Working Paper Series

#2015-048

Structural change and the ability to sustain growth

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UNIDO/UNU-MERIT background papers for the UNIDO, Industrial Development Report 2016: IDR 2016 WP 11

This working paper is part of a collaborative research effort of UNIDO and UNU-MERIT. It has been commissioned as a background paper for the UNIDO Industrial Development Report 2016.

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UNU-MERIT Working Papers

ISSN 1871-9872

Maastricht Economic and social Research Institute on Innovation and Technology, UNU-MERIT

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Structural Change and the Ability to Sustain Growth

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Background paper prepared for the 2016 Industrial Development Report[1]

26th November 2015

Abstract

This paper examines the relationships between structural characteristics and the ability to sustain growth. The analysis is based on a novel dataset of sectoral shares in GDP and growth rates for 108 countries from 1960 to 2010. Rather than focusing exclusively on average growth rates, the paper examines the characteristics of positive growth episodes. Dependent variables include the duration of positive growth episodes and the risk that such growth episodes come to an end. Structural characteristics include the degree of sectoral specialisation, the share of manufacturing and the share of the modern sector in GDP. We find that higher shares of manufacturing, high and increasing shares of the modern sector and a more diversified structure of production contribute to longer duration of growth episodes and reduced volatility of growth patterns. The effects of these same variables on average growth rates are much more ambiguous.

JEL codes: O4, O14, 047, L16

Key words: duration of growth, volatility, specialisation, diversification, structure, structural change, structural transformation

[1] We gratefully acknowledge financial support from UNIDO. Earlier versions of this paper were presented at two expert group meetings at UNIDO headquarters in Vienna on 4-5 February 2015 and 13-14 April 2015. We thank Bart Verspagen, Nicola Cantore and other participants of the expert group meetings for valuable comments, suggestions and criticisms.

1 Introduction

This paper analyses relationships between structural change and the ability of economies to sustain economic growth over longer periods of time. It was written as a background paper for the UNIDO 2016 Industrial Development Report (IDR) on *Sustainable and Inclusive Industrial Development*. The central question addressed in the IDR is under what conditions technological change can trigger virtuous processes of structural change in developing countries and emerging economies resulting in sustainable and inclusive patterns of economic growth. The report distinguishes three dimensions of sustainability: (1) The ability of countries to sustain uninterrupted economic growth over longer periods of time; (2) The inclusiveness of the process of economic development and the extent to which broad segments of the population participate in the fruits of economic development; and (3) The environmental sustainability of economic development. This paper focuses on the first dimension of sustainability and specifically asks what types of economic structure and what patterns of structural change contribute to developing countries' and emerging economies' ability to sustain growth over longer periods of time.

To answer this question we consider different dimensions of economic performance. In particular, we consider the relationship between economic structure and: (i) average growth rates of GDP per capita; (ii) the volatility of per capita GDP growth; (iii) the duration of positive growth episodes; and (iv) growth rates within growth episodes. One of the distinguishing characteristics of the paper is that it not only focuses on average growth rates, but also analyses the duration of positive growth episodes and how this relates to the structure of the economy. In line with the recent literature on growth episodes, we argue that much can be learned from analysing the characteristics and determinants of growth episodes (see Pritchett, 1998 and section 2). In this paper we zoom in on the duration of positive growth episodes.

One main argument put forward in this paper is that in low- and middle income countries, diversification of the structure of economic activities is important for the ability to sustain growth over longer periods of time and thus achieve sustained growth and catch up. To capture this relationship, we relate the indicators of economic performance mentioned above to a wide range of variables measuring different structural characteristics of economies. These include measures of the share of manufacturing (and other modern sectors) in GDP and indicators of the degree of specialisation and diversification. We consider both the levels (structure) and changes over time (structural change) in these variables.

The theoretical rationale for considering indicators of specialisation relates to portfolio type arguments. A country with a more diversified production structure is expected to be less vulnerable to external shocks, fluctuations and growth interruptions. Also, a more diversified structure may create more opportunities for linkage and spillover effects, such that productivity and technological change in one sector may have positive effects on developments in other sectors. Thus, one can hypothesise that a country with a very strong concentration of activities in a single sector (e.g. agriculture, mining or tourism) will be less able to sustain growth over longer periods of time than a country with a broader portfolio of activities. The counter argument is that specialisation according to comparative advantage might provide more growth benefits. For countries at lower levels of per capita income, the findings of this paper show that a more diversified economic structure makes it easier to sustain growth. Dynamically, diversification also contributes to the sustainability of growth.

In the context of structural change, special attention is paid to industrialisation and the role of the manufacturing sector. Does sustainability of growth depend on a large and/or increasing share of manufacturing in GDP (i.e. industrialisation)? One of the well-known methods to approach this issue empirically is to include the share of manufacturing in GDP in growth regressions (see Szirmai and Verspagen, 2015). We also examine the effects of newer measures such the share of the so-called 'modern sector' in total employment (Lavopa, 2015, Lavopa and Szirmai, 2014). The modern sector includes the sectors with the greatest potential for productivity increases. Besides manufacturing, these include mining, utilities, construction, transport, storage and communication and finance, insurance and business services. Finally, we also examine the impact of the share of manufacturing in value added within the modern sector.

The paper provides indications that, other things equal, a larger share of manufacturing in the economy – i.e. greater industrialisation – contributes to a longer duration of positive growth episodes. In contrast, the share of the modern sector as a whole does not have significant effects on duration, though the share of manufacturing within the modern sector has a substantial and significant impact on the ability to sustain growth. These latter effects are even more marked than those of manufacturing shares in the total economy.

In our analysis we account for the possibility of non-linear effects related to a country's level of development. At lower levels of GDP per capita, growth generally tends to be more erratic and vulnerable to interruptions, especially if the production structure is highly undiversified and the manufacturing sector is underdeveloped. Some countries achieve structural transformations, which go hand in hand with in longer and more stable growth experiences. Advanced economies tend to have fewer interruptions in their growth process and longer lasting growth episodes. But at high levels of per capita income, further diversification may no longer be so important. We therefore account for the potentially differing impacts of specialisation and structure on performance at different levels of development in our analysis.

The empirical analysis is primarily based on a newly created database of sectoral shares in value added for the period 1960-2010, which includes data for 108 developing and advanced economies. This dataset is used to construct the indicators of economic structure and specialisation, which are combined with data on economic growth from the Maddison Project database to address our questions of interest.

The paper is structured as follows. Section 2 discusses the relevant literature. Section 3 describes the econometric methodology adopted; Section 4 describes the data used and reports initial summary statistics; Section 5 presents the results; and Section 6 concludes.

2 Theoretical considerations

2.1 The ability to sustain growth: growth episodes and duration

Growth is often not steady. It is characterised by switching among growth regimes (Pritchett, 1998, 2000; Berg *et al.,* 2012; Bluhm *et al.,* 2013; Kar *et al.* 2013). Pritchett (1998) has argued that attempting to explain differences in average growth rates may be misleading. It is more promising to find out what initiates or halts episodes of growth, or what influences the characteristics of growth episodes (Aizenman and Spiegel, 2010; Rodrik, 2003; Rodrik *et al.* 2004; Hausmann *et al.*, 2006; Jerzmanowski, 2006; Kar *et al.*, 2013). The various growth episodes (slumps, recoveries, growth episodes, accelerations, plateaus) are the building blocks of the long-run growth process.

Different authors have examined the characteristics of different kinds of episodes. For instance, Hausmann *et al.* (2005, 2008) focus on growth accelerations. They find that growth accelerations are fairly easy to realise, also in low-income economies. Unleashing a growth acceleration does not always require a comprehensive set of economic reforms. Even limited reforms, removing the most binding constraints to growth, can result in accelerations. What is more difficult and demanding, however, is to sustain the growth process beyond the initial acceleration (Rodrik, 2003, 2006). Other authors focus on the duration of economic crises. An example of this literature is Bluhm *et al.* (2014), which shows that key factors influencing the duration of economic crises are the lack of constraints on the executive and high degrees of ethnic fractionalisation.

Short term fluctuations, extreme volatility, abrupt shocks – whether internal or external, political or economic, natural or man-made – all have the potential to hinder economic growth in the long term (Loayza *et al.*, 2007; Ramey and Ramey, 1995). But countries differ greatly in how they respond to shocks. An important strand of the new institutionalist literature argues that developing countries are more vulnerable to interruptions of growth, in part due to their institutional characteristics, and that it is this very vulnerability that determines long-run differences in growth performance (Acemoglu *et al.*, 2001, 2003, Acemoglu and Robinson, 2012; Agénor *et al.*, 1999; Besley and Persson, 2011, Bluhm and Szirmai, 2013; North *et al.,* 2009).

Thus, understanding the sources of the ability to sustain growth over longer uninterrupted periods is of great importance (Berg *et al.*, 2012). Different authors have focused on different types of growth episodes: growth accelerations, slumps and crises, recoveries. In previous work we have examined the determinants of the onset and duration of slumps (Bluhm *et al.*, 2013, forthcoming). In the present paper we focus on the duration of positive growth episodes (for a definition see section 4). We will show that breaking down average growth rates into growth episodes is not tautological and can provide new insights into the growth process.

In the literature there are two alternative approaches to identifying growth regimes and the trend breaks between the regimes. The first approach used to classify growth episodes is through defining a set of economic criteria (Aizenman and Spiegel, 2010; Calvo *et al.*, 2006; Hausmann *et al.*, 2005, 2008; Reddy and Minoiu, 2009). A second alternative is to use econometric and statistical methods to identify such breaks (Bai and Perron, 1998, 2006; Berg *et al.*, 2012; Bluhm, *et al.*, 2014; Jones and Olken, 2008; Papell and Prodan, 2012). In this paper, we apply very simple economic criteria to identify positive growth episodes (see further section 4).

One of the most glaring omissions of the institutionalist literature, is the neglect of factors such as structural change, technology and innovation which are so prominent in other strands of development economics. Since Lewis (1954), Kuznets (1966) and Fei and Ranis (1964, 1976), structural change and industrialisation are seen as the *conditio sine qua non* for economic development. Structural change is entwined with innovation and technological change because some sectors are seen as the key locations where technological change takes place, while others are not. Technology diffuses from key sectors to the rest of the economy (Cornwall, 1977; Kaldor, 1967). Technological innovations are also drivers of structural change, giving rise to the emergence of new methods of production and new sectors. As mentioned above, much work on growth episodes tends to focus on the institutional and political economy determinants of growth episodes and tends to disregard variables measuring structure or structural change that are much more prominent in studies dealing with average growth rates (for an overview see Szirmai and Verspagen, 2015). A second defining characteristic of this paper, therefore, is that we zoom in on the relationship between structural characteristics of an economy and the duration of positive growth episodes. However we will also examine more standard measures of growth performance such as average growth rates and the volatility of growth rates.[2]

2.2 Structural diversification and growth

Two aspects of structural change will be singled out for attention in this paper, namely specialisation/diversification and industrialisation/deindustrialisation.

A recent UNIDO report, entitled *Diversification vs. Specialization as Alternative Strategies for Economic Development,* summarises the theoretical debates concerning specialisation and diversification (Kaulich, 2012). On the one hand, trade theories of comparative advantage argue that successful economic development is associated with specialisation in a narrow range of activities. On the other hand, many theories argue that economic development involves a process of diversification of sectors, activities and exports. Too much specialisation results in vulnerability to shocks (Osakwe, 2007) and changes in the terms of trade. One needs a broad portfolio of activities.

In a seminal contribution, Imbs and Wacziarg (2003) take an intermediate position. They propose a non-linear U-shaped relationship between GDP per capita and sectoral specialisation. For low-income countries there is a positive relationship between diversification and levels of GDP per capita. The underlying assumption is that developing countries that succeed in diversifying the structure of their production or the structure of their export package will grow more rapidly, because diversification makes them more resilient to external shocks. However, beyond some threshold level of GDP per capita, the opposite relationship comes to dominate. As GDP per capita continues to increase, this is associated with increasing concentration and specialisation, both in the total economy and within manufacturing. The turning point at which specialisation sets in is quite high (16,500 PPP dollars of 2000).

From the perspective of the low- and lower-middle-income economies, this implies that diversification away from agriculture and diversification within the manufacturing sector is associated with increases in GDP per capita. The implication for low-income countries, in particular, is that they can overcome their economic marginalisation through the acquisition of skills and knowledge necessary to diversify their economic portfolio rather than by focusing on "what they do best", while high-income countries seem to only benefit from specialisation (Kaulich, 2012, p. vi). According to Subramanian (2007) diversification is intrinsic to

[2] In future work, we would like to include both institutional and structural variables in the analysis.

development. Diversification is also linked to sophistication. It is the ability to competitively produce a wider range of increasingly sophisticated goods, which drives the process of diversification. Low-income economies are typically specialised in a limited range of products. As their per capita income increases, the economy becomes more diversified and the range of products broadens. At higher levels of income, specialisation again comes to predominate.

In a careful empirical analysis of both export and sector structure data, the author of the UNIDO report examines the inverted U-curve relationship and finds support for the notion that at lower levels of GDP per capita, there is a positive relationship between the degree of diversification and the level of per capita income. With regard to specialisation at higher levels, the findings are mixed, but that is of less relevance to the present report which focuses on low- and middle-income countries. However, the report warns that evidence is not conclusive. In particular, the findings are still driven by large time-invariant differences in degrees of specialisation in cross-country datasets.

In this paper we will examine the effects of specialisation/diversification on growth performance at different levels of economic development. As our database on economic structure refers to value added, we focus on specialisation/diversification of the structure of the economy rather than the structure of exports. Note however, that the inverted U-shape relationship discussed above is about relationships between level variables: How are levels of development related to degrees of specialisation? Our analysis will focus on: (1) the relationship between degrees of specialisation and growth; and (2) the relationship between changes in specialisation and growth.

2.3 Which sectors act as the engines of growth?

What all structuralist theories have in common is that the structure of the economy is important for economic growth, because some sectors have more growth potential than others. This means that when an economy succeeds in increasing the share of sectors with high growth potential in a given period, this will enhance the growth of the economy, while if the share of sectors with low growth potential increases, this will reduce the growth of the economy. This opens the search for the structural shifts which are growth enhancing or reducing (e.g. McMillan and Rodrik, 2011; Timmer and Szirmai, 2000). In this context, there are debates on the respective roles of agriculture and industry, or the respective roles of industry and the service sector. Also, there is a search for specific sectors that can act as engines of growth such as ICT hardware, ICT software services, the automobile industry, capital goods sectors or high-tech sectors. Since 1950, one of the classic hypotheses in development economies is that the manufacturing sector has a key role to play as an engine of growth in low-income economies.

One should realise that the role of sectors may change over time and that different sectors may play key roles in different types of economies. One of the important stylised facts of economic development is that the share of manufacturing in value added and employment tends to increase when developing countries start growing at low levels of development. It peaks at intermediate levels of per capita income and subsequently declines as the service sector becomes more important at high levels of per capita income (Szirmai, 2012; Tregenna, 2013, 2015). The interpretation of the increase in the manufacturing share is that manufacturing plays a special role as engine of growth and catch up at lower levels of economic development. Even when its share starts to decline at higher levels, it remains important as a driver of growth, though perhaps less exclusively so.

The role of manufacturing as an engine of growth is due to the special characteristics of this sector (Kaldor, 1966, 1967; McMillan and Rodrick, 2011; Rowthorn, 1994; Szirmai 2012; Szirmai and Verspagen, 2011, 2015). These presumed characteristics include the following:

1. Productivity levels in manufacturing are higher than those in other sectors and productivity growth is more rapid. Therefore structural changes involving a shift of resources to manufacturing provide both static and dynamic productivity bonuses. The assumption is that the service sector as a whole has fewer productivity bonuses, due to Baumol's law operating in many subsectors of services, especially personal services.

2. Manufacturing provides special opportunities for accumulation of capital, spatial concentration, agglomeration economies and economies of scale.

3. Manufacturing goods are easily tradable so the sector can profit not only from domestic demand but also from global demand (Kaltenberg and Verspagen, 2015).

5. The manufacturing sector plays a special role as a driver of technological advance, the factor which is perhaps the most important in modern economic growth (Kaldor 1966; Cornwall, 1977). Actually, this argument involves a number of strands. Firstly, manufacturing and certain sectors within manufacturing are presumed to be more R&D intensive than other sectors (see Jacob and Sasso, 2015). Secondly, it is assumed that more innovation takes place in manufacturing than in other sectors. This is particularly the case for some subsectors of manufacturing. Thirdly, manufacturing provides special opportunities for technologically lagging countries to profit from global technology and knowledge flows. Finally, it is assumed that the spillovers and linkages for manufacturing are stronger than for other sectors (see Lavopa and Szirmai, 2012). The argument that the manufacturing sector plays a key role in technological advance for the total economy is perhaps the most important argument in favour of industrial policies favouring this sector.

A substantial part of the literature, as summarised in Szirmai (2012), Szirmai and Verspagen (2015), Lavopa (2015) and Tregenna (2015), provides a measure of support for the engine of growth hypothesis. But the hypothesis is also fiercely contested. Critics argue that several modern service sectors such as ICT services, financial services, or transport and logistics can and do play the role of engine of growth in a manner very similar to that of manufacturing in the past (Dasgupta and Sing, 2006; Eichengreen, 2009; Timmer and De Vries, 2009; Van Ark *et al.* 2003). The example of India is often mentioned as a case of service-led growth since the 1990s. In this paper we will empirically examine the relationship between (changes in the) the share of manufacturing and various indicators of growth performance to contribute to the debate of sectoral sources of growth.

One of the arguments of critics of the engine of growth hypothesis is that some modern service sectors such as software, financial services or logistics have many of the same characteristics of dynamic manufacturing sectors and can also act as engines of growth. Rather than focusing only on the distinction between manufacturing and services in the discussion of structural change, Lavopa (2015) and Lavopa and Szirmai (2014) have examined the role of the so-called modern sector. The modern sector includes the industrial sector (mining, manufacturing, utilities and construction) and dynamic services (transport, storage and communication and finance, insurance and business services). While Lavopa and Szirmai develop a new index of modernisation, based on the product of the share of the sector in employment and its relative productivity compared with the global frontier, the present paper only includes a variable measuring the share of the modern sector in GDP (as with the share of manufacturing).

3 Methodology

To examine the relationship between economic structure and both economic growth and growth volatility we estimate the following two regression equations using data on five year periods within the period 1960-2010:

$$\Delta \ln GDPPC_{it} = \alpha_i + \beta_1 \Delta \ln POP_{it} + \beta_2 RELUS_{it} + \beta_3 EXPGDP_{it} + \beta_4 GCF_{it} + \beta_5 KGATEMP_i + \delta Z_{it} + \varphi_t + \varepsilon_{it}$$

$$\sigma_{it} = \alpha_i + \beta_1 \Delta \ln POP_{it} + \beta_2 RELUS_{it} + \beta_3 EXPGDP_{it} + \beta_4 GCF_{it} + \delta Z_{it} + \varphi_t + \varepsilon_{it}$$

Where $\Delta \ln GDPPC$ is the average annual growth rate of per capita GDP within each five year period, σ captures growth volatility and is the standard deviation of the annual growth rate of per capita GDP within each five year period, $\Delta \ln POP$ is the average annual growth rate of population within each five year period, $RELUS$ is the log of the ratio of GDP per capita in country i to that in the USA in the first year of each five year period (i.e. $RELUS_{it} = \ln(GDPPC_{it}/GDPPC_{US,t})$), $EXPGDP$ is the average ratio of exports to GDP within each five year period, GCF is the average ratio of gross capital formation to GDP in each five year period, $KGATEMP$ is a dummy variable taking the value one if the country lies in a temperate climate zone, and Z is our main variable of interest (i.e. a measure of structure or specialisation). Also included in our analysis are country (α_i) and time (φ_t) fixed effects.

Given the panel nature of our dataset, we are able to account for unobserved country-specific effects through the use of either a random or fixed effects regression. As the Hausman specification test rejects random effects specification, we report results from fixed effects regression models.[3] One drawback of the fixed effects model is that it eliminates the between (i.e. cross-country) effects completely, with the within-groups estimator expressing the data in deviations from country means. Given that many of our variables, most notably the indicators of economic structure and specialisation, evolve slowly over time, we may expect that the between effects are relatively strong (c.f. Szirmai and Verspagen, 2015). For this reason we would like to account for these effects. To do this we further report results using the Hausman-Taylor estimator (Hausman and Taylor, 1981). This is essentially a random effects method that takes the dependency between the country effect and some of the dependent variables into account using instrumental variables for the affected explanatory variables (i.e., the "endogenous" variables). The method requires that at least one of the instruments is time-invariant. In our analysis we

[3] We also estimated the model using pooled regression, with results from a Chow test indicating that there are significant differences in the country specific fixed effect, thus supporting the fixed effects model.

have the variable on climate zone ($KGATEMP$) that is time-invariant. When estimating the Hausman-Taylor model however, we further include other variables capturing initial conditions, and in particular the 1960 values of logged population, of logged GDP per capita, and of years of schooling.

The Hausman-Taylor estimations also require us to determine which of the explanatory variables are endogenous, i.e., correlated with the country effect. To do this, we follow a procedure inspired by Baltagi *et al.* (2003) and also applied in Jacob and Osang (2007). In this procedure, we run a regression with our dependent variable, i.e. growth or volatility, and, one at a time, a single explanatory variable. Both a random effects and a fixed effects model is estimated, and a Hausman test is carried out to test whether the random effects estimation is appropriate. If it is, the variable is considered as exogenous (i.e., not correlated with the country effect). If the Hausman test indicates that the random effects estimation is not appropriate, we consider the variable as endogenous in the Hausman-Taylor estimations. In the case of the growth regression, $EXPGDP$, GCF and the changes in the structure and specialisation variables tend to be shown to be exogenous, while $RELUS$, $\Delta \ln POP$ and the initial levels of the structure and specialisation variables are generally considered endogenous. In the case of the volatility regression, only $RELUS$ is found to be endogenous according to this test. $KGATEMP$ and the initial values of population, per capita GDP and years of schooling are taken as the time-invariant exogenous variables.

Turning to the analysis of the duration of growth episodes we adopt two complementary approaches. Firstly, we estimate the following model that relates the probability of being in an episode to the structure of the economy and other control variables:

$$Episode_{it} = \alpha_i + \beta_1 \Delta \ln POP_{it} + \beta_2 \ln POP_{it} + \beta_3 RELUS_{it} + \beta_4 EXPGDP_{it} + \delta Z_{it} + \varphi_t + \varepsilon_{it}$$

Where $Episode$ is a dummy variable taking on the value one if country i is in a growth episode in year t and zero otherwise. In this case we use yearly data within the period 1960-2010, giving us again a panel dataset. Given the binary nature of the dependent variable we have a number of options to estimate this model, and we report results from a number of alternative estimators. Initially, we impose the restriction that all individual effects are identical and estimate the simple Linear Probit Model (LPM) and the pooled Probit model. In later specifications however we allow for unobserved country specific effects through the use of the random effects Probit model and the Mundlak-Chamberlain. As is well-known the non-linear nature of the Probit and Logit model make it difficult to account for country fixed effects in the Probit model, with the result being that there is no fixed effects Probit model. The Mundlak-Chamberlain model is something of a middle way between a random and a fixed effects model, and proceeds by modelling the fixed effects as a function of the explanatory variables. Essentially, the approach involves including individual means of the explanatory variables as additional controls in a random effects Probit model, which allow for a non-zero correlation between the explanatory variables and the individual fixed effects.

Secondly, we consider the relationship between the duration of an episode and economic structure using survival analysis. Initially this involves considering the Kaplan Meier estimator to estimate the survival function, before moving on to relate the duration of an episode to a set of explanatory variables using the Cox proportional hazards model. The survival function gives the probability of surviving past time t, and can be written as: $S(t) = \Pr(T > t)$, with T being the survival time. The cumulative distribution of T is expressed as $\mathrm{P(t)} = \Pr(T \leq t)$, implying that the survival function is the complement of the cumulative distribution function. Related to the survival function is the hazard function, which gives the instantaneous probability of failure (i.e. exit from a growth episode) at time t, conditional upon surviving to that date. This can be written as: $\lambda(t) = \frac{p(t)}{S(t)}$, with $p(t)$ being the probability density function.

The Kaplan-Meier method allows the computation of an estimated survival function in the presence of right censoring and can be written as:

$$\hat{S}(t) = \prod_{t(i) \leq t} \frac{n_i - d_i}{n_i}$$

With n being the number of survivors still at risk just prior to time t and d being the number of deaths at time t.

To relate the survival of a growth episode to explanatory variables we use the Cox Proportional Hazards model[4], which can be written as:

$$\lambda(t; \mathbf{x}) = \kappa(\mathbf{x})\lambda_0(t)$$

With $\kappa(\cdot) > 0$ being a positive function of $\mathbf{x}$ and $\lambda_0(t) > 0$ being the baseline hazard. The baseline hazard is common to all units in the population (i.e. we can think of it as being the hazard if all covariates were equal to zero), with individual hazard functions differing proportionately based on a function $\kappa(\mathbf{x})$ of observed covariates.

The term $\kappa(\cdot)$ is parameterised as $\kappa(\mathbf{x}) = \exp(\mathbf{x}\boldsymbol{\beta})$, such that:

$$\log \lambda(t; \mathbf{x}) = \mathbf{x}\boldsymbol{\beta} + \log \lambda_0(t)$$

With β_j measuring the semi-elasticity of the hazard with respect to x_j. An implication of this setup is that the effect of the covariates is the same at all points of time.

Note that the model is a proportional hazards model, which essentially implies that the ratio of the two hazards (i.e. that for individual i and the baseline) does **not** depend upon time. To see this, assume that we have a two sample problem, with x being a dummy variable taking the value one for group 1 and 0 for group 0. The model can then be written as:

$$\lambda(t; x) = \begin{cases} \lambda_0(t) \\ \lambda_0(t)\exp(\beta) \end{cases}$$

The term $\lambda_0(t)$ represents the risk in time t in group 0, while $\gamma = \exp(\beta)$ represents the ratio of risk in group 1 relative to group 0 at any time t. Note further that if $\gamma = 1$ ($\beta = 0$), then the

[4] In additional analysis we also use linear regression of survival time and parametric survival models. Results from these models are qualitatively similar to those from the proportional hazards model and are available upon request.

risks are the same in the two groups. One advantage of the Cox model over other survival models is that we don't have to make any assumptions about the baseline hazard, $\lambda_0(t)$.

As a final model we consider the relationship between average growth within a growth episode and our indicators of economic structure and specialisation. The model we estimate is:

$$\Delta \ln GDPPC_j = \alpha_i + \beta_1 \Delta \ln POP_j + \beta_2 RELUS_j + \beta_3 EXPGDP_j + \beta_4 GCF_j + \delta Z_j + \varepsilon_j$$

Where $\Delta \ln GDPPC_j$ is the average growth rate of per capita GDP within episode j. This model is estimated as a cross-section regression model, with one observation per episode. It should be remembered however that countries may appear more than once in the data, i.e. there will be as many observations per country as there are growth episodes for that country.

When including the measures of economic structure/specialisation we test a number of possibilities. We begin by including the initial value of structure/specialisation within each five-year period or at the start of each episode. We then examine whether it is the change, rather than the level, of economic structure/specialisation that is more relevant by including the change in structure/specialisation within each five-year period or within each growth episode. For completeness we further include both the level and the change together, along with their interaction. Finally, we allow for the possibility that the effect of structure/specialisation may depend upon the income level of the country (relative to the US). We therefore include an interaction between $RELUS$ and structure/specialisation to capture this, as well as splitting the sample into quartiles based upon $RELUS$ and estimating separate coefficients on structure/specialisation for each of the income quartiles.

4 Data, Variables and Descriptive Statistics

Data for our analysis come from a variety of sources. For the indicators of economic structure and specialisation we constructed our own database. This database includes data on 108 countries for the period 1950-2012. The dataset contains information about sectoral shares in value added at current prices. The sectoral breakdown is in terms of nine major sectors.[5] In our analysis we use data within the period 1960-2010. For the 1950s there were too many missing values, which made it impossible to include this earlier data.

For quite many countries there were no data for the earlier years because of boundary changes or because the country did not yet exist (e.g. Eritrea, Bangladesh, United Germany, former Soviet Republics, United Vietnam, the Czech and Slovak Republics, The former Yugoslav republics). The total number of observations for sector structure in the final unbalanced dataset was 1034.

The dataset was compiled from a variety of sources, namely: (1) the Groningen Growth and Development Centre, Ten-sector database (http://www.rug.nl/research/ggdc/data/10-sector-

[5] 1.Agriculture; 2. Mining; 3. Manufacturing; 4.Utilities; 5. Construction; 6. Trade, Restaurants and Hotels; 7. Transport, Storage and Communication; 8. Finance, Insurance, Real Estate and Business Services; 9. Government Services, Community, Social and Personal Services.

database). This database includes 42 countries, ten sectors, 1950-2010; (2) The Groningen Growth and Development Centre, World Input-Output Database (http://www.wiod.org/new_site/home.htm). This database includes 40 countries, 35 sectors for the period since 1995; and (3) *UN national accounts website*, Table 2.1 Value added by industries at current prices (ISIC Rev. 3), http://data.un.org/Data.aspx?d=SNA&f=group_code%3a201, downloaded February 2015. This source contains country data, with different degrees of breakdown going back to 1950. D. Hard copies of UN National Accounts Statistics: *UN Yearbook of National Accounts, 1967* has data for 1953, 1955, 1957-66; *UN, Yearbook of National Accounts, 1975* which has data for 67-74. This source usually provides a breakdown for 11 sectors. The published yearbooks provide data for more countries before 1975, than source (3).

Data on per capita GDP levels and growth rates are obtained from the Maddison database (http://www.ggdc.net/maddison/maddison-project/home.htm). Data on most of the control variables are from the World Bank's *World Development Indicators database*. Variables constructed from this database include population and population growth, the ratio of gross capital formation to GDP (*GFC*), and the ratio of exports to GDP (*EXGDP*). The variable capturing a country's climate zone (*KGATEMP*), which is the dummy for whether a country lies in the temperate climate zone, is taken from the dataset of Gallup *et al* (1999). Data on years of schooling (*SCH*) is taken from the Barro and Lee dataset (www.barrolee.com).

In terms of the dependent variables in our analysis, average per capita GDP growth is calculated as the difference in the log of per capita GDP and is averaged over each five-year period for the growth modelling, starting with the period 1960-64 and ending with the period 2005-2009. For volatility, we use the standard-deviation of the per capita growth rate across each five-year period.

The duration variable is the length of positive growth episodes. Positive growth episodes are defined in a simple fashion as follows. For each country, a year is considered to be part of a positive growth episode, if its GDP per capita is higher than that of the previous year for two successive years. If GDP per capita is lower than in the previous year, but the difference is less than one per cent and growth resumes in the subsequent year, that year is not treated as an interruption. Using this criterion, positive growth episodes can be distinguished which can be described in terms of simple two characteristics: the number of years of positive growth (duration) and the average rate of growth of GDP per capita within the episode. We have a dataset of in total 457 positive growth episodes.

In the empirical analysis of relationships between economic structure and economic growth, there are a wide range of measures of structural characteristics. The first important distinction that can be made is between measures focusing on the degree of *specialisation or diversification* of the economic structure as a whole and measures capturing the share of selected sectors - e.g. manufacturing - in GDP. The second important distinction is between measures focusing on sector shares in GDP (at either constant or current prices) and sectoral shares in employment. Unless indicated otherwise, we have opted for current price sectoral shares in GDP. The third distinction is between measures characterising the structure of the domestic economy and measures characterising the structure of exports. In this paper we use only indicators for the structure of the domestic economy. (For the use of export shares see Lavopa and Szirmai, 2015, forthcoming). The fourth distinction is that between static measures of structure at given points in time and changes in structural characteristics over time. Combining these four distinctions results in a wide range of measures that could be constructed, with the main constraint being the availability of consistent long run measures of economic structure for long periods of time and large numbers of countries. The measures used in our analysis are discussed below.

In our empirical analysis we focus on three measures of industrial structure that capture different dimensions of economic structure and a single measure of specialisation. The structure variables are the share of manufacturing in current value added ($MANSH$), the share of the modern sector in current value added ($MODSH$), defined as mining, manufacturing, utilities, construction, transport, storage and communication and finance, insurance and business services, and the share of manufacturing value added within the modern sector ($MANMODSH$). This variable derives from Lavopa (2015).

As a measure of specialisation, we use the normalised Theil index ($THEIL$).[6] The (normalised) Theil index is defined as follows:

$$Theil_{ijt} = \left[\frac{1}{N}\sum_{j=1}^{N}\left(\frac{s_{ijt}}{\bar{s}_{it}}\right)\ln\left(\frac{s_{ijt}}{\bar{s}_{it}}\right)\right] \Big/ \ln N$$

where i, j and t index country, sector and time respectively, N refers to the number of sectors, s_{ijt} is the share of industry j in country i in time t, and $\bar{s}_{it}$ is the average share of value added across all sectors for country i in time t, i.e. $\bar{s}_{it} = \frac{1}{n}\sum_{j=1}^{n} s_{ijt}$. Dividing by $\ln N$ ensures that Theil index lies between zero and one, with a larger value indicating more specialisation or a more unequal distribution. In our analysis the Theil index is constructed using data on value added shares for nine sectors.

Table 1 reports descriptive statistics for the data used in the five-year panel regressions with growth and volatility as the dependent variables. The table reports that the average growth rate across countries and five year time-periods was 1.98%, with the average value of the volatility measure being 0.034. The average manufacturing share is just 18%, though the maximum value is as high as 58%. The modern sector however is much larger on average at 51%, with a maximum of 90%. Other notable figures from this table are the relatively low average value of the Theil index computed on the basis of structural shares in value added, suggesting a relatively low degree of specialisation. Also noteworthy are the relatively low values (just 0.28) of income relative to the USA (*RELUS*). This is an indication of large income gaps with respect to the US. Note that the values of *RELUS* in excess of 1 are for Qatar, which has a level of GDP above the US.

The descriptive statistics in this table hide differences across income levels. Table 2 therefore reports the mean and standard deviation of each of the variables for each quartile. Note that the quartiles are constructed on a period-by-period basis rather than by considering quartiles for the

[6] Results are also available using alternative indicators of specialisation (i.e. the Gini, Herfindahl and Hirschmann indices).

full set of data as whole. This table shows substantial differences in the average values of our variables across the different quantiles. Average growth is highest in the highest quantile at 2.3% and lowest in the lowest quantile (1.3%), while growth volatility is highest in the lowest quartile and lowest in the highest quartile. The share of manufacturing in the modern sector is also found, on average, to be largest in the highest quartile and smallest in the lowest quartile. As expected the change in the manufacturing and modern sector shares are negative in the highest quartiles, suggesting a process of deindustrialisation in the richest countries. Specialisation tends to be largest in the lowest income quartile, though the change in specialisation is negative – suggesting increased diversification – and relatively large for this group. As expected, the higher income countries tend to have higher investment rates, lower population growth and be more open to trade.

Table 1: Summary Statistics for the Growth/Volatility Panel Dataset

Variable	Obs	Mean	Std. Dev.	Min	Max
$\Delta \ln GDPPC$	1034	0.0198	0.0347	-0.3080	0.2516
σ	1034	0.0335	0.0294	0.0003	0.2658
$ManSh$	952	0.1827	0.0873	0.0019	0.5839
$ModSh$	964	0.5085	0.1370	0.0935	0.8970
$ModManSh$	952	0.3644	0.1422	0.0023	0.8259
$Theil$	964	0.1618	0.0840	0.0399	0.6355
$\Delta ManSh$	915	-0.0011	0.0296	-0.1936	0.1969
$\Delta ModSh$	929	0.0018	0.0445	-0.2594	0.2408
$\Delta ModManSh$	915	-0.0031	0.0569	-0.3880	0.2451
$\Delta Theil$	929	-0.0057	0.0354	-0.2571	0.3822
$RELUS$	1034	0.2809	0.2835	0.0165	2.8964
$\Delta \ln POP$	1090	0.0181	0.0138	-0.0464	0.1551
$EXPGDP$	904	0.3229	0.2489	0.0378	2.1861
GCF	889	0.2262	0.0731	0.0441	0.6537
$\ln POP_{1960}$	1090	15.6585	1.5640	10.7646	20.3184
$\ln GDPPC_{1960}$	990	7.5913	0.9354	5.9713	10.3985
SCH_{1960}	1010	3.2821	2.3952	0.0133	8.8984
$KGATEMP$	1060	0.3397	0.4211	0.0000	1.0000

Notes: $ManSh$, $ModSh$, $ModManSh$ and $Theil$ refer to the values of the structure and specialisation variables in the initial year of each five-year period, with $\Delta ManSh$, $\Delta ModSh$, $\Delta ModManSh$ and $\Delta Theil$ being the change in these variables within each five-year period. RELUS refers to relative income, SCH to years of education of the population of 15 years and above, GFC to Gross Fixed Capital formation and KGATEMP to the dummy for temperate climate zone and EXPGDP to the share of exports in GDP.

Table 2: Summary Statistics for the Growth/Volatility Panel Dataset by Income Quartile

	Lowest Quartile		Second Quartile		Third Quartile		Highest Quartile	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
$\Delta \ln GDPPC$	0.0128	0.0324	0.0219	0.0323	0.0214	0.0428	0.0226	0.0290
σ	0.0377	0.0335	0.0320	0.0263	0.0398	0.0332	0.0248	0.0209
$ManSh$	0.1128	0.0587	0.1740	0.0676	0.2066	0.0927	0.2261	0.0801
$ModSh$	0.3527	0.1195	0.4856	0.1051	0.5729	0.0917	0.5956	0.0849
$ModManSh$	0.3249	0.1297	0.3695	0.1316	0.3672	0.1516	0.3897	0.1461
$Theil$	0.2242	0.1101	0.1366	0.0544	0.1406	0.0769	0.1530	0.0580
$\Delta ManSh$	0.0025	0.0263	0.0035	0.0315	-0.0012	0.0321	-0.0076	0.0267
$\Delta ModSh$	0.0113	0.0468	0.0088	0.0482	-0.0005	0.0436	-0.0091	0.0373
$\Delta ModManSh$	-0.0020	0.0614	-0.0004	0.0641	-0.0016	0.0531	-0.0078	0.0497
$\Delta Theil$	-0.0128	0.0404	-0.0081	0.0266	-0.0052	0.0334	0.0012	0.0387
$RELUS$	0.0436	0.0142	0.1184	0.0310	0.2666	0.0593	0.6853	0.2615
$\Delta \ln POP$	0.0247	0.0095	0.0215	0.0104	0.0168	0.0165	0.0112	0.0135
$EXPGDP$	0.2201	0.1387	0.3184	0.1614	0.3665	0.2641	0.3778	0.3365
GCF	0.1912	0.0894	0.2250	0.0739	0.2361	0.0636	0.2513	0.0458
$\ln POP_{1960}$	15.6329	1.5785	15.5544	1.4879	15.5715	1.6297	15.8302	1.5519
$\ln GDPPC_{1960}$	6.5325	0.3496	7.2144	0.4148	7.9413	0.5364	8.6814	0.5374
SCH_{1960}	1.0150	0.6547	1.8931	1.1913	3.4930	1.8434	5.7435	1.8756
$KGATEMP$	0.0545	0.2034	0.0997	0.2121	0.3966	0.4217	0.7251	0.3639

Notes: $ManSh$, $ModSh$, $ModManSh$ and $Theil$ refer to the values of the structure and specialisation variables in the initial year of each five-year period, with $\Delta ManSh$, $\Delta ModSh$, $\Delta ModManSh$ and $\Delta Theil$ being the change in these variables within each five-year period.

Table 3: Summary Statistics for the Duration of Episodes Data and Probit Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
$Episode$	5400	0.7235	0.4473	0.0000	1.0000
$\Delta \ln POP$	5243	0.0179	0.0143	-0.0760	0.1748
$\ln POP$	5350	16.1571	1.5427	10.7646	21.0094
$RELUS$	5063	0.2864	0.2830	0.0165	2.8964
$EXPGDP$	4422	0.3211	0.2530	0.0209	2.3027
$ManSh$	4809	0.1811	0.0861	0.0016	0.6278
$ModSh$	4865	0.5080	0.1342	0.0935	0.9329
$ModManSh$	4809	0.3619	0.1427	0.0020	0.8590
$Theil$	4865	0.1608	0.0829	0.0339	0.6355
$Length$	457	8.6433	7.5144	2.0000	49.0000
$\Delta \ln GDPPC^E$	457	0.0304	0.0405	-0.1015	0.2326
$\Delta \ln POP$	455	0.0344	0.0342	-0.0217	0.2676
$\ln POP$	455	16.1042	1.5304	11.3639	20.8706
$RELUS$	457	0.2345	0.2627	0.0168	2.4486
$EXPGDP$	405	0.3170	0.2570	0.0383	2.1306
$ManSh$	438	0.1646	0.0854	0.0019	0.5664
$ModSh$	443	0.4820	0.1520	0.0935	0.8947
$ModManSh$	438	0.3490	0.1424	0.0023	0.7855
$Theil$	443	0.1777	0.0977	0.0532	0.6355
$\Delta ManSh$	398	0.0000	0.0060	-0.0184	0.0448
$\Delta ModSh$	404	0.0015	0.0094	-0.0459	0.0364
$\Delta ModManSh$	398	-0.0010	0.0138	-0.0832	0.0983
$\Delta Theil$	404	-0.0018	0.0073	-0.0390	0.0280

Notes: $ManSh$, $ModSh$, $ModManSh$ and $Theil$ in the upper part of the table are the contemporaneous values of the structure and specialisation variables, while in the lower part of the table they are the values of the structure and specialisation variables in the initial year of the growth episode. $\Delta ManSh$, $\Delta ModSh$, $\Delta ModManSh$ and $\Delta Theil$ are the yearly changes in structure and specialisation within a growth episode. Variable *Episode* is a dummy variable indicating whether a year is part of a positive growth episode.

Table 3 reports initial descriptive statistics for the data used to consider the relationship between structure/specialisation and the duration of episodes. The top half of the table reports summary statistics for the Probit analysis, with the table indicating an unconditional probability of being in an episode of 72%. The bottom half of the table reports descriptive statistics for the duration analysis. The average length of an episode is shown to be 8.6 years, with an average growth rate within each episode ($\Delta \ln GDPPC^E$) being just over 3%. The reported changes in the structure and specialisation measures are average annual changes, rather than the total change within an episode, and as such are found to be quite small.

For completeness, we further report in Table 4 descriptive statistics for the duration data by income quartile. In the upper part of the table income quartiles are constructed on a year by year basis, while in the lower part the income quartile is constructed using all observations (and therefore data from different time periods). Interestingly the table shows that countries in the lowest and highest income quartiles have the lowest unconditional probability of being in an episode (at 67 and 68 per cent respectively). The lower part of the table indicates that the average length of an episode is lowest for countries in the lowest income quartile (at 6.9 years) and highest in the highest income quartile (at 10.6 years), though the average growth rate conditional upon being in an episode is largest for countries in the lowest income quartile (at 3.7%), followed by countries in the highest income quartile (3.4%).

Table 4: Summary Statistics for the Duration of Episodes Data by Income Quartile

	Lowest Quartile		Second Quartile		Third Quartile		Highest Quartile	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
$Episode$	0.6725	0.4695	0.7846	0.4113	0.7641	0.4247	0.6843	0.4649
$\Delta \ln POP$	0.0247	0.0101	0.0211	0.0116	0.0166	0.0169	0.0111	0.0136
$\ln POP$	16.3859	1.6186	16.1369	1.5280	16.0047	1.5503	16.1115	1.4668
$RELUS$	0.0453	0.0149	0.1234	0.0343	0.2754	0.0624	0.6919	0.2494
$EXPGDP$	0.2122	0.1280	0.3143	0.1607	0.3778	0.2740	0.3757	0.3403
$ManSh$	0.1155	0.0598	0.1773	0.0691	0.2048	0.0918	0.2215	0.0797
$ModSh$	0.3624	0.1197	0.4917	0.1036	0.5739	0.0886	0.5911	0.0856
$ModManSh$	0.3253	0.1337	0.3711	0.1320	0.3638	0.1522	0.3843	0.1450
$Theil$	0.2203	0.1075	0.1329	0.0567	0.1388	0.0715	0.1538	0.0578
$Length$	6.9386	7.0526	8.2105	7.3935	8.8158	6.5237	10.5913	8.5583
$\Delta \ln GDPPC^E$	0.0365	0.0416	0.0247	0.0380	0.0266	0.0396	0.0337	0.0418
$\Delta \ln POP$	0.0483	0.0403	0.0320	0.0218	0.0353	0.0352	0.0221	0.0318
$\ln POP$	16.4117	1.5435	15.8930	1.4785	15.8473	1.6057	16.2629	1.4318
$RELUS$	0.0388	0.0107	0.0972	0.0241	0.2167	0.0394	0.5822	0.3074
$EXPGDP$	0.1987	0.1067	0.3016	0.1585	0.4017	0.2880	0.3665	0.3470
$ManSh$	0.1070	0.0574	0.1501	0.0632	0.1779	0.0815	0.2221	0.0905
$ModSh$	0.3408	0.1183	0.4284	0.1276	0.5536	0.1011	0.5993	0.1023
$ModManSh$	0.3246	0.1452	0.3545	0.1100	0.3306	0.1445	0.3854	0.1582
$Theil$	0.2477	0.1113	0.1691	0.0917	0.1365	0.0731	0.1585	0.0732
$\Delta ManSh$	0.0007	0.0059	0.0012	0.0063	0.0003	0.0065	-0.0021	0.0049
$\Delta ModSh$	0.0028	0.0113	0.0029	0.0116	0.0009	0.0078	-0.0004	0.0062
$\Delta ModManSh$	-0.0017	0.0181	0.0010	0.0163	0.0002	0.0112	-0.0035	0.0082
$\Delta Theil$	-0.0039	0.0083	-0.0025	0.0075	-0.0010	0.0069	0.0000	0.0064

Notes: $ManSh$, $ModSh$, $ModManSh$ and $Theil$ in the upper part of the table are the contemporaneous values of the structure and specialisation variables, while in the lower part of the table they are the values of the structure and specialisation variables in the initial year of the growth episode. $\Delta ManSh$, $\Delta ModSh$, $\Delta ModManSh$ and $\Delta Theil$ are the yearly changes in structure and specialisation within a growth episode.

5 Results

In this section we report results from estimating the models described above. Before discussing the regression tables, we start with some descriptive results on duration and volatility in section 5.1. Section 5.2 reports results when considering the manufacturing share in value added as the main explanatory variable; Section 5.3. reports results when considering the share of the modern sector in value added; Section 5.4 reports results when considering the share of manufacturing within the modern sector; and finally Section 5.5 reports results when considering our measure of specialisation, the normalised Theil index.

5.1 Descriptives for duration and volatility

Table 5 gives a first indication of the importance of duration of positive growth episodes for economic development catch up. In the table, we arrange countries according to their relative income positions (quintiles) in 1960 and 2010. We distinguish between countries that remain in the same quintile between 1960 and 2010 and countries that have improved their relative position.[7]

Two interesting patterns can be discerned. First, countries that remain stuck in the bottom quintile have the shortest durations of growth (7 years on average). This indicates that countries staying in the bottom quintile are the countries that are least able to sustain positive growth episodes over longer periods. Countries which have succeeded in maintaining their position in the top quintile have much longer durations (17 years on average). But interestingly there is not much difference in growth rates. Countries which are trapped in the bottom quintile, actually grow more rapidly during their growth episodes than countries in the top quintile. This is line with the observation of Hausmann *et al.* (2005) that achieving growth is easy. Poor countries can grow at least as rapidly as rich countries. But they are much more vulnerable to interruptions of the growth process. They find it more difficult to sustain growth over longer periods and this is what really matters.

A second finding is that developing countries which have achieved improvements in their relative position between 1960 and 2010 tend to have a much longer duration of their positive growth episodes than countries that have remained in the same quintiles or that have moved downwards. Thus, the three countries that moved from the fourth to the fifth quintile have an average duration of no less than 26 years.[8] Not only is the duration of growth episodes longer in catch-up countries, but they also, on average, tend to have much higher rates of growth during their positive growth experiences.

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[7] Improving relative position is based on relative income rankings. It is not the same as catch up, which means reducing the percentage gap in GDP per capita relative to the lead economy. It is possible that a country improves its ranking, while its GDP gap increases.

[8] The only exception to this finding is the two countries that shift from the third to the fourth or the fifth quintile. These have the same average duration as countries that remain in the third quintile.

Table 5: Duration of Growth Episodes by Income Category, 1960-2010

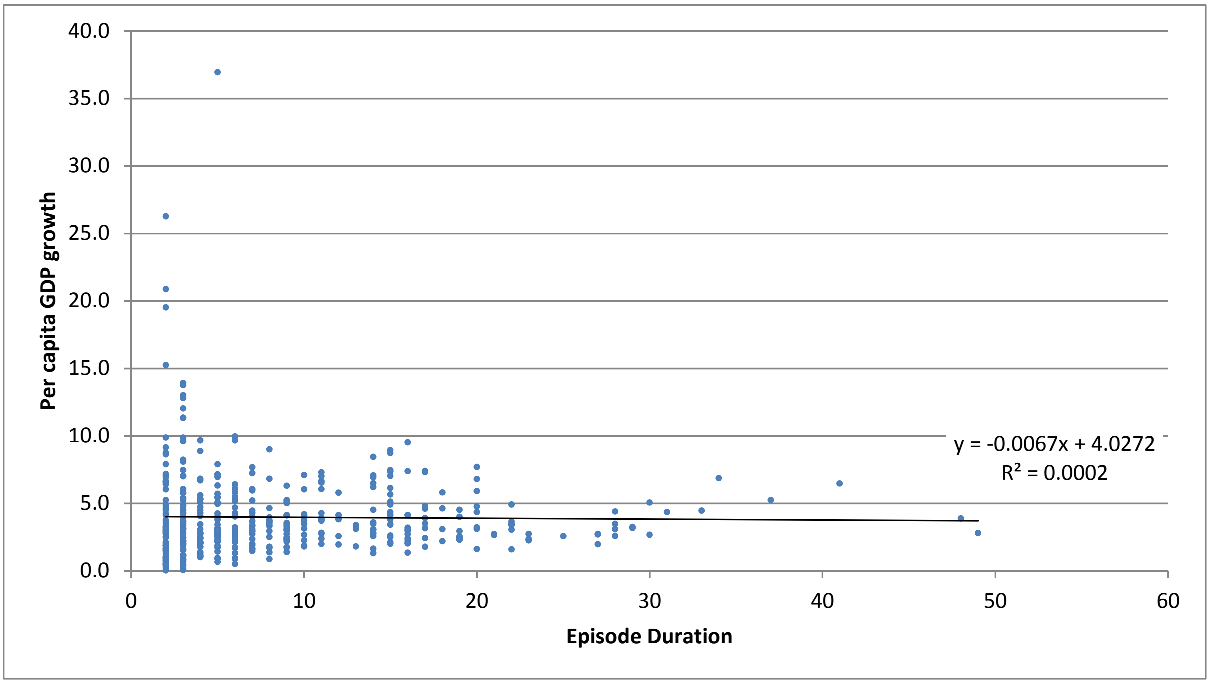
	Duration	Average growth during episode	N
1 Bottom quintile in 1960 and 2010	6.6	3.4	13
2 Relative improvement: bottom quintile in 1960, second or third quintile in 2010	11.4	4.8	7
3 Second quintile in 1960 and 2010	7.9	3.5	12
4 Relative improvement: second quintile in 1960, third quintile or higher in 2010	13.6	5.4	7
5 Third quintile in 1960 and 2010	8.8	3.3	17
6 Relative improvement: third quintile in 1960, fourth or fifth quintile in 2010	8.8	5.6	2
7 Fourth quintile in 1960 and 2010	9.3	4.0	16
8 Relative improvement: fourth quintile in 1960, fifth quintile in 2010	26.2	4.4	3
9 Falling behind: fifth quintile in 1960, fourth quintile in 2010	7.4	4.2	6
10 Fifth quintile in 1960 and 2010	16.8	2.9	14

Note: 97 countries, ranked in quintiles by GDP per capita in 1960 and 2010. Countries that were formerly part of the Soviet Union have been excluded, because no growth rates are available prior to 1989.

Source: Maddison project database.

Interestingly if we plot the duration of each episode against its growth rate (see figures 1 and 2) there turns out to be no significant relationship between the length of an episode and the rate of growth within an episode (in contrast to what we would expect on the basis of Table 5). Growth during longer episodes is not typically faster than during shorter episodes. This means that duration itself has an independent influence on the average growth rate between 1960 and 2010. The longer the growth episodes of a country, the higher the average rate of growth between 1960 and 2010 will be, or in other words duration matters. It is also worth noting that the variation in within-episode growth rates is very much higher in shorter episodes than in longer ones. This pattern remains visible, even if we remove the shortest episodes and only plot the episodes of three years and longer, in Figure 2

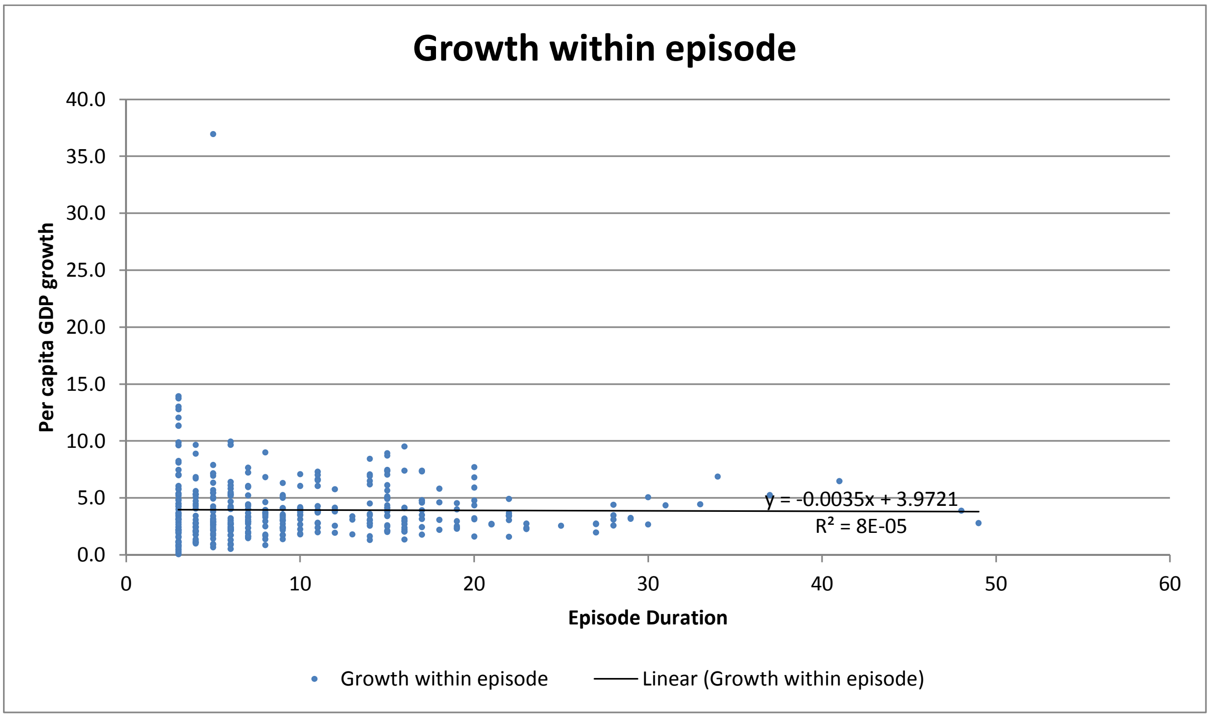
Figure 1: Growth of Per Capita GDP within Episodes by Duration of Episode



Source: see table 5.

Figure 2: Growth of Per Capita GDP within Episode by Duration of Episode

(Excluding episodes shorter than three years)



Note: Excluding episodes of less than three years.
Source: Maddison project database.

Volatility

Another important characteristic of the ability to sustain growth is low volatility of the growth process. The lower the degree of volatility, the more sustainable the growth pattern is. Volatility can be measured by a variety of measures, including the standard deviation of the growth rate or the coefficient of variation. It is typically the case that the volatility of growth is higher in low- and middle-income countries than in advanced economies.

In Table 6 we focus on the coefficient of variation of growth for 97 countries between 1960 and 2010. As in Table 5, we distinguish the ten groups of countries, based on their quintile ranking by GDP per capita in 1960 and 2010.

Table 6: Volatility and income category, 1960-2010

	Volatility	N
1 Bottom quintile in 1960 and 2010	3.7	13
2 Relative improvement: bottom quintile in 1960, second or third quintile in 2010	1.5	7
3 Second quintile in 1960 and 2010	10.6	12
4 Relative improvement: second quintile in 1960, third quintile or higher in 2010	1.3	7
5 Third quintile in 1960 and 2010	2.9	17
6 Relative improvement: third quintile in 1960, fourth or fifth quintile in 2010	1.1	2
7 Fourth quintile in 1960 and 2010	1.8	16
8 Relative improvement: fourth quintile in 1960, fifth quintile in 2010	0.8	3
9 Falling behind: fifth quintile in 1960, fourth quintile in 2010	3.9	6
10 Fifth quintile in 1960 and 2010	0.9	14

Source: see Table 5

Some powerful messages emerge from this table. Volatility is very much higher in low-income countries when compared with high-income countries, with a coefficient of variation of 3.7 for countries stuck in the bottom quintile. In the second quintile the coefficient of variation is no less than 10.6. In contrast, the top quintiles in both 1960 and 2010 have a coefficient of variation of just 0.9. Next, it is also clear that for each given quintile in 1960, the volatility of growth is much lower in countries that have improved their relative income rankings, than in countries trapped in the same quintile. In the long-run, reduced volatility of growth is a key ingredient of successful economic development.

5.2 Manufacturing Share and Sustained Growth

Table 7 reports results from panel growth regressions of the relationship between per capita GDP growth and the manufacturing share using both the within-groups and Hausman-Taylor estimators. Results on the control variables are largely as expected with a negative and significant relationship between growth and initial income in each period (relative to US income) and a positive and significant relationship between growth and the ratios of both investment and exports to GDP. The coefficient on population growth tends to be positive, but is only significant in the case of the Hausman-Taylor estimator. In the case of the Hausman-Taylor model, coefficients on the initial (i.e. 1960) values of population, GDP per capita and schooling are all positive and significant (as expected since we already control for backwardness using the $RELUS$ variable), as is the coefficient on $KGATEMP$ (again consistent with expectations).

In general, we find little evidence of a relationship between the manufacturing share and per capita growth in the panel regression model. There is no significant relationship between the initial manufacturing share (when included linearly) and growth, although the coefficient is positive. While the change in the manufacturing share tends to have a negative coefficient, it is only significant when using the within-groups estimator, and when including the interaction between the initial and the change in the manufacturing share, with the interaction term being large, positive and significant. Accounting for differences in countries' income levels doesn't make a great deal of difference, with none of the coefficients on the initial manufacturing share being significant when either the interaction with *RELUS* is introduced or when the relationship between growth and the manufacturing share is estimated separately for each income quartile. These results differ from those in Szirmai and Verspagen (2015), who did find a positive relationship between the manufacturing share and growth for a somewhat smaller panel dataset with data till 2005.

The results for the relationship between volatility and the manufacturing share in Table 8 are somewhat different. Of the control variables only the ratio of investment to GDP is consistently significant, with the coefficient being negative, while of the initial values of population, GDP per capita and schooling in the Hausman-Taylor model, only the schooling variable is significant (and negative), with the coefficient on $KGATEMP$ also being insignificant. Coefficients on the manufacturing share however tend to be significant, with the coefficient being negative, suggesting that a higher manufacturing share reduces growth volatility. The exceptions to this being when included alone in the within-groups model and when interacted with $RELUS$, in which case the interaction is also found to be insignificant. Coefficients on the change in the manufacturing share are often negative, but usually insignificant, as is the coefficient on the interaction between the initial value and the change in the manufacturing share. Finally, when estimating separate coefficients on the manufacturing share by income quartile we find coefficients that are generally negative, and that tend to be significant for the lowest and highest income quartile. Coefficients tend to be largest (in absolute value) for the lowest income quartile followed by the high income quartile, with coefficients in the middle two quartiles tending to be smaller and insignificant. This non-monotonic pattern to the coefficients when split by income quartile may help explain the insignificant coefficients on the interaction of the manufacturing share with $RELUS$.

To summarise, results from the growth and volatility regressions over the full sample period suggest that the manufacturing share plays no role in a country's average growth performance, but that it may be associated with lower growth volatility, particularly for the poorest and richest countries in the sample.

Table 7: Manufacturing Shares and Growth – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ManSh$	0.0167		0.00822	0.0114	-0.0225		0.0165		0.0152	0.0182	-0.0231	
	(0.0237)		(0.0265)	(0.0255)	(0.0368)		(0.0202)		(0.0219)	(0.0218)	(0.0315)	
$\Delta ManSh$		-0.0582*	-0.0526	-0.267**				-0.0477	-0.0377	-0.276***		
		(0.0346)	(0.0386)	(0.118)				(0.0329)	(0.0359)	(0.0863)		
$ManSh \times \Delta ManSh$				1.136*						1.261***		
				(0.588)						(0.415)		
$ManSh \times RELUS$					0.113						0.115	
					(0.0956)						(0.0703)	
$ManSh(Q1)$						0.0159						0.0211
						(0.0326)						(0.0334)
$ManSh(Q2)$						0.00307						0.00575
						(0.0296)						(0.0253)
$ManSh(Q3)$						-0.00248						-0.00641
						(0.0279)						(0.0232)
$ManSh(Q4)$						0.0413						0.0407
						(0.0330)						(0.0263)
$RELUS$	-0.121***	-0.119***	-0.119***	-0.118***	-0.139***	-0.132***	-0.0907***	-.0959***	-.0956***	-.0935***	-0.110***	-0.103***
	(0.0203)	(0.0203)	(0.0203)	(0.0199)	(0.0284)	(0.0232)	(0.0146)	(0.0145)	(0.0146)	(0.0144)	(0.0190)	(0.0167)
$\Delta \ln POP$	0.284	0.310	0.317	0.324	0.300	0.292	0.245**	0.314***	0.326***	0.337***	0.259**	0.250**
	(0.383)	(0.392)	(0.401)	(0.400)	(0.385)	(0.389)	(0.113)	(0.111)	(0.112)	(0.111)	(0.113)	(0.113)
$EXPGDP$	0.0416**	0.0446**	0.0438**	0.0434**	0.0427**	0.0457**	0.0291***	0.0344***	0.0329***	0.0322***	0.0312***	0.0340***
	(0.0185)	(0.0187)	(0.0188)	(0.0184)	(0.0187)	(0.0188)	(0.00961)	(0.00939)	(0.00964)	(0.00955)	(0.00964)	(0.00984)
GCF	0.127***	0.139***	0.138***	0.135***	0.124***	0.124***	0.129***	0.140***	0.137***	0.135***	0.128***	0.128***
	(0.0375)	(0.0341)	(0.0349)	(0.0351)	(0.0378)	(0.0380)	(0.0156)	(0.0154)	(0.0158)	(0.0157)	(0.0156)	(0.0157)
$\ln POP_{1960}$							0.00522***	0.00660***	0.00630***	0.00609***	0.00564***	0.00586***
							(0.00148)	(0.00141)	(0.00148)	(0.00146)	(0.00148)	(0.00149)
$\ln GDPPC_{1960}$							0.00902**	0.0116***	0.0114***	0.0110***	0.00963**	0.0114***
							(0.00379)	(0.00380)	(0.00383)	(0.00377)	(0.00376)	(0.00394)
$\ln SCH_{1960}$							0.00332**	0.00315**	0.00316**	0.00305**	0.00316**	0.00300**
							(0.00145)	(0.00143)	(0.00143)	(0.00141)	(0.00142)	(0.00144)
$KGATEMP$							0.0178***	0.0179***	0.0175***	0.0181***	0.0164***	0.0166***
							(0.00628)	(0.00623)	(0.00628)	(0.00620)	(0.00623)	(0.00625)
Observations	731	709	709	709	731	731	731	709	709	709	731	731
R-squared	0.262	0.283	0.283	0.292	0.265	0.267						
F-Stat	13.53***	14.14***	13.71***	13.55***	12.01***	12.00***	13.25***	14.42***	13.67***	13.53***	12.73***	11.63***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 8: Manufacturing Shares and Volatility – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ManSh$	-0.0483		-0.0600**	-0.0611**	-0.0532		-0.0431**		-0.0445**	-0.0466**	-0.0298	
	(0.0302)		(0.0273)	(0.0272)	(0.0525)		(0.0176)		(0.0192)	(0.0192)	(0.0269)	
$\Delta ManSh$		-0.0306	-0.0717*	0.00378				-0.0244	-0.0534	0.0751		
		(0.0430)	(0.0427)	(0.116)				(0.0338)	(0.0358)	(0.0882)		
$ManSh \times \Delta ManSh$				-0.400						-0.678		
				(0.490)						(0.425)		
$ManSh \times RELUS$					0.0142						-0.0434	
					(0.0812)						(0.0648)	
$ManSh(Q1)$						-0.100***						-0.0794***
						(0.0369)						(0.0304)
$ManSh(Q2)$						-0.0497						-0.0460**
						(0.0427)						(0.0213)
$ManSh(Q3)$						-0.0187						-0.0127
						(0.0352)						(0.0200)
$ManSh(Q4)$						-0.0508**						-0.0564**
						(0.0252)						(0.0235)
$RELUS$	0.00307	0.00629	0.00461	0.00428	0.000783	0.00451	-0.0111	0.00198	-0.00211	-0.00697	-0.00569	0.000293
	(0.0249)	(0.0234)	(0.0245)	(0.0244)	(0.0292)	(0.0234)	(0.0138)	(0.0145)	(0.0142)	(0.0141)	(0.0186)	(0.0157)
$\Delta \ln POP$	-0.0997	-0.0505	-0.104	-0.107	-0.0977	-0.0905	-0.0412	-0.0180	-0.0618	-0.0617	-0.0480	-0.0351
	(0.222)	(0.233)	(0.235)	(0.236)	(0.223)	(0.227)	(0.104)	(0.106)	(0.107)	(0.107)	(0.105)	(0.104)
$EXPGDP$	0.0192	0.0142	0.0203	0.0205	0.0193	0.0124	0.00812	0.000150	0.00502	0.00607	0.00746	0.000801
	(0.0167)	(0.0180)	(0.0178)	(0.0177)	(0.0169)	(0.0160)	(0.00884)	(0.00900)	(0.00923)	(0.00918)	(0.00896)	(0.00898)
GCF	-0.0650***	-0.0781***	-0.0675***	-0.0665***	-0.0654***	-0.0645***	-0.0478***	-0.0599***	-0.0527***	-0.0504***	-0.0470***	-0.0485***
	(0.0191)	(0.0191)	(0.0190)	(0.0192)	(0.0187)	(0.0189)	(0.0152)	(0.0154)	(0.0157)	(0.0157)	(0.0152)	(0.0151)
$\ln POP_{1960}$							-0.00103	-0.00291**	-0.00191	-0.00158	-0.00116	-0.00187
							(0.00124)	(0.00124)	(0.00132)	(0.00131)	(0.00126)	(0.00123)
$\ln GDPPC_{1960}$							0.00464	0.000512	0.00185	0.00280	0.00461	0.000467
							(0.00325)	(0.00343)	(0.00345)	(0.00341)	(0.00325)	(0.00340)
$\ln SCH_{1960}$							-0.00264**	-0.00259**	-0.00256**	-0.00245**	-0.00249**	-0.00230**
							(0.00119)	(0.00124)	(0.00124)	(0.00123)	(0.00115)	(0.00113)
$KGATEMP$							0.00514	0.00228	0.00390	0.00424	0.00602	0.00542
							(0.00525)	(0.00548)	(0.00554)	(0.00550)	(0.00518)	(0.00508)
Observations	731	709	709	709	731	731	731	709	709	709	731	731
R-squared	0.105	0.102	0.112	0.113	0.105	0.116						
F-Stat	5.797***	5.769***	5.289***	5.052***	5.454***	5.699***	5.182***	4.802***	4.865***	4.740***	4.989***	5.093***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Determinants of duration

We now turn to consider the role of the manufacturing share for growth duration. Table 9 reports marginal effects (i.e. average partial effects) from a Probit analysis that uses annual data over the period 1960-2010 to examine whether economic structure and specialisation impact upon the probability of being in a positive growth episode. In terms of the control variables we find that countries with a larger population are more likely to be in a growth episode. Countries that have higher export ratios also tend to be significantly more likely to be in a growth episode, as are countries with higher per capita GDPs (relative to the US), at least when no interactions between $RELUS$ and our measures of structure are included. Results on the control variables are consistent regardless of the measure of structure/specialisation included and so will not be discussed further in the following sections.

Turning to the results for the manufacturing share we find coefficients that are positive and significant (when no interaction terms are included), with the marginal effects ranging between 0.37 and 0.60. A one standard deviation (i.e. 0.086) increase in the manufacturing share therefore is associated with an increased probability of being in an episode of between 3.2 and 5.2 per cent depending upon the specification. When including the interaction of the manufacturing share with $RELUS$ we obtain non-significant coefficients on the manufacturing share and positive coefficients on the interaction term that are often significant. This result thus suggests that the manufacturing share has a positive impact on the probability of being in an episode only for countries that are relatively rich. This is not consistent with the literature on industrialisation which generally concludes that industrialisation is especially important for low income countries. Interestingly the interpretation of the interaction term is not confirmed when we split the sample by income quartiles. While the marginal effects tend to be positive across quartiles – and often significant – there is no clear pattern across quartiles regarding the size and significance of the marginal effects.

Before turning to the Cox proportional hazards model we report results from the Kaplan-Meier estimator. Figure 3 reports the estimator for all observations, with the figure revealing a median survival time of around 5.5 years (i.e. a logged value of around 1.7). In

Figure 4 we report the Kaplan-Meier survival estimates separately for four groups distinguished by their manufacturing share (i.e. split up into four quartiles based on their manufacturing share at the beginning of the episode).[9] The figure indicates a median survival time that is largest for the highest quartile and smallest for the lowest quartile, which is in line with our descriptive findings on duration in Table 5. The difference in the median estimates is large, with the estimated median survival time being around 4.5 years for the lowest quartile, 5.7 years for the second quartile, 9 years for the third quartile, and 11 years for the fourth quartile.

[9] Where data on the manufacturing shares were not available for the initial year, we used the shares of the nearest year within the episode.

Table 9: Manufacturing Share and the Probability of being in an Episode (Average Partial Effects)

	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC
$ManSh$	0.596***	0.580***	0.591***	0.368**	0.546*	0.404	0.203	0.00874				
	(0.180)	(0.176)	(0.126)	(0.163)	(0.281)	(0.247)	(0.187)	(0.225)				
$ManSh \times RELUS$					0.175	0.739	1.428***	1.390**				
					(0.513)	(0.574)	(0.508)	(0.602)				
$ManSh(Q1)$									0.413	0.430	0.634***	0.520**
									(0.342)	(0.290)	(0.222)	(0.247)
$ManSh(Q2)$									0.666***	0.649***	0.570***	0.288
									(0.224)	(0.200)	(0.154)	(0.194)
$ManSh(Q3)$									0.431**	0.422**	0.475***	0.226
									(0.212)	(0.198)	(0.137)	(0.180)
$ManSh(Q4)$									0.695***	0.839***	0.899***	0.655***
									(0.176)	(0.235)	(0.184)	(0.225)
$\Delta \ln POP$	-0.521	-0.501	-0.181	-0.0169	-0.504	-0.386	-0.0584	0.127	-0.562	-0.492	-0.232	0.0397
	(0.968)	(0.890)	(0.603)	(0.723)	(0.959)	(0.873)	(0.611)	(0.731)	(0.993)	(0.887)	(0.605)	(0.723)
$\ln POP$	0.0181**	0.0180**	0.0214**	0.159***	0.0183**	0.0186**	0.0218**	0.117**	0.0187**	0.0187**	0.0209**	0.133**
	(0.00746)	(0.00764)	(0.00905)	(0.0553)	(0.00750)	(0.00773)	(0.00916)	(0.0583)	(0.00765)	(0.00766)	(0.00905)	(0.0564)
$RELUS$	0.161***	0.182***	0.174***	0.0911	0.128	0.0497	-0.0778	-0.107	0.116	0.0973	0.0762	-0.0183
	(0.0458)	(0.0513)	(0.0481)	(0.105)	(0.112)	(0.116)	(0.101)	(0.138)	(0.0736)	(0.0821)	(0.0730)	(0.118)
$EXPGDP$	0.0661*	0.0744	0.0600	0.0673	0.0682	0.0823	0.0746	0.0647	0.0704*	0.0801*	0.0747	0.0740
	(0.0385)	(0.0466)	(0.0486)	(0.0721)	(0.0419)	(0.0517)	(0.0493)	(0.0721)	(0.0403)	(0.0479)	(0.0488)	(0.0726)
Observations	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221
R-squared	0.123				0.123				0.126			
F-stat	15.49***				15.14***				15.24***			

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile. LPM, RE Probit and MC refer to results using the Linear Probability Model, the Random Effects Probit model and the Mudlak-Chamberlain estimator.

Figure 3: Kaplan-Meier Estimates

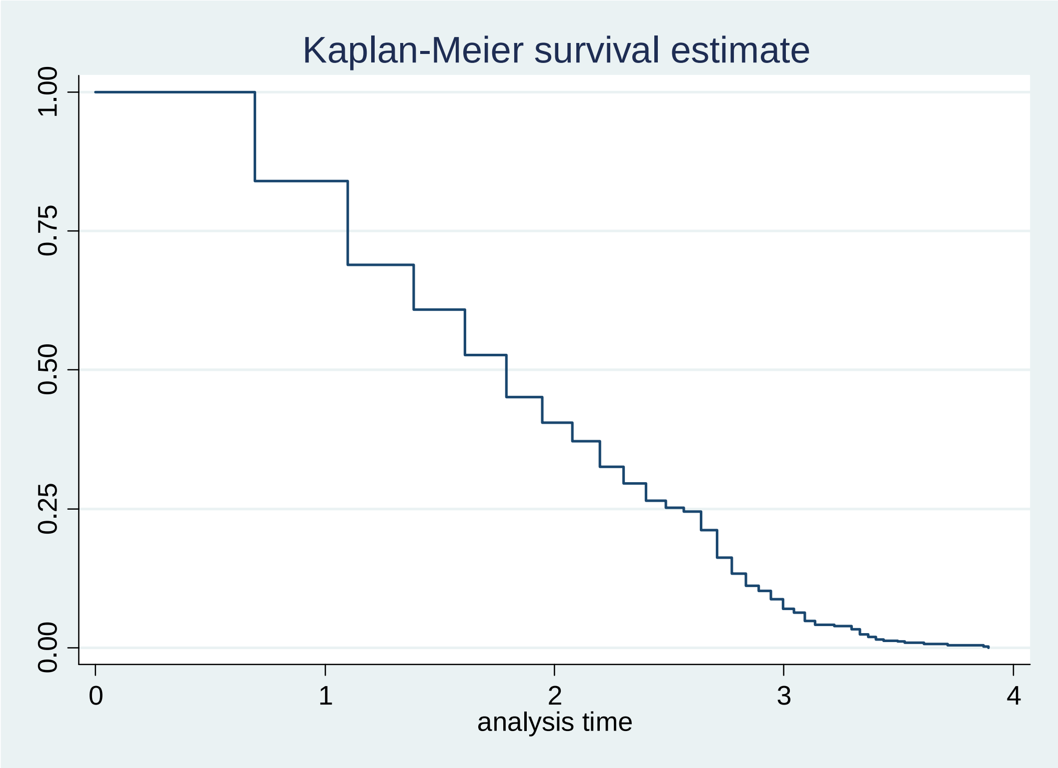
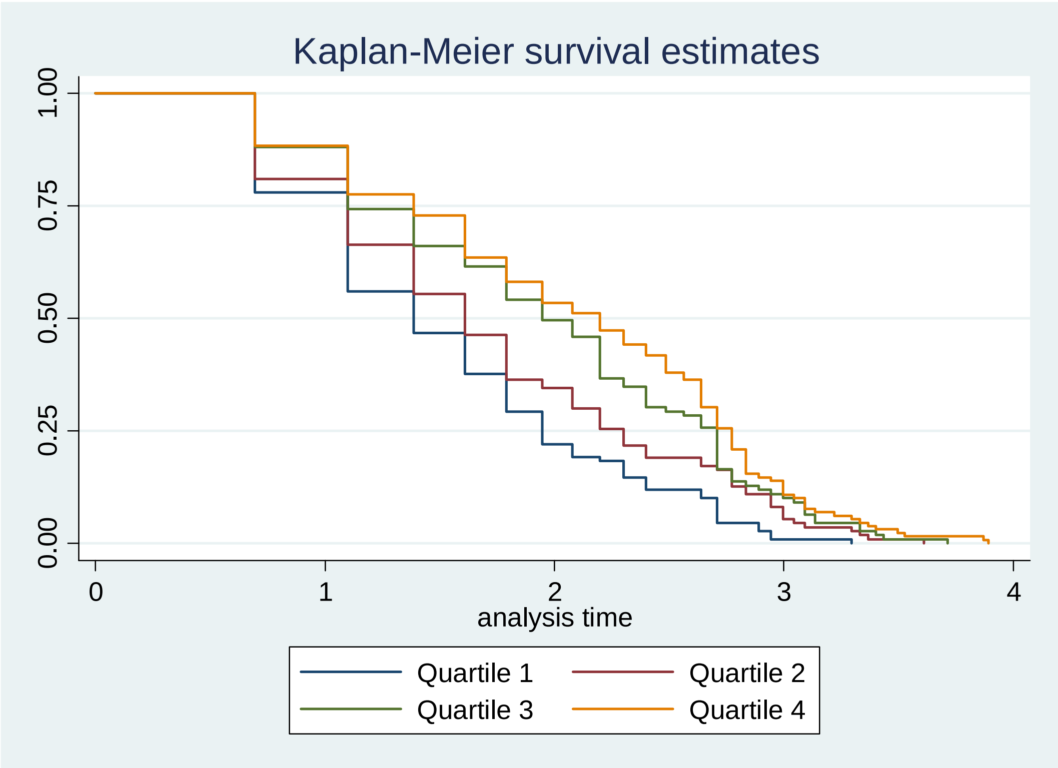


Figure 4: Kaplan-Meier Estimates of the Survival Function by Manufacturing Share Quartile



Note: Quartiles based on ranking by manufacturing share at the beginning of the episode

Table 10 reports results of the analysis of growth episodes. The left panel of Table 10 reports results from the Cox Proportional Hazards model of the duration of episodes, while the right panel reports results from a cross-section growth model with average growth during an episode as the dependent variable.[10] Considering the survival analysis, it is first necessary to note that reported in the table are the estimated hazard rates, $\hat{\gamma} = \exp(\hat{\beta})$. The hazard rate on the manufacturing share is found to be significant at a value of 0.0631. To interpret this result we need to calculate $1 - \hat{\gamma}$, i.e. 1-0.0631=0.9369, which implies that a one unit change in the manufacturing share lowers the hazard or risk of failure by 94%. A one standard deviation increase in the manufacturing share (i.e. 0.0854) is therefore associated with a substantial decrease in the risk of failure (i.e. of leaving an episode) of 8 per cent.

The hazard rate for the change in the manufacturing share is found to be insignificant as is that on the interaction of the manufacturing share with $RELUS$. We do find some limited evidence that hazard rates vary across quartiles however, being relatively low (0.0317) for quartile 1 and rising to 0.104 for quartile 4. Results thus imply that a one standard deviation increase in the manufacturing share lowers the hazard rate by 8.3 (8.2) [8.1] {7.6} percent for countries in income quartile 1 (2) [3] {4}.

Turning to the results on average growth within episodes, we find that of the control variables only the ratio of investment to GDP is consistently significant (and positive), with that on $RELUS$ also being occasionally significant (and negative, as expected). The coefficient on the initial manufacturing share is found to be negative and significant, suggesting that a higher manufacturing share is associated with lower growth during an episode. Combined with results in the left panel, this suggests that a higher manufacturing share makes it more likely that a growth episode is sustained, but that growth within episodes may well be lower. Such a result is consistent with the results suggesting that a higher manufacturing share is associated with lower growth volatility. Coefficients on the change in the manufacturing share are not significant (though also negative), while those on the interaction are positive and significant. Combined with the results when splitting by income quartile, which indicate a negative and significant association between the manufacturing share and growth in an episode for lower quartiles but not for the highest quartile, results on the interaction suggest that the observed negative association between the manufacturing share and growth in an episode exists largely for countries at lower income levels.

The very important conclusion deriving from Table 10 is that more industrialised countries have a significantly longer duration of their positive growth episodes. Manufacturing is important for sustaining growth. Also, manufacturing matters for duration but not for average growth rates.

[10] Note that there can be more than one observation per country in the growth analysis depending upon the number of growth episodes a country had.

Table 10: Manufacturing Share, Survival Analysis and Growth within Episodes

	Cox Proportional Hazard					Growth within Episode				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$ManSh$	0.0631***		0.0482***	0.119*		-0.0479*		-0.0358	-0.131***	
	(0.0500)		(0.0427)	(0.132)		(0.0275)		(0.0297)	(0.0378)	
$\Delta ManSh$		2.308	0.630				-0.0100	-0.0277		
		(2.444)	(0.724)				(0.0632)	(0.0668)		
$ManSh \times RELUS$				0.0817					0.326***	
				(0.250)					(0.0878)	
$ManSh(Q1)$					0.0317**					-0.0944*
					(0.0480)					(0.0498)
$ManSh(Q2)$					0.0411***					-0.104***
					(0.0448)					(0.0343)
$ManSh(Q3)$					0.0536***					-0.0699**
					(0.0476)					(0.0336)
$ManSh(Q4)$					0.104**					0.0203
					(0.106)					(0.0331)
$RELUS$	0.732	0.498***	0.712	1.194	0.542	-0.000579	-0.00605	-0.00285	-0.0637***	-0.0359***
	(0.189)	(0.132)	(0.197)	(0.772)	(0.249)	(0.00761)	(0.00835)	(0.00813)	(0.0178)	(0.0124)
$\ln POP$	0.906**	0.895***	0.933*	0.902**	0.915**					
	(0.0362)	(0.0354)	(0.0385)	(0.0362)	(0.0391)					
$EXPGDP$	0.681	0.692	0.733	0.644*	0.696	-0.0107	-0.00827	-0.00900	-0.00686	-0.00739
	(0.175)	(0.181)	(0.189)	(0.172)	(0.180)	(0.00692)	(0.00686)	(0.00687)	(0.00680)	(0.00679)
$\Delta \ln POP$						0.0607	0.0828	0.0624	0.0700	0.0549
						(0.0648)	(0.0647)	(0.0664)	(0.0676)	(0.0663)
GCF						0.0857***	0.0875***	0.0936***	0.0931***	0.0835***
						(0.0290)	(0.0294)	(0.0299)	(0.0283)	(0.0285)
Observations	398	367	367	398	398	394	363	363	394	394
R-squared					.	0.031	0.029	0.032	0.053	0.055
F-stat						2.402**	2.253**	1.999*	4.212***	2.842***

Notes: The left panel reports results from the Cox proportional hazards model, with hazard rates being reported. The right panel reports results of cross-section growth models, with average growth within an episode being the dependent variable. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. In the case of the growth regressions, standard errors are robust to heteroscedasticity.

5.3 The Value Added Share of the Modern Sector and Sustained Growth

In this section we discuss a similar set of results, but concentrate on the relationship between our dimensions of growth and the share of the modern sector in GDP. Table 11 reports the results from the panel growth model. Coefficients on the control variables are largely in line with those reported in Table 7 above, which allows us to move immediately to the coefficients on the modern sector. We observe that when included alone (or with the interaction with $RELUS$) the share of the modern sector has a negative association with growth (with the interaction being insignificant), while the change in the share of the modern sector is positive and significant when included alone. When including both the initial share and the change in the share of the modern sector (as well as their interaction) we find positive coefficients on both the share and initial level that tend to be significant. Results for the initial shares of the modern sector split by income quartiles tend to suggest a negative relationship between the share of the modern sector and growth for all income quartiles, with coefficients tending to be significant in all quartiles except for the highest one. Coefficients tend to be largest (in absolute value) for the middle two quartiles and smallest for the highest quartile.

The generally negative effect of the modern sector on growth was also found in Lavopa (2015) and Lavopa and Szirmai (forthcoming 2015). As the size of the modern sector is very strongly correlated with the level of per capita income, and as we know that advanced economies close to the global technological frontier growth much more slowly than poorer countries that are catching up, a negative relationship between the size of the modern sector and growth is not unexpected. Nevertheless, this is an area for further research because one would expect that developing countries with larger modern sector are also better placed to achieve growth.

Results on the control variables when considering the relationship between the modern sector share and volatility in Table 12 are also largely similar to those reported in the previous subsection. The coefficient on the initial share of the modern sector is found to be insignificant in the case of the within-groups estimator (though usually positive), while in the Hausman-Taylor case the coefficients are usually positive and usually significant, suggesting that a larger modern sector increases growth volatility. Coefficients on the change in the modern sector however tend to be negative and tend to be significant (the exception being when the change in the modern sector is included alongside the share of the modern sector and their interaction, in which case the coefficients on the interaction are negative – and significant in the Hausman-Taylor case – while those on the change in the modern sector share are positive but not significant). Interesting results are observed when we consider non-linearities related to $RELUS$. When including the interaction with *RELUS* we find a coefficient on the interaction term that is positive and significant (with that on the modern sector share being negative but insignificant). Such a result suggests that it is for relatively richer countries that a larger modern sector increases volatility. This is confirmed when estimating a separate effect of the modern sector share for the different income quartiles. Here we find positive and significant coefficients on the modern sector share in the two highest income quartiles, with coefficients in the two lower quartiles tending to be smaller, sometimes negative, and usually insignificant.

Table 11: The Share of the Modern Sector and Growth – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ModSh$	-0.0329*		0.0486**	0.0476**	-0.0384*		-0.0424***		0.0371**	0.0354**	-0.0469***	
	(0.0194)		(0.0220)	(0.0209)	(0.0199)		(0.0147)		(0.0178)	(0.0178)	(0.0181)	
$\Delta ModSh$		0.139***	0.168***	0.137				0.137***	0.160***	0.124*		
		(0.0330)	(0.0371)	(0.101)				(0.0195)	(0.0222)	(0.0658)		
$ModSh \times \Delta ModSh$				0.0602						0.0671		
				(0.184)						(0.119)		
$ModSh \times RELUS$					0.0281						0.0242	
					(0.0603)						(0.0565)	
$ModSh(Q1)$						-0.0302						-0.0386**
						(0.0233)						(0.0170)
$ModSh(Q2)$						-0.0337*						-0.0413***
						(0.0187)						(0.0152)
$ModSh(Q3)$						-0.0377*						-0.0463***
						(0.0197)						(0.0154)
$ModSh(Q4)$						-0.0211						-0.0286
						(0.0245)						(0.0188)
$RELUS$	-0.114***	-0.112***	-0.121***	-0.120***	-0.132***	-0.129***	-0.0835***	-0.0867***	-0.0955***	-0.0937***	-0.0997**	-0.102***
	(0.0201)	(0.0179)	(0.0170)	(0.0170)	(0.0468)	(0.0270)	(0.0144)	(0.0139)	(0.0143)	(0.0142)	(0.0399)	(0.0205)
$\Delta \ln POP$	0.269	0.284	0.276	0.287	0.256	0.261	0.236**	0.268**	0.263**	0.276**	0.225**	0.231**
	(0.370)	(0.355)	(0.357)	(0.355)	(0.387)	(0.371)	(0.111)	(0.107)	(0.107)	(0.109)	(0.114)	(0.111)
$EXPGDP$	0.0485**	0.0492***	0.0403**	0.0401**	0.0485**	0.0526***	0.0396***	0.0374***	0.0319***	0.0317***	0.0398***	0.0432***
	(0.0188)	(0.0178)	(0.0168)	(0.0166)	(0.0187)	(0.0193)	(0.00963)	(0.00916)	(0.00990)	(0.00989)	(0.00966)	(0.0100)
GCF	0.142***	0.137***	0.121***	0.120***	0.144***	0.141***	0.152***	0.137***	0.122***	0.121***	0.153***	0.151***
	(0.0356)	(0.0310)	(0.0322)	(0.0330)	(0.0351)	(0.0348)	(0.0165)	(0.0149)	(0.0165)	(0.0166)	(0.0169)	(0.0165)
$\ln POP_{1960}$							0.00642***	0.00704***	0.00701***	0.00693***	0.00647***	0.00692***
							(0.00134)	(0.00138)	(0.00148)	(0.00147)	(0.00135)	(0.00138)
$\ln GDPPC_{1960}$							0.0128***	0.0126***	0.0116***	0.0113***	0.0133***	0.0156***
							(0.00372)	(0.00372)	(0.00401)	(0.00398)	(0.00390)	(0.00409)
$\ln SCH_{1960}$							0.00279**	0.00240*	0.00243	0.00243	0.00279**	0.00254*
							(0.00137)	(0.00141)	(0.00152)	(0.00151)	(0.00138)	(0.00139)
$KGATEMP$							0.0150**	0.0164***	0.0186***	0.0186***	0.0155**	0.0153**
							(0.00606)	(0.00614)	(0.00666)	(0.00663)	(0.00619)	(0.00608)
Observations	732	710	710	710	732	732	732	710	710	710	732	732
F-Stat	13.00***	15.89***	15.26***	14.39***	12.16***	12.60***	13.97***	18.20***	17.46***	16.64***	13.22***	12.16***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 12: The Share of the Modern Sector and Volatility – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ModSh$	0.0212		0.00388	0.00736	-0.0167		0.0308**		0.0254*	0.0278*	-0.00456	
	(0.0189)		(0.0304)	(0.0309)	(0.0230)		(0.0125)		(0.0150)	(0.0149)	(0.0164)	
$\Delta ModSh$		-0.0755***	-0.0732***	0.0319				-0.0712***	-0.0553**	0.0760		
		(0.0249)	(0.0276)	(0.0733)				(0.0206)	(0.0226)	(0.0683)		
$ModSh \times \Delta ModSh$				-0.202						-0.254**		
				(0.139)						(0.125)		
$ModSh \times RELUS$					0.195***						0.185***	
					(0.0618)						(0.0564)	
$ModSh(Q1)$						-0.00424						0.00997
						(0.0209)						(0.0153)
$ModSh(Q2)$						0.0203						0.0220*
						(0.0197)						(0.0130)
$ModSh(Q3)$						0.0364*						0.0415***
						(0.0186)						(0.0130)
$ModSh(Q4)$						0.0348*						0.0349**
						(0.0200)						(0.0159)
$RELUS$	-0.000627	0.00200	0.00127	-0.00130	-0.129***	-0.0147	-0.0129	-0.0104	-0.0148	-0.0129	-0.131***	-0.0118
	(0.0227)	(0.0209)	(0.0212)	(0.0201)	(0.0408)	(0.0196)	(0.0137)	(0.0141)	(0.0139)	(0.0138)	(0.0388)	(0.0188)
$\Delta \ln POP$	-0.0572	-0.0431	-0.0437	-0.0803	-0.147	-0.0584	0.00159	-0.00851	-0.00632	-0.0498	-0.0830	0.000611
	(0.213)	(0.211)	(0.210)	(0.218)	(0.225)	(0.213)	(0.103)	(0.105)	(0.105)	(0.106)	(0.105)	(0.102)
$EXPGDP$	0.0110	0.0120	0.0113	0.0119	0.0107	0.00187	-0.00291	-0.000148	-0.00436	-0.00520	-0.00164	-0.00851
	(0.0169)	(0.0181)	(0.0204)	(0.0202)	(0.0174)	(0.0174)	(0.00893)	(0.00898)	(0.00944)	(0.00938)	(0.00882)	(0.00921)
GCF	-0.0814***	-0.0763***	-0.0776***	-0.0739***	-0.0679***	-0.0750***	-0.0694***	-0.0580***	-0.0687***	-0.0653***	-0.0567***	-0.0666***
	(0.0209)	(0.0192)	(0.0212)	(0.0208)	(0.0216)	(0.0210)	(0.0160)	(0.0154)	(0.0167)	(0.0168)	(0.0163)	(0.0160)
$\ln POP_{1960}$							-0.00248**	-0.00290**	-0.00294**	-0.00309**	-0.00219*	-0.00306***
							(0.00114)	(0.00124)	(0.00123)	(0.00121)	(0.00112)	(0.00117)
$\ln GDPPC_{1960}$							0.00118	0.00119	0.000413	-1.70e-05	0.00435	-0.00338
							(0.00326)	(0.00339)	(0.00347)	(0.00342)	(0.00327)	(0.00362)
$\ln SCH_{1960}$							-0.00243**	-0.00193	-0.00196	-0.00199	-0.00256**	-0.00223**
							(0.00115)	(0.00124)	(0.00123)	(0.00122)	(0.00109)	(0.00112)
$KGATEMP$							0.00606	0.00417	0.00564	0.00452	0.00902*	0.00538
							(0.00513)	(0.00548)	(0.00548)	(0.00542)	(0.00503)	(0.00504)
Observations	732	710	710	710	732	732	732	710	710	710	732	732
R-squared	0.101	0.121	0.121	0.125	0.117	0.115						
F-Stat	5.906***	6.022***	5.784***	5.493***	6.993***	5.849***	5.272***	5.555***	5.399***	5.384***	5.661***	5.103***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 13 presents the results from the Probit analysis when including the share of the modern sector as an indicator of economic structure. In general we find little evidence to suggest that the share of the modern sector impacts upon the probability of being in an episode. The marginal effects for the modern sector share tend to be positive, but are never significant. While effects of the interaction of the modern sector share with $RELUS$ are generally negative and sometimes significant, those when splitting the sample by income quartile are never significant, have a variable sign and show no clear pattern across quartiles.

Figure 5 presents the survival curves for four subgroups ranked by the share of the modern sector at the beginning of an episode. When looking at the Kaplan-Meier estimates separately for each modern share quartile we find that the median survival estimate is smallest for observations in quartile 1 (with an estimate of around 4 years, or a logged value of 1.4). The survival estimates for quartiles 2 and 4 are very similar, with a median survival time of around 6 years. Estimated survival time at the median for quartile 3 is largest, at around 9 years.

Results of the survival analysis are reported in Table 14. When considering the left panel and the Cox proportional hazards model we find an insignificant hazard on the modern share when included alone, but a significant effect of the change in the modern sector share. When both the initial level and the change are included hazards are significant for both variables, being equal to 0.34 for the initial share and 0.012 for the change. The result thus suggest that a one standard deviation (0.152) [0.0094] increase in the (initial) [change in the] modern sector share is associated with a (10) [0.9] per cent reduction in the hazard or risk of failure. In other words, the higher the share of the modern sector and the more rapid its increase, the less chance there is of a positive growth episode coming to an end.

When including the interaction of the initial modern sector share with $RELUS$ we find a very large value for the hazard on the interaction that is significant. Such an outcome is consistent with results when splitting the sample by income quartile. Hazards are found to be above one for all income quartiles, but are only significant in quartile 4, with a value of 2.573. Such a result suggests that a one standard deviation increase in the modern sector share is associated with a $1 - 2.573 = -1.573 \times 0.152 = -0.24$, or 24 per cent increase in the hazard rate. We have no satisfactory interpretation for the finding that a larger modern sector has such a substantial negative effect on duration of growth at higher levels of income.

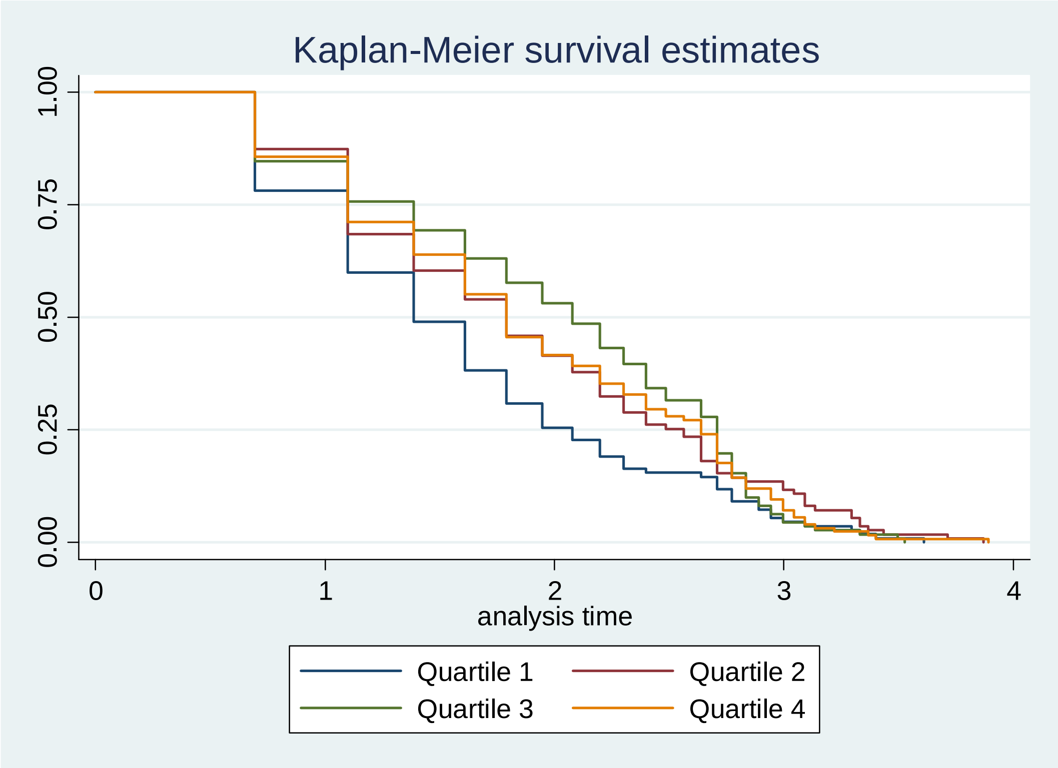
In terms of growth within an episode and the right panel of Table 14 we find a consistently negative and significant coefficient on the initial modern sector share, with insignificant coefficients found for the change in the modern sector share and its interaction with $RELUS$. When splitting by income quartiles coefficients are found to be generally negative, but are only significant for the second and third quartiles.

Table 13: Modern Share and the Probability of being in an Episode (Average Partial Effects)

	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ModSh$	0.0537	0.0128	0.0744	0.0841	0.237	0.140	0.139	0.0412				
	(0.142)	(0.122)	(0.0842)	(0.106)	(0.167)	(0.138)	(0.101)	(0.133)				
$ModSh \times RELUS$					-1.217***	-0.969**	-0.411	0.271				
					(0.428)	(0.428)	(0.360)	(0.453)				
$ModSh(Q1)$									-0.0808	-0.0851	0.105	0.133
									(0.265)	(0.206)	(0.108)	(0.122)
$ModSh(Q2)$									0.0864	0.0619	0.105	0.0408
									(0.178)	(0.142)	(0.0898)	(0.111)
$ModSh(Q3)$									-0.0256	-0.0574	0.0581	0.0400
									(0.154)	(0.126)	(0.0859)	(0.112)
$ModSh(Q4)$									0.00482	-0.0229	0.101	0.134
									(0.157)	(0.141)	(0.110)	(0.129)
$\Delta \ln POP$	-1.721	-1.553*	-0.778	-0.230	-1.096	-1.086	-0.630	-0.269	-1.545	-1.419	-0.858	-0.268
	(1.043)	(0.936)	(0.596)	(0.727)	(1.031)	(0.916)	(0.609)	(0.729)	(1.076)	(0.943)	(0.597)	(0.720)
$\ln POP$	0.0272***	0.0275***	0.0319***	0.204***	0.0271***	0.0274***	0.0317***	0.203***	0.0270***	0.0272***	0.0315***	0.193***
	(0.00794)	(0.00791)	(0.00911)	(0.0514)	(0.00770)	(0.00762)	(0.00899)	(0.0520)	(0.00774)	(0.00763)	(0.00907)	(0.0514)
$RELUS$	0.179***	0.220***	0.198***	0.0725	0.881***	0.776***	0.434**	-0.129	0.193*	0.237**	0.188**	-0.0205
	(0.0612)	(0.0657)	(0.0532)	(0.107)	(0.247)	(0.246)	(0.214)	(0.315)	(0.101)	(0.102)	(0.0951)	(0.136)
$EXPGDP$	0.0920**	0.105**	0.0717	0.0719	0.0915***	0.107***	0.0740	0.0720	0.0882**	0.0985**	0.0754	0.0776
	(0.0358)	(0.0457)	(0.0516)	(0.0742)	(0.0349)	(0.0416)	(0.0512)	(0.0740)	(0.0349)	(0.0428)	(0.0515)	(0.0741)
Observations	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223
R-squared	0.115				0.120				0.120			
F-stat	15.13				16.17				17.17			

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile. LPM, RE Probit and MC refer to results using the Linear Probability Model, the Random Effects Probit model and the Mudlak-Chamberlain estimator.

Figure 5: Kaplan-Meier Estimates of the Survival Function by Modern Share Quartile



Note: Quartiles based on value added share of modern sector at the beginning of an episode

Table 14: Modern Share, Survival Analysis and Growth within Episodes

	Cox Proportional Hazard					Growth within Episode				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$ModSh$	1.440		0.335**	0.780		-0.0333*		-0.0403*	-0.0434**	
	(0.668)		(0.185)	(0.447)		(0.0174)		(0.0207)	(0.0198)	
$\Delta ModSh$		0.0248***	0.0122***				-0.0129	-0.0389		
		(0.0158)	(0.00900)				(0.0342)	(0.0360)		
$ModSh \times RELUS$				55.85*					0.0715	
				(126.5)					(0.0661)	
$ModSh(Q1)$					1.643					-0.0366
					(1.104)					(0.0241)
$ModSh(Q2)$					1.162					-0.0430**
					(0.626)					(0.0202)
$ModSh(Q3)$					1.463					-0.0353*
					(0.698)					(0.0183)
$ModSh(Q4)$					2.573*					-0.00984
					(1.447)					(0.0189)
$RELUS$	0.410***	0.305***	0.389***	0.0427**	0.223***	0.00274	-0.00629	0.00317	-0.0379	-0.0245*
	(0.111)	(0.0760)	(0.107)	(0.0563)	(0.117)	(0.00812)	(0.00754)	(0.00838)	(0.0384)	(0.0147)
$\ln POP$	0.870***	0.901***	0.908**	0.870***	0.871***					
	(0.0337)	(0.0364)	(0.0369)	(0.0335)	(0.0342)					
$EXPGDP$	0.585*	0.798	0.974	0.617*	0.600*	-0.00548	-0.00820	-0.00317	-0.00565	-0.00412
	(0.165)	(0.207)	(0.259)	(0.171)	(0.168)	(0.00660)	(0.00668)	(0.00666)	(0.00665)	(0.00660)
$\Delta \ln POP$						0.102	0.0784	0.0893	0.0914	0.0810
						(0.0658)	(0.0655)	(0.0659)	(0.0670)	(0.0654)
GCF						0.0949***	0.0890***	0.113***	0.0962***	0.0927***
						(0.0301)	(0.0301)	(0.0325)	(0.0300)	(0.0299)
Observations	398	367	367	398	398	394	363	363	394	394
R-squared						0.034	0.029	0.040	0.036	0.045
F-stat						2.618**	2.229*	2.335**	2.589**	2.220**

Notes: The left panel reports results from the Cox proportional hazards model, with hazard rates being reported. The right panel reports results of cross-section growth models, with average growth within an episode being the dependent variable. Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. In the case of the growth regressions, standard errors are robust to heteroscedasticity.

5.4 The Value Added Share of Manufacturing in the Modern Sector and Sustained Growth

Table 15 reports results from the panel growth regression when including the share of manufacturing in the modern sector. Concentrating immediately on the coefficients of the manufacturing share in the modern sector we find coefficients on the initial share of manufacturing in the modern sector that tend to be negative, but are always insignificant. Accounting for nonlinearities associated with income levels also results in insignificant coefficients, suggesting no relationship between the share of manufacturing in the modern sector and growth for countries at any level of income. We do however find significant coefficients when looking at the change in the share of manufacturing in the modern sector. The results indicate that an increase in the share of manufacturing in the modern sector is associated with lower average growth.

When considering the relationship between the share of manufacturing in the modern sector and volatility (Table 16) we find that a higher share of manufacturing in the modern sector is associated with lower growth volatility, a result in line with those reported in Section 5.2. The reduction in volatility is found to be largest for countries in the highest income quartile followed by those in the lowest income quartile. We find no evidence of a change in the share of manufacturing in the modern sector impacting upon volatility.

Table 17 presents the results from the Probit analysis of the probability of being in an episode when measuring economic structure using the share of manufacturing in the modern sector. Similar to the results in Table 7 for the manufacturing share we find a marginal effect that is positive and significant when no interaction terms are included. With the marginal effect ranging between 0.15 and 0.30, the results indicate that a one standard deviation (i.e. 0.14) increase in the manufacturing share in the modern sector is associated with an increase in the probability of being in a positive growth episode of between 2.1 and 4.2 per cent depending upon the specification.

Results from the Kaplan-Meier estimator split by quartiles of the value added share (Figure 6) are largely similar to those when considering the manufacturing share in Figure 4, with the median survival estimate being smallest for the first quartile and largest for the fourth quartile.

Results from the survival analysis are reported in Table 18. The hazard rate for the initial share of manufacturing in the modern sector is found to be significant at a value of 0.2. A one standard deviation (0.1424) increase in this share is associated with a reduction in the risk of failure of 11.4 per cent. The interaction of the share with $RELUS$ is not found to be significant, while hazards for the different income quartiles are found to be significant and range between 0.16 and 0.26. Results thus suggest a decrease in the risk of failure due to a higher manufacturing share in the modern sector for all income quartiles, though there appears to be no clear pattern across the income quartiles.

But the hazard rates for the *change* in the manufacturing share of the modern sector are found to be larger than 1. When included alone the hazard rate is 8.06, which would imply that a one standard deviation (0.0138) increase in the change in the manufacturing share of the modern sector would increase the risk of failure by 9.7 percent. It is somewhat puzzling that a larger share of manufacturing within the modern sector substantially reduces the risk of a growth episode coming to an end, while an increase in this share has negative effects. This should be examined further.

Turning to the within episode growth results in the right panel we observe a negative coefficient on the initial share of manufacturing in the modern sector, though the coefficient is only significant when the interaction with $RELUS$ is included. The interaction itself is found to be positive and significant suggesting that the negative association between growth within an episode and the share of manufacturing in the modern sector is only found for countries with relatively low income levels. Such an outcome is confirmed by the results splitting by income quartile, where we observe a negative and significant association for countries in the bottom three income quartiles, but no significant association for the highest income countries. This finding contradicts the general wisdom that manufacturing is especially important for growth at low levels of income.

The most important findings in this subset of regressions relate to the estimated relationships between the share of manufacturing in the modern sector and duration and volatility. A higher share is associated with a longer duration of growth and less volatility. The relationship with growth rates is far less clear and often negative.

Table 15: The Share of Manufacturing in the Modern Sector and Growth – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ManModSh$	0.0122		-0.0169	-0.0166	-0.00631		0.0162		-0.0102	-0.00908	-0.000708	
	(0.0142)		(0.0163)	(0.0161)	(0.0204)		(0.0113)		(0.0125)	(0.0125)	(0.0157)	
$\Delta ManModSh$		-0.0830***	-0.0932***	-0.146**				-0.0769***	-0.0832***	-0.145***		
		(0.0236)	(0.0278)	(0.0720)				(0.0155)	(0.0172)	(0.0463)		
$ManModSh \times \Delta ManModSh$				0.145						0.172		
				(0.210)						(0.118)		
$ManModSh \times RELUS$					0.0600						0.0553	
					(0.0500)						(0.0354)	
$ManModSh(Q1)$						0.00765						0.0139
						(0.0165)						(0.0146)
$ManModSh(Q2)$						0.00580						0.0104
						(0.0177)						(0.0135)
$ManModSh(Q3)$						0.00386						0.00431
						(0.0172)						(0.0138)
$ManModSh(Q4)$						0.0252						0.0274*
						(0.0200)						(0.0151)
$RELUS$	-0.119***	-0.116***	-0.118***	-0.119***	-0.135***	-0.129***	-0.0885***	-0.0911***	-0.0931***	-0.0924***	-0.104***	-0.0987***
	(0.0205)	(0.0200)	(0.0200)	(0.0202)	(0.0266)	(0.0224)	(0.0147)	(0.0143)	(0.0144)	(0.0144)	(0.0178)	(0.0163)
$\Delta \ln POP$	0.284	0.270	0.242	0.258	0.316	0.299	0.250**	0.282***	0.266**	0.288***	0.278**	0.258**
	(0.382)	(0.343)	(0.336)	(0.337)	(0.391)	(0.392)	(0.112)	(0.109)	(0.110)	(0.111)	(0.113)	(0.113)
$EXPGDP$	0.0421**	0.0461**	0.0476**	0.0475**	0.0425**	0.0450**	0.0291***	0.0354***	0.0366***	0.0362***	0.0300***	0.0329***
	(0.0185)	(0.0187)	(0.0186)	(0.0184)	(0.0189)	(0.0189)	(0.00942)	(0.00929)	(0.00941)	(0.00938)	(0.00938)	(0.00967)
GCF	0.129***	0.137***	0.138***	0.136***	0.122***	0.125***	0.131***	0.137***	0.137***	0.135***	0.126***	0.130***
	(0.0370)	(0.0338)	(0.0340)	(0.0343)	(0.0382)	(0.0384)	(0.0153)	(0.0152)	(0.0152)	(0.0152)	(0.0156)	(0.0157)
$\ln POP_{1960}$							0.00497***	0.00662***	0.00701***	0.00689***	0.00523***	0.00555***
							(0.00145)	(0.00141)	(0.00150)	(0.00149)	(0.00145)	(0.00148)
$\ln GDPPC_{1960}$							0.00901**	0.0114***	0.0117***	0.0115***	0.00879**	0.0107***
							(0.00373)	(0.00379)	(0.00385)	(0.00382)	(0.00369)	(0.00394)
$\ln SCH_{1960}$							0.00331**	0.00270*	0.00269*	0.00269*	0.00325**	0.00307**
							(0.00143)	(0.00143)	(0.00145)	(0.00145)	(0.00142)	(0.00143)
$KGATEMP$							0.0172***	0.0173***	0.0180***	0.0185***	0.0154**	0.0159**
							(0.00625)	(0.00624)	(0.00639)	(0.00639)	(0.00627)	(0.00627)
Observations	731	709	709	709	731	731	731	709	709	709	731	731
R-squared	0.263	0.311	0.313	0.315	0.266	0.266						
F-Stat	13.08***	13.36***	12.93***	12.29***	11.83***	12.32***	13.35***	16.15***	15.32***	14.63***	12.82***	11.63***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 16: The Share of Manufacturing in the Modern Sector and Volatility – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$ManModSh$	-0.0397**		-0.0375*	-0.0372*	-0.0316		-0.0368***		-0.0331***	-0.0336***	-0.0252*	
	(0.0158)		(0.0221)	(0.0224)	(0.0222)		(0.00942)		(0.0106)	(0.0106)	(0.0133)	
$\Delta ManModSh$		0.0212	-0.00149	-0.0549				0.0237	0.00398	-0.0291		
		(0.0260)	(0.0337)	(0.0636)				(0.0162)	(0.0173)	(0.0479)		
$ManModSh \times \Delta ManModSh$				0.147						0.0907		
				(0.195)						(0.122)		
$ManModSh \times RELUS$					-0.0263						-0.0430	
					(0.0326)						(0.0330)	
$ManModSh(Q1)$						-0.0436***						-0.0342***
						(0.0162)						(0.0126)
$ManModSh(Q2)$						-0.0331						-0.0332***
						(0.0207)						(0.0110)
$ManModSh(Q3)$						-0.0264						-0.0221**
						(0.0214)						(0.0112)
$ManModSh(Q4)$						-0.0473***						-0.0499***
						(0.0155)						(0.0131)
$RELUS$	-0.00301	0.00518	-0.000976	-0.00138	0.00415	0.00456	-0.0170	0.000835	-0.00601	-0.0111	-0.00631	-0.000373
	(0.0241)	(0.0239)	(0.0245)	(0.0243)	(0.0285)	(0.0240)	(0.0139)	(0.0145)	(0.0144)	(0.0143)	(0.0170)	(0.0153)
$\Delta \ln POP$	-0.106	-0.0460	-0.108	-0.0923	-0.120	-0.110	-0.0524	-0.0168	-0.0735	-0.0625	-0.0740	-0.0641
	(0.221)	(0.215)	(0.220)	(0.205)	(0.226)	(0.227)	(0.103)	(0.106)	(0.106)	(0.107)	(0.104)	(0.103)
$EXPGDP$	0.0183	0.0140	0.0174	0.0173	0.0181	0.0142	0.00674	-0.000251	0.00261	0.00391	0.00593	0.00114
	(0.0158)	(0.0179)	(0.0173)	(0.0173)	(0.0161)	(0.0157)	(0.00857)	(0.00897)	(0.00891)	(0.00892)	(0.00855)	(0.00875)
GCF	-0.0694***	-0.0769***	-0.0734***	-0.0753***	-0.0665***	-0.0684***	-0.0535***	-0.0586***	-0.0578***	-0.0582***	-0.0493***	-0.0523***
	(0.0177)	(0.0194)	(0.0187)	(0.0185)	(0.0182)	(0.0184)	(0.0148)	(0.0154)	(0.0153)	(0.0153)	(0.0150)	(0.0151)
$\ln POP_{1960}$							-0.000712	-0.00284**	-0.00167	-0.00136	-0.000879	-0.00163
							(0.00118)	(0.00124)	(0.00127)	(0.00127)	(0.00118)	(0.00119)
$\ln GDPPC_{1960}$							0.00446	0.000793	0.00169	0.00270	0.00475	0.00137
							(0.00315)	(0.00341)	(0.00336)	(0.00335)	(0.00304)	(0.00336)
$\ln SCH_{1960}$							-0.00251**	-0.00248**	-0.00248**	-0.00241**	-0.00240**	-0.00230**
							(0.00116)	(0.00124)	(0.00121)	(0.00121)	(0.00111)	(0.00111)
$KGATEMP$							0.00666	0.00235	0.00489	0.00584	0.00832*	0.00748
							(0.00516)	(0.00545)	(0.00541)	(0.00545)	(0.00504)	(0.00505)
Observations	731	709	709	709	731	731	731	709	709	709	731	731
R-squared	0.113	0.103	0.114	0.116	0.114	0.119						
F-Stat	6.189***	5.911***	5.643***	5.290***	5.685***	5.521***	5.786***	4.896***	5.224***	4.957***	5.732***	5.431***

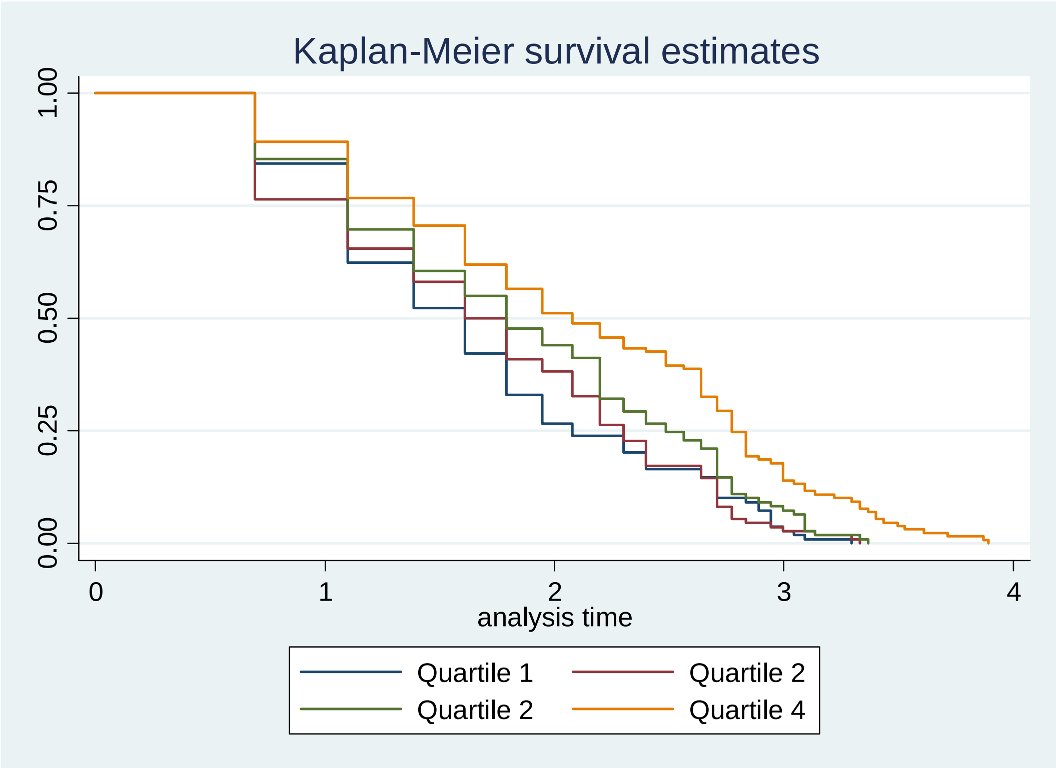
Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 17: Share of Manufacturing in the Modern Sector and the Probability of being in an Episode (Average Partial Effects)

	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC
$ManModSh$	0.302***	0.282***	0.280***	0.149*	0.138	0.105	0.0187	-0.0575				
	(0.111)	(0.100)	(0.0708)	(0.0886)	(0.179)	(0.150)	(0.0946)	(0.109)				
$ManModSh \times RELUS$					0.597*	0.760**	1.064***	0.999***				
					(0.328)	(0.333)	(0.255)	(0.309)				
$ManModSh(Q1)$									0.0564	0.0826	0.131	0.0811
									(0.155)	(0.125)	(0.0897)	(0.104)
$ManModSh(Q2)$									0.296**	0.283**	0.240***	0.116
									(0.136)	(0.117)	(0.0809)	(0.103)
$ManModSh(Q3)$									0.247*	0.237**	0.275***	0.155
									(0.129)	(0.114)	(0.0809)	(0.108)
$ManModSh(Q4)$									0.449***	0.509***	0.540***	0.399***
									(0.0978)	(0.122)	(0.106)	(0.133)
$\Delta \ln POP$	-0.666	-0.632	-0.253	-0.0247	-0.432	-0.303	0.0624	0.231	-0.303	-0.318	-0.0582	0.107
	(0.930)	(0.844)	(0.603)	(0.724)	(0.904)	(0.813)	(0.615)	(0.734)	(0.947)	(0.846)	(0.611)	(0.728)
$\ln POP$	0.0201**	0.0202**	0.0241***	0.181***	0.0212**	0.0212**	0.0241***	0.107*	0.0218***	0.0216***	0.0246***	0.140**
	(0.00806)	(0.00815)	(0.00901)	(0.0528)	(0.00832)	(0.00827)	(0.00909)	(0.0574)	(0.00800)	(0.00791)	(0.00887)	(0.0551)
$RELUS$	0.205***	0.229***	0.217***	0.106	-0.00345	-0.0284	-0.138	-0.135	0.0637	0.0543	0.0336	-0.0195
	(0.0485)	(0.0529)	(0.0476)	(0.105)	(0.132)	(0.130)	(0.0967)	(0.131)	(0.0792)	(0.0867)	(0.0723)	(0.117)
$EXPGDP$	0.0918**	0.105**	0.0850*	0.0806	0.101**	0.113**	0.0991**	0.0737	0.0831**	0.0952**	0.0896*	0.0770
	(0.0369)	(0.0457)	(0.0487)	(0.0719)	(0.0418)	(0.0495)	(0.0489)	(0.0717)	(0.0380)	(0.0450)	(0.0484)	(0.0722)
Observations	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221	4,221
R-squared	0.122				0.124				0.128			
F-stat	14.31				15.08				15.03			

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile. LPM, RE Probit and MC refer to results using the Linear Probability Model, the Random Effects Probit model and the Mudlak-Chamberlain estimator.

Figure 6: Kaplan-Meier Estimates of the Survival Function by Manufacturing Share in Modern Sector Quartile



Note: Quartiles based on the value added share of manufacturing in the modern sector at the beginning of a growth episode.

Table 18: Share of Manufacturing in the Modern Sector, Survival Analysis and Growth within Episodes

	Cox Proportional Hazard					Growth within Episode				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$ManModSh$	0.200***		0.258***	0.360*		-0.0209		-0.0136	-0.0562***	
	(0.0816)		(0.123)	(0.208)		(0.0139)		(0.0162)	(0.0193)	
$\Delta ManModSh$		8.064***	4.366**				0.00529	-0.00181		
		(4.227)	(2.530)				(0.0249)	(0.0272)		
$ManModSh \times RELUS$				0.0884					0.148***	
				(0.149)					(0.0496)	
$ManModSh(Q1)$					0.257**					-0.0302*
					(0.148)					(0.0171)
$ManModSh(Q2)$					0.193***					-0.0460***
					(0.0969)					(0.0175)
$ManModSh(Q3)$					0.162***					-0.0342*
					(0.0776)					(0.0174)
$ManModSh(Q4)$					0.222***					0.0124
					(0.120)					(0.0175)
$RELUS$	0.562**	0.578**	0.638*	1.390	0.553	-0.00517	-0.00512	-0.00469	-0.0594***	-0.0354***
	(0.131)	(0.141)	(0.156)	(0.920)	(0.246)	(0.00737)	(0.00760)	(0.00759)	(0.0187)	(0.0121)
$\ln POP$	0.906**	0.900***	0.928*	0.898***	0.902**					
	(0.0360)	(0.0362)	(0.0385)	(0.0360)	(0.0372)					
$EXPGDP$	0.591**	0.736	0.679	0.557**	0.613*	-0.0118	-0.00839	-0.00978	-0.00969	-0.00818
	(0.156)	(0.188)	(0.177)	(0.149)	(0.162)	(0.00721)	(0.00674)	(0.00694)	(0.00715)	(0.00695)
$\Delta \ln POP$						0.0656	0.0802	0.0669	0.0811	0.0582
						(0.0648)	(0.0645)	(0.0658)	(0.0688)	(0.0665)
GCF						0.0773***	0.0875***	0.0872***	0.0764***	0.0724***
						(0.0283)	(0.0293)	(0.0291)	(0.0279)	(0.0274)
Observations	398	367	367	398	398	394	363	363	394	394
R-squared						0.029	0.029	0.030	0.043	0.050
F-stat						2.307**	2.204*	1.890*	3.286***	2.597***

Notes: The left panel reports results from the Cox proportional hazards model, with hazard rates being reported. The right panel reports results of cross-section growth models, with average growth within an episode being the dependent variable. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. In the case of the growth regressions, standard errors are robust to heteroscedasticity.

5.5 Specialisation and Sustained Growth

In this final section we consider the relationship between our indicator of specialisation and the variables representing growth sustainability. Table 19 reports results of the relationship between the Theil index and average growth rates using our five-year panel dataset. Coefficients on the initial value of the Theil index are consistently negative, suggesting that increased specialisation has a negative association with growth. The coefficients are only significant however when the change in the Theil index is included, with the coefficient on that variable also tending to be negative, but insignificant. When allowing for non-linear effects we find consistent evidence indicating that the negative association between initial specialisation and subsequent growth is stronger for richer countries. This is evidenced by the negative coefficient on the interaction of the Theil index with $RELUS$ and the fact that coefficients are larger (in absolute value) and significant for countries in the highest and in particular the second highest income quartile. This result seems to contradict the U-shaped relationship discussed in Imbs and Wacziarg (2003) and Kaulich *et al.* (2012). This literature suggests that too much specialisation is bad for growth at low levels of income, while specialisation according to comparative advantage has more positive effects for high income countries. Here we find a consistently negative relationship between specialisation and growth, especially at higher levels of income. Note, however, that the U-shaped relation is in terms of levels, while here the dependent variable is growth.

When considering the relationship between both the initial value and the change in specialisation and volatility (Table 20) we find no evidence of any significant relationship.

Table 19: The Theil Index and Growth – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Theil$	-0.0317		-0.0595*	-0.0613*	-0.00133		-0.0225		-0.0528**	-0.0522**	0.0139	
	(0.0252)		(0.0348)	(0.0315)	(0.0333)		(0.0189)		(0.0223)	(0.0230)	(0.0240)	
$\Delta Theil$		0.0220	-0.0147	-0.00386				0.0254	-0.00809	0.00648		
		(0.0625)	(0.0788)	(0.132)				(0.0243)	(0.0280)	(0.0527)		
$Theil \times \Delta Theil$				-0.0500						-0.0582		
				(0.300)						(0.207)		
$Theil \times RELUS$					-0.164						-0.200**	
					(0.0992)						(0.0825)	
$Theil(Q1)$						-0.00512						0.00757
						(0.0287)						(0.0216)
$Theil(Q2)$						-0.0485						-0.0420
						(0.0309)						(0.0262)
$Theil(Q3)$						-0.117***						-0.119***
						(0.0396)						(0.0348)
$Theil(Q4)$						-0.0819**						-0.0810**
						(0.0348)						(0.0392)
$RELUS$	-0.118***	-0.119***	-0.114***	-0.114***	-0.0909***	-0.113***	-0.0889***	-0.0936***	-0.0906***	-0.0906***	-0.0560***	-0.0870***
	(0.0199)	(0.0196)	(0.0196)	(0.0198)	(0.0246)	(0.0221)	(0.0146)	(0.0144)	(0.0145)	(0.0145)	(0.0195)	(0.0178)
$\Delta \ln POP$	0.280	0.313	0.321	0.318	0.316	0.315	0.242**	0.296***	0.305***	0.309***	0.286**	0.285**
	(0.372)	(0.390)	(0.377)	(0.376)	(0.381)	(0.370)	(0.112)	(0.112)	(0.112)	(0.112)	(0.113)	(0.112)
$EXPGDP$	0.0437**	0.0437**	0.0463***	0.0464***	0.0432**	0.0496**	0.0323***	0.0336***	0.0350***	0.0349***	0.0333***	0.0402***
	(0.0185)	(0.0168)	(0.0169)	(0.0170)	(0.0188)	(0.0195)	(0.00944)	(0.00941)	(0.00952)	(0.00953)	(0.00934)	(0.00969)
GCF	0.118***	0.140***	0.120***	0.120***	0.124***	0.125***	0.124***	0.141***	0.123***	0.124***	0.130***	0.134***
	(0.0376)	(0.0348)	(0.0368)	(0.0366)	(0.0363)	(0.0360)	(0.0170)	(0.0154)	(0.0171)	(0.0170)	(0.0171)	(0.0172)
$\ln POP_{1960}$							0.00599***	0.00665***	0.00652***	0.00653***	0.00612***	0.00667***
							(0.00140)	(0.00139)	(0.00144)	(0.00145)	(0.00137)	(0.00140)
$\ln GDPPC_{1960}$							0.0100***	0.0117***	0.0103***	0.0103***	0.0100***	0.0161***
							(0.00386)	(0.00375)	(0.00392)	(0.00393)	(0.00378)	(0.00426)
$\ln SCH_{1960}$							0.00277*	0.00297**	0.00277*	0.00278*	0.00253*	0.00213
							(0.00144)	(0.00142)	(0.00147)	(0.00148)	(0.00141)	(0.00143)
$KGATEMP$							0.0184***	0.0170***	0.0190***	0.0189***	0.0192***	0.0198***
							(0.00633)	(0.00619)	(0.00644)	(0.00646)	(0.00618)	(0.00625)
Observations	732	710	710	710	732	732	732	710	710	710	732	732
F-Stat	13.20***	14.94***	16.36***	15.34***	13.74***	11.57***	13.46***	14.40***	13.98***	13.26***	13.17***	12.23***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Table 20: The Theil Index and Volatility – Panel Regression Results

	Within-Groups Model						Hausman-Taylor Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Theil$	0.00956		0.0259	0.0337	-0.00447		0.0211		0.0284	0.0321	0.0162	
	(0.0256)		(0.0336)	(0.0348)	(0.0339)		(0.0168)		(0.0200)	(0.0211)	(0.0220)	
$\Delta Theil$		-0.000541	0.0155	-0.0317				-0.00598	0.0121	-0.0105		
		(0.0343)	(0.0463)	(0.0711)				(0.0249)	(0.0280)	(0.0542)		
$Theil \times \Delta Theil$				0.217						0.105		
				(0.255)						(0.210)		
$Theil \times RELUS$					0.0760						0.0313	
					(0.0801)						(0.0810)	
$Theil(Q1)$						0.00753						0.0223
						(0.0281)						(0.0188)
$Theil(Q2)$						0.00739						0.00962
						(0.0398)						(0.0244)
$Theil(Q3)$						0.00945						0.0491
						(0.0433)						(0.0300)
$Theil(Q4)$						0.0188						0.0114
						(0.0402)						(0.0352)
$RELUS$	0.00326	0.00562	0.00358	0.00429	-0.00937	0.000311	-0.00936	-0.00464	-0.00943	-0.0107	-0.0201	-0.00614
	(0.0239)	(0.0239)	(0.0241)	(0.0245)	(0.0283)	(0.0259)	(0.0139)	(0.0142)	(0.0142)	(0.0142)	(0.0190)	(0.0169)
$\Delta \ln POP$	-0.0602	-0.0519	-0.0555	-0.0422	-0.0765	-0.0627	-0.0131	-0.0183	-0.0297	-0.0228	-0.0222	-0.0203
	(0.217)	(0.224)	(0.220)	(0.224)	(0.223)	(0.224)	(0.104)	(0.107)	(0.107)	(0.108)	(0.106)	(0.105)
$EXPGDP$	0.0142	0.0144	0.0133	0.0131	0.0144	0.0146	0.00334	0.000964	0.000956	0.00143	0.00337	0.00269
	(0.0163)	(0.0182)	(0.0182)	(0.0183)	(0.0165)	(0.0169)	(0.00867)	(0.00900)	(0.00895)	(0.00898)	(0.00874)	(0.00904)
GCF	-0.0700***	-0.0786***	-0.0700***	-0.0702***	-0.0727***	-0.0707***	-0.0475***	-0.0594***	-0.0496***	-0.0495***	-0.0477***	-0.0485***
	(0.0228)	(0.0192)	(0.0247)	(0.0250)	(0.0238)	(0.0233)	(0.0164)	(0.0155)	(0.0169)	(0.0169)	(0.0165)	(0.0166)
$\ln POP_{1960}$							-0.00207*	-0.00268**	-0.00250**	-0.00245**	-0.00210*	-0.00213*
							(0.00115)	(0.00123)	(0.00122)	(0.00123)	(0.00117)	(0.00118)
$\ln GDPPC_{1960}$							0.00367	0.00164	0.00289	0.00306	0.00422	0.00220
							(0.00330)	(0.00337)	(0.00343)	(0.00345)	(0.00328)	(0.00383)
$\ln SCH_{1960}$							-0.00250**	-0.00238*	-0.00220*	-0.00213*	-0.00219*	-0.00220*
							(0.00117)	(0.00124)	(0.00123)	(0.00124)	(0.00116)	(0.00116)
$KGATEMP$							0.00326	0.00354	0.00278	0.00309	0.00389	0.00325
							(0.00519)	(0.00545)	(0.00542)	(0.00546)	(0.00519)	(0.00520)
Observations	732	710	710	710	732	732	732	710	710	710	732	732
F-Stat	6.080***	5.895***	5.984***	5.500***	5.642***	5.322***	4.964***	4.793***	4.669***	4.434***	4.767***	4.429***

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile.

Results from the Probit model relating specialisation to the probability of being in an episode are reported in Table 21. The results indicate a strong negative relationship between increased specialisation and the probability of being part of a positive growth episode. With marginal effects ranging between -0.37 and -0.65, the results suggest that a one standard deviation (i.e. 0.083) increase in specialisation is associated with a decrease in the probability of being in an episode of between 3.1 and 5.4 per cent. The interaction of the specialisation index with $RELUS$ is found to have a positive effect that is often significant, suggesting that the negative impact of specialisation on the probability of being in an episode declines for countries with higher incomes. This result is confirmed when splitting the data by income quartiles, with significantly negative effects found for countries in the lowest income quartile, but smaller (in absolute value) effects that are less often significant found at higher quartiles. In the highest income quartile there is no significant evidence of a relationship between specialisation and the probability of being in an episode. Different to results reported in Table 19, this result does seem consistent with the hypothesis of a U-shaped relationship between specialisation and income levels.

Results from the Kaplan-Meier estimates (Figure 7) when split into quartiles based on specialisation at the beginning of the episode differ from those based on sector shares in the previous sections. The top quartile, quartile 4, is found to have the smallest median survival estimate at around 4 years, followed by quartile 1 (at around 5 years), with quartiles 2 and 3 reporting similar values of around 7.4 years. The results thus suggest that countries that are either too specialised or too diversified are less likely to have an extended positive growth duration.

Table 22 reports the results of the survival analysis. When both the initial specialisation and the change in specialisation during the episode are included (specification 3) we find significant coefficients. In this case, both hazard rates are found to be above one, with a one standard deviation (0.098) [0.0073] increase in the (initial level of) [change in] specialisation estimated to increase the risk of failure by (31) [25] per cent. This implies that high and increasing levels of specialisation significantly increase the chances of a growth spell coming to an end.

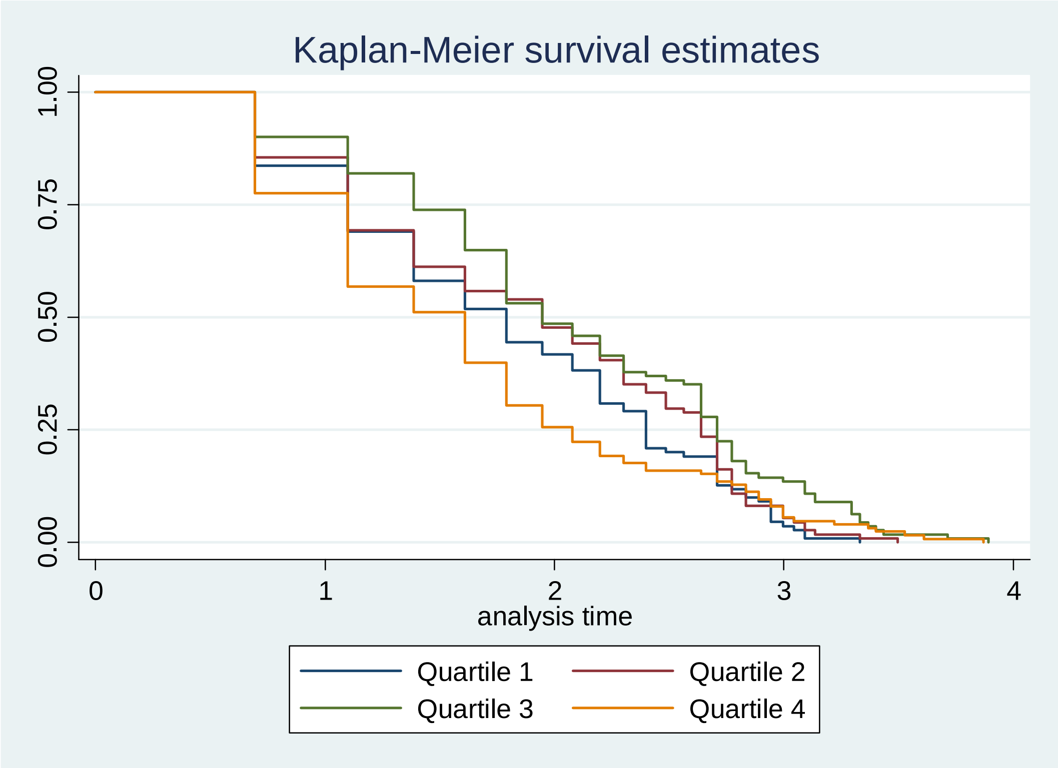
Neither the hazard on the interaction nor those on the different income quartiles are found to be significant. Turning to the right panel and growth within an episode we find a significantly positive association between growth and specialisation, suggesting that increased specialisation is associated with higher average growth in an episode. The coefficient on the change in specialisation is also found to be positive (and significant in one of the two cases). The interaction with $RELUS$ is not found to be significant, which can be explained by the results when splitting by income quartiles. Here we find positive and significant coefficients for the lowest and highest income quartiles, but insignificant effects for the middle two quartiles. The combination of the two sets of findings is extremely interesting. Specialisation tends to result in more rapid growth within a growth episode, but also increases the chance that the growth episode comes to an end. Specialisation results in growth with volatility.

Table 21: Specialisation and the Probability of being in an Episode (Average Partial Effects)

	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC	LPM	Probit	RE Probit	MC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Theil$	-0.503***	-0.372***	-0.591***	-0.649***	-0.671***	-0.496***	-0.759***	-0.860***				
	(0.139)	(0.107)	(0.107)	(0.128)	(0.165)	(0.126)	(0.136)	(0.158)				
$Theil \times RELUS$					0.996	0.851	1.085**	1.362**				
					(0.637)	(0.665)	(0.547)	(0.598)				
$Theil(Q1)$									-0.603***	-0.434***	-0.683***	-0.772***
									(0.143)	(0.110)	(0.115)	(0.144)
$Theil(Q2)$									-0.245	-0.146	-0.626***	-0.731***
									(0.255)	(0.224)	(0.170)	(0.184)
$Theil(Q3)$									-0.367	-0.295	-0.455**	-0.372
									(0.248)	(0.223)	(0.193)	(0.232)
$Theil(Q4)$									0.0608	0.141	-0.0847	-0.00714
									(0.255)	(0.307)	(0.262)	(0.299)
$\Delta \ln POP$	-1.329	-1.301	-0.509	-0.135	-1.448	-1.411	-0.679	-0.332	-1.281	-1.287	-0.619	-0.278
	(1.108)	(0.971)	(0.585)	(0.715)	(1.130)	(1.008)	(0.590)	(0.715)	(1.097)	(0.982)	(0.584)	(0.712)
$\ln POP$	0.0267***	0.0262***	0.0306***	0.164***	0.0250***	0.0252***	0.0293***	0.164***	0.0255***	0.0251***	0.0300***	0.158***
	(0.00765)	(0.00761)	(0.00904)	(0.0515)	(0.00758)	(0.00749)	(0.00907)	(0.0514)	(0.00722)	(0.00727)	(0.00900)	(0.0514)
$RELUS$	0.181***	0.205***	0.190***	0.0922	0.0247	0.0717	0.0130	-0.177	0.0610	0.0970	0.0506	-0.0782
	(0.0509)	(0.0561)	(0.0489)	(0.105)	(0.127)	(0.137)	(0.101)	(0.165)	(0.0879)	(0.104)	(0.0820)	(0.132)
$EXPGDP$	0.0987***	0.0982**	0.0900*	0.117	0.0800**	0.0831**	0.0714	0.101	0.0738**	0.0769*	0.0752	0.0926
	(0.0340)	(0.0421)	(0.0492)	(0.0721)	(0.0334)	(0.0401)	(0.0501)	(0.0727)	(0.0356)	(0.0422)	(0.0500)	(0.0727)
Observations	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223	4,223
R-squared	0.123				0.124				0.127			
F-stat	16.64				16.91				18.36			

Notes: All regressions include unreported time dummy variables; Standard errors are clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; $ManSh(Q1)$, $ManSh(Q2)$, $ManSh(Q3)$, $ManSh(Q4)$ report the coefficients on the manufacturing share for the four income quartiles, with 1 being the lowest and 4 the highest income quartile. LPM, RE Probit and MC refer to results using the Linear Probability Model, the Random Effects Probit model and the Mudlak-Chamberlain estimator.

Figure 7: Kaplan-Meier Estimates of the Survival Function by Specialisation Quartile



Note: Quartiles based on value of Theil index at the beginning of an episode

Table 22: Specialisation, Survival Analysis and Growth within Episodes

	Cox Proportional Hazard					Growth within Episode				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Theil$	1.503		4.127*	1.505		0.0498**		0.0713***	0.0673**	
	(0.952)		(3.042)	(1.247)		(0.0225)		(0.0221)	(0.0274)	
$\Delta Theil$		20.03***	35.69***				0.0525	0.104**		
		(15.94)	(28.58)				(0.0466)	(0.0453)		
$Theil \times RELUS$				0.994					-0.126	
				(4.127)					(0.101)	
$Theil(Q1)$					1.572					0.0489**
					(1.089)					(0.0227)
$Theil(Q2)$					0.662					0.0160
					(0.578)					(0.0388)
$Theil(Q3)$					0.601					0.0292
					(0.713)					(0.0375)
$Theil(Q4)$					1.764					0.0756*
					(2.451)					(0.0423)
$RELUS$	0.475***	0.345***	0.361***	0.475	0.412**	-0.00407	-0.00877	-0.00935	0.0162	-0.0150
	(0.112)	(0.0865)	(0.0904)	(0.323)	(0.179)	(0.00731)	(0.00765)	(0.00754)	(0.0180)	(0.0121)
$\ln POP$	0.873***	0.914**	0.919**	0.873***	0.867***					
	(0.0336)	(0.0365)	(0.0365)	(0.0336)	(0.0336)					
$EXPGDP$	0.643*	0.612*	0.632*	0.643*	0.658	-0.00966	-0.00951	-0.0109*	-0.00794	-0.00818
	(0.168)	(0.166)	(0.168)	(0.172)	(0.175)	(0.00669)	(0.00662)	(0.00654)	(0.00685)	(0.00674)
$\Delta \ln POP$						0.0830	0.0718	0.0494	0.0878	0.0670
						(0.0636)	(0.0653)	(0.0632)	(0.0640)	(0.0627)
GCF						0.0974***	0.0881***	0.114***	0.0998***	0.0916***
						(0.0292)	(0.0293)	(0.0286)	(0.0297)	(0.0303)
Observations	398	367	367	398	398	394	363	363	394	394
R-squared						0.036	0.033	0.051	0.038	0.042
F-stat						3.214***	2.461**	4.328***	2.766**	2.768***

Notes: The left panel reports results from the Cox proportional hazards model, with hazard rates being reported. The right panel reports results of cross-section growth models, with average growth within an episode being the dependent variable. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. In the case of the growth regressions, standard errors are robust to heteroscedasticity.

6 Conclusions

In this exploratory paper, we have examined the relationship between economic structure and the ability of countries to sustain growth. The structural variables included the degree of specialisation in the structure of value added as measured by the Theil index, the share of manufacturing in value added, the share of the modern sector in value added and the share of manufacturing within the modern sector. These variables were measured both in terms of initial levels at the beginning of a period, or in terms of their changes over that period. The key dependent variables were the average growth rates in five-year periods, the volatility of growth rates in five-year periods, the length (duration) of positive growth episodes and the rate of growth within those growth episodes. The analysis resulted in a large set of specifications which have been discussed systematically in the previous sections. The research is not yet at a stage that we can select our definitive specifications and draw firm conclusions. This will require further research. Nevertheless, some interesting patterns are beginning to emerge, which are summarised in the following paragraphs.[11]

First, a higher manufacturing share increases both the probability of being in a growth episode and the duration of growth episodes. It may also help reduce growth volatility. In other words, manufacturing seems to be related to the ability to sustain growth. There is no similar relationship between manufacturing shares and average growth rates. When looking at growth rates within episodes, they tend to be lower for countries with higher manufacturing shares (especially for lower income countries).

Second, if we look at the share of manufacturing value added within the modern sector of the economy rather than its share in GDP, a very similar picture emerges. The modern sector share is significantly associated with a higher probability of being in a growth episode (with the effect even increasing for higher income countries), as well as with lower growth volatility. There is also a lower risk that a growth episode comes to an end, indicating a positive effect of the share on duration. Changes in the share also have positive effects. In other words, a high and increasing share of manufacturing within the modern sector results in longer spells of uninterrupted growth. The relationship with growth rates is again different. First, the share of manufacturing in the modern sector has no impact on average growth rates. Increases in the share even have significant negative effects on growth. At lower levels of income, there is also a negative effect on growth within growth episodes. At higher relative income levels, the effects on growth within episodes are more positive.

Third, the impact of the modern sector share on the ability to sustain growth is more ambiguous than that of manufacturing. It seems to be dependent on the change in that share. When only the modern sector share is entered into the regression, there is no relationship with duration of growth or the risk of a growth episode coming to an end. However, when both the share and its

[11] The conclusions with regard to growth are primarily based on the Hausman-Taylor specifications, which capture both within country and between country variation. The within group specifications are usually less informative, but are almost always in line with the Hausman-Taylor specifications.

change are entered, both significantly reduce the hazard of a growth episode coming to an end. In other words, a high and increasing share of the modern sector makes for more sustained patterns of growth. The impact of the modern sector share on volatility is difficult to interpret, with the direct effects being negative. A larger modern sector is associated with higher volatility. But increases in the share of the modern sector significantly reduce volatility. Turning to growth, the size of the modern sector has a significantly negative effect on growth, when it is entered alone. But when both the size and the change in the size of the modern sector are entered, the coefficients turn positive. A large and increasing modern sector is associated with more rapid average growth. Finally, the effect of the size of the modern sector on growth rates within episodes is negative, consistent with the effects of manufacturing shares.

Fourth, the results for specialisation provide for an interesting story. By and large specialisation has negative effects on the ability to sustain growth. The more diversified the structure of the economy, the smaller the risk of a growth episode coming to an end and the longer the duration of the episode. This is especially true at higher levels of income. This latter finding is somewhat in contradiction with the inverted U hypothesis which suggests that specialisation is beneficial at higher levels of income. Unexpectedly there is no significant effect on volatility. From the portfolio perspective discussed in Section 2 one would expect that a more diversified economy is less subject to volatility. On the basis of our current – imperfect – measures of specialisation and volatility this turns out not to be the case. Increased specialisation not only has negative effects on the sustainability of growth, it also has a negative impact on average rates of growth, in particular for high income countries. But, when we look at growth rates within positive growth episodes, specialisation actually turns out to have a positive effect on growth. In other words, more specialised economies find it hard to sustain growth over longer periods, but while they grow, they tend to grow more rapidly. The net growth effect of these two opposed tendencies is negative: on balance more specialised economies have lower average growth rates.

What emerges clearly from the preceding discussion is that the effect of structure on the duration of growth episodes is often very different from their effects on average growth rates. The analysis of positive growth episodes contributes to a better understanding of growth performance.

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