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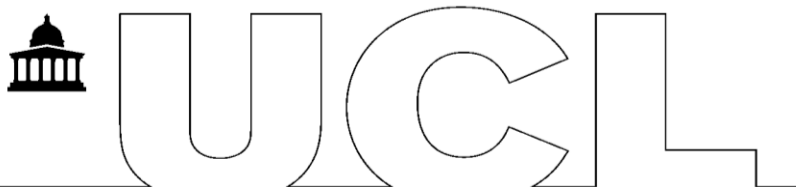

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Technology Choices and Growth: Testing and Expending the propositions of New Structural Economics in Transition Economies

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Technology choices and growth: testing and expanding the propositions of new structural economics in transition economies

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Abstract

We explore the relationship between development policies, finance and growth as approached by New Structural Economics (NSE) (Lin, 2012) with special reference to Transition Economies. On a sample of 164 economies for 1963-2009, our analysis generally confirms NSE's propositions that the type of development policy, as captured by the Technology Choice Index (TCI), has significant effects on long-term growth. However, this differs for Transition Economies (TE) as a whole, and its sub-groups. Further to this, using a sample of 94 countries for 1985-2009, we provide a first empirical test of the relationship between growth, TCI and financial structure distortions and we show that there is a direct significant negative relationship between financial distortions and TCI on the one hand, and medium-term growth on the other hand. We also find that the negative effect of a higher ratio of TCI on medium-term growth could be partly mitigated, although not fully eliminated, by moderate level of financial sector distortions. This points towards some positive externalities of the complementarities between financial and industrial sector distortions, at least in the medium run. But again, transition economies are shown to differ from the rest of the sample investigated as in their case financial distortions are found to play a more pronounced direct negative effect on medium-term growth.

Key words: New Structural Economics, Technology Choice Index, Transition Economies

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1. Introduction

The overarching objective of the paper is to test and expand the basic propositions of New Structural Economics (NSE) theory on growth, with special reference to Transition Economies. NSE essentially builds on neoclassical theory through its recognition of comparative advantages and the importance of structural change for growth (Lin, 2012). It emphasises that the economic structure of an economy is endogenous to its factor endowment structure and that sustained economic development is driven by changes in factor endowments and continuous technological innovation. In other words, it posits that growth patterns will directly reflect whether a country's institutional and policy environment favours technological upgrading in sectors which are compatible with the country's comparative advantage, given its initial endowment structure. Accordingly, NSE distinguishes between comparative advantage following (CAF) and comparative advantage defying (CAD) strategies with countries following CAF strategies argued to be more likely to grow *ceteris paribus*. This proposition brings about an important re-think of development strategies, and their relative successes or failures.

This central proposition of NSE was tested empirically by Lin (2012) using Technology Choice Index (TCI) as an indicator of the strategy followed by a given country. TCI is constructed as the value added to labour ratio in manufacturing over the total value added to labour force ratio in the country. The assumption is that a high TCI ratio represents distortions as high value added in manufacturing sector is not compatible to factor endowments. For example, high value added in manufacturing is not accompanied by required soft and hard infrastructure for 'big push' to generate sustainable growth. In other words, over-investing in an excessive capital or forcing productivity through costly R&D expenditure when the country is far below the sufficient level of development will entail a distorted strategy that will not be sustainable in the long run. Lin's analysis confirmed a

strong negative relationship between long-term growth and CAD strategy for a sample of 122 countries over the period 1963-1999. In this paper we are able to test Lin's propositions on a much larger sample over a longer time span to confirm their validity.

Further to this, Lin (2012) also pointed out that high level of distortions, as captured by high values of TCI, are associated with financial distortions. We take this proposition further to explore the direct effect of financial distortions and TCI on medium-term growth, accounting for potential endogeneity between them, as well as the moderating effect of financial distortions on the relationship between TCI and growth.

Finally, we explore the effects of TCI on growth, and its links to financial distortions in the context of Transition Economies (TEs) only. In conventional perspective, TEs were considered paragons of distortions and big push industrialization followed by strong post-socialist deindustrialization. In itself this represents an interesting case for testing the key propositions of NSE especially how a shift from distortionary to less distortionary environment affects economic growth.

We organise the paper as follows. First, we briefly discuss the basic propositions of NSE – TCI and CAD/CAF and how they relate to the development literature and the literature on socialism and post-socialist transition. Second, we discuss the likely relationship between TCI, financial structure and growth. Third, we present our sample, discuss the construction of the TCI index and the data series used. Fourth, we present our regressions investigating the relationship between TCI and growth. Fifth, we discuss our exploration of the associations between financial distortions and TCI with further implications for growth. Our key findings are summarised in conclusions.

Our analysis confirms the results found by Lin (2012) on a much larger sample and for a longer time period: on average, a CAD strategy, as captured by a high TCI value, is correlated with lower long-term growth. However, when we explore this relationship for the

sample of TE countries, we find a positive relationship between TCI and growth for TE countries as a whole, and for a sub-group of Central and Eastern European Economies and the Baltic States (CEEB), whereas this relationship is negative in the case of Commonwealth of Independent States (CIS). We discuss possible explanations to these contrasting results and how to reconcile them with the NSE framework.

Finally, controlling for potential endogeneity between growth, TCI and financial distortions our study also indicates that both TCI and financial structure gap have independent negative effects on medium-term growth. Interestingly, examining further the moderating effect of financial structure gap on the TCI-growth relationship, our analysis reveals that greater deviations from the optimal financial structure in either direction positively diminishes the negative effect of TCI on growth. However, it is important to note that this effect is only significant at a relatively moderate level of financial distortions, whereas for higher values of financial structure gap, it becomes insignificant. Overall, this points towards some positive externalities of the complementarities between financial and industrial sector distortions, at least in the medium run. Finally, we show that transition economies are different from the rest of the world as financial distortions are found to play a more pronounced direct negative effect on medium-term growth there. At the same time, while the direct effect of TCI on medium-term growth in TE is found to be overall insignificant, indirectly, small increases in TCI are shown to reduce the negative effect of financial distortions on growth in the medium run. Such small increases in TCI are compatible with an increase in firm efficiency due to industrial sector restructuring, entry of de-nuovo firms and exit of uncompetitive incumbent firms as observed in most TEs during transition (World Bank, 2008). Overall, these results can be interpreted as reflecting a shift away from a development strategy based on finance serving just as a counterpart of industrial policy supporting an over-industrialized economy, with large-scale vertically-integrated state-

owned enterprises which were largely low-productive or loss-making, towards a financial sector assuming a more growth enhancing role and funding smaller-scale capital-intensive projects improving productivity. We elaborate on this further in the conclusion section.

2. Development strategies and technology choice

2.1. A rapid overview of the evolution of development thinking since the 1950s

Old structuralism has emerged in development thinking in the 1950s in the writings of early structuralists like Lewis (1954), and Prebisch (1959, 1960) among others. Its key feature is a view that the problems faced by low-income countries were fundamentally different to those faced by more industrialized economies. Accordingly, trade along the traditional lines of comparative advantage offered little hope for industrialization while the developed economies would block any effort to gain a foothold in the market for manufactured goods. These ideas have strongly influenced development policies during the 1950s, 1960s and early 1970s, in particular with an emphasis on import substitution strategies (see Radosevic, 1999 for overview and assessment of these policies). These ideas were in sharp contrast to the view advanced by orthodox economists. The latter saw the causes of differences between advanced and developing economies as primarily rooted in differences in the amount of capital per unit of labour and the resulting labour productivity. Both groups of countries could increase their income per capita by the same means, and relatively independently, provided that they remove policy distortions and follow their comparative advantage.

By the mid-1980s, many developing countries entered into debt crisis, discrediting import substitution strategies which were not anymore seen as a viable option. This led to a radical shift in mainstream policy thinking. Industrial targeting, subsidized credit for specific subsectors and detailed technology transfer regulations were no longer seen as recipes for

development. Instead, the International Monetary Fund (IMF), the World Bank, and the US Treasury had begun practising policies for developing countries that were later on formulated as the 'Washington Consensus' (Williamson, 1990, 2004). They involved balanced budgets, liberalization of interest rates, competitive exchange rates, trade and FDI liberalization, privatization, deregulation, etc. These were then followed by the so called 'augmented Washington consensus' policies which added focus on institutional reforms towards improved corporate governance, anti-corruption policies, flexible labour markets, WTO agreements and so forth. As described by the World Bank (2005), among the key processes that led to the diminished relevance of Washington Consensus-based policies were the severe output losses observed during transition in the former Soviet Union and Eastern Europe on the one hand and the sustained rapid growth observed in China, India and Vietnam on the other hand. This should not have happened, given that China, India and Vietnam pursued more interventionist policies than those of the Washington Consensus, and liberalized in a gradual and heterodox manner, while TE were abandoning central planning and attempting to apply reforms complying with the Washington Consensus.

It is within this context that NSE has emerged as a third way in development thinking. In the core of this approach is the importance of economic structure and structural change which requires attention to industrial upgrading. However, in contrast with the old structural economics thinking of the 1950s, the "structure" is seen as endogenous in NSE. To some extent, the aim of NSE is to marry structural approach to growth with neo-classical economics, and as such it is based on a) an understanding of comparative advantages as the evolving potential of a country's endowment structure, b) a reliance on the market as allocation mechanism at any stage of development, and c) the recognition of a facilitating role of the state in the process of industrial upgrading (Lin, 2012). A country will grow

economically if it does dynamically follow a strategy compatible with its comparative advantage.

2.2. NSE, TCI and growth.

According to NSE, growth is spurred when a country does follow a development strategy consistent with its comparative advantages and endowment structure. On an intuitive and theoretical basis, one would indeed expect it to be true. However, identifying a proxy capturing whether the development strategy followed by a given country falls into a CAD or CAF category is clearly challenging. Lin and Liu (2004) proposed to use a Technology Choice Index or TCI as an indicator of the extent to which a country's strategy and policies are consistent with its comparative advantage.

This indicator is defined as:

$$TCI_{i,t} = \frac{AVM_{i,t}/LM_{i,t}}{GDP_{i,t}/L_{i,t}} \qquad (1)$$

where $AVM_{i,t}$ is the added value of manufacturing industries of country i at time t, $GDP_{i,t}$ is the total added value of country, $LM_{i,t}$ is the labour in the manufacturing industry and $L_{i,t}$ the total labour force.

A high TCI value is therefore indicative that a country follows a CAD strategy by investing in capital-intensive manufacturing. Indeed, the numerator of TCI will be relatively larger in context where manufacturing firms tend to have large market shares or enjoy monopolistic position thanks to government's intervention, where access to subsidised credit and inputs, and supernormal profits lead to heavy investment into capital and where therefore the added value generated by the sector is above what would be generated otherwise.

Simultaneously, less labour will be employed in such a distorted sector as capital-intensive technologies will be favoured, further increasing the gap between the value added to labour ratio in the supported sector and what this ratio would otherwise be.

This indicator therefore captures a situation where a government tries to kick-start economic growth through policies supporting a capital intensive manufacturing sector. Such an indicator of distortion is reminiscent of the economic development policies that were advocated from the 1950s onward, when interventionism was the rule and development planning, protectionism and investment subsidies were thought to be the keys to economic growth, as advocated through the "Big Push" theory or international aid. In terms of development economic theory, Rostow's stages of development (1960) and Lewis's two sectors development model (1954) probably best support such strategy, as both emphasise the shift from low productivity primary production to higher productivity manufacturing as a key stage in the development process of an economy.

By the 1980s, development economics thinking had moved away from interventionist prescriptions, as critics against the failures of the state were getting stronger (e.g. Krueger, 1974) and as embodied by the formulation of the Washington consensus (Williamson, 1989). This movement away from state intervention and towards greater market domination has been described as consistent with Polanyi's pendulum by a number of scholars (see Dale, 2012) who postulated that the economic downturn which started in 2008 would lead to a new period of greater state intervention. Indeed, NSE recognises a facilitating role of the state in the process of industrial upgrading. However, it also argues that failure of the old structural economics is largely due to uncritical application of CAD policies.

Lin (2012) has convincingly demonstrated, using a sample of 122 countries over the period 1962-99, that higher TCI over extended period (i.e. the longer term implication of a CAD strategy) is associated with lower average growth rate and a greater volatility in growth

performances. Such a finding confirms the strong dominance of interventionist views in the greater part of the period covered by the study and the failure of such an approach to produce growth. However, the existence of a strong relationship between high TCI and low growth may masks more subtle variations within the sample of countries covered and over the time-span. In particular, the negative relationship between TCI and growth may not be generally valid but can be confined to specific periods or groups of countries or to specific income level groups. To expend on Lin's work, we are offering to revisit his finding, using a longer time period, and to examine differences in the relationship between TCI and growth in time and for different sub-sample of countries.

2.3. TCI and Transition Economies of Central and Eastern Europe and the Commonwealth of Independent States

Ex-socialist/Transition Economies constitute a very relevant sub-set of countries for exploring and testing the CAD/CAF propositions of NSE. As command economies they tried by political means to achieve fast industrialization by giving preference primarily to heavy industry, and within it to machinery and steelmaking (Kornai, 1992). By implementing forced growth the priority sectors grew very fast at the expense of consumer goods and services. However, these priority sectors proved capable of promoting growth only in the medium term, thus confirming the model of dual economy developed by Lewis (1954) hitting the limits of extensive growth driven by practically unlimited supply of labour or capital (Kornai, 1992). The experience of these countries therefore highlights a key difference between NSE and the principles of socialist industrialization or related theory of unbalanced growth (Hirschman, 1958; Murphy et al., 1989). Indeed, while socialist industrialisation was based on the belief that a few ‘driving sectors’ could pull ahead and their excess demand would encourage other sectors to catch up, NSE posits that this will only be possible if these

'driving sectors' truly reflect the endowment structure of the country and its potential comparative advantage. On that basis ex-socialist economies were following what could be described as strong CAD strategies, and following the logic of Lin (2012), one would expect the TCI ratio for these countries to be high at the onset of transition and progressively decreasing as they adopted more market-oriented policies. However, the evolution of the manufacturing sector in TEs during transition proved more complex.

Indeed, these countries did follow a highly distortive strategy during their centrally planned period which was characterised by an over-emphasis on developing manufacturing and in particular capital-intensive heavy industry, in a way that was compatible with an inflated added value of manufacturing and therefore an inflated TCI (see equation 1). But they also aimed at maintaining full employment, through labour hoarding and hidden unemployment. Under such circumstances, the total value added generated by the manufacturing sector was certainly greater than would have been achieved without intervention, but the hoarding of labour into the sector brought down the value added per worker, reducing the value of the numerator of TCI. Through the combined pressure of these two opposing forces (heavy investment in capital-intensive manufacturing bringing TCI up, and labour hoarding bringing TCI down), it is quite clear that the true extent of distortion in these countries at the onset of transition cannot be appropriately captured by an indicator such as TCI.

Furthermore, with the collapse of communism and the beginning of a transition towards liberal market economies, the countries of CEE and the CIS did restructure away from heavy industry, as shown by Raiser et al. (2004). However the pace of deindustrialisation differed across countries and while CEEB countries have retained a relative share of employment in industry above benchmark market economies, the European CIS countries (Russia, Ukraine, Belarus) were shown to have kept an excessively large

industrial sectors, while the poorer southern and Asian CIS countries reached levels of industrial employment that are at or even below the market economies benchmark (ibid). It is also important to bear in mind that the degree of over-industrialisation differed across countries during socialism, and even with large investment, the productivity of the manufacturing sector of these countries remained low due to systemic misallocation of resources and lack of incentives. Additionally, and as formalised by Aghion and Blanchard (1994) with their modelling of the so-called "optimal speed of transition", the restructuring of these economies would only be possible with a substantial increase of the unemployment rate. This has taken place on a large scale in all countries but with quite different speed.

As a result, overall, in the early stages of transition the total value added per worker generated by the manufacturing sector could have increased, decreased or stayed the same, depending on the speed and extent of deindustrialisation, the spend and extent of labour shedding and the production efficiency gains. Therefore, the combined impact of these factors means that the move away from a CAD strategy as observed in the specific context of TE is unlikely to be captured through a decreasing TCI ratio. Overall, TCI may not be an appropriate indicator of the extent of distortion in the specific case of transition countries[1].

3. Technology Choice Index and Financial Structure Distortions

The CAD and CAF strategy cannot be assessed in an institutional vacuum (Lin et al., 2011). A CAD strategy requires substantial government economic interventions resulting in disparities of prices and costs. Lin (2012) provides some evidence for association between TCI and government interventions in property rights institutions, resource allocation,

[1] Note that in Lin(2003), a different approach was chosen and Lin constructed an optimal level of TCI before measuring the deviation between the actual TCI ratio and its optimal level. In this context, Lin indicated that distortions created to promote a capital-intensive manufacturing sector would lead to inflated TCI and positive gap when compared to its optimal value and distortions created to promote a labour-intensive manufacturing sector would depress TCI and result in a negative gap when compared to its optimal value (page 294). Such an approach would also be inappropriate to capture the types of distortions existing in TEs, as both capital intensive manufacturing and labour hoarding were promoted prior to transition.

enterprise autonomy, and the existence of the black market, suggesting that higher values of TCI are positively associated with the presence of such distortions in the economy.

The government intervention in the financial sector hinders efficient resource allocation. Financial restriction measures were typically part of an 'inward-oriented' development strategy from the late 1950s, and were enacted to protect local firms from foreign competition. Maintaining interest rates below equilibrium level aimed to promote growth in selective industries through directed lending. An undervalued exchange rate made imports relatively more expensive than domestically produced goods. Capital controls prevented inward flows of foreign capital and ensured an increase in domestic investment favouring a shift towards capital-intensive manufacturing.

Empirical research overwhelmingly shows that financial constraints have a negative impact on financial deepening and economic growth (Fry 1995, 1997; Levine, 2005). They crowd out high-yielding investments, creating disincentives to save, and generally inhibit financial sector development and growth. But there is also anecdotal evidence that moderate financial distortions can have a positive effect on growth, as was the case in South Korea in the 1960s where it seemed that they were addressing market imperfections, such as high interest rate margins in imperfectly competitive banking (for an overview of this literature see Korosteleva and Lawson, 2010).

In the late 1970-80s many developing countries started liberalising their financial sectors. Later, financial liberalisation, embodied into the 'Washington consensus', spread to TEs, where financial systems inherited from a planned economy were regarded as underdeveloped and inefficient; stock markets were not existent, and finance, in general, played a rather passive role, serving as a monetary counterpart of an enterprise's output and input.

It is well-established in the literature that the size of financial system plays a crucial role in the growth process (for overview of this literature see Levine, 2005). However, recently the focus in economic theory has shifted towards the importance of financial structure for growth. More specifically, scholars argue that while both banks and securities markets positively influence economic development, each of these two components provide different services critical for different stages of economic development (Levine, 2002). As an economy develops, it requires different mixtures of financial services, and respectively different combinations of financial institutions and markets (Boyd and Smith, 1998).

In the context of NSE, it is argued that financial structure is endogenous to the government's growth strategy. Specifically, CAD strategy requires a financial structure which is farther away from optimal and fails to deliver the appropriate blend of financial services (e.g. Lin and Xu, 2012). This has further deleterious effects on economic activity. Demirgüç-Kunt et al. (2011) show that deviation of a country's actual financial structure from its estimated optimal level, regardless whether such a deviation arises because the country is 'too' bank-based or 'too' market-based, is associated with lower rates of growth.

A deviation of the actual financial structure away from its optimal level, in any direction, represents financial sector distortion. In this context, greater deviations from optimal level of financial structure should be reflected in high values of TCI with further adverse consequences for growth. It is particularly interesting to explore this relationship in the context of TE where large past investments were channelled towards often inefficient capital-intensive manufacturing industry. An important task of transition was to create a financial system independent from the state and able to finance viable projects and support economic change (De Melo and Denizer, 1997). This crucially meant putting a halt to directed credit and subsidised loans, implementing tighter monetary policies and supporting the development of a private lending sector. Overall, the profound changes implemented in

most TEs make them an interesting group of countries to investigate the relationship between financial sector distortion, TCI and growth.

4. Data, methodology and hypotheses

4.1 Constructing TCI index

Data sources for analysis are merged data from World Bank Development indicators database (WDI) for 1960-2010 and United Nations Industrial Statistics database (UNIDO) for 1963-2009. TCI is defined as per formula (1) above, where value added and employees in the manufacturing sector are obtained from UNIDO, while gross value added and labor force size in country *i* at time *t* are from WDI. Both value added in manufacturing and gross values added are measured in current prices by local currency.

We use TCI data for 164 countries. We had to eliminate data for Burundi, Rwanda, Madagascar, Burkina Faso, Nigeria for which TCI represent statistical errors.

The regressions exploit ten years averages (decades 60s, 70s, 80s, 90s and 2000s), the dependent variable being the growth of GDP per capita (at US PPP constant prices) and the key independent variable being TCI. Explanatory variables also include the logarithm of initial level of GDP per capita in each decade, the logarithm of population, countries dummies and time dummies (decades) as controls.

4.2 Constructing Indicators of Financial Structure Gap

Drawing on Demirgüç-Kunt et al. (2011) we define financial structure as a ratio of private credit to stock market capitalisation. This ratio is a commonly used size-based measure of financial structure. To capture distortions in the operation of the financial structure we construct a measure of financial structure gap. It captures how far a country's actual financial structure is from estimate of the country's optimum. To calculate the optimal

financial structure for each given level of economic development, we follow Demirgüç-Kunt et al. (2011). More specifically, we first regress our size-based measure of financial structure on GDP per capita at constant US$ 2000 for the sample of OECD countries[2] for the period 1985-2009, while controlling for key institutional, geographic and structural traits. Similarly to Demirgüç-Kunt et al. (2011) we maintain here that financial systems in OECD economies are least financially distorted, and therefore, conditional on the aforementioned controls, they provide benchmark information on how the optimal financial structure varies with the level of economic development. The financial structure ratio for OECD economies is estimated based on robust regression given the sensitivity of our results to outliers. We further use the coefficients from the OECD regression to compute the estimated optimal financial structure for each country-year observation for the full sample of countries. The financial structure gap is equal to the natural logarithm of the absolute value of the difference between the actual and the estimated optimal financial structure, or it is approximated by the logarithm of the predicted residuals for each country-year[3]. The results of the robust regression for financial structure ratio estimated based on the OECD sample are reported in Annex 1.

4.3. Hypotheses

Our hypotheses are aiming to test the robustness, generality or validity of key NSE propositions, namely (1) we want to test the general validity of the negative relationship between TCI and growth identified by Lin (2012) by investigating the relationship between these two variables on an extended dataset, and on specific sub-groups of countries, looking in particular at TEs and (2) we want to test the NSE assertion that financial structure and TCI

[2] The OECD countries included in our sample include the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, US, United Kingdom. For the purpose of our analysis Czech Republic, Slovakia and Hungary, defined as TEs in our sample, are excluded from this list.

[3] Note that taking a natural logarithm of the absolute value of the deviation from the optimal financial structure gives negative values when deviations are small (between 0.00001 to 0.999), and positive values for greater deviations

affect growth more specifically by investigating whether financial structure distortions have any direct (independent from TCI) and moderating effect on the relationship between TCI and growth, while accounting for their potential endogeneity. Table 1 summarizes our hypotheses.

Table 1: Hypotheses

Type of relationships	**Hypotheses**
(1) TCI & growth	H1.1: On average, a high value of TCI is negatively related to long-term growth H1.2: Transition Economies (TE) differ from the rest of the sample: it is less likely that a negative relationship between TCI and growth will be identified for them, and we expect some further differences to be identified for CEEB versus CIS in the way TCI relates to growth.
(2) Financial distortions, TCI and growth	H2.1: On average, a higher value of TCI and financial structure gap will independently adversely affect medium-term growth H2.2: A moderate increase in the deviation of the actual financial structure from its estimated optimal level (in either direction regardless whether a shift occurs towards a more bank-based or market-based sector) will positively moderate a negative effect of TCI on growth in the medium run. H2.3: In transition economies, financial sector distortions are expected to have a more pronounced negative effect than in the rest of the world; and their effect to be stronger than the TCI effect in this region. However, we also hypothesize that given enterprise restructuring, and entry of new firms, a moderate increase TCI, possibly attributed to efficiency gains as a result of industrial restructuring, is likely to have a positive moderating effect on FSG-growth relationship.

5. Technology Choice Index and growth

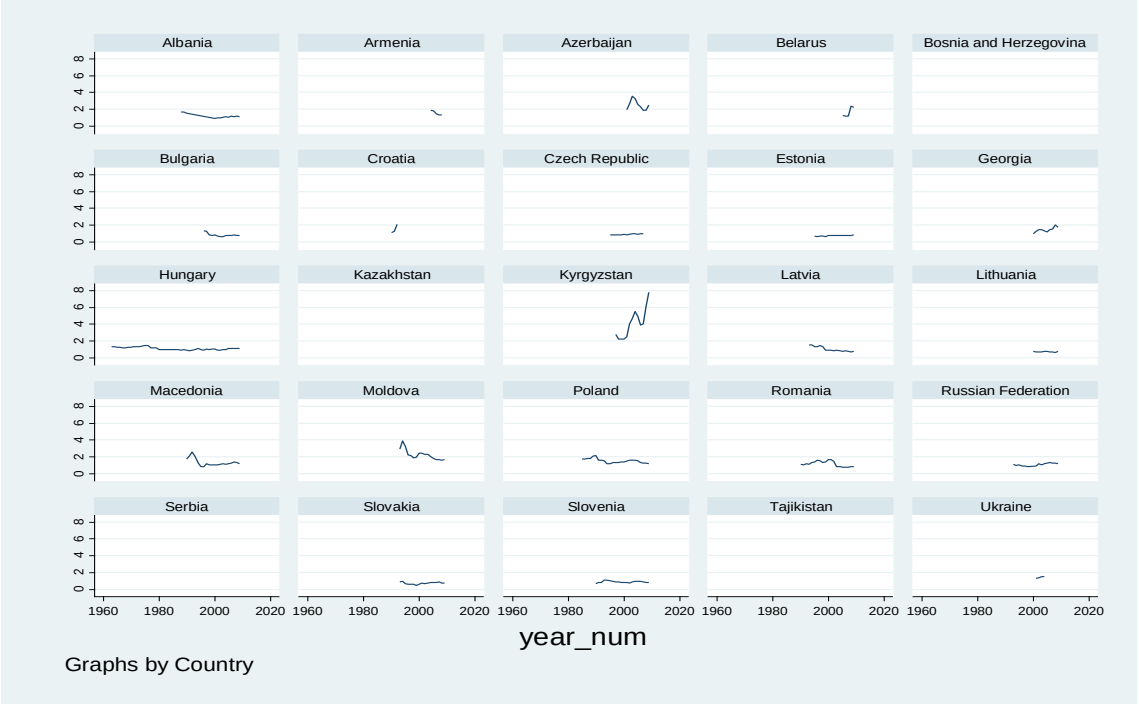
5.1. A bird's eye view of the data

Our database of 164 countries with data spanning from 1963 to 2009 covers the whole spectrum of development phases with the shares of low, middle and high income countries accounting for 17%, 53% and 30% respectively[4]. This gives us confidence that the analysis is rooted in the correct sample variety. TEs , as key focus of our study, account for 18% of the sample.

Focusing on TE specifically and following Lin (2012), we start with the description of the observed patterns of TCI. Figure 1 shows that CEEB tend to have very low level of distortion, as measured through TCI, overall. On the other hand, CIS countries tend to show low TCI values at the onset of transition and greater range of variations afterwards (e.g. Azerbaijan, Kyrgyzstan, Moldova). The Russian Federation is below the overall CIS average values. Unfortunately, for most countries, data points are only available for the 1990s and 2000s, so for the onset of transition and post-transition period (with the notable exception of Hungary, which has been characterized by low distortion throughout many decades). Overall, we are therefore unable to discern the full evolution of TCI from the communist era to the present day. But the data available does show interesting patterns. It appears that, using TCI as an indicator of distortions and CAD strategy, TEs experienced overall quite low level distortions, and that distortions were in particular quite low at the onset of transition. Some countries (CIS countries) experienced a rise in TCI in the following decades. This evidence is in line with our discussion on relevance of TCI as proxy for economies with substantial labor hoarding.

[4]The income category variable is time-invariant, i.e. it is the World Bank definition based on the latest data available.

Figure 1: TCI: the Manufacturing Sector productivity in transition economies



Source: World Bank World Development Indicators dataset (2012 edition); UNIDO.

5.2. Econometric results: base model

We now test the robustness of Lin's (2012) results on the extended sample. We test if the growth rate of the GDP pc (constant 2000 US$) is affected by the level of distortion in the economy as proxied by TCI. For this, we estimated three models analogous to those presented by Lin (2012) in table VI.4., but with 459 and 418 observations instead of 315 and 278 respectively. Following Lin, we have re-arranged the data in 10–year averages (decades) to smooth out the business cycle.

In the regressions in Table 2, we have included controls that are analogous to those found in Lin's regressions, namely the natural logarithm of TCI, the natural logarithm of GDP at the start of the period, a measure of institutional set up (legal origins for our models, and a rule of law indicator and institution indicator for Lin's), distance to equator, a measure of trade openness, population size at the start of the period, and indicator taking the value one

for landlocked countries and 0 otherwise. These regressors are used to ensure that our regressions are as close as possible to Lin's own estimations. We have then added population growth and average years of schooling (Barro Lee), two variables that are absent from Lin's models but which are standard growth regressors[5]. Controlling for human capital in particular seemed quite important in the light of recent evidences showing that it is a more robust determinant of growth than institutions (Glaeser et al., 2004).

Table 2: Estimating the effect of TCI on growth: robust regression results

Dependent variable: growth rate of GDP pc (constant 2000 US$)	Model 1a	Model 1b	Model 1c
Ln TCI	-0.011***	-0.007***	-0.006***
	(0.002)	(0.002)	(0.002)
Ln_gdp_pc_start	-0.004***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)
Ln_PopulationTotal start		0.003***	0.003***
		(0.001)	(0.001)
Distance to equator		0.006	0.011
		(0.008)	(0.008)
Landlocked		-0.004	-0.004
		(0.003)	(0.003)
Population growth		-0.755***	-0.395***
		(0.094)	(0.117)
Ln Average years of schooling Barro Lee		0.004	0.010***
		(0.003)	(0.003)
Trade Openness		0.013***	0.014***
		(0.002)	(0.002)
Legal origin_uk_laporta		0.003	0.000
		(0.004)	(0.004)
Legal origin_fr_laporta		0.005	0.003
		(0.004)	(0.004)
Legal origin_sc_laporta		0.008	0.005
		(0.006)	(0.005)
Constant	0.062***	0.024	0.013
	(0.009)	(0.015)	(0.015)
Decade (time) Fixed effects	No	No	Yes
Observations	459	418	418
Adjusted R-squared	0.076	0.262	0.316

Source: World Bank Financial Structure Dataset (2012), WB WDI 2012 edition; UNIDO.
Note: *,**,*** denote significance at the 10, 5 and 1-percent level, respectively. Standard errors reported in parentheses.

[5] Note that the key results on the relationship between TCI and growth discussed in this paper are unaffected by the addition of these two variables, but they appear significantly related to growth and their addition improves the fit of our models.

Model 1a in Table 2 presents a minimal specification including only TCI and GDP at the beginning of the period, Model 1b includes all the controls listed above and Model 1c also includes time fixed-effect (decades dummies). Again this is to be consistent with the results presented by Lin (2012).

In the three models presented in table 2, the coefficient on TCI is negative and significant which suggest that greater distortions, as measured by a higher TCI value, are associated with lower growth. This supports our hypothesis H1.1, confirming Lin's (2012) findings for a longer period and for a larger number of countries.

5.3 Empirical results: Transition Economies

To investigate further the relationship between TCI and growth, we augment the base models with an interaction term of the log of TCI and a transition countries dummy. Models 2a, b and c of Table 3 are reproducing the specifications of Models 1a, b and c of Table 2 respectively, but including these two new variables. This allows us to test whether there is a different relationship between TCI and growth in the context of TEs, as we posited. We find that the interaction terms between the log of TCI and a transition countries dummy is always positive and significant, irrespective of the specification chosen (i.e. in Model 2a, b and c), the coefficient is also greater than the coefficient estimated for log of TCI in all specifications. This means that the overall effect of TCI on growth in the sub-sample of TEs is positive. We also find that the TE dummy is significant and negative in Model 2b and c, probably capturing the severe output losses of the transitional recession.

Table 3: Estimating the effect of TCI on growth for Transition Economies: robust regression results

Dependent variable: growth rate of GDP pc (constant 2000 US$)	Model 2a	Model 2b	Model 2c	Model 3a	Model 3b	Model 3c
Ln TCI	-0.012***	-0.008***	-0.007***	-0.011***	-0.009***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Ln TCI * TE	0.019**	0.016**	0.013*			
	(0.008)	(0.007)	(0.007)			
TE	-0.001	-0.023***	-0.021***			
	(0.004)	(0.005)	(0.005)			
Ln TCI * CEE				0.009	0.023**	0.017*
				(0.011)	(0.010)	(0.009)
Ln TCI * CIS				-0.014	-0.001	-0.005
				(0.019)	(0.014)	(0.013)
CEE				-0.007	-0.024***	-0.022***
				(0.005)	(0.006)	(0.006)
CIS				0.036***	-0.012	-0.006
				(0.014)	(0.011)	(0.011)
Ln_gdp_pc_start	-0.004***	-0.010***	-0.010***	-0.004***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln_PopulationTotal start		0.003***	0.003***		0.003***	0.003***
		(0.001)	(0.001)		(0.001)	(0.001)
Distance to equator		0.014	0.018**		0.013	0.018**
		(0.008)	(0.008)		(0.008)	(0.008)
Landlocked		-0.007**	-0.006**		-0.007**	-0.006*
		(0.003)	(0.003)		(0.003)	(0.003)
Population growth		-0.831***	-0.486***		-0.832***	-0.472***
		(0.096)	(0.122)		(0.097)	(0.124)
Ln Av. years of schooling Barro Lee		0.008**	0.014***		0.008**	0.014***
		(0.003)	(0.004)		(0.003)	(0.004)
Trade Openness		0.015***	0.016***		0.015***	0.016***
		(0.002)	(0.002)		(0.002)	(0.002)
Legal origin_uk_laporta		-0.007*	-0.009**		-0.008*	-0.011**
		(0.004)	(0.004)		(0.005)	(0.005)
Legal origin_fr_laporta		-0.005	-0.006		-0.005	-0.007
		(0.004)	(0.004)		(0.005)	(0.004)
Legal origin_sc_laporta		-0.004	-0.006		-0.004	-0.007
		(0.006)	(0.006)		(0.006)	(0.006)
Constant	0.062***	0.050***	0.038**	0.058***	0.051***	0.040**
	(0.010)	(0.016)	(0.016)	(0.010)	(0.016)	(0.016)
Decade (time) Fixed effects	No	No	Yes	No	No	Yes
Observations	459	420	420	458	418	418
Adjusted R-squared	0.088	0.287	0.337	0.105	0.284	0.333

Source: World Bank Financial Structure Dataset (2012), WB WDI 2012 edition; UNIDO
Note: *,**,*** denote significance on the 10, 5 and 1-percent level, respectively. Standard errors reported in parentheses.

The positive relationship identified between growth and TCI for TEs suggests that higher distortion in terms of TCI enhances growth in the transition region: at first sight, a puzzling results for supporters of NSE. However, we should bear in mind that: a) the TCI has to be used with caution in the context of TEs due to different speeds of de-industrialization, b) TE itself is heterogeneous region and we need to distinguish between CEEB and CIS countries, as explained in section 2.3.

Table 3 therefore show a further effort to disentangle the specificities of the relationship between TCI and growth found among TEs, through the use of two separate sets of dummy and interaction term for CEEB and CIS countries respectively. Models 3a, b and c show regressions where we decompose the effect in the aforementioned groups of countries. In these regressions, the negative effect of TCI on growth is confirmed overall, but Model 3b and c show that the interaction term between TCI and a CEEB dummy is positive, significant and large compared to the coefficient measuring the effect of TCI on growth for the whole sample, while the interaction term between TCI and a CIS dummy is negative, insignificant and small compared to the coefficient measuring the effect of TCI on growth for the whole sample. To facilitate the interpretation of these results, Table 4 summarizes the overall effect and significance of TCI on growth, using the coefficients estimated in Model 3c.

Table 4: Overall effect of TCI per groups of countries:

	b1 Estimated coefficient for Ln TCI	b2 Estimated coefficient for Ln TCI * CEE	b3 Estimated coefficient for Ln TCI * CIS	Total combined coefficient and significance
Rest of the world CEE=0 & CIS=0	-0.007***	0	0	b1 -0.007***
CEE only CEE=1 & CIS=0	-0.007***	0.017*	0	b1 + b2 0.010**
CIS only CEE=0 & CIS=1	-0.007***	0	-0.005	b1 + b3 -0.012*

These calculations are based on Model 3c, presented in the 7th columns of Table 3.

In line with hypothesis H1.2, CEEB and CIS countries exhibit a relationship between TCI and growth that is distinct from what is estimated for the rest of the world. Countries in the CEEB group show a positive relationship between TCI and growth, whereas for the CIS this relationship is negative and of a greater magnitude than what is observed for the rest of the world.

Overall, our results confirm the validity and robustness of Lin (2012) results about the negative relationship between TCI and growth. However, their robustness and generality is not confirmed on the sample of TEs where TCI is positively related to growth overall. When we split TEs into CEEB and CIS, it turns out that this positive relationship is largely due to CEEB, as a negative relationship is confirmed for the countries of the CIS.

These results are significant as they suggest that there is something fundamentally different in the way distortions, as measured through TCI, relate to growth in these countries during the transition period. First, the type of policies pursued prior to transition were highly distortive, but maybe not in a way that is appropriately captured through TCI. As previously discussed (see section 2.3.), TCI may not appropriately capture the level of distortions existing in transition countries at the onset of transition and in the following decades. Indeed, during the socialist era countries followed a CAD strategy both by over-investing in capital-intensive manufacturing and through hoarding of labor. However, while the former would have inflated the value added of the manufacturing sector and therefore the TCI ratio, the latter would have inflated the number of workers working in the sector, bringing the TCI ratio down. Furthermore, this tension between the need to reduce the size of a capital-intensive sector and to shed labor would have imposed opposing forces on TCI during transition as well, making it difficult to predict the likely evolution of this indicator during transition, and further invalidating its ability to measure the extent of distortions present in TEs.

Second, this puzzling result may also have something to do with the high level of investments in supportive infrastructures (education, transport, energy etc.) that took place in the majority of TEs. This could mean that in the longer term the comparative advantage of TEs may have caught up with the ambitions of their planners (Schaffer et al., 2013). In fact, it seems that those CEEB countries that have been able to maintain a larger manufacturing sector had better chances of recording higher growth. While the CIS countries where industrial restructuring is not yet completed have recorded lower growth. Additionally, the evidences gathered on the economic recovery of TEs after the transitional recession have pointed towards the importance of swiftly implemented reforms allowing for a reallocation of resources across sectors, a process that is facilitated by the availability of skilled labor, and the ability to attract FDI inflows, and integrate into global value chains (Campos and Coricelli, 2002). From this perspective, CEEB had the advantage of being located closer to the EU which offered both an institutional template and a friendly economic partner able to absorb the CEEB's manufacturing products and to provide funds and technical support (Di Tommaso et al., 2007). Further to this, in the Kaldorian tradition, manufacturing has been argued to have a special role in pulling economies forward and generating growth, while deindustrialization has been linked to poor growth performances and reindustrialization has been shown to be difficult (Tregenna, 2009 and 2011). In this context, it is possible that in the period of rapid and drastic change that followed the fall of communism, countries that were able to build up on their excess capacity and attract further investments may have done better than those where deindustrialization has occurred but the slow restructuring of the economy has not yet reached an optimum.

However, these results are not easy to reconcile with the observed relatively higher shares of manufacturing employment in CEE and European CIS when compared to their ‘market economy’ benchmarks and below benchmarks shares for non-European CIS (Raiser

et al. 2004). A thorough investigation of the patterns of changes in TCI in transition is therefore required to fully understand why the relationship between TCI and growth differ in these countries compared to the rest of the world. Crucially alternative proxies capturing whether a country follows a CAF or CAD strategy should also be proposed and tested.

5.4. Further results: TCI and growth for different sub-groups of countries[6]

Above we have shown that most TEs exhibited relatively low TCI at the onset of transition and therefore did not represent highly distorted economies based on this index. To further investigate the relationship between TCI and growth, we examine a group of countries for which TCI appears as a well-suited measure of distortion. We define as highly distorted those economies that belong to the top decile of TCI in our data series. In contrast to TEs which typically exhibit TCI ratios below 2 for the length of our data series, these highly distorted economies have TCI values above 10. These highly distorted economies are largely low income African economies where islands of manufacturing operate in largely agricultural economies. Their economic structures are significantly different from the majority of the TEs which have 'over-industrialized' in the past while also hoarding labor. TCI is much more suited to capturing the type of distortions observed in these highly distorted economies, as small capital-intensive sectors are being promoted in otherwise mostly rural economies. As before we reproduced the Model1c presented in Table 2 adding a dummy for highly distorted economies and an interaction term between TCI and this dummy and found that for highly distorted economies the effect of TCI on growth is significant and negative (-0.004), while the coefficient estimated for the effect of TCI on growth for the rest of world is insignificant. This result confirms that countries that have highly distorted structure where small capital-intensive manufacturing pockets are artificially created do not achieve sustained growth, and

[6] The result tables for the regressions discussed in this section have not been included in the paper due to space limitation but they are available from the authors for an interested reader.

on the contrary see their economies contracting[7]. This results confirms the validity of a key NSE proposition, in context where distortions are appropriately captured through TCI.

In a further attempt to explore the validity of the views formalized in NSE, we also re-estimated our basic models on a restricted sample of Middle Income Countries (MIC) only and a restricted sample of High Income Countries (HIC) only[8]. This exercise reveals a negative and significant relationship between TCI and growth for MIC: the coefficients estimated for log of TCI are -0.016, -0.008 and -0.008, all significant at the 1 percent level, in the models analogous to Model 1a, b and c respectively, and a positive relationship between TCI and growth for HIC: the coefficients estimated for log of TCI are +0.003 (not significant), +0.005 (not significant) and +0.010 (significant at the 1 percent level), in the models analogous to Model 1a, b and c respectively. Overall this confirms the validity of NSE for MIC on average, but it also highlights that a different story might be at play for HIC. This is intuitively plausible as HIC tend to be characterized by large and expending tertiary sectors, while their composition of their manufacturing sector is likely to differ from that of MIC. Furthermore, this results is consistent with Lee and Kim (2009) and Lee (2013) who demonstrated that different development strategies and policies were required at different stages of economic development. To the extent that CEEB countries were typically HIC by the end of the period for which we have data, while most CIS remained MIC, our general results on HIC versus MIC can contribute to explaining the results we found for CEEB country in the previous section.

Overall, considering how TCI relates to growth, our analyses have confirmed the general validity of the NSE proposition that greater level of distortions, as measured through

[7] In the light of this result, we also estimated a model testing for a non-linear relationship between TCI and growth by reproducing our basic model 1c presented in Table 2 adding a quadratic term for Log of TCI, but this quadratic term turned out to be insignificant revealing that the relationship between TCI and growth is complex but not in a way appropriately captured by a quadratic term.

[8] The low number of observations in the group of low income countries left too few degrees of freedom for the regression results to be reliable.

TCI, are linked to lower level of growth. However, we offer a number of qualifications to this proposition. Indeed, first it appears to be valid especially for MIC and less so for more advanced economies, an intuitive result as the drivers of growth are likely to differ for these two groups. We also highlight a possible shortcoming of TCI as a measure of distortion, in the sense that it may not appropriately measure distortions in TEs: it is more suited to context where distortions are caused solely by an over-emphasis on capital-intensive manufacturing.

6. Exploring the relationship between financial structure distortions, Technology Choice Index and Growth

6.1. Financial structure gap and TCI

We continue our examination of some of the key propositions of NSE through the investigation of the relationship between financial structure distortions, TCI and growth, first generally and then for TEs specifically. As mentioned earlier, data limitations force us to change the time span on which we base our investigations (1985 to 2009 instead of 1963-2009 in section 5) and to focus on mid-term growth (5-year period) rather than long-term growth (10-year period).

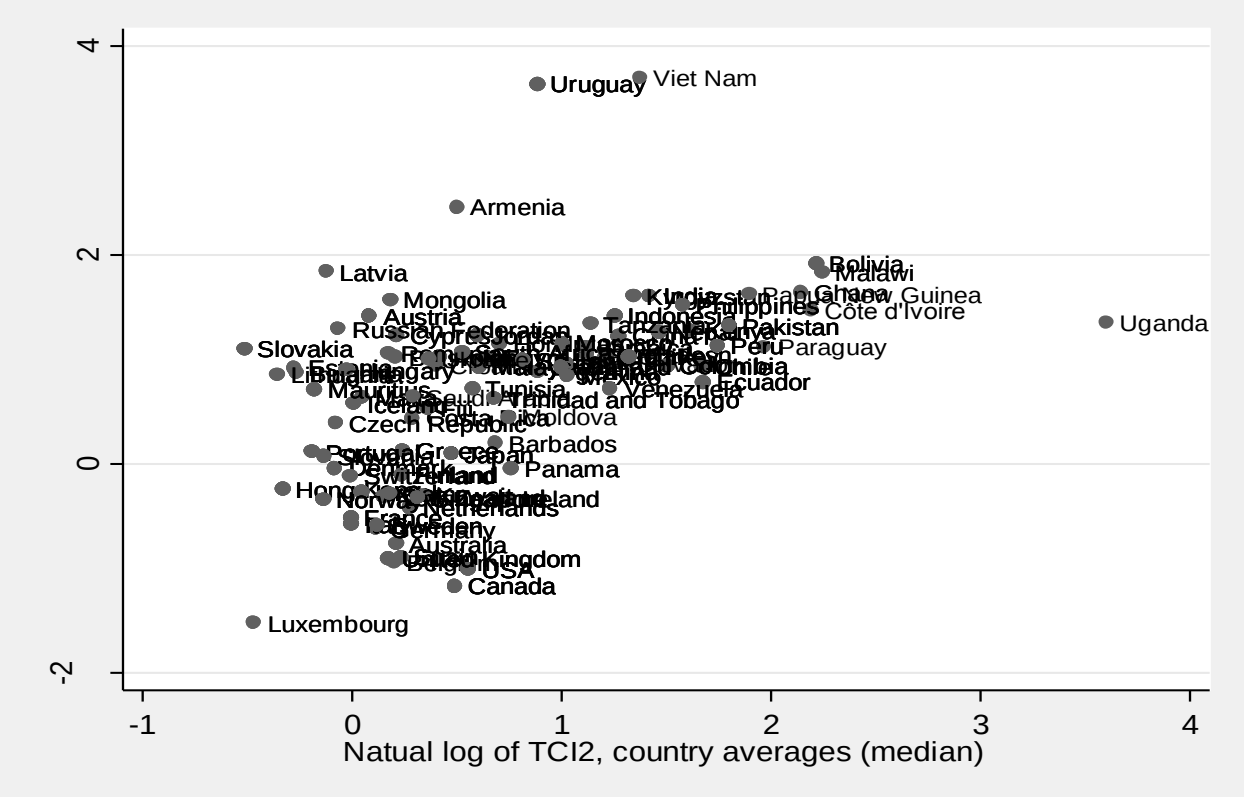
Annex 2 reports indicator of financial development and structure for the whole sample, and some groups of countries. It is evident that economies worldwide remain predominantly bank-based with the median for actual financial structure ratio equal to 1.93. This is even higher for TEs, where the median of the actual financial structure ratio reaches 3.25, being relatively higher for CIS economies, compared to CEEB. Interestingly, Russia is the only transition economy where stock-market capitalisation almost twice exceeds the private credit ratio for the time-span covered by the study.

The financial structure gap (expressed as the natural logarithm of the absolute value of the difference between actual and estimated optimal financial structure) in our sample ranges from -2.46 in Norway to 5.84 in Bulgaria. In addition to Norway, the least financially

distorted countries included in our sample (the 5th centile of the distribution) are Canada, Germany and the UK, whereas in addition to Bulgaria, Bolivia, Uruguay and Viet Nam fall in the group of countries with the worst financial distortions (the 95th centile of the distribution). OECD economies, which were used as a benchmark to create the optimal financial structure show the lowest gap (-0.41) in the sample, respectively corresponding to the unity ratio of actual financial structure to its optimal level.

As regards TEs, they are on average more financially distorted than the rest of the world with the group median as high as 1.04 compared to 0.81 for the rest of the world with larger differences when we use a mean value of financial structure gap (see Annex 2). While for CIS financial structure gap is higher than for CEE economies, such a difference is not substantial. Bulgaria emerges among the most financially distorted countries of this region with the ratio of actual financial structure being in excess of the optimal financial structure (based on the country mean) by a factor of 19. Such large distortions in Bulgaria are observed during the period of the severe financial crisis that hit the country in 1997. Among relatively more financially distorted countries are Armenia, Croatia, Kyrgyzstan and Latvia which given ratios of their actual to optimal financial structure, would generally benefit from developing stock markets vis-à-vis private credit, bringing them more in line with their level of economic development. At the same time, Russia appears too much distorted in a different direction, having far over-sized stock market compared to the ratio of private credit to GDP. Otherwise, the rest of TEs in our sample appear still relatively financially underdeveloped, especially in terms of the private credit to GDP (see Annex 2).

Figure 2: The relationship between TCI and Financial Structure Gap, country averages (median)



Source: World Bank Financial Structure Dataset (2012 edition), UNIDO; The data are plotted based on the exact observations used in the SYS GMM estimation of the growth-TCI-FSG relationship (Table 4).

Turning to the association between TCI and Financial Structure Gap, our exploratory analysis reveals that the two are highly and positively correlated for the whole sample (see Figure 2). This reflects the literature on distortionary financial policies, suggesting that financial sector distortions usually accompany other factor market distortions in selective industries defined by authorities as strategically important. Financial distortions typically is complemented by a form of price controls and wage increase policies, restrictions on import-export operations and fiscal policy envisaging various tax concessions for 'strategic' enterprises (for an overview of this literature see Korosteleva and Lawson, 2010). However, it is less clear whether such a complementary-effect matters in explaining economic growth, and whether TEs exhibit any differences from the rest of the world in the effect of TCI and

FSG on growth. We explore this in the next section.

6.2. TCI, financial distortions and growth

We now investigate the relationship between TCI, financial structure gap and growth, accounting for potential endogeneity between them, by employing a System Generalised Method of Moments (SYS GMM) model (Blundell and Bond, 1998). We aggregate data in 5-year averages from 1985-2009 so that we have a maximum of five observations per country, effectively allowing us to explore the effects of TCI and financial structure gap on medium-term growth. Along with TCI and financial structure gap, we also introduce the interaction term to test for a potential moderating effect of financial structure gap on the TCI-growth relationship, expecting some complementary effect between the two. Finally, we extend our analysis to TEs to shed light on differences in the relationship for this group of economies as a whole, compared to the rest of the world.

We use the following model to examine the effect of TCI and FSG on growth in a panel of 94 countries worldwide during 1985-2009, using five-year averages.

$$dLnGDPpc\_real_{it=} \beta_1 LnGDPpc\_real_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it} \quad (1), \quad i=1,..., N; t=1,...,T$$

$$u_{it}=v_i + e_{it} \quad (2)$$

where $dLnGDPpc\_real_{it}$ is the rate of change in the GDP pc (at US PPP constant prices), $LnGDP_{it-1}$ is the initial level of GDP pc (at US PPP constant prices) with respect to each 5-year period of time (predetermined variable). X_{it} is a vector of our potentially endogenous variables, namely TCI, FSG, and their interaction, trade openness and population growth. Z_{it} is a vector of strictly exogenous control variables used across TCI-growth specifications reported earlier in the text to ensure the issue of compatibility of results. The error term u_{it}

consists of the unobserved country-specific effects, v_i and the observation-specific errors, e_{it}. We also control for time fixed effects across all our SYS GMM specifications.

The dynamic structure of equation (1) makes both the OLS and fixed effects estimators upwards and downwards biased respectively, and inconsistent, since the predetermined variable and endogenous variables are correlated with the error term. Therefore, to estimate equation (1) we use the System Generalised Method of Moments (SYS GMM) estimator (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond 1998). The use of this estimator allows us to address econometric problems which arise from estimating equation (1). These include (a) the problem of potential endogeneity of some of regressors identified above; (b) the presence of predetermined variables - the initial level of GDP pc (in US PPP constant prices) that gives rise to measurement error as it is correlated with past errors; (c) the presence of fixed effects which may be correlated with the regressors; (d) the finite sample. SYS GMM allows the predetermined and endogenous variables in levels to be instrumented with suitable lags of their own differences (in this instance of order one and higher).

The results obtained from the System GMM model pass necessary diagnostic tests: (a) the autocorrelation test shows that the residuals are an AR (1) process which is what is expected. The test statistic for second-order serial correlation is based on residuals from the first-difference equation, and it rejects the null hypothesis of serial correlation of the second order; (b) the instrument set is valid as evidenced by the Hansen test of over-identified restrictions; and (c) all variables of interest have expected signs.

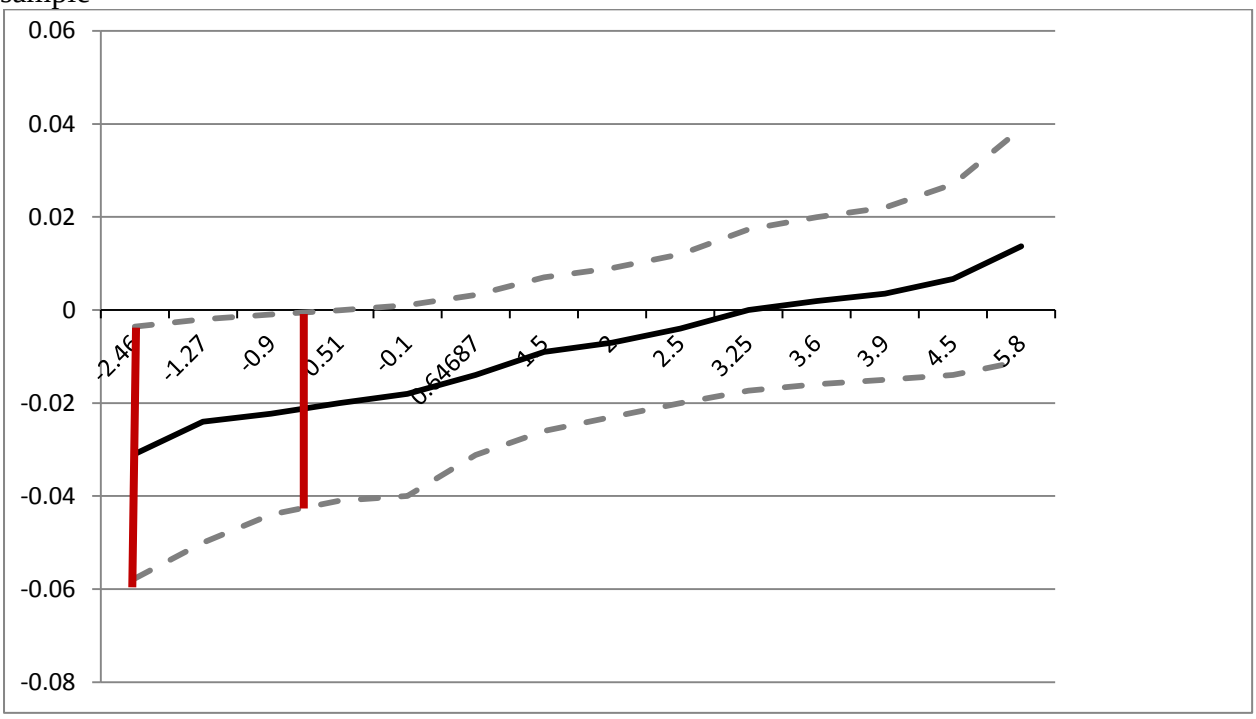
Table 5: SYS GMM regression results: Estimating the effect of TCI and financial structure gap on medium-term growth.

Explanatory variables	(1)	(2)
Ln_gdp_pc_start	-0.010** (0.004)	-0.010** (0.004)
Ln_population_start	0.005*** (.001)	0.003** (.001)
Population growth	-0.113 (.117)	-0.073 (.177)
Ln TCI2	-0.017* (0.009)	-0.006 (0.008)
FinStr gap	-0.005* (0.003)	0.000 (0.003)
Ln TCI_x_FinStr_gap	0.005** (0.002)	0.001 (0.002)
Landlocked	-0.005 (0.007)	-0.007 (0.006)
Distance from equator	0.004 (0.015)	0.028 (0.019)
Legal origin UK	-0.002 (0.009)	-0.006 (0.011)
Legal origin France	0.000 (0.009)	-0.004 (0.01)
Legal origin Scandinavia	0.005 (0.011)	-0.005 (0.010)
Average years of schooling	0.016 (0.011)	0.022* (0.013)
Trade openness	0.012** (0.005)	0.013** (0.005)
TE	-	-.004 (.015)
TE_x_FinStr gap	-	-.008* (0.004)
TE_x_TCI2	-	-.035 (.027)
TE_x_FinStr gap_x_TCI2	-	.025 (.018)
Time fixed effects	Yes	Yes
Number obs.	331	331
F st.	16.12	23.84
Pr>z AR(1) / Pr>z AR(2)	0.00/0.62	0.00/0.63
Hansen test of overid. restrictions, Chi2 (Pr.>chi2)	. 293	.931

Source: World Bank Financial Structure Dataset (2012 edition), WB WDI (2012 edition); UNIDO. Notes: Dependent variable: growth (approximated by the difference in logarithms of real GDP pc at US PPP dollars at current period and previous period), averaged over 5-year non-overlapping periods of time. Level of statistical significance is * 0.1%. ** 0.05% and ***, 0.01%. Standard errors (in parentheses) are robust to heteroskedasticity. The figures reported for the Hansen test and Difference Hansen test are the p-values for the null hypothesis: valid specification. Note: the autocorrelation test shows that the residuals are an AR (1) process which is what is expected. The test statistic for second-order serial correlation is based on residuals from the first-difference equation.

Our results reported in column (1) suggest that both TCI and FSG have a direct negative effect on growth, with the effect of TCI being stronger compared to the effect of FSG. It is interesting to note however, that the negative effect of TCI on growth is reduced by a moderate increase in FSG, implying a positive complementary effect between the two on growth. This is shown in Figure 3 where the marginal effect of TCI on growth conditional on financial distortions is plotted against FSG. When financial structure deviations are fairly moderate (as shown on Figure 3 in the section to the left of the graph delimited by two vertical red lines), there is a small compensating effect of FSG on the negative relationship between TCI and growth. At higher values of FSG, the marginal effect of TCI is statistically insignificant, and the turning point is found when FSG is equal to -0.51).

Figure 3: The marginal effect of TCI on growth conditioned on financial structure gap, whole sample



Source: World Bank Financial Structure Dataset (2012 edition), UNIDO; The marginal effect results are calculated based on obtaining the derivate of the function of growth with respect to TCI, conditioned on different values of FSG, using the SYS GMM estimation of the growth-TCI-FSG relationship (Table 4, specification 1). The dotted lines show the 95% significance confidence interval. Where both lower and upper significance intervals fall either below or above zero, the marginal effects should be read as significant.

Expanding our analysis to TEs (column 2 of Table 5), we show that unlike the rest of the world, financial distortions matter more for TEs, supporting our earlier intuition based on exploratory analysis of the data. Indeed, the financial sector has undergone unprecedented transformation in this region during the period of investigation. In the first transition decade, it remained overly bank-based with banks being overexposed to the problem of bad debts that mounted in the first decade of transition due to the continuing practice of banks lending to affiliated enterprises or, under official pressure, to loss-making state-owned enterprises to keep them afloat.

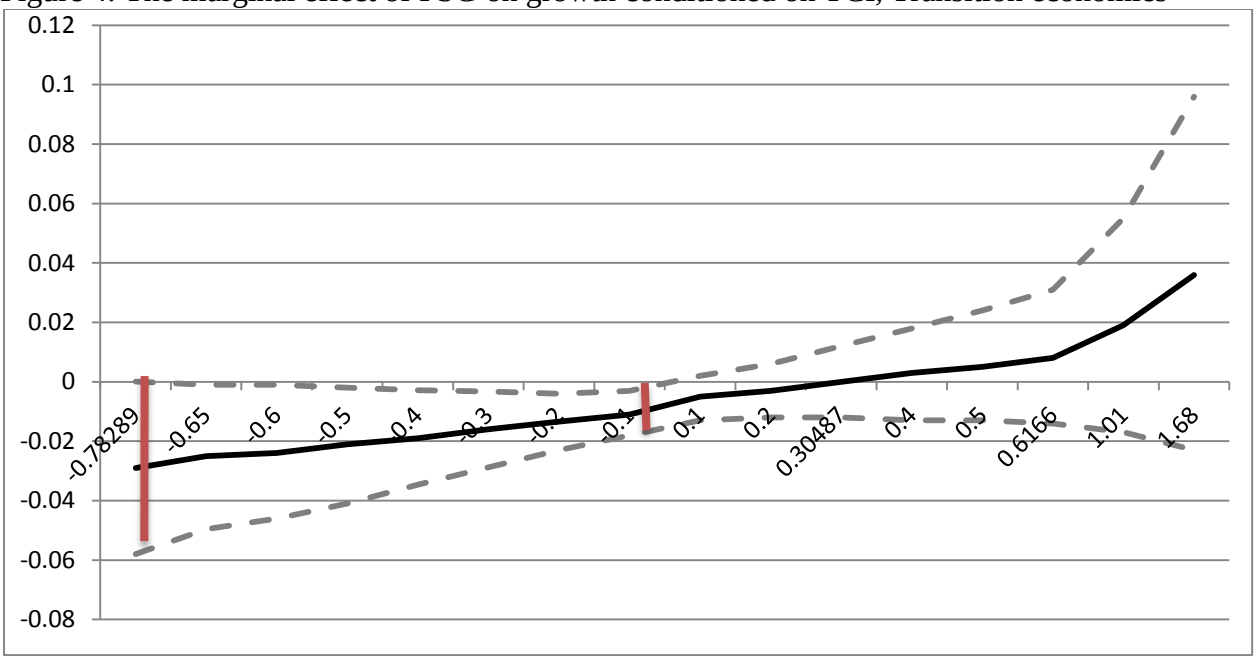
The problem of non-performing loans in banks' portfolios manifested into a problem of moral hazard and adverse selection, resulting in financial crises in the majority of transition economies by the mid-late 1990s (for example, banking crises in Latvia and Lithuania occurred in 1995, Bulgaria, Romania and Czech Republic – 1996-97, Russia – 1998). Thus, the financial reforms of the 1990s, failing to prevent inflationary finance and financial crises in majority of the countries of this region, ultimately contributed to large output losses in the first decade of transition.

Examining the transmission channels of financial development on economic growth Koivu (2004) finds an inverse relationship between bank credit to private sector and growth in the sample of 26 transition economies, explaining these results by the negative relationship between the poor quality of credit stock and its size. Indeed, her sample covers the period 1993-2000, when many transition economies, particularly of the CIS region, continued allocating bank loans to inefficient 'priority' sectors of the economy'.

Similarly, any large deviations in the other direction, like in the case of Russia, with high increase in stock market capitalisation vis-a-vis private credit sector development were also alarming. Under the pressure of structural adjustment programmes, by the mid-1990s the Russian government became convinced that bond financing was the only alternative to

monetary emission in financing the budget deficit. The Ministry of Finance, together with the Russian Central bank, were thoroughly issuing and servicing a series of government bonds, attracting short-term investors with extraordinarily high yields; the latter - up to 100-200 per cent - initially set up many times above the profitability of the real sector. Being tempted by high interest rates promising large profits and quick returns, Russian banks get involved in operations with securities, by that diverting funds from real sector. Moreover, Russian banks were riddled with 'domestic' conflicts of interest. Their directors lent freely to their friends, to themselves, and to powerful politicians. They misspent their depositors' funds, including those of state agencies. They built up vast structures of bad loans, which they carried from year to year, and became increasingly vulnerable[9].

Figure 4: The marginal effect of FSG on growth conditioned on TCI, Transition economies



Source: World Bank Financial Structure Dataset (2012 edition), UNIDO; The marginal effect results are calculated based on obtaining the derivate of the function of growth in reference to FSG, conditioned on different values of TCI, using the SYS GMM estimation of the growth-TCI-FSG relationship in the context of TE (Table 4, specification 2). The dotted lines show the 95% significance confidence intervals. Where both lower and upper significance intervals fall either below or above zero at the same time, the marginal effects should be read as significant.

[9] See Gustafson 1999, p. 79, and Komulainen and Korhonen 2000. For a discussion of the role of deposit insurance in manifestation of moral hazard problem in CEE and FSU countries see Boot and Wijnbergen (1995, pp. 42-57).

While our results suggest that FSG has a direct negative effect on medium-term growth on TEs, TCI does not seem to significantly influence growth directly, instead we find that a relatively small increase in TCI is associated with the reduction in the negative effect of FSG on growth in the context of this region. This is illustrated in Figure 4 where the marginal effect of FSG on growth conditional on TCI is plotted against TCI. This is likely driven by an increase in the productivity of the manufacturing sector thanks to greater firm efficiency after privatisation and restructuring of uncompetitive state-owned enterprises, entry of new firms, and within-industry relocation of resources (World Bank, 2008). As a result, the scope for financial sector supporting loss-making large-scale vertically-integrated enterprises has decreased, implying also a reduction in the problem of bad debts, and finance assuming more growth-enhancing role, oriented towards financing better projects. While we expect the effect of TCI on growth to be less homogenous across TEs, given the differences observed between CIS and CEEB economies in earlier OLS estimations, our limited data set on financial structure gap does not allow us to investigate any differences between the CIS and CEEB sub-groups, leaving this subject for future research when data covering a longer time span becomes available for this region.

7. Conclusions

In the recent past, a third wave of thinking has appeared in the literature on economic development. NSE has appeared as a credible alternative to both Washington Consensus and old structuralism and offers a new way of conceptualising structural change and growth with the objective of formulating better development policies. In this paper we have explored some of the basic propositions of NSE and the empirical approach used to distinguish between comparative advantage following (CAF) and comparative advantage defying (CAD)

strategies. The effects on growth of both these strategies according to Lin (2004, 2012) can be tested through the relationship between TCI and growth, and our first objective was to check for the existence of a negative relationship between TCI and growth, as established by Lin (2012) for a larger sample and for different groups of countries. Second, we also expanded inquiry by empirically exploring the relationship between financial sector distortions and TCI with implications for growth.

Our analysis has confirmed the results found by Lin (2012) on a much larger sample and for a longer time period: on average distortions as captured through a high TCI ratio are negatively related to growth. However, we find that this result cannot be generalized to the overall group of Transition Economies (TE). The higher the value added to labour ratio in manufacturing compared to the whole economy, the higher the growth in this group. However, this positive relationship masks different patterns for two different sub-groups. For CEEB, the relationship between TCI and growth is positive, while for the CIS, it is negative. This important result suggests that the propositions of NSE cannot be generalized to TEs. We interpret this results along two lines: first, we argue that TCI may not accurately capture distortions and their evolution in TEs as these countries had developed capital-intensive manufacturing sectors, while promoting full employment; second, we also discuss the fact that the ability to rebuilt and re-organise the manufacturing sector of these countries was key to their recovery. We also do not find a negative relationship between growth and higher values of TCI for High Income Countries, while a negative relationship is confirmed for very highly distorted economies.

We also find that while TCI and financial sector distortions, captured via the financial structure gap, are negatively associated with growth overall, a moderate increase in financial structure gap positively moderates the negative effect of TCI on growth, suggesting some

possible positive externality of the complementary effect between the two. This moderating effect however is insignificant for higher values of FSG. Interestingly, we find that for TEs as a group, FSG matters more for explaining any decline in growth than TCI directly, but indirectly, small increases in TCI have a positive mitigating effect on the FSG-growth relationship that we do not observe in the rest of the world.

An increase in TCI per se in TE could be attributed to a number of reasons; underlying the complexity of TCI interpretations in the context of TE. For example, it could be associated with a release of labour from manufacturing to try and correct for the labour hoarding practiced under central planning. However, some scholarly work suggests that the increase in productivity of the manufacturing sector in the period of 1990s-mid 2000s in TEs is less likely to be due to a reduction in employment in manufacturing, given the inflexibility of labour market regulations, and the overall political sensitivity of this issue; in fact, in a number of countries of Commonwealth of Independent States labour productivity fell in the 1990s as a result of inability of enterprises to reduce employment against the backdrop of a sharp output decline (World Bank, 2008). This makes the 'labour release' explanation less credible for explaining TCI dynamics. Similarly, given underdevelopment and shallowness of the financial sector over at least half of the transition period (Koivu, 2004), increase in TCI is unlikely to be driven by higher investment in capital. Therefore, we could explain a moderate increase in TCI, and the associated positive moderating effect of this on the FSG-growth relationship, with a possible increase in firm efficiency in the manufacturing sector associated with enterprise restructuring and exit of inefficient incumbent firms from the market, entry of new firms and reallocation of labour across continuing firms within the industry (World Bank, 2008). Overall, this signifies a move away from a pattern of economically costly subsidizing of an oversized industrial sector towards finance gaining a more growth enhancing role in the region, oriented towards financing of smaller-medium-

scale businesses with higher productivity. In a way, transition itself has created an opportunity to address distorted industrial and financial structures inherited from a planned economy (ibid).

How do we explain the limited relevance of NSE in explaining the links between type of development strategy (CAD/CAF), financial sector and technology choices in TE and its robust relevance on average for a large sample of countries? There are three groups of factors that can explain this. First, our results for TE are partial since we only have a limited number of observations for the 1960-1980s period. This limits our ability to discuss the full evolution of TCI during central planning and transition. Second, it is well-accepted that TEs have been over-industrialized in socialist times and have subsequently undergone profound changes associated with de-industrialization and restructuring. However, these proceeded at very different pace in different countries. Hence, the varying degrees of progress in the process of industrial restructuring may have an effect on our results and may partly explain why a very strong negative relationship (stronger than for the rest of the sample) between TCI and growth is found for the CIS while a positive relationship is identified for the CEEBs. Thirdly, the majority of CEEBs are upper middle to high-income economies for which NSE may only have limited relevance. Indeed appropriate growth strategies will differ for countries at different stages of development (see Lee, 2013 for a discussion of this), and NSE may speak more to developing countries than it does to more advanced economies In particular, comparative advantage choices for upper middle income economies may involve investments in intangible assets and big push' investments in R&D and knowledge-based sectors.

Based on this, more work is needed to first fine-tune our understanding of TCI as an indicator of distortions in TEs. Second, it also appear that it would be interesting to test the

key propositions of NSE for other sub-groups of countries to complement the more nuanced picture we are painting about the relationship between growth and TCI.

In conclusions, further research should try to resolve these issues by exploring the propositions of NSE for specific historical sub-periods and for specific income levels groups. In addition, construction of TCI should include value added generated in knowledge intensive activities in addition to manufacturing.

References

Beck, T., A. Demirgüç-Kunt, and R. Levine (2009) “Financial Institutions and Markets across Countries and Over time: Data and Analysis”, World Bank, Washington, DC.

Boot, A. W. A., van Wijnbergen, S. (1995) Financial sector design, regulation, and deposit insurance in Eastern Europe. *In:* J. Rostowski, ed. *Banking reform in Central Europe and the Former Soviet Union.* Budapest: Central European University Press.

Boyd, J. and B., Smith (1998) “The Evolution of Debt and Equity Markets in Economic Development”, *Economic Theory*, 12: 519-560.

Blundell R and S. Bond (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, 87: 111–143.

Campos, N. and A. Coricelli (2002) "Growth in Transition: What We Know, What We Don't and What We Should." *Journal of Economic Literature*, 40(3): 793-836.

Dale Gareth (2012) "Double Movements and Pendular Forces: Polanyian Perspectives on the Neoliberal Age", *Current Sociology*, 60(3)

Demirgüç-Kunt, A., F. Erik, and R. Levine (2011) “Optimal Financial Structures and Development: The Evolving Importance of Banks and Markets”, World Bank, Washington, DC.

Di Tommaso, M., M. Raiser and Weeks M. (2007) "Home Grown or Imported? Initial Conditions, External Anchors and the Determinants of Institutional Reform in the Transition Economies", *The Economic Journal*, 117(520): 858-881.

Fry, M. J**.,** 1995. *Money, interest, and banking in economic development.* 2nd edition. Baltimore: The Johns Hopkins University Press.

Fry, M. J. (1997) “In Favour of Financial Liberalization”, *The Economic Journal*, 107: 754-770.

Glaeser, E., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2004). "Do Institutions Cause Growth?", *Journal of Economic Growth*, 9: 271-303.

Gustafson, T. (1999) *Capitalism Russian-Style.* Cambridge: Cambridge University Press.

Hirschman, Albert O. (1958). *The Strategy of Economic Development*. New Haven, Conn.: Yale University Press

Koivu, T. (2004) “Banking Sector Development and Economic Growth in Transition Countries” in Balling, M., Lierman F. and Mullineux, A (eds) “Financial Markets in Central and Eastern Europe”. Routledge, London, pp. 47-60.

Komulainen, T. and Korhonen, I., eds., 2000. *Russian crisis and its effects.* 2nd edition. Helsinki: Kikimora Publications.

Korosteleva, J., Lawson, C. (2010). "The Belarusian Case of Transition: Whither Financial Repression?" *Post-Communist Economies* 22(1): 33-53

Kornai, J. (1992) *The Socialist System. The Political Economy of Communism*, Clarendon Press, Oxford.

Lee, K. (2013) *Schumpeterian Analysis of Economic Catch-up: Knowledge, Path Creation, and the Middle-income Trap*, Cambridge University Press, 2013.

Lee, K and Kim (2009) "Both Institutions and Policies Matter but Differently for Different Income Groups of Countries: Determinants of Long-Run Economic Growth Revisited.", *World Development*, 37(3):533-549.

Levine, R. 2002. "Bank-based or market-based financial systems: Which is better?" *Journal of Financial Intermediation* 11: 398-428.

Levine, R. 2005. "Finance and Growth: Theory and Evidence." In Phillippe Aghion, and Steven Durlauf (Eds.) *Handbook of Economic Growth*, Volume I.A. Amsterdam: North Holland.

Lewis, W.A. (1954) "Economic development with unlimited supplies of labour." *The Manchester School,* 22: 139–91.

Lin, Justin Yifu (2003) "Development Strategy, Viability, and Economic Convergence", *Economic Development and Cultural Change*, 51 (2): 277-308.

Lin, Justin Yifu (2012) *New Structural Economics. A Framework for Rethinking Development and Policy*. The World Bank, Washington D.C., ch 6: 287-347.

Lin, J.Y. and M. X. Liu (2004) "Development Strategy, Transition and Challenges of Development in Lagging Regions". In F. Bourguignon and B. Plekovic (eds.) *Annual World Bank Conference on Development Economics 2004 (Bangalore Conference Proceedings)*, The World Bank, Washington D.C., 197-223.

Lin, J.Y. and L.C. Xu (2012) "Financial Structure and Economic Development". In Lin, J.Y. (2012) New Structural Economics. A Framework for Rethinking Development and Policy. The World Bank, Washington D.C., pp. 261-283.

Lin, J. Y., X. Sun, and Y. Jiang. 2011. "Toward a Theory of Optimal Financial Structure". World Bank, Washington, DC.

De Melo, M. and C. Denizer (1997) "Monetary Policy during Transition: an Overview". *Policy Research Working Papers*, 1706. Washington D.C.: World Bank.

De Melo, M., C. Denizer, and A. Gleb (1997) "From Plan to Market: Pattern of Transition". *In*: M. I. Blejera and M. Skreb, eds. Macroeconomic Stabilisation in Transition Economies. Cambridge: Cambridge University Press, pp. 17-70.

Murphy, M.K., A. Shleifer, and R.W. Vishny (1989) "Industrialization and the Big Push", *Journal of Political Economy*, 97(5): 1003-1033.

Prebisch, R. (1959), 'Commercial policy in underdeveloped countries', *American Economic Review* (Proc.), 49(2), 251–73.

Prebisch, R. (1960), The Economic Development of Latin America and its Principal Problems, United Nations: Economic Commission for Latin America.

Radosevic, S. (1999) *International Technology Transfer and Catch-Up in Economic Development*, Cheltenham: Edward Elgar.

Radosevic, S (2009) "Policies for Promoting Technological Catch Up: A Post-Washington Approach", *International Journal of Institutions and Economies*, 1(1): 23-52.

Raiser, M., M. Schaffer, J. Schuchhardt (2004), "Benchmarking Structural Change in Transition", *Structural Change and Economic Dynamics*, 15: 47–81.

Tregenna, F. (2009) "Characterising Deindustrialization: Changes in manufacturing Employment and GDP Internationally." *Cambridge Journal of Economics*, 33(3): 433-466

Tregenna, F. (2011) "Manufacturing Productivity, Deindustrialization and Reindustrialization" UNU WIDER, Working Paper Number 2011/57.

Williamson, J. (1990) "What Washington Means by Policy Reform", in Williamson, J. (ed.), *Latin American Adjustment: How Much has Happened?*, Washington: Institute for International Economics, Ch. 2.Williamson, J. (2004) "A Short History of the Washington Consensus", paper presented at Foundation CIDOB conference held in Barcelona in September "From the Washington Consensus Towards a New Global Governance", Columbia University. Available at ~~http://www.iie.com/publications/papers/williamson0904-2.pdf~~

World Bank (2005) *Economic Growth in the 1990s: Learning from a Decade of Reform*, Washington DC: World Bank.

World Bank (2008) *Innovation, Inclusion and Integration: From Transition to Convergence in Eastern Europe and the Former Soviet Union*, Washington DC: World Bank.

Annex 1: Estimated Financial Structure Ratio: robust regression results (estimated on OECD sample)

Dependent variable: Financial structure ratio	Private Credit/Stock Market Capitalisation
Ln GDP per capita at const US 2000	-1.126*** (.165)
Ln Population Size	.026 (.035)
Ln Population Density	-.006 (.045)
English Legal Origin	-1.09*** (.155)
French Legal Origin	-.837*** (.156)
Scandinavian Legal Origin	-.581** (.202)
Distance to equator	.103 (.558)
Natural Resources Exports	-.001 (.004)
Constant	13.9 (1.63)
Year controls	Yes
Observations	484
F-st.	8.43***

Source: World Bank Financial Structure Dataset (2012 edition), WB WDI (2012 edition); Global Development Network Growth Database. Note: *,**,*** denote significance on the 10, 5 and 1-percent level, respectively. Standard errors reported in parentheses. The model includes the same set of controls as in Demirgüç-Kunt et al. (2011).

Annex 2: Financial development & structure indicators for selected countries and groups

Country Groups/ Countries	Real constant GDP per capita median	Private credit to GDP (%) median	Stock market capitalization to GDP (%), median	Act. Fin. structure ratio median	Fin. structure Gap (log) median	Act. fin. structure/Optimal Fin. structure, median
Whole sample	4,831	48.7	29.7	1.93 (5.8)	0.81 (0.65)	0.66 (1.52)
OECD	22,382	92.9	54.5	1.85	-0.41	1.08
Transition Economies	3,888	33.8	9.16	3.25 (13.5)	1.04 (1.10)	0.70 (2.74)
CIS	777	11.3	2.8	3.73 (7.7.)	1.31 (1.50)	0.62 (1.4)
CEE	4,681	37.9	16.3	2.96 (15.3)	0.92 (1.21)	0.73 (3.15)
Transition economies (included in the sample)						
Armenia	1,055	10.85	0.86	19.4	2.5	3.67
Bulgaria	1,795	28.4	6.5	3.42 (99.7)	0.87 (2.44)	0.65 (19.1)
Croatia	4,144	38.14	3.5	8.22	1.29	1.8
Czech Republic	5,857	46.8	23.8	1.9	0.73	0.48
Estonia	4,904	46.3	22.1	1.98	0.92	0.49
Hungary	4,514	36.1	22.6	2.3	0.90	0.53
Kyrgyzstan	298	7.02	0.83	9.3	1.61	0.45
Latvia	3,888	33.8	9.1	10.5 (8.28)	1.8 (1.26)	2.3 (1.86)
Lithuania	4,641	38.0	19.3	2.5	0.78	0.71
Moldova	371	9.5	3.2	3.3	0.46	0.56
Poland	4,262	24.2	13.8	2.3 (15.4)	1.03 (1.6)	0.54 (2.99)
Romania	1,893	11.1	8.6	2.1 (8.2)	1.1 (1.6)	0.47 (1.93)
Russia	2,004	18.8	34.96	0.69	1.29	0.16
Slovakia	5,396	44.4	5.65	7.2	1.1	1.7
Slovenia	10,716	40.3	19.9	2.7	0.08	0.79
Ukraine	766	18.3	8.7	2.4	1.11	0.44
Benchmark countries (selectively)						
Germany	23,185	110.1	46.8	2.5	-1.27	1.00
France	20,189	87.7	57.4	1.83	-0.51	1.15
United Kingdom	22,389	116.4	125.11	1.12	-0.90	0.66
United States	31,906	155.0	122.5	1.72	-1.00	1.43
Canada	21,104	98.00	87.9	1.6	-1.16	0.92

Source: World Bank Financial Structure Dataset (2012 edition), WB WDI (2012 edition). Note: the table provides country medians for the period 1985-2009 of Private credit to GDP, Stock market capitalization to GDP, Actual financial structure ratio (private credit/stock market capitalisation), Financial Structure Gap and Actual Financial structure ratio / Estimated Optimal financial structure ratio. Country averages are presented based on the observations actually used in the SYS GMM estimations of the growth-TCI-FSG relationship. Where the difference between mean and median is substantial we also report means in brackets.