year intervals and in most cases take averages for the period. Our basic reduced form is:[9]

$$GRT_{6095} = \rho + \delta \; LGAP_t + \omega \; SCHL_t + \eta \; LABG_t + \theta \; TECHX_t + \varepsilon_t \qquad (1)$$

where the dependent variable, *GRT*, is the real per-capita GDP growth rate, and is constructed as the differences of the log values of per capita GDP averaged over each period. *LGAP* is the natural logarithm of the ratio of a country's per capita GDP to the per capita GDP of the United States and represents the speed of the catching up process with respect to the technology frontier, as argued by De Long and Summers (1991). *SCHL* represents the average years of schooling in the population (Barro and Lee, 1993). *LABG* is the rate of growth of the labor force, proxied by the average growth rate of the population. The sources of the above variables are the Penn World Tables, Mark 5.6 from Summers and Heston (1991), Barro and Lee (1993), and the World Bank (1997).

As explained above, our variable of interest is exports of manufactured goods that embody relatively high technological content. Following Klodt (1990) and Patel and Pavitt (1990), we use the United Nations' Yearbook of International Trade Statistics to identify sectors that embody a relatively high degree of technology, but low fixed capital costs, and minimum requirement of skilled labor in the production process, as is typical in developing countries, as we are interested in having a sample that includes a reasonable number of observations from developing countries, too. With these simple criteria, the

[9] Specification (4) also includes time dummies. Also, the juncture where the second slope begins cannot be estimated directly. We follow an artifice to by calculating the second slope using the variable Threshold * [*TECHX* –Threshold].

activities in the SITC classification that best match our data requirements are those in category 7 and a few in category 8.[10] Since there may be some controversy on the 'correct' proxy we use a wide array of proxies, five in total, each defined as total exports of the chosen SITC categories as a percentage of GDP.[11] On the other hand, we use a balanced panel that covers 96 countries. The advantages of using a panel are clear as the time-series dimension and country specific effects can be better accounted for. The problem, similar to typical cross-country growth regressions, has to do with the fact that there might be endogeneity in some of the controls in particular in our variable of interest, *TECHX*. Simply assuming that such a variable is strictly exogenous might lead to inconsistent regression estimators. To avoid these problems, we assume weak exogeneity of the explanatory variables.[12] This allows for the possibility of dealing with issues related with simultaneity and reverse causation by using some recent econometric techniques. Our preferred method of estimation is the generalized method of moments estimator for dynamic models of panel data introduced by Arellano and Bover (1995) and Blundell and Bond (1997). This estimator employs jointly the regression equation in both differences and levels, each with its specific set of instrumental variables. It is called the GMM 'system estimator' to underline its characteristic of joining in a single system level and difference specifications. The consistency of the GMM estimator depends on whether lagged values of the explanatory variables

[10] Appendix 3 details the different SITC categories employed and thus it provides the precise definition of the different technology export variable used.

[11] Although the use of a broad array of proxies may provide additional information and sensitivity analysis, we agree that this approach has still some weaknesses that derive from the fact that there is no agreed standard upon what exactly 'high embodiment of technology' is.

[12] Weak exogeneity in the sense that they are assumed to be uncorrelated with future realizations of the error term. This weaker assumption means that current explanatory variables may be affected by past and current realizations of the dependent variable but not by future ones.

are valid instruments in the growth regression. To address this issue we consider two specification tests suggested by Arellano and Bond (1991) and Arellano and Bover (1995). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. Failure to reject the null hypothesis gives support to the model. The second test examines the hypothesis that the error term is not serially correlated. We test whether the differenced error term (that is, the residual of the regression in differences) is first, second, or third-order serially correlated. First-order serial correlation of the differenced error term is expected even if the original error term (in levels) is uncorrelated, unless the latter follows a random walk. Second-order serial correlation of the differenced residual indicates that the original error term is serially correlated and follows a moving average process at least of order one. If the test fails to reject the null hypothesis of absence of second-order serial correlation, we conclude that the original error-term is serially uncorrelated and use the corresponding moment conditions.[13] Appendix 1 gives a formal explanation of the econometric procedure employed and tests.

V. Results

Table 1 presents summary statistics of each of the five exports proxies used in this paper.[14] As explained above, the idea of using a wide array of proxies for exports of manufactures with high technological content, is consistent with the fact that there is not one single 'correct' definition, in which case a pragmatic, more empiricist approach seems reasonable. However, the simple correlation among the five proxies is, as expected, high and it ranges from 0.88 (*TECHX 1* and *TECHX 5*) to 0.99 (*TECHX 4* and *TECHX 5*). The simple correlations of the proxies with growth are not high though, and range from 0.14 (*TECHX 1*) to 0.17 (*TECHX 5*).

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[13] In other words, these tests confirm whether the lagged values are good instruments.

[14] Exact definitions of export proxies are described in Appendix 3.

Table 1. Summary Statistics

	Variable of Interest: TECHX				
	TECHX1	TECHX2	TECHX3	TECHX4	TECHX5
Mean	0,0050	0,0127	0,0165	0,0180	0,0208
Median	0,0002	0,0010	0,0014	0,0015	0,0018
Maximum	0,4314	0,5972	0,6131	0,7550	0,7819
Minimum	0,0000	0,0000	0,0000	0,0000	0,0000
Std. Dev.	0,0236	0,0384	0,0428	0,0500	0,0542
Observations	633	633	633	633	633

Table 2 to Table 6 present our results for each of our manufactured exports proxies using the Arellano and Bover (1995) generalized method of moments "system estimator" technique, as described in the previous section and in Appendix 1.[15] The tables report the results of using an arbitrary conjectured structural break point along the range of values of the *TECHX* proxies according to specification (1). We report the resulting slopes, and check whether the difference in slopes is statistically significant. Additionally, we report the Sargan and serial correlation tests associated with the Arellano and Bover (1995) technique. In fact, Sargan tests of over-identifying restrictions and second and third-order serial correlation tests show that the instruments employed are appropriate.

As explained above, since we use systematic values of conjectured structural breaks along the range of the values of our variable of interest, at almost all conjectured structural breaks, all the *TECHX* definitions yield

[15] Ordinary least squares and instrumental variables were also used. We obtain very similar results although, as expected, the regressions do not pass the second and third-order serial correlation tests.

statistically significant differences in slopes. We find that the larger the conjectured break, the smaller the first slope (the one that goes from zero to the conjectured value), while the resulting second slope (the one that begins at the conjectured break to the right) though still positive and statistically significant, remains stable. The difference in slopes, though always statistically significant (for all the proxies employed) becomes smaller the higher the conjectured break. For example, at a conjectured change of 0.002, the difference in slopes is –15.7, but it becomes –0.6 at a conjectured break of 0.025. This is consistent with a non-linear pattern between exports of manufacturing and growth. Exports of manufactures appear to have an initial large impact on rates of growth to later become stable. Though this simple method cannot provide definitive evidence on the exact nature of this non-linearity, it is consistent with a concave link between the variables.[16] Aggressive strategies, such as pricing, management, distribution, and marketing tools appear to yield rapid increases in the rates of growth. After a while they appear to stabilize to their long run values.[17]

[16] Interestingly, when estimating a logarithmic or quadratic functions on exports of manufactures directly, we obtain from barely statistically significant (10 percent) to statistically non-significant results. On the other hand, linear specifications are, as expected statistically significant, though the fit is not as good as the non-linear approach employed above.

[17] We obtain similar results when we use five-year average values of the *TECHX* proxies, instead of initial values for corresponding periods.

Table 2. Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX1)**

Conjectured break*	Coefficient estimates: Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests: 1st. order	2nd. order	3rd. order
0.0020	7.616	0.124	-7.492	0.413	0.001	0.923	0.395
	(2.297)	(0.013)	(2.307)				
0.0030	4.416	0.123	-4.293	0.443	0.001	0.952	0.425
	(1.676)	(0.014)	(1.687)				
0.0040	3.073	0.123	-2.950	0.441	0.001	0.966	0.430
	(1.311)	(0.016)	(1.324)				
0.0050	2.234	0.124	-2.110	0.457	0.001	0.979	0.425
	(1.069)	(0.017)	(1.083)				
0.0060	2.093	0.119	-1.975	0.458	0.001	0.978	0.433
	(0.889)	(0.017)	(0.903)				
0.0070	2.360	0.098	-2.262	0.421	0.001	0.961	0.448
	(0.677)	(0.016)	(0.691)				
0.0080	0.953	0.119	-0.834	0.314	0.001	0.846	0.517
	(0.279)	(0.019)	(0.296)				
0.0100	2.596	0.076	-2.520	0.345	0.001	0.943	0.482
	(0.526)	(0.015)	(0.540)				
0.0120	2.388	0.065	-2.324	0.243	0.001	0.953	0.501
	(0.431)	(0.016)	(0.445)				
0.0140	2.172	0.056	-2.116	0.279	0.001	0.954	0.521
	(0.366)	(0.016)	(0.381)				
0.0160	2.014	0.048	-1.966	0.310	0.001	0.952	0.531
	(0.321)	(0.018)	(0.337)				
0.0180	1.915	0.042	-1.874	0.324	0.001	0.950	0.527
	(0.297)	(0.017)	(0.313)				

Table 2. (Continue) Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX1)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0200	1.745	0.034	-1.711	0.335	0.001	0.937	0.519
	(0.267)	(0.018)	(0.284)				
0.0250	1.440	0.027	-1.413	0.327	0.001	0.927	0.498
	(0.218)	(0.020)	(0.237)				

Notes: * Variable TECHX1/GDP. ** Estimating technique, GMM-IV System Estimator. Slopes obtained from benchmark specification (1) in text. See Appendix 3 for definitions of technological index. Time and country dummies included. Standard errors in parenthesis.

Table 3. Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX2)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0020	11.489	0.079	-11.411	0.242	0.001	0.694	0.394
	(2.363)	(0.009)	(2.367)				
0.0030	8.390	0.070	-8.319	0.263	0.001	0.743	0.425
	(1.842)	(0.009)	(1.847)				
0.0040	7.953	0.056	-7.897	0.251	0.001	0.798	0.367
	(1.432)	(0.009)	(1.437)				
0.0050	7.537	0.044	-7.492	0.248	0.001	0.826	0.329
	(1.085)	(0.009)	(1.090)				

Table 3. (Continue) Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX2)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0060	6.713	0.036	-6.677	0.240	0.001	0.792	0.341
	(0.852)	(0.009)	(0.856)				
0.0070	4.922	0.027	-4.895	0.231	0.001	0.795	0.375
	(0.609)	(0.009)	(0.614)				
0.0080	0.413	0.054	-0.359	0.217	0.001	0.944	0.518
	(0.100)	(0.007)	(0.098)				
0.0100	3.733	0.024	-3.709	0.225	0.001	0.812	0.414
	(0.475)	(0.009)	(0.479)				
0.0120	2.975	0.023	-2.953	0.212	0.001	0.860	0.414
	(0.394)	(0.009)	(0.398)				
0.0140	2.486	0.022	-2.464	0.205	0.001	0.907	0.409
	(0.335)	(0.009)	(0.340)				
0.0160	2.082	0.022	-2.060	0.269	0.001	0.922	0.413
	(0.295)	(0.009)	(0.300)				
0.0180	1.837	0.023	-1.814	0.277	0.001	0.931	0.410
	(0.268)	(0.009)	(0.274)				
0.0200	1.540	0.023	-1.517	0.253	0.001	0.929	0.414
	(0.245)	(0.010)	(0.252)				
0.0250	1.075	0.027	-1.047	0.218	0.001	0.939	0.440
	(0.205)	(0.012)	(0.214)				

Notes: * Variable TECHX2/GDP. ** Estimating technique, GMM-IV System Estimator. Slopes obtained from benchmark specification (1) in text. See Appendix 3 for definitions of technological index. Time and country dummies included. Standard Errors in parenthesis.

Table 4. Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX3)**

Conjectured break*	Coefficient estimates			Sargan test	Serial correlation tests		
	Slope 1	Slope 2	Difference		1st. order	2nd. order	3rd. order
0.0020	12.993	0.067	-12.926	0.220	0.001	0.585	0.379
	(2.236)	(0.008)	(2.239)				
0.0030	8.728	0.061	-8.666	0.205	0.001	0.664	0.343
	(1.770)	(0.008)	(1.774)				
0.0040	6.618	0.055	-6.562	0.205	0.001	0.742	0.371
	(1.458)	(0.142)	(1.463)				
0.0050	6.303	0.046	-6.257	0.226	0.001	0.807	0.336
	(1.186)	(0.009)	(1.191)				
0.0060	5.755	0.037	-5.719	0.248	0.001	0.855	0.320
	(0.966)	(0.009)	(0.970)				
0.0080	4.806	0.022	-4.784	0.238	0.001	0.843	0.351
	(0.687)	(0.009)	(0.690)				
0.0090	0.121	0.071	-0.050	0.229	0.001	0.982	0.470
	(0.069)	(0.007)	(0.069)				
0.0100	3.723	0.017	-3.706	0.209	0.001	0.832	0.376
	(0.511)	(0.009)	(0.513)				
0.0120	2.788	0.016	-2.772	0.215	0.001	0.819	0.418
	(0.401)	(0.009)	(0.403)				
0.0140	2.209	0.016	-2.193	0.235	0.001	0.840	0.438
	(0.311)	(0.009)	(0.333)				
0.0160	1.822	0.015	-1.807	0.230	0.001	0.865	0.445
	(0.285)	(0.009)	(0.287)				
0.0180	1.608	0.015	-1.592	0.214	0.001	0.881	0.445
	(0.256)	(0.009)	(0.259)				

Table 4. (Continue) Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX3)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0200	1.354	0.014	-1.340	0.248	0.001	0.907	0.441
	(0.225)	(0.009)	(0.228)				
0.0250	1.034	0.013	-1.020	0.217	0.001	0.917	0.438
	(0.181)	(0.010)	(0.186)				

Notes: * Variable TECHX3/GDP. ** Estimating technique, GMM-IV System Estimator. Slopes obtained from benchmark specification (1) in text. See Appendix 3 for definitions of technological index. Time and country dummies included. Standard Errors in parenthesis.

Table 5. Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX4)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0020	13.102	0.055	-13.047	0.285	0.001	0.511	0.269
	(2.032)	(0.007)	(2.035)				
0.0030	10.563	0.054	-10.509	0.260	0.001	0.552	0.264
	(1.723)	(0.007)	(1.726)				
0.0040	7.227	0.050	-7.176	0.232	0.001	0.653	0.314
	(1.272)	(0.007)	(1.276)				
0.0050	5.852	0.045	-5.807	0.222	0.001	0.739	0.304
	(0.929)	(0.007)	(0.933)				

Table 5. (Continue) Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX4)**

Conjectured	Coefficient estimates			Sargan	Serial correlation tests		
break*	Slope 1	Slope 2	Difference	test	1st. order	2nd. order	3rd. order
0.0060	5.095	0.039	-5.056	0.222	0.001	0.797	0.287
	(0.733)	(0.007)	(0.737)				
0.0080	3.937	0.031	-3.906	0.229	0.001	0.839	0.308
	(0.554)	(0.007)	(0.557)				
0.0090	0.045	0.067	0.022	0.225	0.001	0.987	0.468
	(0.071)	(0.006)	(0.072)				
0.0100	2.699	0.030	-2.669	0.203	0.001	0.874	0.351
	(0.449)	(0.008)	(0.453)				
0.0120	1.810	0.033	-1.776	0.269	0.001	0.898	0.380
	(0.376)	(0.008)	(0.381)				
0.0140	1.330	0.036	-1.294	0.248	0.001	0.919	0.401
	(0.316)	(0.008)	(0.321)				
0.0160	1.041	0.037	-1.004	0.212	0.001	0.928	0.413
	(0.271)	(0.008)	(0.276)				
0.0180	0.911	0.037	-0.873	0.216	0.001	0.936	0.421
	(0.247)	(0.008)	(0.252)				
0.0200	0.801	0.036	-0.765	0.209	0.001	0.947	0.424
	(0.217)	(0.009)	(0.223)				
0.0250	0.678	0.033	-0.645	0.214	0.001	0.960	0.422
	(0.173)	(0.009)	(0.180)				

Notes: * Variable TECHX4/GDP. ** Estimating technique, GMM-IV System Estimator. Slopes obtained from benchmark specification (1) in text. See Appendix 3 for definitions of technological index. Time and country dummies included. Standard Errors in parenthesis.

Table 6. Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX5)**

Conjectured break*	Coefficient estimates: Slope 1	Coefficient estimates: Slope 2	Coefficient estimates: Difference	Sargan test	Serial correlation tests: 1st. order	Serial correlation tests: 2nd. Order	Serial correlation tests: 3rd. order
0.0020	15.760	0.059	-15.702	0.300	0.001	0.504	0.393
	(2.523)	(0.125)	(2.524)				
0.0030	11.660	0.058	-11.602	0.296	0.002	0.470	0.315
	(1.707)	(0.007)	(1.710)				
0.0040	8.008	0.057	-7.951	0.266	0.001	0.589	0.294
	(1.296)	(0.007)	(1.300)				
0.0050	6.496	0.052	-6.444	0.255	0.001	0.647	0.304
	(0.963)	(0.007)	(0.966)				
0.0060	5.348	0.047	-5.300	0.232	0.001	0.710	0.301
	(0.732)	(0.007)	(0.735)				
0.0080	3.861	0.040	-3.821	0.215	0.001	0.777	0.305
	(0.449)	(0.007)	(0.452)				
0.0090	0.169	0.058	-0.110	0.223	0.001	0.998	0.425
	(0.055)	(0.006)	(0.053)				
0.0100	2.834	0.035	-2.799	0.205	0.001	0.812	0.347
	(0.351)	(0.007)	(0.354)				
0.0120	2.056	0.034	-2.023	0.244	0.001	0.842	0.376
	(0.294)	(0.007)	(0.296)				
0.0125	1.902	0.034	-1.868	0.216	0.001	0.850	0.383
	(0.282)	(0.007)	(0.284)				
0.0140	1.548	0.033	-1.515	0.262	0.001	0.869	0.392
	(0.251)	(0.007)	(0.254)				
0.0160	1.216	0.034	-1.182	0.225	0.001	0.881	0.408
	(0.218)	(0.007)	(0.221)				

Table 6. (Continue) Non-Linearities in Exports of Manufactures, 1960-1995. (Dependent Variable: Per-Capita GDP Growth; Variable of Interest: TECHX5)**

Conjectured break*	Coefficient estimates Slope 1	Slope 2	Difference	Sargan test	Serial correlation tests 1st. order	2nd. order	3rd. order
0.0180	1.067	0.034	-1.033	0.218	0.001	0.889	0.417
	(0.198)	(0.007)	(0.201)				
0.0200	0.890	0.034	-0.856	0.246	0.001	0.903	0.426
	(0.172)	(0.007)	(0.176)				
0.0250	-0.689	-1.344	-0.656	0.281	0.001	0.925	0.438
	(0.138)	(0.007)	(0.141)				

Notes: * Variable TECHX5/GDP. ** Estimating technique, GMM-IV System Estimator. Slopes obtained from benchmark specification (1) in text. See Appendix 3 for definitions of technological index. Time and country dummies included. Standard Errors in parenthesis.

VI. Robustness

Sala-i-Martín (1997) argues that the well-known sensitivity analysis by Levine and Renelt (1991) is too strict. If one single regression in which either the sign of the coefficient of the variable of interest changes, or the statistical significance of such a coefficient varies, the relationship is considered not robust. This researcher develops a robustness test by looking at the entire distribution of the estimator of the variable of interest by focusing on the fraction of the density function lying on each side of zero.[18] Given that zero

[18] Sala-i-Martín. If 95 percent of the density function for the estimates of the coefficient of interest lies to the right of zero, one could say that this variable is more likely to be correlated with our dependent variable.

divides the area under the density in two, this researcher denotes the larger of the two areas, cumulative distribution function *[cdf(0)]* regardless of whether it is above or below zero. Assuming that the distribution of our coefficient of interest, institutional quality, is non-normal the *cdf(0)* is computed as follows. First, similar to Levine and Renelt (1991), we test the benchmark specification for all possible three-combinations of ancillary variables. We compute variance, integrated likelihood, and individual *cdf(0)* for the difference in slopes for each conjectured structural break.[19] Second, we compute the aggregate *cdf(0)* for the measure defined as the weighted average of all individual *cdf(0)s* where the weights are the integrated likelihoods.[20] The structural break is said to be robust if the weighted *cdf(0)*, is greater than or equal to 0.95. Results are reported in Table 7. We report the aggregate *cdf(0)* under the restrictive assumption of non-normality. In fact, we find that there is robust evidence on the presence of structural breaks, especially in the lower conjectured breaks. For instance, for a conjectured break of 0.0020 the difference in slopes obtained in Tables 2-6 (for each of the *TECHX* proxies) yield a robust result at one percent. We obtain similar results for most conjectured breaks except the higher ones (e.g., 0.025).

VII. Conclusions and Agenda for Future Research

In this paper, we confirm previous empirical evidence along the lines that

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[19] We use thirty ancillary variables, which by using Levine and Renelt method, yields 4,060 regressions. The set of variables consists of measures of health and quality of life (access to health care, access to safe water, access to sanitation services), measures of urbanization (urban population growth rate, urban agglomerations), government transfers, public sector employment, participation of female workers in the labor force, several measures of education quality, measures of political violence, several macroeconomic measures, and others.

[20] The weights are $w_{i,j} = \frac{L_{i,j}}{\sum_{k=1}^{M} L_{i,k}}$ where $L_{i,j}$ are the integrated likelihoods.

Table 7. Test of Robustness in Differences in Slopes. (Weighted Cumulative Distribution Function [cdf (0)])

Conjectured Break*	TECHX1	TECHX2	TECHX3	TECHX4	TECHX5
0.0020	0.99	0.99	0.99	0.99	0.99
0.0030	0.95	0.99	0.99	0.99	0.99
0.0040	0.95	0.99	0.99	0.99	0.95
0.0050	0.95	0.95	0.95	0.95	0.99
0.0060	0.95	0.99	0.99	0.95	0.99
0.0080	0.95	0.99	0.99	0.95	0.99
0.0090	0.95	0.99	0.99	0.99	0.99
0.0100	0.95	0.95	0.99	0.99	0.99
0.0120	0.95	0.95	0.99	0.99	0.99
0.0125	0.90	0.99	0.90	0.90	0.95
0.0140	0.80	0.99	0.90	0.90	0.95
0.0160	0.80	0.99	0.90	0.90	0.95
0.0180	0.90	0.95	0.95	0.90	0.90
0.0200	0.80	0.80	0.95	0.90	0.95
0.0250	0.70	0.90	0.90	0.90	0.90

Note: * Estimating technique, GMM-IV System Estimator. See Appendix 3 for definitions of technological index. Time and country dummies included. It shows the *cumulative distribution function (0)*. A variable whose weighted *cdf(0)* is larger than 0.95 is significantly correlated with the dependent variable (i.e. robust) at a 5 % significance level. The *cdf* is computed assuming non-normality of the parameters estimated. Results are similar if we assume normality, instead. The benchmark regression employed is from specification (1) in text.

manufactured exports are positively associated with long term growth. This, when controlling for reverse causality and endogeneity in the growth variable in a panel data of countries for the period 1960 and 1995. The main question of this research, that there might be non-linearities in exports of manufactures and economic growth, also appears to be confirmed as we obtain such a finding for a broad range of exports of manufactures proxies and when sensitivity analysis is applied. Though our simple method gives some indication on the shape of the non-linearity, such method should not be seen as an approach to uncover the exact non-linear relationship between variables, but as a first approximation in order to use additional, more sophisticated, methods. We believe such contribution is not trivial, as it may well occur that testing for non-linearities in panel data with more "direct" methods may yield statistically non-significant or non-robust results although non-linearities may be present. In fact, we find barely statistically significant evidence of non-linearities between exports of manufactures and growth when using a logarithmic specification, although our indirect method provides evidence on some type of non-linearity. Perhaps, a future research agenda should include a more in-depth study on the shape of the non-linearities between exports of manufactures and economic growth we have uncovered. New questions that remain unanswered are: what is the exact shape of the non-linearity?[21] Are thresholds present? More fundamentally, if there is a threshold level of exports, what reasons do we have to believe that it is the same across countries? Why would a group of countries share a similar threshold ratio beyond which growth accelerates or slows down? Hopefully, we have provided some clues that may help answer these and other related future questions.

[21] For instance, further study should focus on the fact that it may be possible that an initial increase in exports in manufactures in a country with little comparative advantage in such goods may provoke long run distortions in the adequate allocation of resources. Also, the insertion in international markets may be of limited profitability at first, until learning by doing and scale economies are better exploited.

Appendix 1

We formulate a set of moment conditions that can be estimated using GMM techniques in order to generate consistent and efficient estimates. We assume that the error process $\{\varepsilon_{i,t}\}$ is serially uncorrelated and use a first differences specification of N individual time series and T periods so that,

$$y_{i,t} - y_{i,t-1} = \alpha\ (y_{i,t-1} - y_{i,t-2}) + \beta\ (x_{i,t} - x_{i,t-1}) + \mu_i + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \qquad (2)$$

where, by construction, the error term and the lagged-dependent variable are correlated. In order to achieve the desired parameters we follow previous research and assume the presence of unobserved effects and weakly exogenous regressors. Our first assumption states that $\{\varepsilon_{i,t}\}$ is serially uncorrelated, i.e. $E(\varepsilon_{i,t}\,\varepsilon_{i,s}) = 0$ for $t \neq s$. For $T \geq 3$. This assumption implies the following linear moment conditions:

$$E[\ (\varepsilon_{i,t} - \varepsilon_{i,t-1})\ y_{i,t-j}\ ] = 0 \qquad (j = 2,\ldots, t-1\ ;\ t = 3,\ldots,T) \qquad (3)$$

The assumption of weakly exogenous regressors states that $E[x_{i,t}\,\varepsilon_{i,s}] = 0$ for $s > t$. Hence, for $T \geq 3$, this assumption implies the following the additional linear moment conditions:

$$E[\ (\varepsilon_{i,t} - \varepsilon_{i,t-1})\ x_{i,t-j}\ ] = 0 \qquad (j = 2,\ldots,t-1\ ;\ t = 3,\ldots,T) \qquad (4)$$

Our moment conditions, equations (6) and (7), can be written in the following vector form: $E[\ Z_i'\ \zeta_i\ ] = 0$, where the instrument matrix, Z_i, is a matrix of the form $Z_i = \text{diag}\ (y_{i,1} \ldots y_{i,s}\ , x_{i,1} \ldots x_{i,s})$, $s = 1, 2,\ldots, T-2$, and the errors of the first-differenced equation is $\zeta_i = [\ (\varepsilon_{i,3} - \varepsilon_{i,2}) \ \ldots\ (\varepsilon_{i,T} - \varepsilon_{i,T-1})]'$.[22] The estimator of the *k x 1* coefficient vector $\theta = (\alpha\ \beta')'$ is given by:

[22] Note that number of columns of Z_i, e.g. matrix of rank column M, is equal to the number of available instruments.

$\bar{q} = (\bar{X}'Z\Omega^{-1}Z'\bar{X})^{-1}\bar{X}'Z\Omega^{-1}Z'\bar{y}$, where $\bar{X}$ is a stacked *(T-2) N x k* matrix of observations $\bar{x}_{i,t}'$ on $\bar{y}_{i,t-1}'$ and $\bar{y}$ is a stacked *(T-2) N x 1* vector of $\bar{y}_{i,t}'$; Z = (Z_i' … Z_N')' is a *(T-2) N x M* matrix; and Ω is any *M x M*, symmetric, positive definite matrix. A bar denotes that the variables are expressed in first differences. For an arbitrary Ω, a consistent estimate of the asymptotic variance-covariance matrix of $\bar{q}$ is given by:

$$Asy.Var(\hat{q}) = N(\bar{X}'Z\Omega^{-1}Z'\bar{X})^{-1}\bar{X}'Z\Omega^{-1}\left(\sum_{i=1}^{N} Z_i'\hat{v}_i\hat{v}_i'Z_i\right)$$

$$.\Omega^{-1}Z'\bar{X}(\bar{X}'Z\Omega^{-1}Z'\bar{X})^{-1} \qquad (5)$$

when Ω is chosen such that V = E[Z_i'$v_i v_i$'Z_i] we obtain the most efficient GMM estimator for θ. This covariance matrix may be consistently estimated using the residuals obtained from a preliminary, consistent estimation of θ. We first assumed that $\{\varepsilon_{i,t}\}$ is independent and homoskedastic both across units and over time. We relax such assumptions across units and use the residuals obtained in the first step to construct a consistent estimate of the variance-covariance matrix of the moment conditions. This matrix, denoted by Ω_2, becomes the optimal choice of Ω and is used to re-estimate the coefficients of interest. Here, $\Omega_2 = (1/N)\,\Sigma_{i=1} Z_i'\hat{v}_i^1\hat{v}_i^{1\prime} Z_i$, where $\hat{v}_i^1$ are the residuals estimated in the first step. Given the fact that persistence of lagged dependent and explanatory variables over time might generate inconsistent estimates which may have adverse consequences on both the asymptotic and small-sample performance of the difference estimators, we use an estimator that complements the moment conditions above applied to the regression in differences, with appropriate moment conditions applied to the regression in levels (Arellano and Bover, 1995). We obtain a system estimator that combines the regression in differences with the regression in levels. Here, the instruments for the regression in differences are the lagged levels of the corresponding variables and the moment conditions in equations (6) and (7) apply to this first part of the system. The instruments for the regression in levels are the lagged differences of the corresponding variables, being these the appropriate instruments under the assumption that the error term ε is not serially correlated, and that although there may be correlation between the levels of the explanatory variables and the country-specific effects, there is no correlation between the differences of these variables and the specific-effect. Thus, this yield the stationary property E [$y_{i,t+p}\, \mu_i$] = E [$y_{i,t+q}\, \mu_i$]; for all p and q, and E [$X_{i,t+p}\, \mu_i$] = E [$X_{i,t+q}\, \mu_i$]; for all p and q. The additional moment conditions for the second part of the system (the regression in levels) are given by E [$(y_{i,t-s} - y_{i,t-s-1})\,(\mu_i + \varepsilon_{i,t})$] = 0; for s = 2, E [$(X_{i,t-s} - X_{i,t-s-1})\,(\mu_i + \varepsilon_{i,t})$] = 0, for s = 1. Finally, we use Sargan tests to verify the overall validity of the instruments and serial correlation tests to examine the hypothesis that the error term in the differenced regression $\varepsilon_{i,t} - \varepsilon_{i,t-1}$, is not second-order serially correlated, which implies that the error term in the level regression, $\varepsilon_{i,t}$, is not serially correlated.[23]

[23] If $v_{i,t}$ is the first differences of $\varepsilon_{i,t}$, E [$v_{i,t}\, v_{i,t-1}$] = 0 to obtain a consistent GMM estimator where it is required that E [$v_{i,t}\, v_{i,t-2}$] = 0. Consider $v^*(t)_i \equiv [\, v^*_{i,3}, \ldots, v^*_{i,T}\,]'$, $v^*(t-2)_i \equiv [\, v^*_{i,1}, \ldots, v^*_{i,T-2}\,]'$, $v^*(t-2)_i \equiv [v^*(t-2)_1, \ldots, v^*(t-2)_N]'$. The serial correlation statistic:

$$m_2 = \frac{v^*(t-2)'v^*(t)}{Q}$$

is standard normal (Q is a standardization factor) and may be used as a test of the null that E[$v_{i,t}\, v_{i,t-2}$] = 0. Also, in a Sargan test we test E [$Z_i' v_i$] = 0 based on the statistic:

$$s = v^{*}{}'Z\left(\sum_{i=1}^{N} Z_i' v_i^* v_i^*{}' Z_i\right)^{-1} Z'v^*$$

where $v^* = [v_i^{*}{}', \ldots, v_N^{*}{}']'$ are the residuals from the second stage. Under the null, the asymptotic distribution of the statistic s is χ^2 with $M - k$ degrees of freedom (M are instruments and k are explanatory variables).

Appendix 2. Countries in Sample

Africa
01. Algeria
02. Botswana
03. Cameroon
04. C. African R.
05. Congo
06. Egypt
07. Ethiopia
08. Ghana
09. Cote d'Ivoire
10. Kenya
11. Lesotho
12. Madagascar
13. Malawi
14. Mali
15. Mauritius
16. Morocco
17. Nigeria
18. Rwanda
19. Senegal
20. Seychelles
21. Sierra Leone
22. South Africa
23. Swaziland
24. Togo
25. Tunisia
26. Uganda
27. Zaire
28. Zambia
29. Zimbabwe
30. Tanzania

Americas
31. Barbados
32. Canada
33. Costa Rica
34. El Salvador
35. Dominican R.
36. Guatemala
37. Haiti
38. Honduras
39. Jamaica
40. Mexico
41. Nicaragua
42. Trinidad & Tobago
43. United States
44. Argentina
45. Bolivia
46. Brazil
47. Chile
48. Colombia
49. Ecuador
50. Guyana
51. Paraguay
52. Peru
53. Uruguay
54. Venezuela

Asia
55. Myanmar
56. Hong Kong
57. India
58. Indonesia
59. Iran
60. Iraq
61. Israel
62. Japan
63. Jordan
64. South Korea
65. Malaysia
66. Nepal
67. Pakistan
68. Philippines
69. Singapore
70. Sri Lanka
71. Syria
72. Taiwan
73. Thailand

Europe
74. Austria
75. Belgium
76. Cyprus
77. Denmark
78. Finland
79. France
80. Germany
81. Greece
82. Iceland
83. Ireland
84. Italy
85. Netherlands
86. Norway
87. Portugal
88. Spain
89. Sweden
90. Switzerland
91. Turkey
92. United Kingdom

Oceania
93. Australia
94. Fiji
95. New Zealand
96. Papua N. Guinea

Appendix 3. Definitions of Manufactured Exports Variables: SITC Categories Employed

Definitions of *TECHX* employed:

TECHX 1	714, 723, 725, 726
TECHX 2	712, 714, 715, 716, 717, 718, 719, 723, 724, 725, 726, 812, 861, 862, 864, 891
TECHX 3	712, 714, 715, 716, 717, 718, 719, 723, 724, 725, 726, 731, 732, 733, 812, 861, 862, 864, 891
TECHX 4	All 7, except 711, 712, 733, and 734
TECHX 5	All 7

Description of SITC Indices:

7	Machines, transport equipment
711	Power machinery non-electrical
712	Agricultural machinery
714	Office machines
715	Metal working machinery
716	Miscellaneous machinery
717	Textile, leather machinery
718	Machinery for special industries
719	Machines non electric
721	Electrical machinery and equipment
723	Electrical distributing machinery
724	Telecommunications equipment
725	Domestic electrical equipment
726	Electro-medical, Xray equipment
731	Railway vehicles
732	Road motor vehicles
733	Road vehicles non motor

734 Aircraft
735 Ships and boats
812 Plumbing, heating, lighting equipment
861 Instruments apparatus
862 Photo, cinema supplies
864 Watches and clocks
891 Sound recorders, producers

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