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FAST AND FURIOUS. A KALDORIAN ANALYSIS OF DYNAMIC INDUSTRIES

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Fast and furious. A Kaldorian analysis of dynamic industries

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Abstract

Kaldor's first growth law claims that the growth rate of GDP is strongly fuelled by the growth rate of manufacturing. Despite the fact that the literature has demonstrated the empirical validity of this law for decades, only now a strand of research is emerging, which focuses on whether specialization in certain manufacturing sub-industries is relevant for growth. This paper examines whether specialization in high-tech manufacturing entails a growth premium in addition to the growth impulse generated by industrialization. Based on a dataset of 146 countries over the period 1971 – 2011, we find that high-tech manufacturing industries foster economic growth more so than low- and medium-tech industries. Economies of scale and technological spillovers are among the drivers identified in the literature to explain the growth enhancing effects of technology-intensive industries.

Keywords: *Kaldor's first law, engine of growth, high-tech manufacturing*

JEL CODE: O25, O32

1. Introduction

According to Kaldor, the manufacturing sector acts as an engine of economic growth, considering that a growing manufacturing sector does not only have a direct impact on economic growth, but also leads to increased economies of scale, positive externalities and spillovers to the rest of the economy. As a result, manufacturing growth leads to economic growth that is higher than expected in terms of manufacturing share in total output. Since Kaldor's seminal contribution (1966) to the literature on economic growth, the hypothesis of manufacturing as an engine of growth, i.e. Kaldor's first law, has been extensively investigated. The literature on Kaldor's first law has broadly evolved into two strands of research.

The first strand of research focuses on the significance of the relationship between the growth of gross domestic product (GDP) and that of manufacturing value added (MVA)**.** Fagerberg and Verspagen (2002) examined whether the coefficient of manufacturing growth is positive and whether it is larger than the share of manufacturing in GDP. If the coefficient is larger than the share of manufacturing in GDP and if this difference is significant, it is interpreted as verifying the engine of growth hypothesis. Pacheco-Lopez and Tirlwall (2014) posit that the manufacturing sector's engine of growth effect in an open economy is primarily driven by an increasing dynamism in exports. Marconi et al. (2016) test Kaldor's first law using a Generalized Method of Moments approach to address endogeneity issues in case of a reverse causality bias.

The second emerging strand of research investigates the conditions under which industrialization boosts economic growth. The underlying notion of this approach is that an increase in MVA share does not automatically trigger an engine of growth mechanism. The modalities that lie behind industrialization are crucial in activating backward and forward linkages, spillovers and economies of scale of manufacturing. Cantore et al. (2014) emphasize that not every dollar for additional industrialization matters for economic growth. While intensive industrialization enhances the growth of the manufacturing sector through increases in manufacturing productivity and in manufacturing employment share, extensive industrialization entails the growth of MVA derived from additional deployment of labour under the assumption that the manufacturing employment share and manufacturing productivity will remain constant. Cantore et al. (2014) also find that intensive rather than extensive industrialization is closely linked to the GDP growth rate variable. Szirmai and Verspagen (2015) conclude that industrialization is particularly effective when combined with skills upgrading and education.

This study contributes to this second strand of research and investigates which manufacturing industries are the most effective in contributing to the engine of growth mechanism. An important component of this strand of literature is the role high-tech industries play in boosting economic growth. As highlighted in the Industrial Development Report 2016, the manufacturing sector is the most research and development (R&D) intensive sector when compared with services and agriculture. The role manufacturing plays for the propulsion of technology spillovers is indisputable. As regards the specific role of high-tech industries, two competing views dominate the debate.

One view builds on theories of structural change, maintaining that economies are characterized by cycles of declining and emerging industries (Kuznets, 1959). In this "destructive creation" process (Schumpeter, 1942), one of the ways in which structural change manifests itself is through a continuously increasing share of high-technology industries in total manufacturing output and a positive and significant correlation between shares of high-tech in total output and in the levels and growth rates of GDP (Kaloudis et al., 2005). At higher income levels, firms and in particular entrepreneurs are better equipped to run businesses characterized by high-technology intensity. High-tech firms are, moreover, the most profitable. Romero and McCombie (2015) show that high-tech manufacturing industries exhibit larger degrees of returns to scale than low-tech ones and that the increasing magnitude of the returns to scale in manufacturing is attributable to high-tech industries.

The alternative view focuses on the importance of medium- and low-tech industries for sustaining growth. Hansen and Winther (2011) claim that medium- and low-tech industries are often overlooked despite their crucial role as partners in the innovation process of high-tech firms and as buyers of high-tech products. Hansen and Winther contest the idea that the lack of competitiveness in European countries since the 1990s vis à vis the United States can simply be explained by lower rates of R&D investments. Kaloudis et al. (2005) find that the growth performance across countries is not correlated with increasing shares of high-tech sectors in manufacturing value added. Applying a theoretical model, Ju et al. (2009) maintain that countries' optimal industrial structure significantly depends on their endowments. Low-income countries are better prepared to invest in industries requiring an abundant and cheap workforce rather than in capital and technology-intensive industries. High-tech industries could hardly be a target for prioritization in low-income countries.

Starting from the standard Kaldorian literature investigating the relationship between manufacturing and GDP, this paper investigates whether—beyond the well-known role of manufacturing as an engine of growth—a specialization in high-tech industries delivers a growth premium when compared with low- and medium-tech industries. Our study contributes to the literature on Kaldor's first law by introducing a more refined model that discusses the impact of specialization in manufacturing sub-industries on growth. This paper also contributes to the literature on high-tech vs low-tech industries by analysing an aspect that is usually investigated at firm level (Cozza et al. (2012), for example, provide evidence of an "innovation premium" in terms of growth and profitability, but only by using a panel of high-tech manufacturing firms). The paper is organized as follows: Section 2 describes the data, Section 3 introduces the methodology, Section 4 discusses the results, and the final section concludes.

2. Data

We construct a panel of up to 146 countries over the period 1970 to 2011, using information on countries' output and MVA, broken down by technology intensity. Manufacturing data by industry are drawn from UNIDO's manufacturing database, which provides value added data based on the two-digit ISIC version 3. To construct value added by level of technology, we rely on the classification developed by (OECD, 2003) and adapted by (UNIDO, 2011). This classification was developed by ranking industries according to their ratio of R&D expenditure to value added and production, in which industries such as wearing apparel, textiles and food and beverages fall into the low-tech group, while machinery, motor vehicles and medical instruments are classified as high-tech sectors (Annex A lists industries by technology group). We calculate value added figures for each country by summing up the value added of the industries in each technology group. Information on economy-wide and MVA at constant prices is derived from the United Nation's National Accounts Main Aggregates Database. Finally, we construct manufacturing deflators using data from the United Nation's National Accounts database to transform manufacturing figures from UNIDO's database from current into constant prices. The growth rates of GDP, MVA, high-tech manufacturing industries and low-/medium-tech manufacturing industries are calculated on the basis of a compound annual growth rate (CAGR) formula under a continuous compounding assumption.

Based on our panel dataset,

Figure 1 Manufacturing and high-tech manufacturing shares

illustrates the trend in manufacturing share in total value added (VA) and in high-tech industries in manufacturing VA across income groups since the 1970s. Table 1 presents the share of high-tech in total VA.

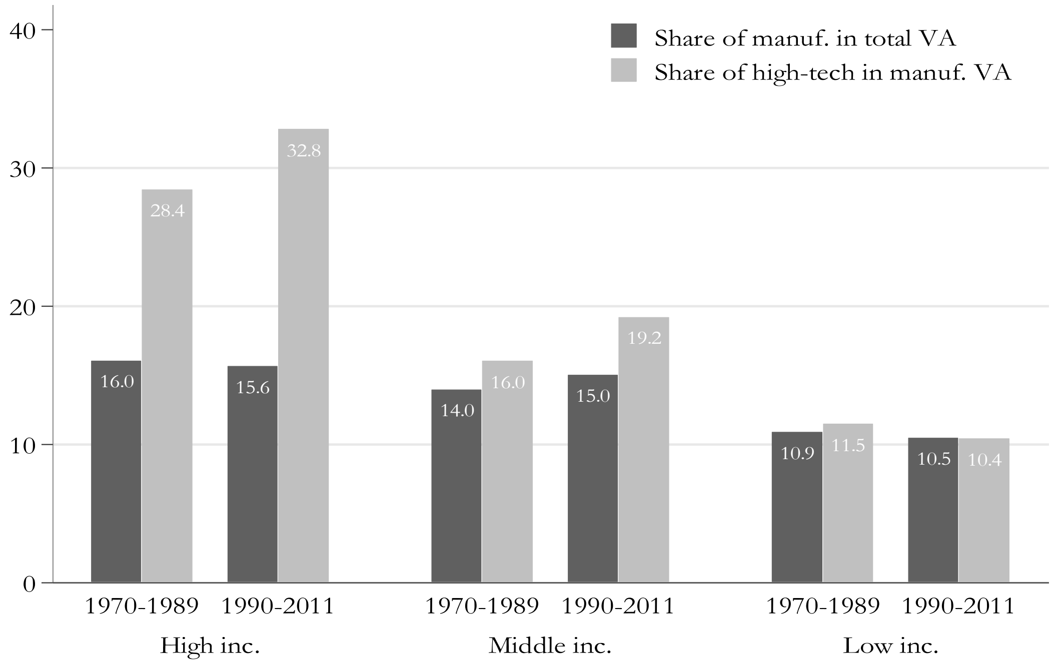
Table 1 High-tech share in total VA (percentage)

Income group	1970 - 1989	1990-2011
High income	5.02	7.73
Middle income	2.10	5.58
Low income	0.53	0.70

Source: Authors' calculations.

Although manufacturing specialization remained relatively stable among the economies studied, structural change towards high-tech industries among the high- and middle-income economies is evident (Figure 1). The share of high-tech industries in MVA increased by 4.4 per cent and 3.2 per cent among high- and middle-income economies, respectively. This trend only reinforces a specialization pattern already observed in the 1970s, whereby countries with a higher income are characterized by a larger specialization towards high-tech industries (Table 1). As such, high-tech industries accounted for nearly one-third of MVA in high-income countries, one-fifth in middle-income economies, and only one-tenth in low-income economies over the last two decades.

Figure 1Manufacturing and high-tech manufacturing shares



Source: authors' calculations.

Note: Country shares are aggregated over time and income group using simple averages.

3. Methodology

We use Eq. 1 as our baseline model, in which GDP growth *gr(VA)* in country *i* at time *t* is explained by MVA growth *gr(MVA)*. All models include a set of annual dummies (δ_t) to control for common shocks across countries, such as the global financial crisis of 2008, that might impact both MVA and production. We add the growth of value added of technology-intensive industries *gr(MVAHT)* in Eq. 2 of the model. The underlying idea behind Eq. 2 is that by keeping the growth rate of the manufacturing sector's value added constant, countries with a higher value added growth rate in high-tech industries grow more in terms of GDP. This equation is particularly relevant, as it relates to the main argument of our paper: the growth of countries depends on the extent of the countries' industrialization as argued in the traditional Kaldor literature, but also on how they industrialize. The implication of this hypothesis is that the expansion of high-tech sectors provides a growth premium. The model is supplemented by the dummy variable $LMI1991$, tagging observations for low- and middle-income countries in 1991. The idea is to focus attention on that group of countries that is most interesting for the development debate in a more recent time period. Eq. 3 is identical to Eq. 2, with the exception that low-/ medium-tech industries rather than high-tech industries are analysed. The aim is to test whether the growth of low-/ medium-tech industries *gr(MVALMT)* also entails a growth premium. A separate equation is necessary to avoid collinearity among the growth rate of manufacturing *gr(MVA)*, the growth rate of high-tech industries *gr(MVAHT)* and that of low-/ medium-tech industries *gr(MVALMT)*. As in Holland et al. (2012), the lagged value of *gr(VA)* is included on the right hand side to capture persistence dynamics in growth in all equations.

Eq.1 $\mathrm{gr}(VA_{it}) = \beta_0 + +\beta_1 gr(VA)_{it-1} + \beta_2 gr(MVA)_{it} + \delta_t + \mu_{it}$

Eq. 2

$$\mathrm{gr}(VA_{it}) = \beta_0 + \beta_1 gr(VA)_{it-1} + \beta_2 gr(MVA)_{it} + \beta_3\, gr(MVAHT)_{it} + \beta_4 LMI1991 + \beta_5 LMI1991 gr(MVAHT) + \delta_t + \mu_{it}$$

Eq. 3

$$\mathrm{gr}(VA_{it}) = \beta_0 + \beta_1 gr(VA)_{it-1} + \beta_2 gr(MVA)_{it} + \beta_3\, gr(MVALMT)_{it} + \beta_4 LMI1991 + \beta_5 LMI1991 gr(MVALMT) + \delta_t + \mu_{it}$$

The core of our analysis lies in the significance and magnitude of the variables *gr(MVALMT)* and *gr(MVAHT)*. Non-significance of both variables would suggest that the traditional Kaldor claim that the growth rate of GDP is affected by the growth rate of manufacturing is valid, which does not need to be supplemented by variables representing the modalities by which countries specialize. A significance of both coefficients would to some extent be inconclusive as it would signal that specialization in either high-tech or in low-/ medium-tech industries delivers a growth premium, but uncertainty would remain as regards the conclusion which of the two categories is more effective in propelling growth. The significance of only one of the two coefficients *gr(MVALMT)* or *gr(MVAHT)* would indicate that specialization in industries with different technological intensities have an impact on economic growth. In particular, the significance of *gr(MVAHT)* would be a further validation of the hypothesis proposed in the literature that high-tech industries are effective in boosting growth through spillovers and economies of scale. The significance of *gr(MVALMT)* would question this claim and highlight the role of low-/ medium-tech industries in generating linkages with other industries (e.g. mining, construction, agriculture) and with high-tech industries. Low-/ medium-tech industries would deliver a growth premium at early stages of development induced by low wages and an abundant workforce, and as key partners of high-tech industries in generating innovation at later stages of development. The significance of the variables *LMI1991gr(MVAHT)* and

LMI1991gr(MVALMT) would suggest similar interpretations, with a focus on a more restricted set of countries of interest (namely low-/ middle-income countries) and a restricted timeframe.

Using the Ordinary Least Squares (OLS) estimation technique to test Eq. 1 would lead to a bias in the coefficients of interest due to endogeneity. In particular, in our specification, endogeneity can arise from simultaneity, reverse causality and from omission of relevant variables that, in turn, might be correlated with the included regressors. First, a country's output might reflect not only its production capacity, but also demand for the country's products.[1] In this context, a country's output can be thought of as being the determinant rather than the result of manufacturing production. Second, the level of specialization in production increases over time and with it, the interlinkages between industries through outsourcing and the use of intermediate products. However, we explicitly omit the value added of other industries of the economy such as services and the mining industry which might be crucial to the production chain of manufacturing products and therefore correlated with the manufacturing variable.

Table 2 Interpretation of the coefficients of Eq. 2 and Eq. 3

	gr(MVALMT) Significant	*gr(MVALMT)* Non-Significant
gr(MVAHT) Significant	Both high-tech and medium-/high-tech industries deliver a growth premium. Inconclusive on whether high-tech industries are more growth enhancing than low-/ medium-tech industries	High-tech industries are more effective than low-/ medium-tech industries in delivering a growth premium through economies of scale and spillovers
gr(MVAHT) Non-significant	Medium- and low-tech industries are more effective than high-tech industries in delivering a growth premium as they require less sophisticated capabilities and as they have stronger links with the rest of the economy.	Technological intensity/ specialization do not matter for growth, only the growth rate of manufacturing do as argued in the traditional Kaldorian hypothesis

While the Instrumental Variable (IV) and the Two Stage Least Squares (2SLS) estimating techniques are customarily used to deal with endogeneity, it might be difficult to identify suitable external instruments in our specification that feed into these models. This is because a

[1] This might be particularly true for countries with unemployment and spare capacity.

valid instrument must be relevant for explaining MVA and not directly determine a country's value added. However, due to simultaneity, the determinants of MVA must also act as determinants of a country's value added. In addition, any supply or demand side determinant affecting manufacturing production might, albeit to different degrees, also affect other sectors of the economy.

Against this backdrop, the Generalized Method of Moments (GMM) estimator offers an appealing alternative. The GMM estimators form part of a broader trend in econometric methods towards fewer assumptions about the underlying data process. Specifically, by using a set of internal instruments, the GMM estimator allows researchers to relax some of the assumptions of OLS such as strict exogeneity and non-autocorrelation. This makes the GMM estimator suitable for estimating models with endogenous variables that might be correlated with past and current error terms, unobservable country characteristics (country fixed effects), heteroskedasticity and autocorrelation of error terms within countries (Roodman, 2009).

All of our model specifications include a lagged dependant variable (GDP growth rate) as a regressor. GMM is also suitable for models in which the lagged dependant variable is not used as a regressor. Blundell et al. assert that "However, if we are unwilling to assume that Qir [independent variable in the equation] is strictly exogenous…or wish to entertain the possibility of more general dynamic models including the lagged dependent variable, then both the within groups estimator and the GLS estimator are inconsistent" (Blundell et al., 1992:242).

In our analysis, we use the System GMM estimator as proposed by (Arellano & Bover, 1995) and (Blundell & Bond, 1998). The System GMM estimator constructs a system of equations in which endogenous variables in levels are instrumented by their past first-differences, while endogenous variables in first-differences are instrumented by their past values in levels. Applied to our model specification, we instrument the MVA growth rate (*gr(MVA)*) in differences by its value in levels as well as the MVA growth rate in levels by its first-difference.[2] The same instrumenting technique is applied to the other endogenous regressors (*gr(MVALMT), gr(MVAHT),* the lagged value of gr(VA), *LMI1991gr(MVAHT)* and *LMI1991gr(MVALMT)).* Results obtained by a standard fixed effects (FE) panel technique also serve as a benchmark. The FE model specification does not contain the variable *LMI1991* as it is time invariant. Roodman (2009) points out that fixed effects models are biased when they contain a lagged dependant variable as a regressor, but the results of the FE model remain useful for comparison purposes.

[2] Estimations are carried out in Stata using xtabond2 command developed by (Roodman, 2009).

As a final robustness test, we analyse Eq. 1), 2) and 3) with a different procedure to “clean” the dataset. INDSTAT contains combinations of data. Some countries are not able to report data belonging to a specific ISIC (from 15 to 37) for specific manufacturing industries. They provide data for combined industries (e.g. combination 15A refers to data for ISIC 15 and 16) which cannot be easily associated with a specific technology category. With this final robustness test, we eliminate problematic combinations containing industries belonging to different technology categories (high-tech, medium-tech, low-tech).

4. Results

The results are presented in Tables 3 and 4. The GMM estimator is only suitable for panels with a low number of years and a large number of countries. The reason for this is that as the number of years increases, so does the number of internal instruments generated. Thus, using long time series might make the number of instruments in the model soar. As a rule of thumb, the number of instruments must be lower than the number of countries. Since we have a long time series ranging from 1970 to 2011, we only keep the data for every 5 years in our sample to reduce the time dimension to nine periods. The results of Table 3 column a) and b) reflect the empirical validity of Kaldor’s first law hypothesis. The coefficient associated with *Gr(MVA)* is positive and significant, and, in line with Cantore et al. (2014), is larger when estimated with GMM rather than with panel fixed effects. The coefficient associated with the lagged GDP growth rate is insignificant. This signals the absence of persistence in the evolution of the GDP growth rate.

Estimates of Eq. 2) and 3) incorporate the analysis of our core variables related to high-tech and low-/ medium-tech industries. In columns c) and d), the variable representing the growth rate of high-tech manufacturing industry *gr(MVAHT)* is positive and significant. The robustness of the coefficient is clearer when using the GMM technique than the fixed effects model, but this can be attributable to the biasness of the fixed effects results. The coefficient associated with high-tech industries *gr(MVAHT)* is about 25 times smaller than the coefficient associated with manufacturing *gr(MVA)*. This would suggest that industrialization, regardless of specialization type, remains the privileged engine of growth, and that the growth of high-tech industries delivers a significant but minor additional “growth premium”. Unsurprisingly the dummy variable representing low- and middle-income countries after 1991 *LMI1991* has a positive sign, which means that countries at lower stages of development are characterized by a higher growth rate. However, the coefficient is not significant and suggests a wide heterogeneity of the growth rate performance of countries at lower income levels. The interaction variable representing the growth rate of medium- and high-tech sectors for low- and middle-income countries after 1991 *LMI1991gr*(*MVAMHT)* has a negative sign, but is also non-significant at a 10 per cent significance level. Using a GMM estimate, the lagged dependant variable is again significant and shows a relevant, albeit small, persistent growth rate performance

The results of Eq. 3 (columns e) and f)) produce different conclusions. The coefficient associated with the growth rate of manufacturing *gr(MVA)* is significant and positive with a magnitude comparable to that estimated using the other model specifications (a) – d)). For these model specifications, excluding the lagged dependant variable, all other variables are not significant. The variables *gr(MVALMT)*, *LMI1991gr(MVALMT)* and *LMI1991*, in particular, are not significant. The growth of low- and medium-tech industries does not deliver a GDP "growth premium".

When combining all these results, they clearly suggest that manufacturing remains a key driver of growth, and that specialization only matters when countries industrialize towards high-tech industries. Specialization towards medium- and high-tech industries matters to the extent that it contributes to industrializing the country.

Our findings are robust to several tests proposed in the relevant literature (Roodman (2009)):

1) In all the GMM estimates b), d) and f), the Hansen test for identifying restrictions is overwhelmingly over the 0.1 per cent level which excludes endogeneity;
2) In all the GMM estimates b), d) and f), evidence suggests a lack of autocorrelation (values higher than 0.1);
3) In all the GMM estimates b), d) and f), the number of instruments is lower than the number of countries, which is a "rule of thumb" suggested by Roodman (2009) to avoid biases from overfitting;
4) In all the GMM specifications b), d) and f) the lagged pendant variable (L.(VA)) is lower than unity, which is another rule of thumb suggested by Roodman to evaluate GMM goodness of fit.
5) Fixed effects results, if considered as comparators, do not differ significantly in qualitative terms from the GMM results.
6) The results contained in Table 4, which were obtained using a different data cleaning technique, do not differ in qualitative terms from those contained in Table 3. Even though the values (not surprisingly) change, the significance and sign of the core coefficients concerning the growth of the groups of industries with different

technological intensity (high-tech and low-/ medium-tech) in the GMM estimates remain almost equivalent.

Table 3 System GMM - explaining countries' VA growth

	Eq. 1 (fixed effects) a)	Eq. 1 (System GMM) b)	Eq. 2 (fixed effects) c)	Eq. 2 (System GMM) d)	Eq. 3 (fixed effects) e)	Eq. 3 (System GMM) f)
L.Gr(VA)	0.000	0.063	0.009	0.092**	0.010	.074**
	[0.044]	[0.042]	[.039]	[0.040]	[0.038]	[0.034]
Gr(MVA)	0.478***	0.486***	0.470***	0.475***	0.475***	0.483***
	[0.038]	[.044]	[0.038]	[0.043]	[0.048]	[0.052]
Gr(MVAHT)			0.016*	0.025***		
			[0.008]	[0.007]		
Gr(MVALMT)					0.003	-0.000
					[0.033]	[0.032]
LMI1991MVAHT			-0.003	-0.008		
			[0.015]	[0.013]		
LMI1991MVALMT					0.017	-0.020
					[0.040]	**[0.042]**
LMI1991				0.318		0.227
				[0.280]		[0.327]
Constant	1.702***	1.778***	1.622***	1.509***	1.647***	1.615***
	[0.438]	[0.289]	[0.462]	[0.350]	[0.455]	[0.369]
Observations	611	611	611	611	611	611
Number of Countries	136	136	136	136	136	136
First year	1971	1971	1971	1971	1971	1971
Last year	2011	2011	2011	2011	2011	2011
Year FE	YES	YES	YES	YES	YES	YES
R^2	0.49		0.50		0.50	
N° of inst.		68		113		113
p val. Hansen for overid.		0.291		0.364		0.290
p val. of AR(2)		0.360		0.330		0.384

*** p<0.01, ** p<0.05, * p<0.1, # p<0.15. Robust standard errors in brackets, errors are consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels and corrected by Windmeijer's finite sample correction for the two-step covariance matrix. Estimations are carried out using the Stata command xtabond2 developed by (Roodman, 2009).

Table 4 System GMM - explaining countries' VA growth. Robustness test with a different dataset cleaning technique

	Eq. 1 (fixed effects) a)	Eq. 1 (System GMM) b)	Eq. 2 (fixed effects) c)	Eq. 2 (System GMM) d)	Eq. 3 (fixed effects) e)	Eq. 3 (System GMM) f)
L.Gr(VA)	-0.000	0.083*	0.005	0.126**	0.007	0.090**
	[0.040]	[0.042]	[0.038]	[0.060]	[0.036]	[0.039]
Gr(MVA)	0.426***	0.447***	0.464***	0.463***	0.407***	0.411***
	[0.062]	[0.059]	[0.038]	[0.044]	[0.071]	[0.071]
Gr(MVAHT)			0.031	0.048**		
			[0.023]	[0.025]		
Gr(MVALMT)					0.028	
					[0.038]	
LMI1991MVAHT			-0.015	-0.027		
			[0.015]	[0.017]		
LMI1991MVALMT					-0.015	0.037
					[0.051]	[0.039]
LMI1991				0.453		0.357
				[0.302]		[0.371]
Constant	1.936***	1.762***	1.447***	1.252***	1.848***	1.378***
	[0.484]	[0.275]	[0.290]	[0.297]	[0.485]	[0.387]
Observations	629	629	590	590	628	628
Number of Countries	136	136	133	133	136	136
First year	1971	1971	1971	1971	1971	1971
Last year	2011	2011	2011	2011	2011	2011
Year FE	YES	YES	YES	YES	YES	YES
R^2	0.45		0.46		0.57	
N° of inst.		68		113		113
p val. Hansen for overid.		0.200		0.475		0.220
p val. of AR(2)		0.299		0.370		0.349

*** p<0.01, ** p<0.05, * p<0.1, # p<0.15. Robust standard errors in brackets, errors are consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels and corrected by Windmeijer's finite sample correction for the two-step covariance matrix. Estimations are carried out using the Stata command xtabond2 developed by (Roodman, 2009).

5. Concluding remarks

This study investigated not only the role of manufacturing in economic growth but also whether technology-intensive manufacturing industries have a more extensive impact on total output compared to low-tech manufacturing industries. Using a panel of up to 146 countries between 1970 and 2011, and applying the System-GMM estimator to deal with endogeneity, we found that manufacturing and high-tech manufacturing do indeed play an important role in national economies. Specifically, the rate of growth of high-tech industries is key for fostering growth through backward and forward linkages.

This paper generally confirms Kaldor’s first law assuming a positive and significant relationship between the growth rates of manufacturing and of GDP. This finding is confirmed in all model specifications with a strong robustness of statistical significance. As regards the role of manufacturing specialization, the most important finding is that specialization in high-tech industries provides an important growth premium. This result is in line with recent Kaldor literature, which reveals that the modalities by which countries’ industrialization also matter for economic growth. In contrast, the coefficients for low and medium manufacturing activities are not significant.

The literature on the impact of manufacturing specialization on growth is often polarized around two main views: on the one hand, high-tech industry is considered an important engine of growth due to the related technological spillovers and economies of scale. On the other hand, however, low- and medium-tech industries are seen as the core of industrialization on account of their characteristics to generate linkages with other sectors of the economy and because they are more aligned with the endowments of low- and middle-income countries in particular.

Another finding that emerges from this paper is that both low-/ medium-tech and high-tech industries contribute to growth through the traditional Kaldorian channel, namely industrialization. High-tech industries deliver a growth premium because of their power to spread technological capabilities, but their impact, when compared with the overall effect of industrialization, is lower, albeit significant and statistically robust. In terms of the development debate, it is quite interesting that we do not find evidence that our results qualitatively change when we specifically focus on low-/ middle-income countries in a more recent timeframe.

A next step in research could be the testing of the same results with other relevant sectorial categories such as high/ low capital intensive industries, high/ low energy intensive industries, etc. to analyse which categories of industries, together with high-tech manufacturing industries are best placed to deliver long-term growth.

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Annex

Table 5 Classification by level of technology

Code	Two-digit ISIC rev 3.	Technology intensity
20	Wood products (excl. furniture)	Low
19	Leather, leather products and footwear	Low
18	Wearing apparel, fur	Low
22	Printing and publishing	Low
36	Furniture; manufacturing n.e.c.	Low
16	Tobacco products	Low
15	Food and beverages	Low
17	Textiles	Low
21	Paper and paper products	Low
28	Fabricated metal products	Medium
27	Basic metals	Medium
25	Rubber and plastics products	Medium
26	Non-metallic mineral products	Medium
23	Coke, refined petroleum products, nuclear fuel	Medium
30	Office, accounting and computing machinery	High
31	Electrical machinery and apparatus	High
35	Other transport equipment	High
24	Chemicals and chemical products	High
32	Radio, television and communication equipment	High
29	Machinery and equipment n.e.c.	High
34	Motor vehicles, trailers, semi-trailers	High
33	Medical, precision and optical instruments	High
37	Recycling	No data

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