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Crucial for Modern Sector Development? The Role of Exports and Institutions in Developing Countries

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Crucial for Modern Sector Development? The Role of Exports and Institutions in Developing Countries

Over the past decades there has been ample evidence that a manufacturing sector plays an important role in overall development. In East Asia, recent job creation in industry has lifted large parts of the population to higher income levels. However, while this connection is well supported by anecdotal evidence as well as empirical and theoretical research, there is less evidence on what exactly supports modern sector development. With cross-country time-series data for 75 developing countries we analyze whether international trade and institutions, both the subject of much discussion in the general development debate, play a special role in manufacturing sector growth. Our estimation results, produced using an instrumental approach that is less susceptible to endogeneity issues, show that indeed both exports and institutions are vital for a manufacturing sector. Our results also provide interesting insights into the role of natural resources and official development aid.

JEL classifications: C23, O11, O14, F15

Keywords: manufacturing growth, international trade,
panel analysis, institutions,
developing countries

1 Introduction

A thriving modern sector is often crucial to a country's long-term development. The historical experience of today's advanced economies suggests that the path to growth in these countries was accompanied by a structural shift towards a modern manufacturing sector. While western countries already industrialized as early as the mid 19th century, newly industrialized countries such as South Korea or Taiwan massively expanded their manufacturing sector in the mid to late 20th century. Moreover, recently we have been witnessing the emergence of a strong Chinese manufacturing sector that drives the overall economic performance of the whole country. In addition to such anecdotal evidence, recent research by Rodrik (2013) on modern sector development underlines the importance of understanding the mechanisms that drive development in the modern, respectively the manufacturing sector.¹

In the literature a number of empirical and theoretical studies emphasize the importance of a modern sector for overall economic performance. While some contributions (e.g., Szirmai 2012, De Vries et al. 2012, Timmer and De Vries 2009, Rodrik 2009, Peneder 2003) document the positive impacts of modern sector dynamics on overall economic development empirically,² others suggest that there are links between sectoral and general productivity or development by using an analytical framework (e.g., Duarte and Restuccia 2010, Kuralbayeva and Stefanski 2013, Dekle and Vandenbrouke 2012).

[Figure 1 around here]

Figure 1 illustrates the connection between overall and sectoral growth using data from the sample examined in this study. We map growth rates of the manufacturing sector and growth rates of per capita GDP in developing countries over three different time periods between 1980 and 2010. Figure 1 clearly shows that in these developing countries³ a dynamic modern sector seems to be positively related to overall income growth.

However, while this relationship achieves consensus among economists, naturally the question arises of what exactly makes a country's (modern) *manufacturing* sector grow. What drives eco-

¹Throughout we focus on the whole manufacturing sector and term it 'modern' especially vis-à-vis a traditional agricultural sector in developing countries. A further refinement of sub-sectoral activity is not subject of this study and would greatly alter data requirements.

²This literature focuses on the impact of modern (manufacturing) sector growth on overall growth but (mostly) also acknowledges that e.g., a service sector can play an important role in development (see, e.g., Szirmai and Verspagen 2011).

³Our sample includes 75 countries; see appendix for details.

economic dynamics in this sector? In this paper we therefore focus on the forces that drive manufacturing sector development. We explore these along the lines of existing growth literature. Closely related is recent research by Rodrik (2013) who analyzes manufacturing sector development. He transfers the prominent convergence idea from the discussion of overall growth to the modern sector. Based on a comprehensive empirical analysis, he then provides circumstantial evidence of an unconditional convergence in labor productivity in manufacturing across countries. In this paper we incorporate Rodrik's finding and depart by expanding the analysis towards potential determinants of manufacturing sector development, in particular the influence of trade and institutions.

Why is the manufacturing sector expected to promote growth and in particular, eligible to be associated with trade and institutions? The answer, we argue, lies on the one hand in its special characteristics and on the other hand, in the mechanisms that connect trade and institutions with development in the general growth literature. Szirmai (2012) thoroughly reviews the key characteristics (that also make the sector especially relevant for overall growth). First, the sector is said to provide better opportunities for capital accumulation, which is a crucial factor for growth. Typically, capital intensity is higher and manufacturing is more concentrated than spatially dispersed agriculture. Second, the manufacturing sector evokes higher productivity increases, a mechanism that has also been referred to as the structural change bonus (Rodrik 2009, Temple and Woessmann 2006, Timmer and de Vries 2009). Apart from opportunities for economies of scale, linkage and spillover effects are important aspects of the modern manufacturing sector. The linkage effect refers to a situation where direct forward and backward interaction (linkages) between different (sub)sectors occur and present positive externalities to investment. Spillover effects are special externalities to investments in knowledge and technology and occur both within and across sectors.

Our proposition, namely that exports impact on modern sector development, is guided by the trade literature on the impacts of *manufacturing exports* on overall development (e.g., Herzer and Nowak-Lehmann 2006, Berg et al. 2012, Hesse 2008, Imbs and Wacziarg 2003, Ledermann and Maloney 2003, Herzer et al. 2006, and Naudé et al. 2010). While the literature on general trade and development remains rather inconclusive⁴, the line of argumentation in the mentioned

⁴See, e.g., Sachs and Warner (1995), Dollar and Kraay (2003), Alesina et al. (2000), Frankel and Romer (1999) or Wacziarg (2001) for a positive account of the impact of trade on growth, and Rodriguez and Rodrik (2001) for a critical account. Further, Birdsall and Hamoudi (2002) focus on the inadequacy of the openness measure in the debate, while Greenaway et al. (2002) suggest an unfavorable time framing of the analysis. Very recent empirical studies also focus on trade liberalization in times of crisis (Falvey et al. 2012) and on cross-country heterogeneity in the trade-income relationship (Herzer 2013).

strand suggests that a vertical diversification of exports, i.e., manufacturing in addition to primary products, is beneficial (Herzer and Nowak-Lehman 2006, Berg et al. 2012) because it alleviates (export) price instabilities for primary products (Hesse 2008). This is also supported by Lederman and Maloney (2003), who find that an export sector that concentrates on natural resources has a rather negative impact on growth. Further, the benefits of exports of and diversification towards manufacturing products include i) (firm-level and industry-wide) productivity and efficiency gains (Herzer et al. 2006, Naudé et al. 2010, Melitz 2003, Dogan et al. 2011), ii) (knowledge) spillovers and diffusion (Herzer et al. 2006, Naudé et al. 2010), and iii) the loosening of a country's foreign exchange constraint (Naudé et al. 2010). We argue that the benefits of vertical diversification vis-à-vis traditional primary production⁵ are channeled through the manufacturing sector with the special characteristics outlined above, and naturally most of these effects will primarily have an impact on the modern manufacturing sector. Some empirical evidence for the beneficial channel of trade is presented in Chandran and Munusamy (2009) for the case of Malaysian manufacturing.

Similarly to trade, or more precisely exports, institutions may well prove a determinant of manufacturing sector dynamics. The broad discussion of the impact of institutions on growth dates back to North (1990) and has spawned influential research that argues that it is relevant (e.g., Acemoglu et al. 2005, Rodrik 2002). Thus, if institutions matter in the hypothesized way to the aggregate economy, we would expect them to be all the more important to modern sector development. As the concept of institutions is highly complex, we highlight only some of the aspects. A much-discussed institution that is highly relevant to our analysis is property rights. Acemoglu et al. (2001) focus on expropriation risk as a dimension of property rights enforcement and find that this has a strong impact on per-capita income development. When it comes to the modern sector, we consider this important as the manufacturing sector is characterized by higher capital needs, so consequently uncertain property rights (in this case expropriation risk) can hamper investment. A second dimension of property rights that is presumably important to the modern sector is the availability of contractual enforcement institutions. Focusing on the firm environment, Johnson et al. (2002) find, without differentiating any further, that weak property rights prevent firms from investing their profits.

In our panel analysis of a sample of 75 developing countries from 1970 until 2005 we find evi-

⁵Imbs and Wazciarg (2003) analyze the distribution and find u-shaped empirical evidence that countries are diversified according to their development level with low and high levels of development representing specialisation and in between higher diversification.

dence of the importance of both manufacturing exports and institutional quality for manufacturing sector growth. These findings are robust across model specifications and different estimation strategies. While we are also able to underline the importance of secure property rights as an economic institution, we are unable to conclude that manufacturing exports are equally important across all income levels. The remainder of the paper is structured as follows. The next section contains our empirical analysis with an in-depth description of model, estimation strategy, and data, followed by a results section including tables. The last section concludes.

2 Empirical Analysis

In this section we map out the econometric model and explain our dataset. We are particularly interested in whether exports and institutions drive manufacturing sector development. Based on the literature referenced above, we are positive that it is possible to establish this link empirically. Our estimations are based on a GMM estimator that explicitly accounts for endogeneity among the regressors as well as country-specific effects. However, we also use several other estimators to review our primary results' robustness. In the following we motivate the model and the estimation technique, and discuss several of the estimators that are common in growth estimations.

Model and Methodology: We analyze a panel of 75 developing countries over the period 1970 to 2005, which is split into six non-overlapping five-year intervals. Since we wish to identify the drivers of manufacturing sector growth, we estimate the model as follows:

$$y_{it}^m - y_{i(t-1)}^m = gr_{it}^m = \alpha + \beta y_{i(t-1)}^m + \gamma Exp_{it}^m + \delta Inst_{it} + \theta Cont_{it} + \xi_t + \eta_i + \varepsilon_{it} \quad (1)$$

where the subscripts i and t denote country and time, respectively. y^m is manufacturing output in logarithmic form, Exp^m and $Inst$ represent the regressors of interest, exports in manufacturing and institutions while $Cont$ is a varying set of control variables. ξ and η are unobserved period- and country-specific effects, α is a common intercept and ε is an i.i.d. error term. In our half-decade panel we average most variables over the time period. This removes short cycles that are not of interest here, and therefore displays the relationship of the variables within five years. We hypothesize that the timeframe is well chosen to capture the effects of our independent variables on our dependent one, that is we expect the effects to materialize within five years. However, even though

commonly conducted and necessary averaging the variables comes at the cost of reducing sample size and losing variation. The lagged term of y^m captures the convergence present in manufacturing as found by Rodrik (2013) and is the beginning of period value of the dependent variable. For example, we regress the growth rate of manufacturing output between 1990 and 1995 on the control variables averaged over the same time period but also on the initial value of manufacturing output in 1990. The panel specification enables us to include η , a control for unobserved country-inherent and time-invariant effects. These may otherwise be a source of endogeneity from omitted variables. We are therefore able to control for characteristics including geographical and population features such as natural resources, colonial history, climate, and remoteness. Di Giovanni and Levchenko (2009) even argue that institutional quality and the political system can be captured. The time effects we control for (ξ) pick up shocks common to the whole system, e.g., world market fluctuations.

However, if rewritten, equation (1) represents a classic dynamic model with a lagged dependent variable

$$y_{it}^m = \alpha + (1 + \beta)y_{i(t-1)}^m + \gamma Exp_{it}^m + \delta Inst_{it} + \theta Cont_{it} + \xi_t + \eta_i + \varepsilon_{it} \quad (2)$$

that introduces known estimation problems. The inclusion of η is especially problematic for the conventional OLS estimator. For consistency, the country-specific effects would have to be orthogonal to other regressors (Caselli et al. 1996), a feature that has to be ruled out due to the presence of a lagged dependent variable.

A prominent approach is to use a class of estimators which first start by eliminating the country-specific term by either taking deviations from period averages and focusing on within-country variation (fixed-effects or least squares dummy variable estimator, LSDV) or by using period averages right away (between estimator) (DeJong and Ripoll 2006). The former has been found to be consistent only for a large time dimension, a feature that most macroeconomic panels, including ours, lack. However, as the bias is well-known (Nickell 1981) bias-correcting estimators have been developed for small-T panels (e.g., Kiviet 1995, or for unbalanced panels, Bruno 2005). Even though the latter estimator already deals successfully with this bias it still requires, as does the fixed-effects estimator, strictly exogeneous regressors. If this is not given, there is a lasting contemporaneous correlation between regressors and disturbances which aggravates the estimation (Caselli et al. 1996). We have to acknowledge that imposing the strict exogeneity restriction on our regressors would be

highly critical because when it comes to our two variables of interest, exports and institutions, one can convincingly argue that they are not only causes but also effects of manufacturing development. For example the firm-level literature on exports often argues that there may be more productive companies selecting themselves into the export market, which would mean a reverse causality also in the aggregate case, or that exports enhance a company's productivity through exposition to international competition or economies of scale.⁶ The latter is the channel explored in this research. However, as we only want to capture the channel from exports to sectoral growth we have to best avoid the potential source of the endogeneity bias.

An often-used solution for this problem is to use the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). The system GMM estimator is similar to the difference GMM estimator proposed by Arellano and Bond (1991). Both estimators use a differenced version of equation (1)

$$\begin{aligned}
 gr_{it}^m - gr_{i(t-1)}^m &= (\alpha - \alpha) + \beta(y_{i(t-1)}^m - y_{i(t-2)}^m) + \gamma(Exp_{it}^m - Exp_{i(t-1)}^m) \\
 &\quad + \delta(Inst_{it} - Inst_{i(t-1)}) + \theta(Cont_{it} - Cont_{i(t-1)}) \\
 &\quad + (\xi_t - \xi_{t-1}) + (\eta_i - \eta_i) + (\varepsilon_{it} - \varepsilon_{i(t-1)})
 \end{aligned} \tag{3}$$

to eliminate the country-fixed effect η_i . Endogeneity concerns associated with the regressors are circumvented by using within-instruments. In our model it is particularly important to account for the potential endogeneity problem for two reasons. First, both variables of interest, institutions and exports, can be determined by manufacturing development. Second, the included control variables may flaw the estimation if they are not exogenous. The use of within-instruments, that is, the use of instruments from the available data, is an appealing approach since we would struggle to find convincing instruments from outside. For example, lagged level data are used as instruments in the first-differences equation (3), which is the difference estimator. Similarly, first differences may serve as instruments in the levels equation (1). This is done by the system GMM estimator. However, it is obvious that the validity of the instruments used has to be carefully verified. The system GMM estimator has some advantages over the difference GMM estimator. Easterly and Levine (2001)

⁶Examples of both may be found in e.g. Greenaway and Kneller (2007) or Greenaway et al. (2007).

note that lagged levels of persistent regressors may prove weak instruments in equation (3) and bias the estimation. Further, the sole use of differences leaves information about the level relationship unused (DeJong and Ripoll, 2006) and reduces the time dimension of the sample. Especially the latter fact is critical as our time dimension is already short ($T = 6$). Due to these backdraws of the differences GMM estimator, our preference lies with the system GMM estimator.

Even though this estimator controls for many caveats in panel data estimation, it hinges on assumptions that need to be validated. We follow Roodman (2006) and report next to regression coefficients and sample-size important test statistics, which validate the identifying assumptions. These include the Hansen-J test for over-identification (Hansen, 1982) and Arellano and Bond's (1991) tests for autocorrelation. The Hansen test's null hypothesis is that the instruments are exogenous and thus should not be rejected. As this test may be weakened by instrument proliferation (Roodman 2009), we limit the number of instruments and report their count. Next, we report the m_1 - and m_2 - tests for autocorrelation in the differenced errors ($\varepsilon_{it} - \varepsilon_{i(t-1)}$). The presence of second-order serial correlation (in differenced errors) implies first order serial correlation of the ε_{it} which violates our assumptions. Therefore we should not reject the null of no serial correlation in the m_2 - test. We use the finite-sample Windmeijer (2005) correction and the two-step estimator to deal with heteroscedasticity and arbitrary correlation patterns within countries.

Our strategy involves running several specifications with a differing set of control variables and using several different estimators. However, as outlined above, we obtain most results from our preferred system GMM estimator.

Data and Variables To obtain a large set of panel data with the regressors of interest and relevant controls, we combine several data sources. These include the World Bank's development indicators, Barro and Lee's educational attainment dataset, the comtrade dataset on exports by category, the Penn World Tables, the Fraser Institute's World Freedom Index, and the International Country Risk Guide (ICRG). The countries in the sample are selected solely based on data availability and the World Bank's income classification. We include developing countries that are associated with either income group three, four, or five.⁷ Summary statistics are given in Table A1.

⁷Upper middle-income countries, Lower middle-income countries, Low-income countries with 2011 per capita GNI of US\$ 4 036-US\$ 12 475, US\$ 1 026-US\$ 4 036 and less than US\$ 1 025, respectively.

Dependent variable: Our dependent variable is the growth rate, averaged over five years, of per capita manufacturing output. In analogy to common empirical growth estimations we relate output to population, as this makes the results comparable among countries and is meaningful in the context of human development. Manufacturing output is taken as value added in constant 2000 US\$ from the World Bank's development indicators (World Bank 2012), while the population figures are from the Penn World Tables version 7.1 (Heston et al 2012)

Independent variables: Our subject of interest is the effect of exports and institutions on manufacturing sector dynamics. First, we use manufacturing exports from the United Nations Commodity Trade Statistics database (Comtrade 2012). Manufacturing comprises products in SITC categories 5 to 8. Again, we relate manufacturing exports to population figures to achieve comparability across countries. Next, the Fraser Institute's Economic Freedom Index (Gwartney et al. 2012) serves as an approximation of institutional quality. It is scaled from 1 to 10, with 10 being the best developed institutions across several dimensions including size of government, legal structure and property rights, access to money, freedom to trade, and regulation of credit, labor, and business. The index is often used in the literature, not least because it provides a long series of data and is thus suitable for the panel analysis we perform.

Control variables: We would expect the amount of human capital available to impact the growth of a more modern sector.⁸ In developing countries, manufacturing activities (in comparison to, e.g., subsistence agriculture) generally require the use of more complex technology which in turn can only be put to productive use by an educated workforce. The absorption of better technology should thus be facilitated by a more highly educated workforce. To approximate the level of human capital we mainly use average years of schooling of both males and females. The data source is Barro and Lee's educational attainment dataset (2010). Another common determinant of growth is investments. Especially for a capital-intensive modern manufacturing sector investments appear invaluable. We also include investments in our regression to comply with standard empirical growth estimations (e.g., Mankiw et al. 1992). Next, foreign aid is also believed to impact especially on the manufacturing sector. Rajan and Subramanian (2011) conduct an empirical investigation of this. According to them, aid favors the domestic non-tradables sector over an export manufacturing

⁸For a general account of human capital and growth see e.g. Barro (2001).

sector in that it affects the real exchange rate. Empirically, they find that recipient countries perform worse in terms of their manufacturing sector's share in GDP. We control for the impact of aid on manufacturing in our estimations using aid data from the World Bank (World Bank 2012). We also use official per-capita information on development aid and assistance. Next, we include urbanization, which can be regarded as a driver of modern sector development in three ways. First, urban agglomerations provide easy access to a pool of labor that can be employed in manufacturing. Second, geographical closeness facilitates spillover effects. Third, urbanization can also be regarded as a measure of modernization in general (health, education, infrastructure). However, because urbanization can also be easily thought of as an effect rather than a cause, it is important to treat it as a potentially endogenous variable. And lastly, natural resource dependence may also influence modern sector development and is therefore included. Several channels are suggested in the related literature (see e.g. van der Ploeg 2011). First, resource availability may divert funds away from more beneficial activities, of which the modern sector is certainly one. Second, triggering conflicts over rents, resource dependence also increases uncertainty, which can affect real investments and human capital accumulation negatively. Third, a boom in natural resource exports can drive up the exchange rate and decrease competitiveness of the manufacturing sector. For these reasons, we let natural resource dependence enter our model. However, as the effects potentially dependent on the insitutional environment we do not necessarily expect a strong impact in either direction. The data are drawn from the World Development Indicators (World Bank 2012) and represent resource rents as a share of GDP, and seperately its subcomponents oil, gas, coal, mineral and forest rents as shares of GDP.

As mentioned in the introduction, recent research by Rodrik (2013) analyzes convergence in manufacturing sector productivity. He finds *unconditional* convergence for both two-digit categories and aggregate manufacturing activities, which also leads us to expect *conditional* convergence across countries. We take the proposition of convergence as a point of departure to derive additional driving mechanisms. Thus we set up a base case with conditional convergence and add our proposed influencing mechanisms, namely exports and institutions. Technically, that means we control for β -convergence by including the lagged level of the dependent variable as a regressor. In our estimation we include the beginning-of-period level of per capita manufacturing output as an explanatory variable for the growth rate.

3 Results

Exports and Institutions: Table 1 shows our estimation result for the first set of estimations. This set employs the strategy of estimating *different* model specifications with the *same* estimator, our preferred system GMM estimator. Later we turn to alternative ways of estimation. Column (1) shows the basic estimations of the effects of our regressors of interest. Both variables, exports and institutions, display an impact on manufacturing sector growth, which is positive and significant alongside controls of convergence and time- and country specific effects. The next column includes controls for effects other than country, time, and convergence. We include a control for human capital and official development assistance (2), and also for urbanization and investments (3). In columns (4) and (5) we present the estimations with an included control for natural resource rents (4) and the subcomponent mineral rents (5)⁹. Even though the inclusion of further controls reduces the magnitude of the main effects they clearly remain significant at the 1% level. Further, including additional regressors forces us only slightly to reduce the sample for data availability reasons alone. However, we see that this reduction does not change our estimation results.

[Table 1 around here]

Given that the system GMM estimator rests on restrictive assumptions we discuss our instrument's validity based on common diagnostics. Almost all our estimations fulfill the required assumption about no serial correlation in the errors. According to the m_2 -test we cannot reject the hypothesis of no second-order serial correlation (in the differenced errors). Further, as the consistency of the estimator critically hinges on the validity of the used instruments we conclude from the J-test confirmation that our set of instruments is valid in the estimation. That is, the null hypothesis of exogenous instruments cannot be rejected. Finally, we test for the validity of instrument subsets, that is, we test whether the instruments for each endogenous regressor qualify separately as valid. The results indicate that this is the case for almost all subsets.

[Table 2 around here]

Having established exports and institutions impact positively on the growth rate of manufacturing, with a presumably well qualified estimator for dynamic panel data models, we turn to estimating the full specification (i.e., specification (5) in Table 1) with alternative estimators. While

⁹For brevity we do not show the results for other subcomponents of natural resources. They are similar to the composite indicator in column (4). However mineral rents, which appear significant, are maintained throughout the following estimations.

column (1) in Table 2 replicates the estimated coefficients in Table 1, columns (2) to (5) represent the estimations with the difference GMM estimator (2), the LSDVC estimator (3), the fixed-effects estimator (4), and the cross-sectional OLS estimator (5).

The estimated coefficients for exports are positive and significant across the various estimators. Their magnitude is greatest among the GMM estimations, however significance is given at the 1% level across the board. The results for the institutions variable differ slightly. The obtained results are positive and significant (as the main estimation) in three of the five cases. The difference GMM estimator and the OLS estimator do not confirm a positive impact of institutions on modern sector development. The latter two results are also from the smallest samples. While the difference estimator reduces the sample to 61 countries the cross-section OLS sample consists of only 45 countries. However, the remaining significant results are of a similar magnitude.

Control variables: From the broad (theoretical) literature we would expect *human capital* to enhance modern sector growth, for example as it facilitates the absorption of modern technology. However, looking at our estimations we find mixed evidence of a positive impact of the level of human capital on modern sector growth.¹⁰ Even though it is often times positive, in no estimation does the variable significantly support modern sector development. We measure human capital in average years of schooling. As summarized in Glewwe (2002) the link between schooling and productivity may not hold in all cases, especially not in Sub-Saharan Africa. That the links from schooling to skills to productivity are not adequately given may explain our results.¹¹ Next, we find that *investments* are positively related to manufacturing development. In most of our estimations we find a significant effect and thus support for the standard proposition that higher investment levels support growth. This is expected, as manufacturing is on average more capital-intensive than basic agricultural activities. By contrast, we do not find much evidence that *urbanization* significantly supports manufacturing growth. In other words, we can assume neither that there is a functioning link between a prospective labor pool and the sector's activity, nor that a more modern environment has a positive impact. The latter, however, may be due to the broad measure which urbanization is or that we may be dealing with different types of urbanization as proposed by Gollin et al. (2013). One fuels industrialization by supplying labor to the modern sector, while the other

¹⁰In fact this finding is in line with work of e.g. Pritchett (2001) who notes that especially in macro estimations, as ours, the link may be weak.

¹¹The use of other approximations for human capital available (e.g., secondary schooling in the labor force, secondary schooling, primary schooling (all World Bank 2012) does not change our results.

is based on the consumption of, e.g., resource rents where people engage in low-productivity petty services instead of high-productivity industry jobs. And next, we find evidence of a negative impact of *official development aid* on manufacturing growth. While the effect is smaller in magnitude than our main effects, trade and institutions, we can argue that official development aid is by no means a driver of structural change as it impedes modern sector development. The proposed link via the real exchange rate (Rajan and Subramanian 2011) may thus indeed put the manufacturing (tradable) sector at a disadvantage compared to a non-tradable sector. In the last two columns of Table 1 we present the results of natural resources as a factor that impacts on modern sector development in our sample. The broad literature on natural resource dependence proposes several channels, which are in short outlined above.¹² In column (4) we include natural resource dependence in our model and note two aspects. First, our results hold, lending further credibility to our specification. And second, which is almost equally interesting and important, we see no significant impact of natural resources on modern sector development. However, from this estimation we can only infer that natural resources do not impede modern sector development controlling for institutions, exports and human capital. All of these are major channels of impact described in the natural resource literature. Another reason could be that natural resource subcomponents (i.e., gas, oil, coal, minerals, and forests) show different effects and hence lead to a non-significant overall effect. We consider this second explanation and report the most interesting result in column (5). For the minerals subcomponent we find a significant negative effect, even though we still control for the main channels of impact. We assume mineral extraction in developing countries to have comparatively higher labor intensity, especially in Sub-Saharan Africa. This may present a further constraint to modern sector development as the labor force may be absorbed by the mineral mines. Our results suggest that even though in general natural resources may not be problematic or even a curse, individual resources may differ in their impact on modern sector development, as the example of minerals shows in our estimation.

Convergence: Our estimation results indicate that there is conditional convergence in aggregate per capita manufacturing output growth. Countries with a lower prior level of manufacturing output hence grow faster, as indicated by the negative coefficients on initial manufacturing output in Tables 1 and 2. The convergence effect is significant across all estimations. Our estimation

¹²See, e.g., Gylfason and Zoega (2006) or van der Ploeg (2011) for a discussion of channels through which natural resources impact on growth.

is thus in line with the proposition of Rodrik (2013) concerning the existence of convergence in manufacturing sector productivity, although in our case it is conditional upon the set of control variables. Nevertheless, our conditional convergence effects are similar in magnitude to Rodrik's, giving further credibility to the model's specifications and estimation methodology. To illustrate this, we report the implied λ which is the annualized rate of convergence derived from the coefficient for our lagged dependent variable. λ solves $1 + \beta = e^{-\lambda t}$, with β being the estimated coefficient and t the time in years between the current value and the lagged term, in this case $t = 5$.¹³ The annualized rate of convergence in manufacturing is estimated at around 5% a year, while Rodrik's conditional estimations vary between 5 and 6%.¹⁴ Finally, from an econometric point of view we gain confidence that we model and specify correctly by comparing estimates of the fixed effects, OLS and system GMM estimations. As argued by Bond (2002) the estimates of the cross-section OLS model and the fixed-effects model represent upwards and downwards biased estimates of the lagged dependent variable's coefficient. So the true value should lie in between. In our estimations this is clearly the case for the system GMM estimates.¹⁵

3.1 Extension

Having established the relevance of both institutions and trade for modern sector growth we extend the estimations to improve and strengthen the results along two lines, namely a differentiation of institutions and trade effects across income levels.

First, in the main analysis we use the broad measure of economic freedom from the Fraser Institute. As the index is also available in subcategories, namely size of government, legal structure and property rights, access to money, freedom to trade, and regulation of credit, labor, and business we can also use these to approximate the quality of economic institutions more precisely (assuming that the index components are obtained in an unbiased and comprehensive manner). First we exclude the subcomponent 'size of government' of the institutional quality index. We do so to avoid to rely on an indicator that is frequently criticized for being ideologically skewed. A bigger 'size of government' generally reduces the institutional quality score, a procedure that may be regarded as questionable (column 1). Next, we reduce the index to legal structure and property rights

¹³For more details on convergence see, e.g., Barro and Sala-i-Martin (1992).

¹⁴See Rodrik (2013), p. 176, Table 1, even-numbered columns.

¹⁵The simple (in contrast to the reported time-averaged) OLS levels estimation with all observations produces an estimate of -0.14 for the lagged dependent variable, close to that reported in column (6).

and regulation of credit, labor, and business (column (2)). Especially property rights are in this context expected to be important (Johnson et al. 2002). In columns (3) we reestimate (2) without investments, an important channel for institutional quality. And lastly in column (4) of Table 3 we look at an institutional quality indicator from the international country risk guide, namely socio economic conditions. First we see that our estimations remain robust to a change in the institutions index in column (1). This index excludes the size of government score which comprises, among others, tax rates. Next, by focusing on aspects of institutions promoting modern sector growth (column (2)), i.e., secure property rights and the regulation of credit, labor, and business, which are more direct from a theoretical perspective, we still estimate a significant coefficient as expected. However, this result is not strengthened when we leave out investments (column (3)). The latter result is somewhat surprising as especially property rights are associated with modern sector growth via enhancing the investment environment. A reconciling aspect might be that we capture the investment level with a very broad indicator. The last column (4) shows that the institutional quality indicator from the international country risk guide is similarly positively and significantly associated with modern sector growth. Further the effects of our included control variables (especially official development aid and mineral resource rents) do not change in this extension.

[Table 3 around here]

Next, we estimate our core model and interact our trade variable with dummies for different income levels in the countries under investigation. We propose and perform this exercise to evaluate whether our effects are robust across this dimension and whether policy implications can be generated across the board for different levels of income. We generate quintile dummies according to the income at the end of the sample. In Table 4 we see evidence that the impact of trade levels may well be connected to income group. While the interaction with higher income levels generates the previously found evidence of a positive impact, the first quintile does not suggest a significant impact of trade levels on modern sector growth. The quintile-specific results are derived from the joint validity of the two export coefficients. We get the strong impression that countries at the lower end of the income scale have not been able to boost modern sector growth through trading over the time frame studied. Because trade levels are comparatively low in the lowest income group we could argue that we are experiencing size effects, meaning that the volume of trade is not large enough to make an impact. Though this seems plausible when we look at the levels, there is

another possible explanation. As prior literature has shown, diversification of exports (e.g., Berg et al. 2012) is beneficial as it insures against drawbacks in specific industries. We calculate the Herfindahl diversification index across income groups and find that the lowest income group is least diversified in its manufacturing exports. We may thus argue that the lack of diversification also plays a role in the relationship between trade levels and modern sector growth. (cf. Table A1)

[Table 4 around here]

4 Conclusion

In this contribution we study the determinants of modern sector development and contribute to the recently revived interest in modern sector development (e.g., Rodrik 2013). Given the history of developed countries we focus on the drivers of manufacturing sector growth, namely trade and institutional quality. In a cross-section time-series analysis we use several model specifications as well as several panel estimators to obtain robust results and account for potential econometric drawbacks, especially endogeneity. In our sample of 75 developing countries from all regions of the world, we find that both exports and institutional quality impacted on manufacturing sector growth over the sample period 1970 to 2005.

Our results for manufacturing exports indicate that the manufacturing sector benefits from exporting its products to international markets. One possible reason is that developing countries can bridge domestic demand shortages for manufacturing products by selling to the large global market. However, productivity and spillover gains are also likely induced by exposure to international competition. Next, we find that the aforementioned positive impact is not uniform across income levels. The poorest countries in our sample do not benefit from trade, possibly due to their negligible trade volumes that have no measureable impacts on the entire sector. In addition to low export levels, these countries are also the least diversified.

Similarly, we find that the quality of overall institutions is beneficial for manufacturing sector development. Our measure of institutional quality comprises several dimensions, including secure property rights, a dimension hypothesized as being especially important for capital-intensive manufacturing. Looking at this dimension more in isolation, we find evidence that this aspect is important, too, to modern sector development.

Further, we find interesting results for our control variables. These include a negative impact

of official development assistance on modern sector development. That said, natural resources generally do not seem to weaken a country's likelihood of developing a successful modern sector. However, this latter result is conditional on factors such as institutions or exports. Finally, our isolated analysis of mineral resources indicates that their presence has a negative impact on the modern sector, giving rise to the assumption that the mineral sector impacts via a different channel than other resources. We propose that it is a labor-intense sector which absorbs human capital that would be needed to form the manufacturing sector.

The implications of our results are twofold. First, even though trade in general may not be found to be unambiguously positive for overall growth, we provide evidence that when it comes to the modern sector, exports appear to be a largely important source of growth. Thus, to enlarge the modern sector there need to be adequate export opportunities for its products. And second, we also find that sound (economic) institutions, especially secure property rights, are vital to this sector. However, since we do not find that exports are relevant in countries with very low income levels, further research is required to gain insights into how to encourage manufacturing sector growth in least developed countries.

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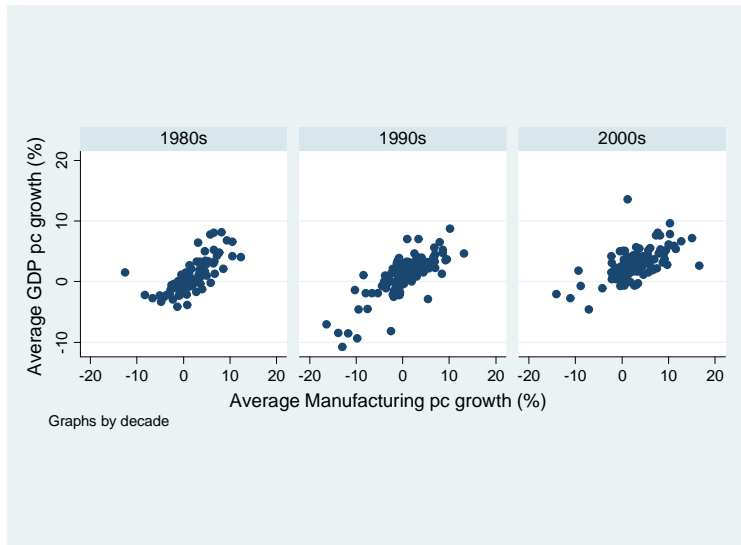


Figure 1: Relation between manufacturing growth and GDP growth in developing countries over 3 decades.

Table 1: Manufacturing Growth in Developing Countries - System GMM Estimates

Dependent: Manufacturing Growth	All Countries				
Model:	(1)	(2)	(3)	(4)	(5)
Initial Manufacturing _{t-1}	-0.298*** (0.055)	-0.243*** (0.074)	-0.221*** (0.049)	-0.218*** (0.052)	-0.201*** (0.056)
Manuf. Exports _t	0.184*** (0.041)	0.127*** (0.035)	0.124*** (0.039)	0.114*** (0.039)	0.119*** (0.039)
Institutions _t	0.111*** (0.027)	0.104*** (0.037)	0.085*** (0.022)	0.089*** (0.023)	0.079*** (0.022)
Schooling _t		0.016 (0.025)	-0.023 (0.022)	-0.016 (0.022)	-0.016 (0.018)
Urbanization _t			0.002 (0.003)	0.001 (0.003)	0.001 (0.002)
Investments _t			0.085* (0.049)	0.093* (0.053)	0.069 (0.051)
ODA _t		-0.064** (0.031)	-0.040** (0.020)	-0.047*** (0.016)	-0.035* (0.019)
Natural res. rents _t				0.003 (0.002)	
Mineral res. rents _t					-0.015*** (0.004)
Implied λ	0.071	0.056	0.050	0.049	0.045
Observations	292	279	279	279	279
Countries	77	71	71	71	71
Hansen (p-value)	0.62	0.36	0.56	0.52	0.46
Instruments	54	56	68	69	69
AR(1) (p-value)	0.00	0.00	0.00	0.00	0.00
AR(2) (p-value)	0.35	0.28	0.32	0.32	0.40

Notes: Dependent variable in all models is per capita Manufacturing Growth. Initial Manufacturing, Manufacturing Exports, Investments and ODA are used in per capita terms and natural logarithms. Natural and mineral resource rents are shares of GDP. *, ** and *** denote significance at the 10-, 5- and 1% level, respectively. Windmeijer corrected S.E.s in parentheses. All models are estimated with constant, time- and country-fixed effects. Sample range is 1970 - 2005 in 5-year averaged non-overlapping periods.

Table 2: Manufacturing Growth in Developing Countries - Different Estimators

Dependent: Manufacturing Growth	All Countries				
Estimator:	SysGMM	DiffGMM	LSDVC	FE	cs-OLS
Initial Manufacturing _{t-1}	-0.201*** (0.056)	-0.596*** (0.147)	0.733*** (0.060)	-0.422*** (0.048)	-0.116*** (0.017)
Manuf. Exports _t	0.119*** (0.039)	0.198*** (0.071)	0.062*** (0.021)	0.092*** (0.028)	0.045*** (0.010)
Institutions _t	0.079*** (0.022)	0.016 (0.053)	0.056*** (0.019)	0.043** (0.018)	0.034 (0.024)
Schooling _t	-0.016 (0.018)	0.042 (0.061)	-0.002 (0.029)	0.008 (0.040)	0.011 (0.008)
Urbanization _t	0.001 (0.002)	-0.040*** (0.014)	-0.005 (0.004)	-0.003 (0.004)	0.001 (0.001)
Investments _t	0.069 (0.051)	0.061 (0.170)	0.141** (0.055)	0.195*** (0.048)	0.039** (0.015)
ODA _t	-0.035* (0.019)	-0.007 (0.032)	0.015 (0.020)	0.012 (0.027)	-0.041*** (0.009)
Mineral res. rents _t	-0.015*** (0.004)	-0.006 (0.010)	-0.009 (0.010)	-0.006 (0.009)	-0.012** (0.005)
Implied λ	0.045	0.181	0.062	0.110	0.025
Observations	279	201	279	279	45
Countries	71	61	71	71	
Hansen (p-value)	0.46	0.64			
Instruments	69	37			
AR(1) (p-value)	0.00	0.20			
AR(2) (p-value)	0.40	0.81			

Notes: Dependent variable in all models is per capita Manufacturing Growth rate, except in the LSDVC estimation. The LSDVC model's dependent is per capita manufacturing output. Initial Manufacturing, Manufacturing Exports, Investments and ODA are used in per capita terms and natural logarithms. Mineral resource rents are a share of GDP. *, ** and *** denote significance at the 10-, 5- and 1% level, respectively. Windmeijer corrected S.E.s in parentheses. All models are estimated with a constant, time- and country-fixed effects. Sample range is 1970 - 2005 in 5-year averaged non-overlapping periods. OLS estimates based on complete period averages.

Table 3: Manufacturing Growth in Developing Countries - Different Insitutions

Dependent: Manuf. Growth Model:	Fraser			ICRG
	No GS (1)	PR & BR (2)	PR & BR (3)	Soc Econ (4)
Initial Manufacturing $_{t-1}$	-0.218*** (0.067)	-0.224*** (0.061)	-0.230*** (0.065)	-0.200*** (0.072)
Manuf. Exports $_t$	0.095** (0.042)	0.099*** (0.033)	0.138*** (0.038)	0.103* (0.057)
Institutions [2-5] $_t$	0.051** (0.020)			
Institutions [2+5] $_t$		0.075*** (0.028)	0.062** (0.028)	
Soc Econ $_t$				0.050** (0.021)
Schooling $_t$	0.009 (0.022)	-0.000 (0.016)	0.001 (0.016)	0.002 (0.015)
Urbanization $_t$	0.000 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)
Investments $_t$	0.085* (0.048)	0.089* (0.053)		
ODA $_t$	-0.044** (0.022)	-0.040* (0.021)	-0.037* (0.023)	-0.042** (0.017)
Mineral res. rents $_t$	-0.013*** (0.003)	-0.015*** (0.004)	-0.015*** (0.005)	-0.013** (0.007)
Implied λ	0.049	0.051	0.052	0.045
Observations	266	269	269	245
Countries	70	71	71	66
Hansen (p-value)	0.27	0.46	0.47	0.18
Instruments	69	69	63	52
AR(1) (p-value)	0.00	0.00	0.00	0.00
AR(2) (p-value)	0.33	0.37	0.33	0.22

Notes: Dependent variable in all models is per capita Manufacturing Growth. Initial Manufacturing, Manufacturing Exports, Investments and ODA are used in per capita terms and natural logarithms. Mineral resource rents are a share of GDP. *, ** and *** denote significance at the 10-, 5- and 1% level, respectively. Windmeijer corrected S.E.s in parentheses. All models are estimated with constant, time- and country-fixed effects. Sample range is 1970 - 2005 in 5-year averaged non-overlapping periods. Subcomponents of Institutions index: Government Size (GS 1), Property Rights (PR 2), Access to money (3), Freedom to trade (4) and Business Regulation (BR 5).

Table 4: Manufacturing Growth in Developing Countries - Income Interactions

Dependent: Manufacturing Growth Model:	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Initial Manufacturing _{t-1}	-0.277*** (0.056)	-0.268*** (0.068)	-0.276*** (0.076)	-0.247*** (0.057)	-0.267*** (0.066)
Manuf. Exports _t	0.122*** (0.035)	0.124*** (0.042)	0.104** (0.048)	0.093** (0.046)	0.105*** (0.040)
Exports _t x Inc1	-0.102*** (0.039)				
Exports _t x Inc2		0.005 (0.017)			
Exports _t x Inc3			-0.001 (0.009)		
Exports _t x Inc4				0.013 (0.014)	
Exports _t x Inc5					-0.002 (0.014)
Institutions _t [All]	0.080*** (0.030)	0.077** (0.032)	0.099*** (0.026)	0.105*** (0.026)	0.109*** (0.032)
Schooling _t	-0.000 (0.014)	-0.007 (0.015)	0.000 (0.022)	-0.007 (0.018)	0.006 (0.012)
Urbanization _t	0.002 (0.002)	0.002 (0.003)	0.002 (0.003)	0.001 (0.002)	0.001 (0.002)
Investments _t	0.060 (0.047)	0.098 (0.060)	0.102* (0.060)	0.108* (0.056)	0.097 (0.062)
ODA _t	-0.039* (0.022)	-0.043** (0.021)	-0.047** (0.023)	-0.050** (0.021)	-0.054*** (0.021)
Mineral res. rents _t	-0.013*** (0.004)	-0.016*** (0.005)	-0.013** (0.005)	-0.013*** (0.004)	-0.014*** (0.005)
Implied λ	0.065	0.062	0.065	0.057	0.062
Observations	279	279	279	279	279
Countries	71	71	71	71	71
Hansen (p-value)	0.50	0.51	0.43	0.52	0.53
Instruments	69	69	69	69	69
AR(1) (p-value)	0.00	0.00	0.00	0.00	0.00
AR(2) (p-value)	0.34	0.37	0.42	0.40	0.41

Notes: Dependent variable in all models is per capita Manufacturing Growth. Initial Manufacturing, Manufacturing Exports, Investments and ODA are used in per capita terms and natural logarithms. Mineral resource rents are shares of GDP. *, ** and *** denote significance at the 10-, 5- and 1% level, respectively. Windmeijer corrected S.E.s in parentheses. All models are estimated with constant, time- and country-fixed effects. Sample range is 1970 - 2005 in 5-year averaged non-overlapping periods.

Table A 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Manuf. Growth	0.08	0.276	-1.326	1.151	517
Manuf. Output pc	217.99	267.775	3.564	1699.99	651
Manuf. Exports pc	122.086	285.535	0.031	3544.31	479
Institutions	5.452	1.15	2	7.9	498
Schooling (Years)	5.28	2.531	0.088	10.982	672
ODA pc	120.911	308.743	-2.723	6869.789	863
Investment pc	915.185	1068.276	11.838	7547.74	882
Urbanization (%)	40.005	19.932	2.884	91.685	956
Mineral rents (% of GDP)	1.111	3.135	0	23.934	817
Manuf. Exports pc by group	Mean	Std. Dev.	Min.	Max.	
Inc group 1	7.272	16.61	0.031	83.917	
Inc group 2	27.241	35.938	0.439	212.646	
Inc group 3	67.957	85.466	0.398	394.425	
Inc group 4	175.436	271.405	1.173	1585.311	
Inc group 5	303.74	491.405	4.61	3544.31	
Export diversification by group	Herfindahl-Index for SITC 5 - 8				
Inc group 1	0.358	0.253	0.031	0.985	
Inc group 2	0.338	0.227	0.03	0.985	
Inc group 3	0.315	0.24	0.013	0.986	
Inc group 4	0.192	0.17	0.003	0.826	
Inc group 5	0.301	0.22	0.012	0.881	

Table A 2: Countries included

Argentina, Armenia, Benin, Bangladesh, Bulgaria, Belize, Bolivia, Brazil, Botswana, Central African Republic, Chile, China, Cote d'Ivoire, Cameroon, Colombia, Costa Rica, Dominican Republic, Algeria, Ecuador, Egypt, Fiji, Gabon, Guatemala, Guyana, Honduras, Indonesia, India, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Sri Lanka, Lesotho, Lithuania, Morocco, Moldova, Mexico, Mali, Mongolia, Mozambique, Mauritius, Malawi, Malaysia, Namibia, Niger, Nicaragua, Nepal, Pakistan, Panama, Peru, Philippines, Papua New Guinea, Paraguay, Rwanda, Senegal, El Salvador, Togo, Thailand, Tunisia, Turkey, Tanzania, Uganda, Ukraine, Uruguay, Venezuela, Vietnam, South Africa, Zambia, Zimbabwe