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Technology choices and growth: testing New Structural Economics in Transition Economies

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We explore the relationship between development policies, finance and growth as approached by New Structural Economics (NSE) with special reference to Transition Economies (TEs). On a sample of 164 economies for 1963–2009, our analysis confirms NSE propositions that the type of development policies, as captured by the Technology Choice Index (TCI), has a significant effect on long-term growth. However, this differs for TEs as a whole and its subgroups. 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 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 is partly mitigated, although not eliminated, by moderate level of financial sector distortions. This points towards some positive externalities of simultaneous financial and industrial sector distortions, at least in the medium run. However, TEs are shown to differ from the rest of the sample as financial distortions play a more pronounced direct negative effect on medium-term growth in these countries.

Keywords: New Structural Economics; Technology Choice Index; Transition Economies

1. Introduction

We propose to test and expand the basic propositions of New Structural Economics (NSE) theory, with special reference to Transition Economies (TEs). NSE essentially builds on neoclassical theory through its recognition of comparative advantages and the importance of structural change for growth (Lin 2012, 2015). It emphasizes 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 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 forms interesting premises on which to analyse development strategies and their relative success or failure.

Lin (2012) empirically tested his proposition using Technology Choice Index (TCI) as an indicator of the strategy followed by a given country. TCI is constructed as the

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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 captures an inadequacy between a high value-added manufacturing sector and a relatively backward “rest of the economy”. For example, soft and hard infrastructure is missing to generate a balanced and sustainable growth. In other words, over-investing in an excessive capital or forcing productivity through costly R&D when a country is 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 negative relationship between long-term growth and TCI 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 and over a longer time span.

Further to this, Lin (2012) also pointed out that high level of distortions is also 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, as well as a possible moderating effect of financial distortions on the relationship between TCI and growth.

Additionally, we explore the effects of TCI on growth and its links to financial distortions in the context of TEs specifically. 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 propositions of NSE and how a shift from distortionary to less distortionary environment affects economic growth.

We organize 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 summarized in conclusions.

2. Development strategies and technology choice

2.1. Overview of development thinking since the 1950s

Old structuralism has emerged in development thinking in the 1950s in the writings of early structuralists including Lewis (1954) or Prebisch (1959, 1960). It posited that low-income countries faced fundamentally different problems from 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 influenced development policies during the 1950s, 1960s and early 1970s, in particular through import substitution strategies (see Radosevic 1999 for an assessment of these policies). These ideas contrasted sharply with the view advanced by orthodox economists, who 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 removed policy distortions and followed their comparative advantage.

By the mid-1980s, many developing countries entered into debt crisis, discrediting import substitution strategies. This led to a radical shift in 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, the World Bank and the US Treasury begun advocating the policies that became known 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 and so forth. However, Washington Consensus-based policies lost their relevance after the severe output losses observed during transition in the former Soviet Union and Eastern Europe, and the sustained rapid growth observed in China, India and Vietnam (World Bank 2005). This should not have happened, as China, India and Vietnam were said to pursue more interventionist policies and liberalize in a gradual and heterodox manner, while TEs were abandoning central planning and attempting to apply reforms complying with the Washington Consensus.

Within this context, NSE emerged as a third way in development thinking, reinstating the importance of economic structure and industrial upgrading. However, in contrast with the old structural economics thinking of the 1950s, the “structure” is endogenous in NSE. To some extent, the aim of NSE is to marry structural approach to growth with neoclassical 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

The basic idea that growth is spurred when a country follows a development strategy consistent with its comparative advantages and endowment structure is intuitively and theoretically appealing. It is, however, difficult to test. Indeed identifying a proxy capturing whether a development strategy falls into a CAD or CAF category is challenging. Lin and Liu (2004) proposed to use a TCI.

This indicator is defined as follows:

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

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 $L_{i,t}$ is the total labour force.

A high TCI value is therefore indicative that a country follows a CAD strategy by investing in capital-intensive manufacturing. The numerator of TCI will be relatively larger in context where manufacturing firms have large market shares, thanks to government’s intervention, where access to subsidized 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 inflating the value added to labour ratio in the supported sector.

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 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.

Lin (2012) has convincingly demonstrated, using a sample of 122 countries over the period 1962–1999, that higher TCI over a 10-year period (i.e. long-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 targeted 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 mask more subtle variations within the sample of countries investigated. In particular, the negative relationship between TCI and growth may not be generally valid but can be confined to specific groups of countries or to specific income levels. To expand on Lin's work, we revisit his finding, using a longer time period, and different sub-sample of countries.

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

TEs constitute a very relevant subset of countries for exploring and testing the CAD/CAF propositions of NSE. As command economies they tried by political means to achieve fast industrialization, giving preference 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). This therefore highlights a key difference between NSE and the principles of socialist industrialization or related theory of unbalanced growth (Hirschman 1958; Murphy, Shleifer, and Vishny 1989). Indeed, while socialist industrialization 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, TEs 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, manufacturing and heavy industry were actively promoted under central planning, but simultaneously, government 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 possibly 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 clear that the extent of distortion in these countries at the onset of transition cannot be appropriately captured by TCI.

Furthermore, with the collapse of communism, the countries of CEE and the CIS did restructure away from heavy industry, as shown by Raiser, Schaffer, and Schuchhardt (2004). However, the pace of deindustrialization 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-industrialization 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 formalized by Aghion and Blanchard (1994) with the so-called “optimal speed of transition”, the restructuring of these economies would only be possible with a substantial increase in unemployment. This has taken place in all countries but with quite different speed.

As a result, 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 deindustrialization, the speed 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 is not an appropriate indicator of the extent of distortion in the specific case of transition countries.¹

3. Financial structure distortions

Further to this, the CAD and CAF strategy cannot be assessed in an institutional vacuum (Lin, Sun, and Jiang 2011; Lin 2015), as a CAD strategy requires substantial government interventions. Lin (2012) provides evidence of an association between TCI and government interventions in property rights institutions, resource allocation, enterprise autonomy, and the existence of a black market, suggesting that higher values of TCI are positively associated with the presence of such distortions in the economy. We focus on financial structure.

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 inflows 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 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 1970–1980s, many developing countries started liberalizing their financial sectors. Later, financial liberalization, 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.

The crucial role played by the size of financial system in the growth process is well established (see Levine 2005). However, recent evidences have focused on the importance of financial structure for growth. More specifically, scholars argue that while both banks and securities markets positively influence economic development, they provide different services critical at different stages of economic development (Levine 2002) as a result, different combinations of financial institutions and markets are needed at different development stages (Boyd and Smith 1998).

For NSE, financial structure is endogenous. Specifically, a CAD strategy requires a sub-optimal financial structure which fails to deliver the appropriate blend of financial services but contributes to supporting targeted sectors (e.g. Lin and Xu 2012). This has further deleterious effects on economic activity. Demirgüç-Kunt, Erik, and Levine (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 and greater financial sector distortions 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, as 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).

4. Data, methodology and hypotheses

4.1. TCI index

The data come 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), where value added and employees in the manufacturing sector are obtained from UNIDO, while gross value added and labour force size in country i at time t are from WDI. Both value added in manufacturing and gross value added are measured in current prices and local currency.

We use TCI data for 164 countries as Burundi, Rwanda, Madagascar, Burkina Faso, Nigeria had TCI representing statistical errors and were removed from the sample.

The regressions exploit 10 years averages (decades 1960s, 1970s, 1980s, 1990s and 2000s), the dependent variable being growth of GDP per capita (at US PPP constant prices) and the key independent variable being TCI.

4.2. Indicators of financial structure gap

Drawing on Demirgüç-Kunt, Erik, and Levine (2011), we define financial structure as a ratio of private credit to stock market capitalization. It is a commonly used size-based

measure of financial structure. To capture distortions in the operation of the financial sector, we construct a measure of financial structure gap, which captures how far a country's actual financial structure is from an estimated optimum. This optimal financial structure is estimated as in Demirgüç-Kunt, Erik, and Levine (2011). We first regress our size-based measure of financial structure on GDP per capita at constant US\$ 2000 for the sample of OECD countries² for the period 1985–2009, while controlling for key institutional, geographic and structural traits. This assumes that 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 economic development. The financial structure ratio for OECD economies is estimated based on robust regression given the sensitivity of our results to outliers. We then use the coefficients from the OECD regression to compute the estimated optimal financial structure for each country-year observation in the full sample. 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 available from Bruno et al. (2014).

4.3. Hypotheses

Our hypotheses are aiming to test the robustness and validity of key NSE propositions, namely (1) we want to test the negative relationship between TCI and growth on an extended data set, and on specific subgroups of countries, looking in particular at TEs and (2) we want to test the NSE assertion that financial structure and TCI 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.

5. TCI and growth

5.1. Overview of the data

Our database of 164 countries from 1963 to 2009 covers the whole spectrum of development phases with the shares of low-, middle- and high-income countries (HIC) accounting for 17, 53 and 30%, respectively.⁴ TEs, as key focus of our study, account for 18% of the sample.

Focusing on TE, we want first to describe the observed patterns of TCI change. Unfortunately, for most TE countries, data points are only available for the 1990s and 2000s (with the notable exception of Hungary, which is characterized by low distortion throughout). We are therefore unable to discern the full evolution of TCI from the communist era to the present day. But the data available do show interesting patterns for the transition period. It appears that TEs experienced low-level distortions as measured through TCI overall and in particular at the onset of transition (TCI below 2). Some countries (mostly CIS) experienced a rise in TCI in the following decades. This evidence is in line with our discussion on the relevance of TCI as proxy for economies with substantial labour hoarding.

Table 1. Hypotheses.

Type of relationships	Hypotheses
(1) TCI & growth	<p>H1.1: On average, a high value of TCI is negatively related to long-term growth</p> <p>H1.2: Transition Economies (TEs) 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 vs. CIS in the way TCI relates to growth</p>
(2) Financial distortions, TCI and growth	<p>H2.1: On average, a higher value of TCI and financial structure gap will independently adversely affect medium-term growth</p> <p>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</p> <p>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</p>

5.2. Econometric results: base model

We now test the robustness of Lin's (2012) results on our 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. The data are rearranged in 10-year averages (decades) to smooth out the business cycle.

In the regressions in Table 2, we 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 specifications. We 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).

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

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*** (0.002)	-0.007*** (0.002)	-0.006*** (0.002)
Ln_gdp_pc_start	-0.004*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)
Ln_PopulationTotal start		0.003*** (0.001)	0.003*** (0.001)
Distance to equator		0.006 (0.008)	0.011 (0.008)
Landlocked		-0.004 (0.003)	-0.004 (0.003)
Population growth		-0.755*** (0.094)	-0.395*** (0.117)
Ln Average years of schooling Barro Lee		0.004 (0.003)	0.010*** (0.003)
Trade Openness		0.013*** (0.002)	0.014*** (0.002)
Legal origin_uk_laporta		0.003 (0.004)	0.000 (0.004)
Legal origin_fr_laporta		0.005 (0.004)	0.003 (0.004)
Legal origin_sc_laporta		0.008 (0.006)	0.005 (0.005)
Constant	0.062*** (0.009)	0.024 (0.015)	0.013 (0.015)
Decade (time) fixed effects	No	No	Yes
Observations	459	418	418
Adjusted R^2	0.076	0.262	0.316

Note: Standard errors reported in parentheses.

Source: World Bank Financial Structure Data-set (2012), WB WDI 2012 edition; UNIDO.

*Denotes significance at the 10% level, respectively.

**Denotes significance at the 5% level, respectively.

***Denotes significance at the 1% level, respectively.

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. Econometric results: TEs

To go further, 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 (see models 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 models 2b and c, probably capturing the severe output losses of the transitional recession.

Table 3. Estimating the effect of TCI on growth for TEs: 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*** (0.002)	-0.008*** (0.002)	-0.007*** (0.002)	-0.011*** (0.002)	-0.009*** (0.002)	-0.007*** (0.002)
Ln TCI * TE	0.019** (0.008)	0.016** (0.007)	0.013* (0.007)			
TE	-0.001 (0.004)	-0.023*** (0.005)	-0.021*** (0.005)			
Ln TCI * CEE				0.009 (0.011)	0.023** (0.010)	0.017* (0.009)
Ln TCI * CIS				-0.014 (0.019)	-0.001 (0.014)	-0.005 (0.013)
CEE				-0.007 (0.005)	-0.024*** (0.006)	-0.022*** (0.006)
CIS				0.036*** (0.014)	-0.012 (0.011)	-0.006 (0.011)
Ln_gdp_pc_start	-0.004*** (0.001)	-0.010*** (0.001)	-0.010*** (0.001)	-0.004*** (0.001)	-0.010*** (0.001)	-0.010*** (0.001)
Ln_PopulationTotal_start		0.003*** (0.001)	0.003*** (0.001)		0.003*** (0.001)	0.003*** (0.001)
Distance to equator		0.014 (0.008)	0.018** (0.008)		0.013 (0.008)	0.018** (0.008)
Landlocked		-0.007** (0.003)	-0.006** (0.003)		-0.007** (0.003)	-0.006* (0.003)
Population growth		-0.831*** (0.096)	-0.486*** (0.122)		-0.832*** (0.097)	-0.472*** (0.124)
Ln Av. years of schooling Barro Lee		0.008** (0.003)	0.014*** (0.004)		0.008** (0.003)	0.014*** (0.004)
Trade Openness		0.015*** (0.002)	0.016*** (0.002)		0.015*** (0.002)	0.016*** (0.002)
Legal_origin_uk_laporta		-0.007* (0.004)	-0.009** (0.004)		-0.008* (0.005)	-0.011** (0.005)
Legal_origin_fr_laporta		-0.005 (0.004)	-0.006 (0.004)		-0.005 (0.005)	-0.007 (0.004)

Legal origin_sc_laporta									
Constant	0.062*** (0.010)	-0.004 (0.006)	-0.006 (0.006)	-0.004 (0.006)	0.058*** (0.010)	0.051*** (0.016)	-0.004 (0.006)	-0.007 (0.006)	
Decade (time) fixed effects	No	No	Yes	No	No	No	No	Yes	
Observations	459	420	420	420	458	418	418	418	
Adjusted R^2	0.088	0.287	0.337	0.284	0.105	0.284	0.284	0.333	

Note: Standard errors reported in parentheses.

Source: World Bank Financial Structure Data-set (2012), WB WDI 2012 edition; UNIDO.

*Denotes significance at the 10% level, respectively. **Denotes significance at the 5% level, respectively. ***Denotes significance at the 1% level, respectively.

Growth and TCI are positively correlated in TEs suggesting 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 an heterogeneous region and we should distinguish between CEEB and CIS countries.

Table 3 therefore shows a further effort to disentangle the specificities of the relationship between TCI and growth in 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 models 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. Based on Model 3c, we can report the overall effect and significance of TCI on growth for CEEB, CIS and the rest of world to be, respectively, +0.010 (significant at 5%), -0.012 (significant at 10%) and -0.007 (significant at 1%).

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. These results are significant as they suggest something fundamentally different in the way distortions, as measured through TCI, relate to growth in these countries. To explain this, we suggest first, that the type of policies pursued prior to transition in these countries were highly distortive, but maybe not in a way that is appropriately captured through TCI. This is because during the socialist era, these countries were *both* over-investing in capital-intensive manufacturing and hoarding of labour. During transition, the tension between the need to reduce the size of a capital-intensive sector and to shed labour would have imposed opposing forces on TCI making it difficult to predict the likely evolution of this indicator and invalidating its ability to measure the extent of distortions in TEs.

Second, this puzzling result can also be related to high level of investments in supportive infrastructures (education, transport, energy, etc.) which may have helped growth to bounce back faster during transition. In the longer term, the comparative advantage of TEs may have caught up with the ambitions of their planners (Carlin, Schaffer, and Seabright 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, recorded lower growth. Additionally, the evidences gathered on the economic recovery of TEs after the transitional recession have pointed towards the importance of swift reforms allowing for resource reallocation across sector, a process that is facilitated by the availability of skilled labour, and the ability to attract FDI inflows, and integrate into global value chains (Campos and Coricelli 2002). From this perspective, CEEB also had the advantage of being located closer to the EU which offered 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, Raiser, and Weeks 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, 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 and slow restructuring has not yet reached an optimum.

5.4. Further results: different subgroups of countries⁶

As discussed previously, 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 (TCI values above 10). These highly distorted economies are typically low-income African economies, where islands of manufacturing operate in largely agricultural economies. As before, we reproduced the Model 1c presented in Table 2 adding a dummy for highly distorted economies and an interaction term with 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 highly distorted economies where small capital-intensive manufacturing pockets are artificially created do not achieve sustained growth.⁷ This result 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 re-estimated our basic models on a sample of middle-income countries (MIC) and a sample of HIC.⁸ This exercise reveals a negative and significant relationship between TCI and growth for MIC (-0.008 , significant at the 1% level in a model analogous to Model 1c) and a positive relationship between TCI and growth for HIC ($+0.010$, significant at the 1% level in a model analogous to Model 1c). This confirms the validity of NSE for MIC on average, but a different story may be at play for HIC. A plausible finding, as HIC tend to be characterized by large and expanding tertiary sectors, while the composition of their manufacturing sector is likely to differ from that of MIC. This also conforms with Lee and Kim (2009) and Lee (2013) who defend that different development strategies and policies are 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 vs. MIC can contribute to explaining the results we found for CEEB country in the previous section.

6. Financial structure distortions, TCI and growth

6.1. Financial structure gap and TCI

We continue our examination of key NSE propositions through the investigation of the relationship between financial structure distortions, TCI and growth. Due to data limitations, the time span on which we base our investigations is 1985–2009 (instead of 1963–2009 in Section 5) and we focus on midterm growth (5-year period) rather than long-term growth (10-year period).

We first report indicator of financial development and structure for the whole sample, and some groups of countries. Economies worldwide remain predominantly bank-based with the median for actual financial structure ratio equal to 1.93 in our sample. This is even higher for TEs, where the median of the actual financial structure ratio reaches 3.25.

The financial structure gap in our sample ranges from -2.46 in Norway to 5.84 in Bulgaria. OECD economies, which were used as a benchmark to create the optimal financial structure, show the lowest gap (-0.41) in the sample.

As regards TEs, they are more financially distorted than the average country with a group median at 1.04 compared to 0.81 for the rest of the world. The financial structure gap is higher in CIS than CEEB economies, but the difference is not substantial. Bulgaria emerges among the most financially distorted countries 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 (in line with the severe financial crisis that hit the country in 1997). Among relatively more financially distorted countries are Armenia, Croatia, Kyrgyzstan and Latvia. They would all benefit from developing stock markets vis-à-vis private credit. On the contrary, Russia appears distorted in the opposite direction, having a relatively over-sized stock market. Otherwise, the rest of TEs in our sample appear still relatively financially underdeveloped, especially in terms of private credit to GDP.

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 1). This is not surprising as financial sector distortions usually accompany other factor market distortions in industries defined by authorities as strategically important. Financial distortions typically are 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 (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 next.

6.2. TCI, financial distortions and growth

We now investigate the relationship between TCI, financial structure gap and growth. We aggregate data in 5-year averages from 1985 to 2009 for 94 countries, so that we have a maximum of five observations per country, 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 their interaction term to test for a potential moderating effect of financial structure gap on the TCI-growth relationship. Finally, we look at these relationships for TEs.

We use the following model to examine the effect of TCI and FSG on growth:

$$\begin{aligned} \text{dLnGDPpc_real}_{it} &= \beta_1 \text{LnGDPpc_real}_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it} \\ i &= 1, \dots, N; t = 1, \dots, T \end{aligned}$$

$$u_{it} = v_i + e_{it} \tag{2}$$

(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.

Our results reported in column (1) in Table 4 suggest that both TCI and FSG have a direct negative effect on growth, with the effect of TCI being relatively stronger.

Table 4. 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 over-identification restriction, χ^2 (Pr. > χ^2)	.293	.931

Source: World Bank Financial Structure Data-set (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.

However, the negative effect of TCI on growth is reduced by a moderate increase in FSG, implying positive complementarities. This is illustrated in Figure 2 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 in Figure 2 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 .

Expanding our analysis to TEs (column 2 of Table 4), we show that financial distortions matter more for TEs compared to the rest of the world, supporting intuitions 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 through lending to failing affiliated enterprises or, under official pressure, to loss-making state-owned enterprises. This resulted in financial crises in the majority of TEs by the mid-late 1990s (e.g. banking crises in Latvia and Lithuania occurred in 1995, Bulgaria, Romania and Czech Republic – 1996–97, Russia – 1998).

This is also consistent with the literature on financial development and growth in TEs. For example, Koivu (2004) found an inverse relationship between bank credit to private sector and growth in a sample of 26 TEs, explaining these results by the negative relationship between quality of credit stock and its size, focusing on the period 1993–2000, when many TEs, particularly of the CIS region, continued allocating bank loans to inefficient “priority” sectors of the economy. Similarly, large deviations in the other direction, as observed in Russia, with high increase in stock market capitalization vis-a-vis private credit sector development have also been linked to negative outcomes.⁹

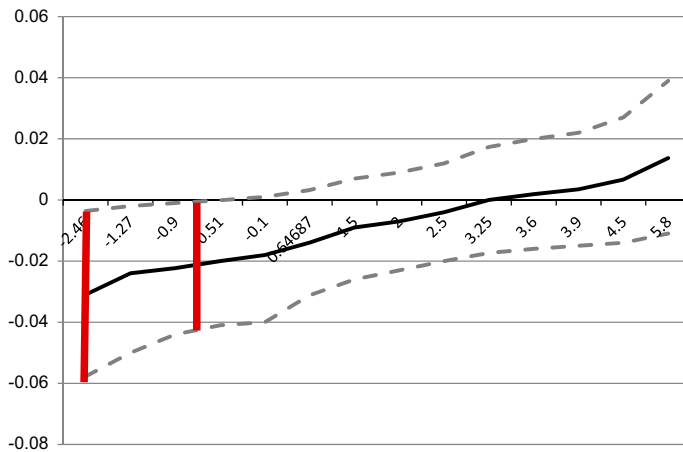


Figure 2. The marginal effect of TCI on growth conditioned on financial structure gap, whole sample.

Source: World Bank Financial Structure Data-set (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.

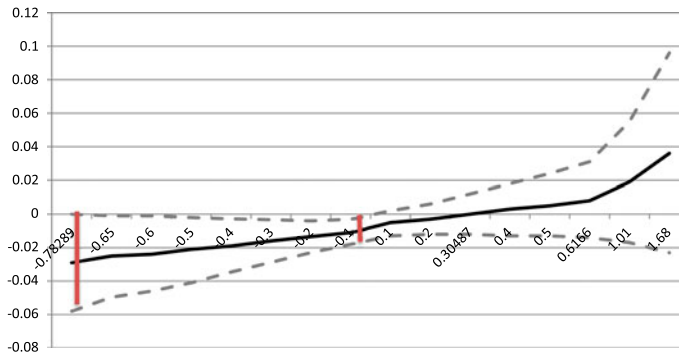


Figure 3. The marginal effect of FSG on growth conditioned on TCI, TEs. Source: World Bank Financial Structure Data-set (2012 edition), UNIDO; The marginal effect results are calculated based on obtaining the derivate of the function of growth in reference to FSG, conditioned on different values of TCI, 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.

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 this region. This is illustrated in Figure 3 where the marginal effect of FSG on growth conditional on TCI is plotted against TCI. This can be related to an increase in the productivity of the manufacturing sector after privatization and general restructuring in the early stages of transition (World Bank 2008). As a result, the scope for financial sector supporting loss-making large-scale vertically integrated enterprises 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 subgroups, leaving this subject for future research when data become available.

7. Conclusions

In the recent past, NSE has appeared as a credible alternative to both Washington Consensus and old structuralism offering a new way of conceptualizing structural change and growth to formulate better development policies. In this paper, we have explored some of the basic propositions of NSE and the empirical approach used to distinguish between CAF and CAD strategies. The effects on growth of such strategies were tested through the relationship between TCI and growth, and a negative relationship was established by Lin (2012).

Our analysis has confirmed this result on a 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 offer a number of qualifications to this proposition. First, we find that this result cannot be generalized to the overall group of TEs. We indeed find a

positive relationship between TCI and growth in CEEB and a negative relationship in CIS countries. We interpret this result along two lines: first, we argue that TCI does not accurately capture distortions and their evolution in TEs, and second, we also suggest that their abilities to rebuild and reorganize their economies was key to their recovery. We also find that this NSE proposition appears to be valid 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.

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 complementarities 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, the inflexibility of labour market regulations, and the political sensitivity of this issue meant that in a number of countries of Commonwealth of Independent States in particular 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 “labour release” explanation possibly hold the key to the difference observed in the relationship between growth and TCI in CEEB vs. CIS but may not be sufficient to explain our financial distortions results. 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- to medium-scale businesses with higher productivity. Transition itself created an opportunity to address distorted industrial and financial structures inherited from a planned economy (World Bank 2008).

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. Third, 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 (Lee 2013), 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 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 subgroups 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 could include value added generated in knowledge intensive activities in addition to manufacturing.

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Notes

1. Note that in Lin (2003), a different approach was chosen and an optimal level of TCI was constructed 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, while distortions created to promote a labour-intensive manufacturing sector would depress TCI and result in a negative gap when compared to its optimal value (294). Such an approach would also be inappropriate to capture the types of distortions existing in TEs, as capital-intensive manufacturing and labour hoarding were promoted simultaneously prior to transition.
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 and 0.999), and positive values for greater deviations.
4. The income category variable is time-invariant, i.e. it is the World Bank definition based on the latest data available.
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.
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.

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 it turned out insignificant.
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.
9. See Gustafson 1999, 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 van Wijnbergen (1995, 42–57).

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