Inefficient Growth

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Abstract

Since the early days of law and economics scholarship we know that legal institutions have a significant impact upon societies and their wealth. However, the particular effects of different types of rules on growth and on efficiency are still out of sight and offers ample opportunities for further research.
This paper seeks to quantify the impact of different legal rules on economic growth and compare it with the effect of such rules on total factor productivity. Paper identifies several legal institutions as sources of transaction costs that actually lead to inefficient growth (lower TFP) and others which tend to improve the efficient allocation of resources over time. Our model predicts the agents with higher transaction costs will achieve persistently slower path of economic growth compared to the counterfactual scenario. It also predicts the agents with lower transaction costs are substantially more likely to embark on the path of technology improvements pushing it production function outward. High transaction costs directly discourage technology adoption and set the agents on the path of inefficient factor accumulation which is bound by the diminishing marginal products and constrained by the long-run stationary equilibrium. The underlying model predicts lower transaction costs encourage the convergence of per capita across countries although the convergence pattern depends on the temporal evolution of transaction costs and the strength of the change over time. Higher transaction costs predict divergence of per capita output across countries in either rapid or gradual fashion which is somewhat mediated by the presence of external shocks.

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1. Introduction

Since the early days of law and economics scholarship we know that legal institutions have a significant impact upon societies and their wealth. The significant impact of legal institutions on the path of economic growth has been widely discussed by the pioneers of law and economics (Coase 1960, Arrow 1969, Demsetz 1988, Cheung 1969, North 1990, Williamson 1996, Posner 2011). However, the particular effects of different types of rules on growth and on efficiency are still out of sight.

Conventional law and economics wisdom also holds that growth is always efficient. Building the neoclassical growth model augmented by transaction cost parameter, our parameter-calibrated model implies that the non-zero transaction cost assumption leads to the suboptimum allocation of resources under the constant returns to scale and diminishing marginal returns in the production function. Our model predicts the agents with higher transaction costs will achieve persistently slower path of economic growth compared to the counterfactual scenario. It also predicts the agents with lower transaction costs are substantially more likely to embark on the path of technology improvements pushing it production function outward. High transaction costs directly discourage technology adoption and set the agents on the path of inefficient factor accumulation which is bound by the diminishing marginal products and constrained by the long-run stationary equilibrium. The underlying model predicts lower transaction costs encourage the convergence of per capita across countries although the convergence pattern depends on the temporal evolution of transaction costs and the strength of the change over time. Higher transaction costs predict divergence of per capita output across countries in either rapid or gradual fashion which is somewhat mediated by the presence of external shocks.

We construct the measure of TFP, i.e. Solow residual, for 143 countries in our time period from the augmented growth model with human capital and unobserved effects, and examine the contribution of transaction to the differential TFP paths across and within countries. The results suggest higher transaction costs are significantly more likely to discourage TFP growth. The baseline effects are stable across various operationalized categories of transaction costs and do not appear to be driven by the measurement error and excessive sampling variation in the underlying indices. Employing a latent factor model, we construct three synthetic indices of transaction costs to examine broader effects on TFP and the evidence suggests administrative transaction costs tend to encourage inefficient growth with the exception of stricter minimum capital requirements which strongly encourage TFP growth by addressing the potential sources of moral hazard, opportunism and adverse selection. Lower cross-border transaction costs and lower procedural (property rights and contracts) transaction costs tend to discourage accumulation-driven growth, and encourage the aggregate efficiency improvements, and thus directly contribute to TFP growth. The negative effects of rising transaction costs are stable across various parts of global TFP distribution although the size of the effect tends to decrease among TFP high performers. Relatively greater importance and robustness of property rights-related and contractual transaction costs over administrative and cross-border transaction costs in explaining TFP gaps across countries is further evident in the extreme bounds analysis where we employ more than 3.5 million regressions to tackle the robustness of various transaction costs in explaining TFP paths.

Finally, our evidence suggests higher transaction costs restrain the entry into the efficient growth regime while encourage the entry in the regime based on inefficient resource accumulation. Employing a combined test of stationarity and structural break, we show that most countries are characterized by either declining or stationary TFP performance while only a handful of countries managed to embark on the path of stable and sustained TFP growth. Our results suggests lower property rights-related and contractual transaction costs are associated with TFP breakthroughs and turning points in TFP performance across countries whereas the role of administrative transaction costs as well as cross-border transaction costs in facilitating TFP breakthrough is ambiguous. Lower transaction costs are associated with TFP acceleration whereas higher costs of contract enforcement and property registration correlate strongly with collapses of efficient growth although our evidence implies that increasing the administrative transaction costs to deter moral hazard and opportunistic behavior can yield substantial gains in TFP performance over time. Countries which fail to decrease transaction costs related to low-cost enforcement of contracts and secure property rights are highly unlikely to enter the TFP frontier whereas lowering property rights-related and contractual transaction costs is directly associated with substantially improved odds of entering the 75th and 90th percentile of the distribution.

This article is organized as follows. In Section 2 we construct the conceptual framework for interpreting the effects of transaction costs on growth and development. Section 3 presents the modelling of efficient vs. inefficient growth, Section 4 discusses data and methodology while Section 5 discusses the results and presents our main findings and the robustness checks. Section 6 concludes.

2. Why Transaction Costs Matter?

Do transaction costs matter? Since Adam Smith, economists have constructed their growth models on the gains from trade and highlighted the role of specialization, division of labor, capital accumulation, human capital, entrepreneurship and technology as key factors in long-run development patterns. However, in constructing such models, they have ignored the costs of transacting and their potential impact on economic growth (North, 2005). Yet, as Coase (1960), North, (1990), Acemoglu (2009) and many other scholars have stressed out such levels of physical, human capital and technology of societies should be regarded as endogenously determined by differences in institutional incentive streams. The importance and origin of such institutions might be emphasized by their transaction costs generating/increasing/decreasing capacity /function. Assessment of those transaction costs might reveal the *rationale* behind the sheer existence of institutions, their role in the function of societies and the patterns in the long-run performance of economies. In this section we will (a) specify the general role of transaction costs for economic performance and (b) explore main features of Mexican legal institutions.

Transaction cost economics began to take shape as one of the most ambitious economic disciplines some 60 years ago and, despite being a relatively young discipline it now has to its credit numerous analytical findings, applications and insights. Since any issue that can be defined as a contracting problem can be examined to advantage in comparative contracting terms, and since so many problems have this structure, transaction cost economics can be used to illuminate a wide range of economic and non-economic phenomena (Williamson & Masten, 1999). Conceptually, transaction cost economics owes its origin to a series of independent but complementary scholarly research projects and was introduced in Coase’s 1937 paper ‘The Nature of the Firm’ (Coase, 1937). Coase’s paper was then followed by the ground-breaking works of Williamson (1975, 1985, 1996, 1998 and 2000), Joskow (1991), Alchian (1977), Demsetz (1968), Gabre-Madhin (2001) and many, many others.

However, the economic significance of transaction costs’ concept has also been questioned by several scholars. Simon, for example believes that transaction costs economics is remiss in empirical respects:

awaiting empirical testing, the new institutional economics and related approaches like law and economics are merely acts of faith, or perhaps of piety (Simon, 1991). Veljanovski (1982) sees transaction costs concept as one that have "more in common with astrology than with market analysis." Others, for example skeptically argue that the transaction costs concept is a mere tautology where almost anything can be rationalized by invoking suitably specified transaction cost (Regan, 1972; Fischer, 1977; Niehans, 1987, Cooter 1989) and is hence unfitted for analytical scholarly research (Hodgson, 1988). In addition, Zerbe (1980) doubts the relevance of transaction costs concept arguing that its impact comes down to "how one interprets the almost mystical world of zero transaction costs," whereas Allen (1991) argues that transaction costs are simply ubiquitous. Hence, one could also argue that transaction costs are actually irrelevant for analytical assessments of patterns of economic growth. Such an elusive concept might be for example relevant for the traditional law and economics analysis of contract law (e.g. Shavell, 1997) but might simply be unsuitable for any scientific investigation of the mysterious paths of economic growth.

Such a conclusion may well be a premature one and calls for a brief synthesis of arguments supporting the importance of transaction costs for studies/investigations of patterns of economic growth. Namely, the welfare of a human society depends on the flow of goods and services, and this in turn depends on the productivity of the economic system (Coase, 1998). The productivity of the economic system depends on specialization which is only possible if there is an exchange of goods and services. Such an exchange, a voluntary transaction is beneficial to both parties, but transaction costs than reduce the value of an exchange and both contracting parties will want to minimize them. In other words, the amount of that exchanges which spur allocative efficiency depends, as Coase (1988) and North (1990) argues, also upon the costs of exchange[1] – the lower they are the more specialization there will be and the greater the productivity of the system. Coase (1960) made clear that only in the absence of transaction costs did the neoclassical paradigm yield the implied allocative results and in the world of positive transaction costs, resource allocations are altered by property and contract rights structures. In other words, transaction costs analytically speaking slow the movement of scarce resources to their most valuable uses and should be minimized in order to spur allocative efficiency. Hence, without the concept of transaction costs it might be impossible to understand the working of the economic system, to analyze many of its problems and to identify the key factors, mechanisms of economic growth. In a world of zero transaction costs parties would always produce economically efficient results without the need of legal intervention. In such a world, transaction cost would indeed be completely irrelevant for any investigation on the mechanisms of economic growth. However, since in reality transaction costs are imposed daily, intervention becomes necessary and the legal rules by reducing transaction costs imposed upon an exchange can improve (or worsen in case of increased transaction costs) allocative efficiency and thus maximize social welfare. In such world of positive transaction costs the law (i.e. the costs of the legal system) should play a crucial role in determining how resources are used (Coase, 1988) and consequently should have also a significant impact upon long-term patterns of economic growth. Thus, transaction costs do matter and "…as a result, the legal system will have a profound effect on the working of the economic system and may in certain respects be said to control it (Coase, 1994)." Moreover, information processing by the market actors as a result of such costliness of transacting underlies the formation of institutions (North, 1990).

Furthermore, recent empirical investigations (North and Wallis, 1986; Masten, Meehan and Snyder, 1991; McCloskey and Klamer, 1995; Dollery and Leong, 1998; Kovač and Spruk, 2015) offer additional set of evidences on the impact/importance of transaction costs for the long-term path of economic growth. Hence, the efficiency, welfare minded policy maker should, in order to spur economic growth, economize on transaction costs generated by different legal institutions.

[1] The costs of exchange actually depend on the institutions of a country: its legal system, its political system, its social system, its educational system its culture and so on (Coase, 1998).

Transaction costs, in the original formulation by Coase (1937, 1988, 1998), are defined as 'the cost of using the price mechanism' or 'the cost of carrying out a transaction by means of an exchange on the open market'. As Coase (1961) explains, 'In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on'. Coase actually sees transaction costs as a crucial factor in shaping the institutions, including law that determines the allocation of resources (Polinsky and Shavell, 2007). As Dahlman (1988) notes, the absence of transaction costs would also imply the absence of any transfer costs and thus of costs resulting from incomplete information about aspects of the contract. Any allocation of resources to more productive uses would be achieved immediately and we would be all in an ideal world of allocative efficiency (Demsetz, 2002).

North (2007) also argues that "the costliness of information is the key to the costs of transacting, which consist of the costs of measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements." He also adds that precisely those transaction costs (i.e. costs of measurement and enforcement) are the sources of social, political, and economic institutions (North, 2007). Arrow (1969), De Geest (1994), Williamson (1996) and Posner (2011), while closely resembling Coase's concept, insightfully define transaction costs as the costs of running the economic system of exchanges – costs of exchange. For example, when Robinson Crusoe was alone on the island, there were no transaction costs – as soon as Friday arrived, and they started working together, transaction costs appear. Here, one should note that transaction costs are not costs like the production costs or precaution costs (which Robinson would also have if one would want to have the optimal pollution on his island) but merely costs of economic exchanges. Coase's (1960) definition of transaction costs actually encompasses *ex ante* costs (before the exchange) associated with search, negotiation and *ex post* costs (after exchange) of monitoring and enforcement.

In this concept transaction costs are actually an aggregate of *ex ante* search, negotiation, decision, persuasion and *ex post* monitoring and enforcement costs. The later *ex post* component (i.e. the enforcement costs, or institutional transaction costs) represents also the focus of our attention. Those are actually the direct costs of the legal system which affects overall transaction costs and they are also, due to the availability of data, the sole focus of our investigation. Hence, for the purpose of our investigation we focus solely on the several sub-categories of transaction costs and define them as a fraction of overall transaction costs representing the external costs of legal institutions that are imposed upon the system of economic exchanges. In other words, assessed sub-categories of overall transaction costs are the costs of legal systems imposed upon the system of exchanges. Since it is impossible to acquire data on the whole spectrum of transaction costs, we focus solely on those 5 sub-categories that are available and generated by the underlying structure of the legal institutional framework.

3. Modelling Efficient vs. Inefficient Growth

3.1 The Environment

Suppose the agents in the economy have access to the Cobb-Douglass production function with Harrod-neutral labor-augmenting technological progress and produce the unique final good:

$$Y = F\left[K, H, AL\right] \tag{1}$$

where Y is the output level, K denotes the amount of physical capital, H denotes the stock of human capital, A is the level of technology, L represents the units of labor used to produce the final good. The production function is continuous, differentiable and exhibits the positive and diminishing marginal products for K, H, and L. Assuming the production function $F(\cdot): \mathbb{R}_+^4 \to \mathbb{R}_+$ is twice continuously differentiable and following Euler's theorem (Acemoglu 2009) it satisfies:

$$F_K(K,H,AL) \equiv \frac{\partial F(\cdot)}{\partial K} > 0 \qquad F_H(K,H,AL) \equiv \frac{\partial F(\cdot)}{\partial H} > 0 \qquad F_L(K,H,AL) \equiv \frac{\partial F(\cdot)}{\partial L} > 0$$

$$F_{KK}(K,H,AL) \equiv \frac{\partial^2 F(\cdot)}{\partial K^2} < 0 \qquad F_{HH}(K,H,AL) \equiv \frac{\partial^2 F(\cdot)}{\partial H^2} < 0 \qquad F_{LL}(K,H,AL) \equiv \frac{\partial^2 F(\cdot)}{\partial L^2} < 0$$

Assume the markets are competitive where households supply the labor inelastically and considering the diminishing marginal products under constant returns to scale, the production function ensures the existence of the steady-state inner equilibria under the Inada conditions:

$\lim_{K\to 0} F_K(\cdot) = \infty$ and for all $L > 0$, $H > 0$ and all A

$\lim_{K\to \infty} F_K(\cdot) = 0$

$\lim_{H\to 0} F_H(\cdot) = \infty$ and for all $K > 0$, $L > 0$ and all A

$\lim_{H\to \infty} F_H(\cdot) = 0$

$\lim_{L\to 0} F_L(\cdot) = \infty$ and for all $K > 0$, $H > 0$ and all A

$\lim_{L\to \infty} F_L(\cdot) = 0$

The level of technology is exogenous Dropping time dependence, the level of technology and population growth at the continuous rates:

$$\frac{\dot{A}_{t-1\to t}}{A_t} = g \qquad \frac{\dot{L}_{t-1\to t}}{L_t} = n$$

Setting the capital supply and demand equal to the market clearing rules, the stock of physical and human capital evolves through the fundamental Brownian law of motion in a non-linear difference equation:

$$\Delta K_{t-1\to t} = s_k \cdot F\left[K_t, A_t L_t\right] - \delta_k K_t \tag{2}$$

$$\Delta H_{t-1\to t} = s_h \cdot F\left[H_t, A_t L_t\right] - \delta_h H_t \tag{3}$$

where δ denotes the depreciation rate which differ between the stock of physical capital vs. human capital, s_k and s_h denote the constant savings rates which as a behavioral rule ensure the existence of the competitive general equilibrium. Define the effective capital-labor ratios for the stock of physical and human capital:

$$k_t = \frac{K_t}{A_t L_t} \tag{4}$$

$$h_t = \frac{H_t}{A_t L_t} \tag{5}$$

where k and h denote the ratios at time t. Dropping time dependence and differentiating the effective capital ratios in (3) and (4) yields the steady states ensuring the existence of interior equilibrium:

$$\Delta k_{t-1\to t} = \Delta K_{t-1\to t} - g - n \tag{6}$$

$$\Delta h_{t-1\to t} = \Delta H_{t-1\to t} - g - n \tag{7}$$

Suppose the productivity growth path can be described by the output per effective unit of labor. Denoting the output per effective unit of labor as $\hat{y}$ at time t simplifies the general equilibrium production function:

$$\hat{y}_t \equiv \frac{Y_t}{A_t L_t} = F\left[\frac{K_t}{A_t L_t}, \frac{H_t}{A_t L_t}, 1\right] = f\left[k_t, h_t\right] \tag{8}$$

The production function in (1) and (8) assumes the augmented labor-saving technological progress which implies that any change in the level of technology interacts with the stock of labor. Allowing the level of technology to shape the productivity growth path directly, and rearranging (8) by restricting the labor-augmenting technology assumption leads to the per capita output characterization:

$$y_t = \frac{Y_t}{L_t} = A_t \cdot \hat{y}_t = A_t \cdot f\left[k_t, h_t\right] \tag{9}$$

where y is the per capita output at time t, A is the level of technology which shapes the productivity path both directly and independently of the stock of physical and human capital. The restricted production function in (9) implies that if $\hat{y}_t$ is constant, y_t will grow as long as A is growing which implies that balanced growth paths should be derived where per capita income is growing at the constant rates whereas in the steady state, per capita income is stationary. Substituting $\Delta K_{t-1\to t}$ from (2) into (4) leads to the characterization of the balanced growth paths alongside their respective steady states:

$$\Delta k_{t-1\to t} = \frac{s_k \cdot F\left[K_t, A_t L_t\right]}{K_t} - \left(\delta_k + g + n\right) \tag{10}$$

$$\Delta h_{t-1\to t} = \frac{s_h \cdot F\left[H_t, A_t L_t\right]}{H_t} - \left(\delta_h + g + n\right) \tag{11}$$

Using effective capital-labor ratios in (4) and (5), the capital stock evolves with heterogeneous savings rates and rates of depreciation:

$$\Delta k_{t-1\to t} = \frac{s_k \cdot f\left[k_t\right]}{k_t} - \left(\delta_k + g + n\right) \tag{12}$$

$$\Delta h_{t-1\to t} = \frac{s_k \cdot f\left[h_t\right]}{h_t} - \left(\delta_h + g + n\right) \tag{13}$$

which implies that in the basic Solow growth model with positive but diminishing marginal returns to capital where the level of technology and population grow at their respective rates g and n and where Inada conditions provide the existence of stable interior equilibria, then for given effective capital-labor ratios in (4) and (5), there exists a unique balanced growth path where the effective capital-labor ratios are equal to $k^* \in \left(0,\infty\right)$ and $h^* \in \left(0,\infty\right)$ and given by:

$$\frac{f\left(k^*\right)}{k^*} = \frac{\delta_k + g + n}{s_k} \tag{14}$$

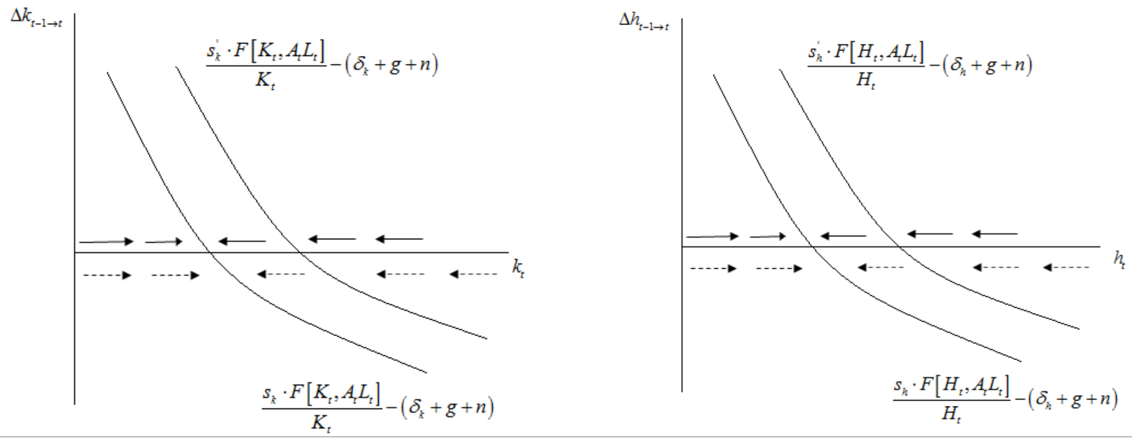
$$\frac{f\left(h^*\right)}{h^*} = \frac{\delta_h + g + n}{s_h} \tag{15}$$

which suggests that the total savings are used to replenish the physical and human capital stock as a counteracting effect of the depreciation rate which depletes the capital stock, population growth which reduces the stock of capital per unit of labor, and as the effect of technological change shaping the balanced growth path directly. Replenishing capital labor ratio thus requires investment to be equal to $k \cdot \left(\delta_k + g + n\right)$ and $h \cdot \left(\delta_k + g + n\right)$ respectively and henceforth implies that an improvement in the balanced growth path as an outcome of the shifting capital-labor ratio is possibly only with further capital deepening. For the production function with positive and diminishing marginal returns and assuming the Inada conditions are met, the growth model is asymptotically stable which implies that starting from any $k\left(0\right) > 0$ and $h\left(0\right) > 0$, the effective capital-labor ratios converge to steady-state values k^* and h^*.

Consider the adjustment path of the economy following the shift in the capital-ratio parameter. Taking the evolution of capital stock in (12) and (13) and suppose the savings rates increases from its initial equilibrium s to s'. Figure 1 presents the equilibrium response of the capital-labor ratios to the exogenous change in the savings rate for physical capital (a) and human capital stock (b). The comparative dynamics of the shift in the savings rate which enhances the speed of capital accumulation is straightforward. First, permanent increases in the savings rates reflect the speed of capital accumulation which implies that the stock of capital shifting the stock of capital right of its initial value. Second, non-linear differential equation using the Brownian law of motion to characterize the evolution of physical and human capital implies that the stock of capital will shift left of its initial equilibrium due to replenishment effect and diminishing marginal returns. And finally, such accumulation-based growth path will not generate a permanent shift in the growth path but is bound to the stationary equilibrium with continuously diminishing growth trajectory.

Figure 1: Equilibrium Response of Capital Ratio to an Exogenous Change in the Savings Rate (Capital Accumulation Effect):

(a) Physical Capital-Labor Ratio *(b) Human-Capital Labor Ratio*



2.2 Solow Growth Model with Transaction Costs

The Cobb-Douglass production function in (1) suggests the output per capita alongside the steady states and its balanced growth path can increase either as a result of more inputs or as a consequence of the technological progress influencing the balanced growth path both directly and independently. The latter implies that output can increase with the same resources as an outcome of the more efficient use while the former suggests more resources are necessary to improve growth without technology improvements. Such capital accumulation-driven growth is bound to the stationary equilibrium when Inada conditions are met and when marginal returns are positive and diminishing using constant returns to scale. The production function in (1) implicitly and trivially assumes zero transaction costs ignoring the peculiar role of legal institutions in shaping the path of balanced growth. In this sub-section, we introduce transaction costs in the augmented Solow growth model.

Assume the world consists of $j=1,2,...J$ economies producing the final good with the augmented Cobb-Douglass production function under constant returns to scale with positive and diminishing marginal returns satisfying the Inada conditions:

$$Y_{j,t}=K_{j,t}^{\alpha}H_{j,t}^{\beta}\left[(1-\lambda)A_{j,t}L_{j,t}\right]^{1-\alpha-\beta} \tag{16}$$

where Y is the final output, K denotes the stock of physical capital, H is the stock of human capital, L is the stock of labor, α and β represent the rates of return to physical and human capital, and λ denotes transaction costs parameter with the normalized mass

$\lambda \in \{0,1\}$ Our assumption postulates that transaction costs directly bear upon the use of technology whereas we assume no direct effect of transaction costs on the rates of accumulation. Transaction costs parameter implies that agents move within this range of transaction costs. For an agent with zero transaction costs, the Cobb-Douglass production function will converge to its textbook form. For an agent with prohibitively high transaction costs, the production function will not yield a final good since extremely high costs deter the use of either existing or new resources. For an agent located between both extremes, the production function with positive and non-zero transaction costs is bounded to sub-optimum resource allocation which is not possible in the world zero transaction costs.[2]

Define the appropriate capital-labor ratios in the production function with non-zero transaction costs for *j*-th country:

$$k_j = \frac{K_j}{(1-\lambda)\cdot A_j L_j} \tag{17}$$

$$h_j = \frac{H_j}{(1-\lambda)\cdot A_j L_j} \tag{18}$$

which implies that for each $\lambda > 0$ the capital-labor ratios are socially sub-optimal in the steady-state compared to the equilibrium with $\lambda = 0$, and which suggests the stock of physical and human capital investment suffers from efficiency loss leading to sub-optimum resource allocation. Assuming the countries differ in terms of their savings rates, $s_{k,j}$ and $s_{h,j}$, population growth rates, n_j, and technology growth rates, $g_j = \Delta A_{j,t-1\to t}$, consider the fundamental Brownian laws of motion for the capital behavior in (12) and (13), and construct the respective steady-state values by setting the respective motion laws to zero and replacing them with (17) and (18):

$$k_j^* = \left[\left(\frac{s_{k,j}}{n_j + g_j + \delta_k}\right)^{1-\beta}\left(\frac{s_{h,j}}{n_j + g_j + \delta_h}\right)^{\beta}\right]^{\frac{1}{1-\alpha-\beta}} \tag{19}$$

$$h_j^* = \left[\left(\frac{s_{k,j}}{n_j + g_j + \delta_k}\right)^{\alpha}\left(\frac{s_{h,j}}{n_j + g_j + \delta_h}\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha-\beta}} \tag{20}$$

Denote the output per effective unit of labor allowing for technology differences across countries and construct the per capita output along the balanced growth path with non-zero transaction costs using log-linearization:

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[2] Since the measure of transaction costs is a normalized mass $\lambda \in \{0,1\}$, zero transaction cost assumption $\lambda = 0$ implies that the Cobb-Douglass production function $Y_{j,t} = K_{j,t}^{\alpha} H_{j,t}^{\beta}\left[(1-\lambda) A_{j,t} L_{j,t}\right]^{1-\alpha-\beta}$ exhibits the textbook version of the augmented Solow growth model since

$$\lim_{\lambda\to 0}\left(K_{j,t}^{\alpha} H_{j,t}^{\beta}\left[(1-\lambda) A_{j,t} L_{j,t}\right]^{1-\alpha-\beta}\right) = K_{j,t}^{\alpha} H_{j,t}^{\beta} A_{j,t} L_{j,t}{}^{1-\alpha-\beta}$$

$$y_j^* = \frac{Y_t}{L_t} = (1-\lambda) A_{j,t} \left(\frac{s_{k,j}}{n_j + g_j + \delta_k} \right)^{\frac{\alpha}{1-\alpha-\beta}} \left(\frac{s_{h,j}}{n_j + g_j + \delta_k} \right)^{\frac{\beta}{1-\alpha-\beta}} \tag{21}$$

which suggests for each $\lambda > 0$, per capita output tends to balance-out into the sub-optimum growth regime. When countries differ in the respective λ parameter, the relative difference tends to feed into the shape of the Cobb-Douglass production function as a result of the differential access to technology holding the effects of human and physical capital stocks fixed. The difference in the λ between two countries thus critically shapes the growth regime and its path for the given steady-state values. A simple log-linearization yields:

$$\ln y_{j,t} = (1-\lambda) \ln \bar{A}_{j,t} + g_t + \frac{\alpha}{1-\alpha-\beta} \ln \left(\frac{s_{k,j}}{n_j + g_j + \delta_k} \right) + \frac{\beta}{1-\alpha-\beta} \ln \left(\frac{s_{h,j}}{n_j + g_j + \delta_k} \right) \tag{22}$$

If countries do not share the common rate of technology growth (g), per capita output will diverge as a result of the difference in the transaction costs between countries. Mankiw, Romer and Weil (1992) critically assume countries differ in the initial technology but explicitly assume they share the same growth rate over time, $A_{j,t} = \bar{A}_j e^{g_t}$ where $\bar{A}$ is the initial technology and g denotes its growth rate over the finite time horizon $t = 1, 2, ...T$. Such assumption inevitably advocates the technology progress shifts the balanced growth path either inward if $g < 0$ or outward if $g > 0$. For each $\lambda > 0$, non-zero transaction costs shape the initial value of the technology parameter and allow for the countries to differ in the initial technology. In addition, the assumption on common technology growth rate precludes any possibility of different rates of technology growth over time since, following (16), *j*-th country's initial and contemporaneous technology level is contingent on λ. We allow the technology of j-th country to differ both in its initial value and the growth rate over time which yields:

$$A_{j,t} = (1-\lambda) \bar{A}_j e^{(1-\lambda) g_t} \tag{23}$$

Using a log-linearized growth model in (22) together with (23) allows us to construct the balance together with (20), allows us to construct the balanced output per capita growth path for country $j = 1, 2, ...J$ by taking the natural logs of (21) and plugging (23) in (22) suggests:

$$\ln y_{j,t} = (1-\lambda) \ln \bar{A}_{j,t} + (1-\lambda) g_t + \frac{\alpha}{1-\alpha-\beta} \ln \left(\frac{s_{k,j}}{n_j + g_j + \delta_k} \right) + \frac{\beta}{1-\alpha-\beta} \ln \left(\frac{s_{h,j}}{n_j + g_j + \delta_k} \right) \tag{24}$$

Four direct implications follow from the balanced growth path in (23). First, leaving the transaction costs parameter unchanged, the growth equilibrium evolves around the factor accumulation regime since any increase in per capita output is driven by s_k and s_h, respectively. Second, keeping the savings rates and capital stock constant, a downward shift in λ implies a first-order improvement in the level of existing technology and its growth rate over time as a direct effect of lower transaction costs. Such growth path is necessarily efficient as it is based on the technology improvements. Conversely, higher transaction costs deteriorate the use of existing technology and hamper its growth rate over time which implies that in such circumstances growth is the chiefly determined by the speed of factor accumulation. Such growth regime is designated as inefficient as it is based on adding new capital to the existing stock which, given diminishing marginal returns, is bound to the stationary equilibrium. Third, since the production function in (16) is constrained by the positive but diminishing marginal returns under constant scale returns, growth resulting from accumulation improvements tends to slowly diminish and is bound to the stationary equilibrium for unchanged transaction costs parameter. And fourth, incorporating non-zero transaction costs assumption into the standard neoclassical growth model inevitably invokes the sub-optimum resource allocation and also suggests the growth paths across countries might be driven by the differences in transaction costs.

3.3. Model Calibration

How would a hypothetical exogenous change in transaction costs affect the behavior of long-run growth? In this sub-section, we briefly discuss the implications of the underlying changes of transaction costs building on the transaction costs-augmented Solow growth model in (24). Following Mankiw et. al. (1992) and Acemoglu (2009), we first replicate the cross-country growth regressions using the augmented Solow growth model with human capital and physical capital to obtain the estimates of the rates of return, α and β. Table 1 presents the estimated augmented Solow growth model using the updated 2012 data from Feenstra et. al. (2012). Column (1) reports the whole sample estimated based on the variation across 141 countries while column (2) excludes the oil-producing countries from the whole sample to control for the possible outliers contaminating the estimated rates of return. In both cases, the implied rates of return are $\alpha = 0.05$ and $\beta = 0.61$ regardless of the outliers in the sample selection.

Table 1: Two Estimates of the Augmented Solow Growth Model

	Whole Sample	Non-Oil Producing Sample
	(1)	(2)
$\ln(n+g+\delta)$	-.107	-.210*
	(.114)	(.110)
$\ln s_k$	.177	.167
	(.195)	(.200)
$\ln s_h$	1.903***	1.830***
	(.184)	(.183)
Constant Term	4.622***	4.829***
	(.765)	(.798)
Implied α	0.05	0.05
Implied β	0.61	0.61
Obs	141	131
R2	0.64	0.67

Notes: the table reports the coefficients of the estimated augmented Solow growth model by replicating Mankiw, Romer and Weil (1992) and Acemoglu (2009) cross-country growth regressions. The dependent variable is the natural log of per capita GDP ($Geary-Khamis 2005 Constant Prices). Huber-White standard errors are computed using the robust OLS variance-covariance matrix estimator, and denoted in the parentheses. Asterisks denote statistically significant coefficients at 10% (*), 5% (**), and 1% (***), respectively.

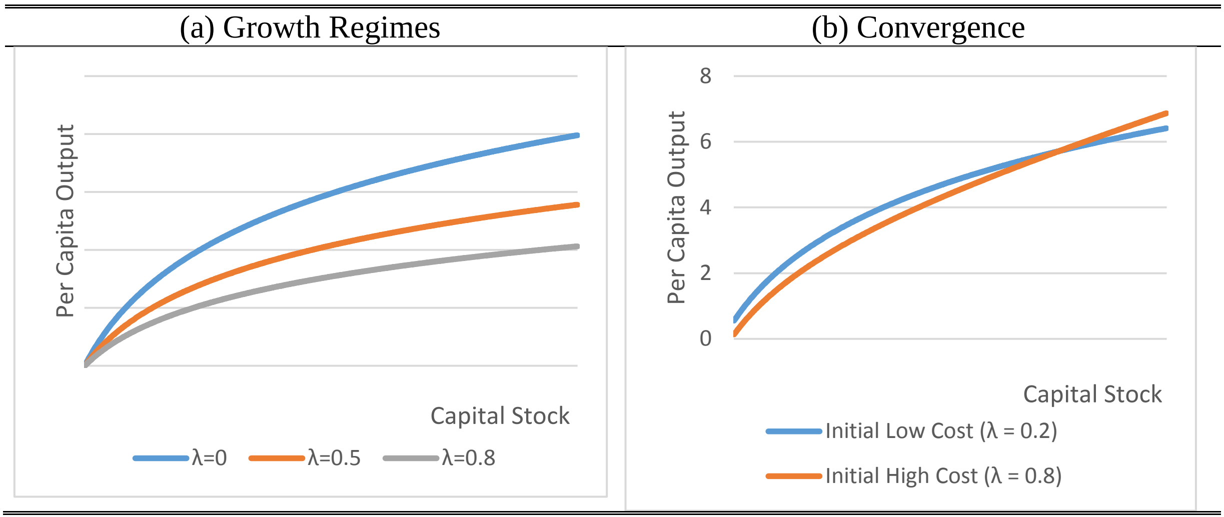
Using the implied α and β, cross-country productivity differences are calibrated using the hypothetical scenario for the change in transaction costs represented by the λ parameter. We specifically distinguish between the frontier economy and the laggard economy. The former is characterized by low-cost equilibrium whereas the latter is constrained by high transaction cost. Calibrating productivity differences following the exogenous change in transaction costs specifically allows for the dynamic responses of the long-run growth behavior of the high-cost economy at time $t+1$ to the changes in transaction costs at time t considering the steady-states and given capital-labor ratios. Four different scenarios are considered. First, in the initial equilibrium the frontier country is endowed with low transaction costs whereas the laggard country is constrained by high transaction costs. At time t+1, transaction costs between the frontier and the laggard level-off as the former decides to decrease the costs to the frontier level whereupon the adjustment path is gradual. In the second scenario, leveling-off the λ parameter is the same as in the first one except that the adjustment is immediate, i.e. the laggard attains the low-cost equilibrium of the frontier economy immediately rather than gradually. Third, at the initial stage, the frontier and the laggard share the same transaction costs whereas the laggard at time $t+1$ embarks on the gradual path of increasing transaction costs. And fourth, the frontier and the laggard at the initial stage share the same transaction costs but the laggard at time $t+1$ encounters a one-off permanent increase in transaction costs. The hypothetical scenarios are summarized in Table 2.

Table 2: Calibrating Cross-Country Productivity Differences

	Initial Transaction costs (t)		Equilibrium Transaction Costs		Transaction Costs Adjustment
	Frontier	Laggard	Frontier	Laggard	
1	$\lambda_t^{Frontier}=0.2$	$\lambda_t^{Laggard}=0.5$	$\lambda_{t+1}^{Frontier}=0.2$	$\lambda_{t+1}^{Laggard}=0.2$	Gradual
2	$\lambda_t^{Frontier}=0.2$	$\lambda_t^{Laggard}=0.8$	$\lambda_{t+1}^{Frontier}=0.2$	$\lambda_{t+1}^{Laggard}=0.2$	One-Off
3	$\lambda_t^{Frontier}=0.2$	$\lambda_t^{Laggard}=0.2$	$\lambda_{t+1}^{Frontier}=0.2$	$\lambda_{t+1}^{Laggard}=0.8$	Gradual
4	$\lambda_t^{Frontier}=0.2$	$\lambda_t^{Laggard}=0.2$	$\lambda_{t+1}^{Frontier}=0.2$	$\lambda_{t+1}^{Laggard}=0.8$	One-Off

Differential growth regimes with non-zero transaction costs of varying degrees are presented in Figure 2. Specifically, we distinguish between zero-transaction cost economy ($\lambda=0$), medium-transaction cost economy ($\lambda=0.5$), and its high-cost counterpart ($\lambda=0.8$). The evidence from Panel (a) clearly suggests higher transaction costs impede the balanced growth path and cause the per capita output gap across the three hypothetical countries to widen over time. The widening of per capita output differences is attributed to the first-order effect of transaction costs on the technology level, and to the second-order effect on the paths of accumulation. Considering the contrasting paths of long-run growth behavior between low-cost and high-cost equilibrium, high-cost economy is characterized by sub-optimum and inferior factor accumulation. Leaving transaction costs unchanged and relying on the factor accumulation clearly exacerbates the inefficient growth behavior. On one hand, high costs constrain technology adoption and depress the technology growth over time while, on the other hand, rising per capita output through factor accumulation is bound to the stationary ground as the returns to scale tend to diminish further. In Panel (b), we assume the frontier and the laggard differ in initial transaction costs at time t but at time $t+1$, the laggard embarks on the gradual path of decreasing transaction costs to the minimum level while the frontier keeps the costs unchanged alongside. Conditional on the steady-state behavior of capital-labor ratios, the calibrated long-run growth behavior indicates the laggard would not only catch-up the frontier but, in the long run, exceed its per capita output level if the frontier fails to shift transaction costs further down from its initial level. A continuous and gradual reduction of transaction costs below the level attained by the frontier exacerbates the convergence of per capita output between the frontier and the laggard through two interrelated channels. First, a decrease in transaction costs shifts the technology parameter upward, immediately improving the growth trajectory coupled with an increase in technology growth rate, espoused by (23). And second, higher marginal returns to the capital in the laggard economy tend to exhibit higher productivity levels at given steady-state suggesting further improvements in the balanced growth path without excessive increase the factor accumulation via capital deepening which is the bedrock of inefficient growth. Crucially, a decrease in transaction costs does not trigger the stationarity trap via the diminishing returns and hence boosts the efficient type of growth.

Figure 2: Growth Regimes and Convergence in the Solow Growth Model with Non-Zero Transaction Costs



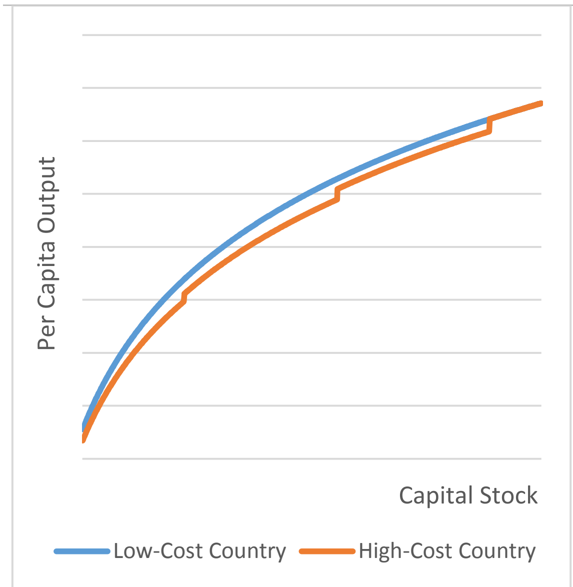
Do changing levels of transaction costs evolve into different growth regimes? Since transaction costs critically shape the path of balanced growth and determine the long-run growth equilibrium, the underlying change in the growth regime depends on the changes in the magnitude of transaction costs both over time and across different steady-state. An initial advantage stemming from low transaction costs implies that keeping the costs low across the growth path evolves into stable and persistent per capita output differences across countries. But what if the lagging high-cost country suddenly breaks out of the initial high-cost equilibrium towards the frontier-based low transaction costs? In a slightly more different scenario, how does the departure from the low-cost equilibrium towards high transaction costs alter the path and regime of growth in the long-run?

In Figure 3, four different scenarios developed in Table 1 are simulated using the calibrated Cobb-Douglass production function with positive and diminishing marginal returns. In Panel (a), the underlying assumption is that the laggard economy gradually moves from high transaction costs to the low-cost equilibrium of the frontier alongside various steady states. The piecewise transition to low transaction costs highlights a fuzzy-style gradual convergence of laggard's per capita output to the frontier level when the laggard following its transition to the low level of transaction costs of the frontier assuming the former does not depart from the low-cost equilibrium. Relaxing the institutional constraints imposed by high transaction costs leads to the gradual convergence and suggests the departure from high-cost equilibrium is associated with sustained efficient type of growth, and is not undermined by the diminishing marginal returns to the capital accumulation. In Panel (b), the frontier and the laggard initially differ in the size of transaction costs but at time $t+1$, the laggard economy departs from the high-cost equilibrium towards low transaction costs. Compared to Panel (a), the reduction in transaction costs is immediate following a one-off move from the high-cost level to the low-cost level of the frontier rather than in a piecewise fashion. Subsequently, the rapid convergence of per capita output between both agents is expected as an outcome of the rapid reduction in transaction costs. The structural effect of lower transaction costs is immediate. Before the reduction of costs, the laggard's balanced growth path has improved only as a result of further capital deepening. Faced by diminishing marginal returns and the frontier's low-cost advantage, both agents embarked on the path of gradual divergence. Once the laggard's transaction costs reached the frontier's level from the initial equilibrium, the long-run growth equilibrium of both agents is expected. High transaction costs exacerbate the laggard's inefficient growth as it drifted apart from the efficient growth of the frontier under low transaction costs. Once the costs are equalized between both agents, long-run growth paths are expected to converge.

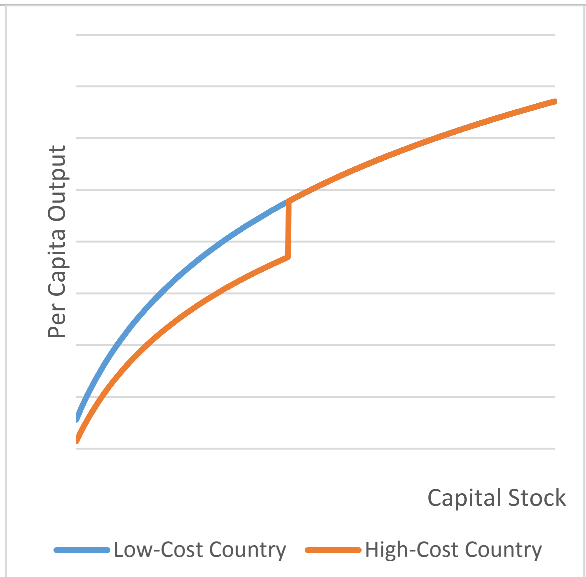
Can higher transaction costs over time trigger the divergence of per capita output between two countries? In Panel (c), we assume the laggard and the frontier share the same level of transaction costs in the initial equilibrium which implies that their respective per capita output is the same based on the calibrated augmented growth model. Suppose the laggard economy embarks on the path of rising transaction costs in a gradual and piecewise fashion whilst the frontier maintains the low-cost equilibrium. The calibrated growth model implies that such gradual and persistent increase in the level of transaction costs by the laggard offsets the rising gap in per capita output over time, exacerbating a "jigsaw" pattern of long-run per capita output divergence. A piecewise increase in the level transaction costs implies that the gradual transition towards high-cost equilibrium evolves into an accumulation-based growth regime since any resulting increase in per capita output stems from adding more capital and resources to the existing stock. Consequently, the laggard's gradual increases in transaction costs trigger a persistent divergence of per capita income which cannot be overhauled by further capital accumulation since the combination of diminishing marginal returns and high transaction costs push laggard's per capita output further away from the frontier. The divergence of per capita output can also be driven by a one-off large increase in transaction costs triggered by a large-scale shock such as war, revolution or natural disasters. In Panel (d) the augmented growth model is calibrated using the implied return parameters considering a one-off increase in transaction costs. The underlying assumption is that, similar to Panel (c), is that the laggard and the frontier share the same level of transaction costs in the initial equilibrium as indicated by Table 1. At time $t+1$, the laggard encounters a large-scale shock which tends to push the level of transaction costs from the "low-cost" equilibrium to the "high-cost" one. In the absence of major exogenous or endogenous changes in transaction costs in the aftermath of the one-off large-scale shock, the paths of balanced growth alongside their respective steady states drift apart since the laggard's per capita output sets on the path of divergence from the frontier. In spite of the acceleration of the growth in the aftermath of the shock, the laggard's growth path is driven by factor accumulation and capital deepening, and is being too slow to catch-up with the frontier where "low-cost" equilibrium is being held intact. The laggard's growth path is bound to the stationary equilibrium where diminishing marginal returns are bound to zero in the absence of a decrease in transaction costs in the aftermath of the large-scale shock. The calibration of the augmented growth model clearly suggests non-zero transaction costs exhibit the sub-optimum allocation of resources and, hence, lead to sub-optimum long-run growth equilibrium. Since both agents differ in the degree of transaction costs, this implies that different cost level evolve into distinctive long-run growth equilibria where higher costs push per capita output further away from the frontier whilst lower transaction costs exhibit the convergence of per capita output across countries. Specifically, growth path in the absence of low transaction costs can only be characterized by the factor accumulation via capital deepening which is bound to the stationary equilibrium, and such inefficient episodes of growth are more likely to fizzle out, and does not facilitate the convergence of per capita output to the frontier.

Figure 3: Cross-Country Convergence and Divergence with Transaction Costs

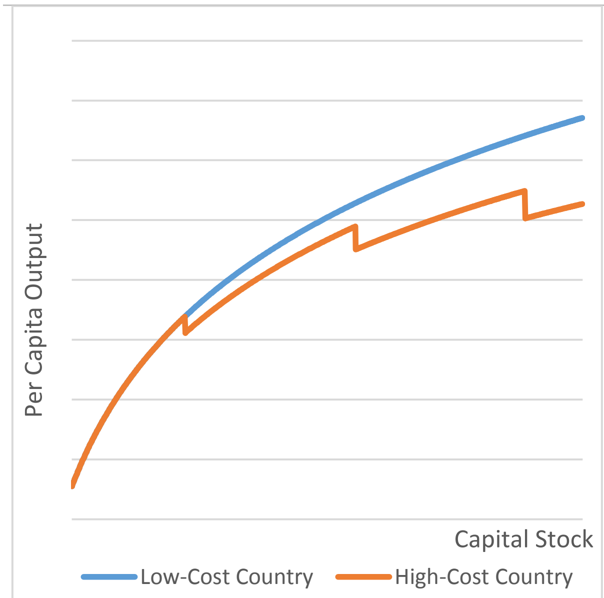
(a) Gradual Convergence with Transaction Costs



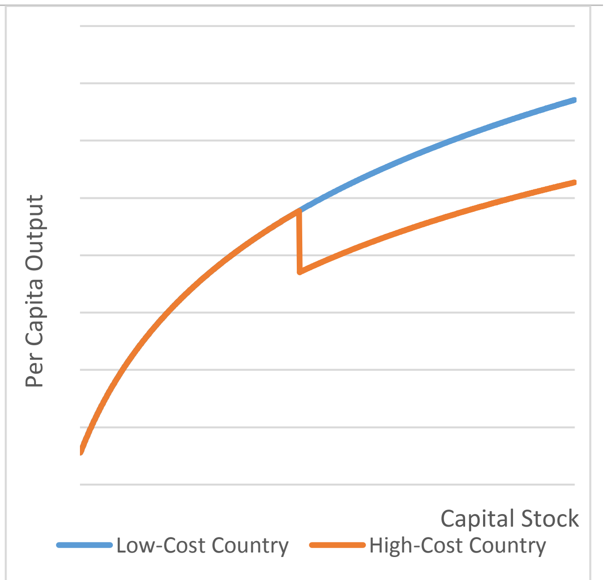
(b) Rapid Convergence with Transaction Costs



(c) Gradual Divergence with Transaction Costs



(d) Rapid Divergence with Transaction Costs



2.4 Measuring Total Factor Productivity

Our goal is to provide a full measure of total factor productivity as a direct first-order approximation of the efficient type of growth. Suppose each continuous-time economy produces a final good with the Cobb-Douglass production function described by (1):

$$Y = F\left[K, H, AL\right]$$

Differentiate the production function in (1) with respect to time and drop time dependence which yields:

$$\Delta Y_{t-1\to t} = \frac{\partial F(\cdot)}{\partial A}\cdot\Delta A_{t-1\to t} + \frac{\partial F(\cdot)}{\partial K}\cdot\Delta K_{t-1\to t} + \frac{\partial F(\cdot)}{\partial H}\cdot\Delta K_{t-1\to t} + \frac{\partial F(\cdot)}{\partial L}\cdot\Delta L_{t-1\to t} \tag{25}$$

Further simplifying the first-order derivative of the production suggests $g_{Y,t-1\to t} = \Delta Y_{t-1\to t}$, $g_{K,t-1\to t} = \Delta K_{t-1\to t}$, $g_{H,t-1\to t} = \Delta H_{t-1\to t}$, and $g_{L,t-1\to t} = \Delta L_{t-1\to t}$. Recall the first-order partial derivative of the Cobb-Douglass production function indicates technology's share in total output. Define the total contribution of technology to the output and
Define the contribution of technology to the total output:

$$\varepsilon_{j,t} = \frac{\partial F(\cdot)}{\partial A}\cdot\Delta A_{t-1\to t} \tag{26}$$

And assume competitive factor markets with market-clearing prices denoted by:

$$w = \frac{dF(\cdot)}{dL} \tag{27}$$

$$r_K = \frac{dF(\cdot)}{dK} \tag{28}$$

$$r_H = \frac{dF(\cdot)}{dH} \tag{29}$$

where w is the wage rate earned by the owners of labor, r_K is the rate of return on capital, and r_H is the rate of return on human capital. Define the factor shares in the total output:

$$\alpha_K = \frac{r_K K}{Y} \tag{30}$$

$$\alpha_H = \frac{r_H H}{Y} \tag{31}$$

$$\alpha_L = \frac{wL}{Y} \tag{32}$$

Solving (25) for ε yields the fundamental growth accounting equation used to construct the TFP series:

$$\varepsilon_{j,t} = g_{Y,t-1\to t} - \alpha_K \cdot g_{K,t-1\to t} - \alpha_H \cdot g_{H,t-1\to t} - \alpha_L \cdot g_{L,t-1\to t} \tag{33}$$

To compute the TFP series and distinguish between efficient vs. inefficient component of growth, consider first the cross-country growth regression by restricting the baseline balanced growth paths equation in (24) to $\lambda = 0$ which yields an augmented Solow growth model without transaction costs:

$$\ln y_{j,t} = \ln \bar{A}_{j,t} + \frac{\alpha}{1-\alpha-\beta} \ln\left(\frac{s_{k,j}}{n_j + g_j + \delta_k}\right) + \frac{\beta}{1-\alpha-\beta} \ln\left(\frac{s_{h,j}}{n_j + g_j + \delta_k}\right) \tag{34}$$

Since technology is unobserved to the econometrician, orthogonality assumption does not solve the omitted variable bias which bias the underlying human capital and physical capital contribution to the total output. Neglecting common technology shocks might render the technology parameter both biased and inconsistent since country-specific heterogeneity might bias the contribution of technology downward as a result of unobserved effects. Our strategy sets to address the omitted variable bias by controlling for unobserved country-fixed effects and time-fixed effects to net out the country-specific and temporal heterogeneity that otherwise render the underlying parameters biased. Specifically, we compute the total factor productivity across $j = 1, 2, \ldots J$ countries by considering the following cross-country growth model:

$$\begin{aligned}\ln y_{j,t} &= \ln \bar{A}_{j,t} + \frac{\alpha}{1-\alpha-\beta} \ln\left(\frac{s_{k,j}}{n_j + g_j + \delta_k}\right) + \frac{\beta}{1-\alpha-\beta} \ln\left(\frac{s_{h,j}}{n_j + g_j + \delta_k}\right) \\ &+ \sum_{j=1}^{J} \Phi_j \cdot D_j + \sum_{t=1}^{T} \pi_t \cdot D_t + \varepsilon_{j,t}\end{aligned} \tag{35}$$

where $\sum_{j=1}^{J} \Phi_j \cdot D_j$ denote the contribution of country-fixed effects captured by the set of coefficients Φ where D_j is the j-th country dummy variable, π is the set of coefficients representing the response of per capita output to the technology shocks common across all countries and denoted by the full set of time-specific dummy variables D_t. Solving (35) for ε to obtain the TFP term: the contribution of unobserved total factor productivity ("efficient growth") to per capita output which is equivalent to the residual from the cross-country growth regression:

$$\begin{aligned}\varepsilon_{j,t} &= \ln y_{j,t} - \left[\ln \bar{A}_{j,t} + \frac{\hat{\alpha}}{1-\hat{\alpha}-\hat{\beta}} \ln\left(\frac{s_{k,j}}{n_j + g_j + \delta_k}\right) + \frac{\hat{\beta}}{1-\hat{\alpha}-\hat{\beta}} \ln\left(\frac{s_{h,j}}{n_j + g_j + \delta_k}\right)\right] \\ &+ \sum_{j=1}^{J} \hat{\Phi}_j \cdot D_j + \sum_{t=1}^{T} \hat{\pi}_t \cdot D_t\end{aligned} \tag{36}$$

Employing the augmented Solow growth model in (35), we estimate the level of TFP by computing the residual adjusted for the unobserved effects across countries and over time using the residual in (36) for 143 countries in the period 2003-2014 based on Penn World Tables 8.1 (Feenstra et. al. 2015) whereas the data on the stock of human capital is based on the average years of education from Van Leeuwen et. al. (2011). A valid inference on the development of TFP as a first-order approximation of efficient growth path concerns accurate inference since the residuals are most likely correlated within countries. The failure to control for intra-cluster correlation of the residual can lead to massively underestimated standard error and the subsequent over-rejection of the null hypothesis (Moulton 1986, 1990) in examining the effects of transaction costs on efficient growth. Bertrand et. al. (2004) showed that intra-cluster serially correlated residuals can persist in two-dimensional panel data, and do not disappear once the country-specific unobserved effects and time-fixed effects are controlled for (Davis 2002, Pepper 2002). We address the potential intra-cluster residual correlation by using a non-nested multiway clustering scheme proposed by Cameron et. al. (2011) and clustered the standard errors in the augmented Solow growth model in (35) simultenously at the country- and year-level based on two-way error component model under i.i.d. assumption. Compared to the traditional one-way clustering (White 1980), the non-nested multiway clustering estimator permits the valid inference amid the presence of within-country residual correlation compared to one-way clustering (White 1980, 1984, Pfefferman and Nathan 1981, Liang and Zeger 1986, Arellano 1987, Wooldridge 2002, 2003, Cameron and Trivedi 2005, Hansen 2007) where the within-country residual correlation is neglected.

4. Data

4.1 Total Factor Productivity

Our total factor productivity series encompasses 143 countries spanning across 2003-2014 period based on the underlying augmented Solow growth model with physical capital and human capital. Since the total factor productivity is measured as a residual from the cross-country growth regression, our approach is similar to Feenstra et. al. (2015) where our data on real GDP per capita ($Geary-Khamis 2005 constant prices) are from. Our measure of human capital is based on the average years of education (Van Leeuwen et. al. 2011, Barro and Lee 2012) rather than a combined index of human capital return and years of schooling (Psacharopoulos 1994). Replacing the average years of education with the combined index of human capital formation yields a very similar pattern of TFP development across countries and over time. The data on the stock of physical capital is from Feenstra et. al. (2015) using the investment-to-GDP ratio as a proxy for the capital stock following Mankiw et. al. (1992) and Acemoglu (2009) whereas the data on population growth is from United Nations *Demographic Yearbook* series.

4.2 Transaction Costs

The data on the size and distribution of transaction costs is based on the series of Doing Business reports from the World Bank for the period 2003-2014. Our focus does not encompass the entire range of transaction costs but the subset of costs which can be observed consistently over the 12-year period across a large number of countries, and are in the realm of the firm's life cycle. Even though our approach does not address the entire realm of transaction costs, emphasizing several distinctive institutional categories of costs permits a first-order approximation of the size of transaction costs and its importance in influencing the paths of economic growth and total factor productivity.

Six institutional categories and domains are considered in building the indices of transaction costs. First, the costs of starting business records all procedures officially required and commonly held in practice to start and formally operate an industrial or commercial business

(Djankov et. al. 2002). The set of procedures includes obtaining all necessary licenses and permits, and completing any required notifications, verifications, and inscriptions for the firm and employees with the relevant authorities. The cost of starting business is decomposed into four sub-categories: (i) number of procedures, (ii) duration, (iii) monetary cost, and (iv) paid-in minimum capital requirements. The number of procedures is measured on the basis on the interaction between company founders and external partners such as government agencies, notaries, auditors, and lawyers. Procedures before and after the incorporation required for the formal operation of the firm are taken into account as well as procedures interacted with public agencies. Duration of starting business is measured using the calendar days. It captures the median duration that notaries or incorporation lawyers indicate it is necessary de facto to complete a procedure with some follow-up of government agencies and excluding unofficial payments and bribes. The monetary cost of starting business is measured as a percentage of the economy's per capita income. It includes all official fees, and fees for legal and professional services if required by law or commonly used. The cost does not exclude the fees for purchasing and legalizing company books if this is required by law. Paid-in minimum capital requirement denotes the amount necessary to be deposited in a bank or with a notary before the registration or up to three months after the incorporation, and is measured in percentage of per capita income terms.

Second, the costs of dealing with construction permits records all necessary procedures for a firm in the construction industry to build a warehouse. The transaction costs of dealing with permits are decomposed into (i) number of procedures, (ii) duration, and (iii) cost of obtaining permits to comply with formalities to build a warehouse. The number of procedures in the interaction between company employees and external agents (government agencies, notaries, land register, cadaster, utility companies, public inspectors, and technical experts, architects) to build a warehouse includes legally required procedures, and those that are done in practice by the majority of the firms even if some procedures may be avoided under specific circumstances. Duration of obtaining the construction permit to build a warehouse is measured in calendar days and captures the median duration necessary to complete a procedure as indicated by the local experts. The cost of building a warehouse is measured in terms of the percentage of warehouse value and covers all official costs, legal fees, land use approvals, preconstruction design clearance costs, inspection costs before and after the construction, costs of obtaining utility connections, and the nonrecurring taxes required for the completion of the project.

Third, the cost of property registration measures the full sequence for a firm to purchase a property from another firm, and to transfer the property title to the buyer’s name to be used for expanding its business, as a collateral in taking new loans, or to sell the property to another firm. The total cost of property registration is broken down into three specific sub-categories: (i) the number of procedures to legally transfer title on immovable property, (ii) time required to complete each procedure, and (iii) cost required to complete each procedure. A procedure is defined as any interaction of the buyer or the seller, and their legally required agents with external agents (government agencies, inspectors, notaries, and lawyers). All legally required procedures or those done in practice are considering. Duration of completing each procedure is measured in calendar days. It captures the median duration that property lawyers, notaries, or registry officials indicate is necessary to complete a procedure. The cost required to complete each procedure is measured as a percentage of the property value where only official costs required by law are considered. It includes fees, transfer taxes, stamp duties, and any other payment to the property registry, notaries, public agencies or lawyers.

Fourth, the cost of paying taxes measures the mandatory contributions that a medium-sized firm must pay in a given fiscal year, and the administrative burden of paying taxes and contributions (Djankov et. al. 2010). Measured taxes and contributions include corporate income tax, social contributions, labor tax paid by the employer, property taxes, property transfer taxes, dividend tax, capital gains tax, financial transactions tax, waste collection tax, vehicle and road taxes, and other small taxes and fees. The difficulty of paying taxes is decomposed into two specific sub-categories: (i) time to pay taxes, and (ii) total tax rate. The time to pay taxes is denoted in calendar days. It measures the time to prepare, file and pay corporate income tax, value-added tax, and labor taxes, including payroll taxes and social contribution. It includes the time to collect all necessary information to compute the tax and amount payable. Filing time includes the time to complete all necessary tax return forms and file the relevant returns at the tax authority. The time to pay taxes is denoted in the hours needed to make payment online or in person. The total tax rates measures the amount of taxes and mandatory contributions borne by the business in the second year of operation, and is denoted as a share of commercial profit. The total tax rate is a comprehensive measure of the cost of all taxes borne by the firm and differs from the statutory rate.

Fifth, the cost of international trade measures the time and cost associated with the logistical and administrative process of exporting and importing goods (Djankov et. al. 2008), and provides a comprehensive measure of long-distance trade costs. The cost of international trade is broken down into three sub-categories: (i) time to export and import, (ii) number of documents necessary to export and import, and (iii) monetary cost of export and import. The time to export and import is measured in hours and takes into account customs clearance, documentary compliance, and border compliance. Number of documents necessary to export and import encompass the official documents prescribed by the fiscal and customs authorities. The monetary cost to export and import measures the total cost associated with domestic transport, border compliance and documentary compliance, and excludes insurance costs and informal payments for which no receipt is issued. The cost is expressed in U.S dollars.

Sixth, the cost of contract enforcement measures the time and cost for resolving a commercial dispute through a local first-instance court. It provides a comprehensive measure of the efficiency of judicial system in resolving a commercial dispute (Djankov et. al. 2003). Three distinctive sub-categories of contract enforcement cost are considered: (i) number of procedures to enforce a contract, (ii) duration of enforcing a contract, and (iii) cost of enforcing contracts. The number of procedures counts the total number of resolution procedures during filing and serving the case, judicial trial, obtaining judgement, and enforcing judgement. Duration of enforcing a contract is recorded in calendar days, counted from the moment the plaintiff decides to file a lawsuit in court until payment, including the days the action takes place and the waiting periods in between. The cost of enforcing a contract is measured as the percentage of the claim assumed at 200% of per capita income, and includes court costs, enforcement costs, and average attorney fees. Court costs do not exclude the fees to be paid to obtain an expert assessment. Enforcement cost encompasses all costs that the plaintiff must advance to enforce the judgement through a public sale of buyer's moveable assets. Attorney fees are the fees that the plaintiff must advance to the local attorney for the representation in the standardized case. Bribes and unofficial payments are not taken into account.

And seventh, the cost of resolving an insolvent firm captures the time, cost and outcome of insolvency proceedings, and is derived from questionnaire-based responses by local practitioners on insolvency proceedings and bankruptcy systems. Three sub-categories are considered: (i) time to resolve an insolvent firm, (ii) cost of resolving an insolvent firm, and (iii) creditor recovery rate. The time for the creditors to recover the credit is recorded in calendar days. It is measures from the company's default until payment of some or all of the money owed to the bank. It also includes potential delay tactics by the parties such as the filing of dilatory appeals and extension requests. The cost of resolving insolvency is measured as a percentage of debtor's estate, and is calculated on the basis of questionnaire responses. It includes court fees, government levies, insolvency administrative fee, auctioneer fee, assessor fee, legal fees and some other smaller fees. Recovery rate is recorded as cents on the dollar recovered by secured creditors through firm reorganization, liquidation or debt enforcement proceedings such as foreclosure and receivership.

Table 3: Descriptive Statistics

		StD							
	Mean	Within	Between	Overall	Min	Max	P25	P75	P90
Panel A: Outcomes									
Real GDP Per Capita	12256	1375.92	13716	13741	204.01	70385	2233	17853	33405
Total Factor Productivity	0.000	0.219	0.758	0.787	-1.863	7.631	-0.516	0.572	0.927
Panel B: Transaction Costs									
Costs of Starting Business									
# Procedures	0.367	0.093	0.178	0.201	0	1	0.167	0.500	0.722
Duration (#days)	0.162	0.090	0.135	0.162	0	1	0.055	0.204	0.353
Cost (% per capita income)	0.024	0.061	0.037	0.071	0	1	0.001	0.004	0.049
Paid-in minimum capital (% per capita income)	0.004	0.024	0.011	0.026	0	1	0.000	0.001	0.009
Cost of Dealing with Construction Permits									
# Procedures	0.222	0.086	0.135	0.160	0	1	0.109	0.182	0.418
Duration (# days)	0.163	0.051	0.110	0.122	0	1	0.089	0.198	0.295
Cost (% warehouse value)	0.052	0.056	0.097	0.112	0	1	0.005	0.047	0.124
Cost of Property Registration									
# Procedures	0.359	0.049	0.170	0.176	0	1	0.231	0.429	0.571
Duration (# days)	0.074	0.052	0.079	0.095	0	1	0.021	0.085	0.167
Cost (% property value)	0.204	0.055	0.169	0.177	0	1	0.079	0.266	0.442
Costs of Paying Taxes									
Duration (# hours)	0.121	0.036	0.107	0.113	0	1	0.062	0.139	0.230
Total tax rate (% commercial profit)	0.128	0.056	0.097	0.112	0	1	0.079	0.143	0.199
Cost of International Trade									
# Documents to export	0.345	0.094	0.148	0.175	0	1	0.222	0.444	0.556
Time to export (# days)	0.221	0.055	0.178	0.186	0	1	0.095	0.288	0.476
Cost to export (USD per standardized cargo container)	0.160	0.043	0.143	0.149	0	1	0.064	0.198	0.333
#Documents to import	0.329	0.070	0.141	0.157	0	1	0.222	0.444	0.500
Time to import (# days)	0.225	0.069	0.174	0.187	0	1	0.090	0.310	0.500
Cost to import (USD per standardized cargo container)	0.147	0.043	0.126	0.133	0	1	0.067	0.176	0.311
Cost of Contract Enforcement									
# Procedures	0.468	0.023	0.178	0.179	0	1	0.353	0.588	0.676
Duration (# days)	0.325	0.045	0.189	0.194	0	1	0.198	0.396	0.561
Cost of enforcement (% claim)	0.190	0.040	0.176	0.181	0	1	0.091	0.221	0.360
Cost of Resolving Insolvency									
Duration (# years to resolve an insolvent firm)	0.284	0.081	0.149	0.169	0	1	0.160	0.360	0.510
Cost (% estate)	0.202	0.023	0.153	0.155	0	1	0.107	0.280	0.387
Recovery rate (cents per USD)	0.613	0.056	0.255	0.261	0	1	0.522	0.801	0.912

We construct the level of transaction costs for a total of 24 different indicators using the linear scaling transformation (Kovac and Spruk 2015) to normalize the differences in transaction costs are countries in the range without excessive sampling variation on the scale between 0 and 1 where higher values indicate greater transaction costs. Specifically, the linear scaling transformation for *i*-th indicator of transaction that takes place is:

$$\tau_{i,j,t} = \frac{\mathrm{T}_{i,j,t} - \min\limits_{T_{1t,2t,...,Jt}} \{\mathbf{T}\}}{\max\limits_{T_{1t,2t,...,Jt}} \{\mathbf{T}\} - \min\limits_{T_{1t,2t,...,Jt}} \{\mathbf{T}\}}$$

where τ is the normalized index of *i*-th transaction cost across $j = 1, 2, ...J$ countries and $t = 1, 2, ...T$ years, T is the original untransformed transaction cost indicator, and $\mathbf{T}$ is the vector of transaction cost values per indicator for each year. The key advantage of linear scaling transformation is that it allows us to observe a direct response of total factor productivity and growth paths to the change in transaction costs. Secondly, linear scaling transformation does not suffer from excessive sampling variation in the underlying indicators since the extent of transaction costs is normalized in a definite range between 0 and 1. And thirdly, normalizing cross-country differences in transaction costs partially alleviates the presence of outliers resulting from either excessively high or low observed transaction costs and does not render the identification strategy inconsistent or vaguely defined. In Table 3, some descriptive statistics for the key outcomes of interest and for the transaction costs is presented.

5. Empirical Framework

Our goal is to estimate the contribution of transaction costs to the efficient and inefficient growth consistently. Our strategy comprises two steps in distinguishing between efficient and inefficient growth. In the first step, we examine the effects of transaction costs on aggregate per capita output as an indicator of the growth path driven by factor accumulation. In the second step, the computed residual from the cross-country growth regression is constructed to assess the effects of transaction costs on total factor productivity indicating the growth path driven by technology and efficiency improvements. Such a strategy permits the decomposition of the effects of transaction costs on efficient vs. inefficient growth path. The basic cross-country growth relationship with the unobserved effects that takes place is:

$$\ln y_{j,t} = \ln \bar{A}_{j,t} + \hat{\lambda} \cdot C_{j,t} + \sum_{j=1}^{J} \hat{\Phi}_j \cdot D_j + \sum_{t=1}^{T} \hat{\pi}_t \cdot D_t + \varepsilon_{j,t} \tag{4.1}$$

where y is the per capita output for country $j = 1, 2, ...J$, $\bar{A}$ is the common technology level accessible to all countries, C denotes transaction costs, D_j comprises the full set of country-fixed effects, D_t is the full set of time-fixed effects capturing the influence of technology shocks common to all countries, and ε is the Solow residual. The key coefficient of interest is $\hat{\lambda}$ which denotes the contribution of transaction costs to per capita output. To allow for arbitrary serially correlated stochastic disturbances and heteroskedastic distribution of residual variance across and within countries, the standard errors are clustered on country-level and time-level using the non-nested multiway clustering estimator for the empirical distribution function (Cameron, Gelbach and Miller 2011). Eq. (4.1) describes the relationship between transaction costs and economic growth which contains the contribution of efficiency improvements and inefficient factor accumulation simultaneously. Using the parameter estimates from Eq. (4.1), we compute the Solow residual to net out the aggregate efficiency improvements as a separate growth mechanism and to distinguish it from the growth path driven by factor accumulation. Specifically, the contribution of transaction costs to the Solow residual is given by:

$$\varepsilon_{j,t} = \ln \bar{A}_{j,t} + \hat{\lambda} \cdot C_{j,t} + \sum_{j=1}^{J} \hat{\Phi}_j \cdot D_j + \sum_{t=1}^{T} \hat{\pi}_t \cdot D_t + u_{j,t} \tag{4.2}$$

where u denotes the stochastic disturbances capturing the contribution of unobserved components to the total factor productivity (TFP). A full set of country-fixed effects and time-fixed effects is retained to control for the country-specific unobserved effects and common technology shocks. To allow for between-country and intra-country serially correlated stochastic disturbances and heteroskedastic distribution of the random error variance, the standard errors are clustered simultaneously at country- and time level using the non-nested multiway clustering scheme (Cameron, Gelbach and Miller 2011). In contrast to Eq. (4.1), Eq. (4.2) describes the relationship between transaction costs and TFP, capturing the effects of transaction costs on efficiency improvements. Comparing the parameter estimates between Eq. (4.1) and Eq. (4.2) allows us to detect which specific measures of transaction costs influence the path of economic growth through factor and resource accumulation and which types of transaction costs improve or impede economic growth based on aggregate efficiency improvements.

The key threat to the validity of the established effects of transaction costs on the efficient and inefficient growth path concerns the uncertainty in the level of transaction costs since the indices and samples used to build transaction cost indicators can be ridden by measurement error which renders the established effects biased, inconsistent, and potentially unreliable. Suppose the given measure of transaction costs is subject to pervasive measurement error:

$$\tilde{C}_{j,t} = C_{j,t} + w_{j,t} \tag{4.3}$$

where $\tilde{C}$ is the sample transaction cost index, C denote true transaction costs, and w is the measurement error. Assuming zero conditional mean independence, the bias from measurement error can disappear once the sample size used to build the indices of transaction costs is large enough and thus asymptotically efficient. If transaction costs are measured with error, the growth models in (4.2) and (4.1) are contamined by the typical error-in-variables problem. To tackle the measurement error inherent in $\tilde{C}$, substitute (4.3) into (4.2). Ignoring the non-linearities and fixed effects, the bias triggered by the mismeasurement of transaction costs is proportional to:

$$\varepsilon_{j,t} = \lambda\left(\tilde{C}_{j,t} - w_{j,t}\right) + u_{j,t} = \lambda\tilde{C}_{j,t} - \lambda w_{j,t} + u_{j,t} \tag{4.4}$$

which leads to biased and inconsistent effects of transaction costs on total factor productivity since the underlying effect of transaction costs is plagued by the true effect and by the effect triggered by the measurement error. Recall the size of the bias is proportionate to the OLS estimator:

$$\hat{\lambda} = \frac{\operatorname{cov}\left(\tilde{C}_{j,t}, \varepsilon_{j,t}\right)}{\operatorname{var}\left(\tilde{C}_{j,t}\right)} = \frac{\operatorname{cov}\left(C_{j,t} + w_{j,t}, \lambda C_{j,t} + u_{j,t}\right)}{\operatorname{var}\left(C_{j,t} + w_{j,t}\right)} \tag{4.5}$$

which implies that the sample moment for $\hat{\lambda}$ does not converge to its true population value. Hence, using the OLS estimator to examine the effects of transaction costs on aggregate efficiency improvements vs. factor accumulation is bound to yield inconsistent estimates ridden by the measurement error. As a result, the resulting probability limit of $\hat{\lambda}$ fails to converge to its true value which implies that the sample analogue does not yield the unbiased effect:

$$\text{plim}\hat{\lambda} = \frac{\lambda\sigma_C^2}{\sigma_C^2 + \sigma_w^2} = \Omega \cdot \hat{\lambda} \tag{4.6}$$

Where σ_C^2 is the variance of the measured transaction cost, σ_w^2 is the measurement error variance, and Ω is the signal to variance ratio which is proportional to the size of the bias contained in the OLS estimator and where, by default, $\Omega \equiv \frac{\sigma_C^2}{\sigma_C^2 + \sigma_w^2}$. Since $0 < \Omega < 1$, the contribution of transaction costs with measurement error will be biased towards zero. Such attenuation bias is proportional to:

$$\text{plim}\hat{\lambda} - \lambda = \Omega\left(\hat{\lambda} - \lambda\right) = -(1-\Omega)\cdot\lambda = \frac{\sigma_C^2}{\sigma_C^2 + \sigma_w^2}\cdot\lambda \tag{4.7}$$

We address the attenuation bias and the extract the measurement error from our transaction cost covariate by weighing it with the respective sample size upon which each indicator used in the cross-country growth regression is built. The underlying logic is the overweighing the countries for which large samples are used to build the set of transaction cost indicators is inversely proportional to the signal-to-variance ratio. Large samples diminish σ_C^2 which implies that for a given σ_w^2, Ω is set to decrease while $\hat{\lambda}$ is set to converge to its true moment condition. Using large samples to build the indices of transaction costs partially alleviates excessive sampling variation in transaction cost indicators where small samples, typically involving no more than a few respondents, have been used. Letting $S_t^j = \left\{s_t^{1j}, s_t^{2j}, \ldots s_t^{KJ}\right\}$ denote a vector of sample sizes for the set of $k = 1, 2, \ldots K$ transaction cost indicators for $j = 1, 2, \ldots J$ countries across $t = 1, 2, \ldots T$ years, each underlying transaction cost covariate is weighted by the respective sample size s upon which the indicator is built to partially address the attenuation bias and potentially excessive sampling variance in each underlying indicator. Using the proposed weighing scheme leads to the following set of estimated cross-country growth regression models:

$$\ln y_{j,t} = \ln \bar{A}_{j,t} + \hat{\lambda}\cdot\left(\frac{C_{j,t}}{s_{j,t}}\right) + \sum_{j=1}^{J}\hat{\Phi}_j \cdot D_j + \sum_{t=1}^{T}\hat{\pi}_t \cdot D_t + u_{j,t} \tag{4.8}$$

$$\varepsilon_{j,t} = \ln \bar{A}_{j,t} + \hat{\lambda}\cdot\left(\frac{C_{j,t}}{s_{j,t}}\right) + \sum_{j=1}^{J}\hat{\Phi}_j \cdot D_j + \sum_{t=1}^{T}\hat{\pi}_t \cdot D_t + u_{j,t} \tag{4.9}$$

where $\frac{C_{j,t}}{s_{j,t}}$ is the transaction cost covariate adjusted for sample size and potentially excessive variation as a result of measurement error. Concurrent to the growth models without weighted transaction cost indicators, the standard errors are clustered simultaneously on country- and year level to allow for arbitrary serially correlated stochastic disturbances and heteroskedastic distribution of random error variance across and within countries while at the same time controlling for unobserved effects.

5. Results

5.1 Basic OLS Regressions

In Table 4, the baseline OLS results are presented. For each set of categorized transaction cost indicators, both types of cross-country growth regression models are estimated to capture the differential effects of transaction costs on factor accumulation and aggregate efficiency improvements. Columns (1) and (2) feature the contribution of the costs of starting business to the Solow residual and per capita GDP. The results highlight substantial differential impact of the costs of starting business. Greater procedural complexity in setting up a new firm is associated with a slight and marginally significant decline per capita GDP whereas there appears to be no discernable effect on TFP. Increasing the duration of starting business by 10 percentage points tends to decrease the long-run per capita output by 15 percentage points whereas the TFP is set to decline by 9 percentage points following the identical increase the number of days to start a business. Both estimated coefficients are statistically significant at 1%. On the other hand, increasing the cost of starting business relative to per capita income, is associated with a drop in per capita output whilst the effect on TFP appears to be weak. Increasing paid-in minimum capital requirements tends to exhibit a weakly negative effect on per capita output whereas we find a large and strong upward effect on TFP. This clearly suggests that while stricter minimum capital requirements depress accumulation-driven growth, such requirements foster TFP growth by deterring opportunism and other sources of moral hazard as shown in our conceptual framework. Specifically, a country that sets to tighten minimum capital requirements by 10 percentage points can expect its long-run TFP to increase by 17 percent which suggests that minimum capital requirements resemble the form of productive formalism compared to the procedural complexity as unproductive formalism; and play a pivotal role in facilitating long-run TFP improvements.

A slightly similar pattern is indicated by the set of effects of license and permit requirements in columns (3) and (4) where, holding everything else equal, procedural complexity is not associated with per capita output and TFP at all. On the other hand, the duration of obtaining licenses and permit tends to depress both per capita output and TFP improvements although the magnitude of the effect on TFP is more than half the magnitude of the effect on per capita output, yet statistically significant at 5%. Higher cost of obtaining permits and licenses is associated with a marked drop in per capita output, highlighting a depressing effect on factor accumulation while there appears to be no effect on TFP improvements even at artificially high significance level. The evidence clearly suggests that while duration of obtaining permits matters a great deal for TFP improvements, the laxer procedural complexity and lower monetary cost of getting permits relative to per capita income do not foster TFP improvements. Hence, targeting the costs and procedural complexity in getting permits appear to be associated with the more intensive factor and resource accumulation which leads to the inefficient type of growth subjective to diminishing returns rendering such accumulation-ladden growth episode out of steam.

Columns (5) and (6) feature the effects of the cost of property registration on the paths of economic growth. The evidence straightforward suggests strongly negative effects of costlier property registration procedures on per capita output when the costs of property registration are measured either via the procedural complexity, duration of registration procedures or the cost of property registration. The effects of property registration procedures on TFP are smaller, and yet statistically significant.

Table 4: Effects of Transaction Costs on Economic Growth and Total Factor Productivity, 2003-2014

	Cost of Starting Business		Cost of Dealing with Construction Permits		Cost of Property Registration		Cost of Paying Taxes		Cost of International Trade		Cost of Contract Enforcement		Cost of Resolving Insolvency	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP
# Procedures to start business	-.771*	.033												
	(.438)	(.298)												
# Days to start business	-1.515***	-.901***												
	(.492)	(.290)												
Cost of starting business (% per capita income)	-4.381***	-.834*												
	(1.453)	(.457)												
Paid-in minimum capital (% per capita income)	-3.663*	1.796***												
	(1.992)	(.675)												
# Procedures to deal with construction permits			.242	.024										
			(.474)	(.301)										
# Days to deal with construction permits			-1.922***	-.685**										
			(.582)	(.341)										
Cost of dealing with construction permits (% warehouse value)			-4.158***	-.750										
			(.783)	(.695)										
# Property registration procedures					-1.476***	-.779***								
					(.487)	(.288)								
# Days to complete property registration procedures					-2.222***	-1.104**								
					(.864)	(.507)								
Cost of property registration (% property value)					-2.778***	-.330								
					(.454)	(.306)								
# Hours to pay taxes per annum							-1.454	-.747						
							(.967)	(.567)						
Total tax rate (% commercial profit)							-2.679***	-.288						
							(.648)	(.611)						
# Documents to export									-.260	-.766***				
									(.492)	(.287)				
# Days to export									-1.010	-.335				
									(.1.611)	(.769)				
Cost to Export (USD per standardized cargo container)									3.989***	-.037				
									(1.312)	(.941)				
# Documents to import									-2.091**	-.183				
									(.968)	(.659)				
# Days to import									-2.782**	-1.252*				
									(1.402)	(.720)				
Cost to import (USD per standardized cargo container)									-.2.960**	1.603*				
									(1.382)	(.990)				
# Procedures to enforce a contract											-1.894***	-.372		
											(.514)	(.389)		
# Days to enforce a contract											-.766**	-.138		
											(.398)	(.301)		
Contract enforcement cost (% claim)											-3.689***	-1.221***		
											(.490)	(.312)		
# Years to resolve an insolvent firm													.611	.753***
													(.430)	(.305)
Cost of resolving an insolvent firm													-.969**	-.154
													(.496)	(.567)

(% estate)														
Recovery rate (cents per USD)													-3.450***	-1.569***
													(.267)	(.243)
Constant Term	.936***	.157	9.195***	.146	9.981***	.430***	9.236***	.128	10.142***	.452***	10.554***	.452***	10.855***	.779***
	(.018)	(.118)	(.175)	(.110)	(.198)	(.125)	(.183)	(.124)	(.154)	(.095)	(.210)	(.165)	(.100)	(.087)
Obs	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713
Adj. R2	0.17	0.04	0.17	0.02	0.26	0.06	0.07	0.01	0.46	0.14	0.42	0.09	0.52	0.20
Wald Test ($Pr>\chi 2$)	0.000	0.000	0.000	0.095	0.000	0.000	0.000	0.366	0.000	0.000	0.000	0.000	0.000	0.000

Notes: the dependent variables are real GDP per capita (2005 $Geary-Khamis) in natural log and total factor productivity (TFP) index computed from the augmented growth model with human capital as Solow residual. Standard errors are adjusted for serially correlated stochastic disturbances and heteroskedastic distribution of error variance allowing for intra-class residual correlation into 143 country-specific clusters and 12 time-specific clusters using Cameron, Gelbach and Miller (2011) non-nested multi-way clustering scheme for finite-sample adjustment of the empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Two-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant sample regression coefficients at 10% (*), 5% (**), and 1% (***), respectively.

Compared to the costs of starting business and costs of getting construction permits, increasing the procedural complexity in the cost of property registration is associated with a marked drop in TFP level. For instance, a hypothetical 10 percentage point increase in the procedural complexity is associated with 7.7 percent decline in TFP over time, holding everything else fixed. In addition, increasing the duration of property registration procedures by 10 percentage points corresponds to 17 percent decline in TFP whereas there appears to be no effect of the cost of registration procedures on TFP which suggests that procedural complexity and duration of procedure influence both aggregate efficiency improvements and factor accumulation to a large degree whilst the monetary cost relative to per capita income matters a great deal for factor accumulation while it does not seem to foster TFP growth at all. Columns (7) and (8) feature the effects of the costs of paying taxes on per capita output and TFP. Greater firm-level administrative burden of taxation is associated with marginally significant decrease in per capita output although the effect appears to be weak whereas increasing the total tax rate in percentage of the profit tends to stifle per capita output by 26 percent following a 10 percentage point increase in the tax rate. The effects of administrative burden of taxation on TFP is wholly weak and almost non-existent either when the burden is proxied by the number of hours to pay taxes or by the total tax rate even when significance levels are pushed upward to 25%. In this respect, the results contend that lower administrative burden of taxation tends to trigger the path of growth driven by factor accumulation while it fails to foster the aggregate efficiency improvements.

In columns (9) and (10), we examine the effects of the cross-border transaction costs related to the international trade on economic growth and TFP. The evidence highlights heterogeneity of the effect between various types of transaction costs of international trade. Greater procedural complexity, duration of import procedures and cost of import tend to depress per capita output while similarly complex, burdensome and costly export procedures do not. With respect to TFP, more complex export procedures tend to stifle TFP improvements, and the underlying effect of requiring more documents is associated with a marked drop in TFP level. For instance, decreasing the required number of export documents by 10 percentage points is associated with a rise in TFP by 7.7 percent holding everything else fixed. In a similar vein, expanding the duration of the import procedures is associated with a strong but marginally significant drop in TFP which overall highlights somewhat limited role of cross-border transaction costs in explaining the differential paths of TFP across countries.

Do the difficulty of enforcing contracts and creditor protection shape the development of TFP? Columns (11) and (12) exhibit the effects of contract enforcement costs on per capita output and TFP. The results clearly suggest the pivotal importance of the ease of enforcing contracts on aggregate efficiency improvements and a marked difference compared to the effects on factor accumulation. For instance, greater procedural complexity in contract enforcement appears to stifle the level of per capita output while there appears to be a small and insignificant effect on TFP. Greater duration of contract enforcement procedures is associated with a marked drop in per capita output whilst the effect on TFP is weak. On the other hand, greater monetary cost of contract enforcement relative to per capita income exhibits a strongly negative effect both on per capita output and TFP, and is statistically significant at 1%. In addition, the cost of resolving insolvent firms matters a great deal for TFP and there is a marked difference in the strength and direction of the effect compared to per capita output. For instance, greater temporal length of resolving an insolvent firm is weakly associated with per capita output whereas greater duration tends to foster TFP improvements, suggesting such procedures are associated with better insolvency-related outcomes that bear directly upon the resource allocation and technological improvements. In addition, greater cost of resolving an insolvent firm is associated with a marked drop in per capita output, and there appears to be no effect upon TFP improvements. In addition, lower creditor recovery rate is associated both with a marked and all-encompassing drop in per capita output and TFP suggesting its deep importance for aggregate efficiency improvements and factor accumulation.

The results from the two cross-country growth regression models suggest a multitude of peculiar differences in the effects of transaction costs on TFP and accumulation-driven growth. First, procedural complexity in administrative transaction costs tends to downgrade factor accumulation since such costs typically foster market access for incumbent firms which is associated with greater stock of production factors. However, rising the costs of procedural complexity in starting business and obtaining construction permits and licenses does not always weigh against TFP improvement. For instance, while greater duration of administrative procedures tends to discourage TFP growth, greater procedural complexity and the monetary costs of starting business and obtaining permits does not downgrade TFP performance which highlight the distinction between productive and unproductive formalism (Epstein ???). Moreover, while raising minimum capital requirements tends to falter per capita output and thus discourage factor accumulation, more stringent and stricter minimum capital requirements are associated with a strong and disproportionate acceleration of TFP growth which indicates its pivotal importance for aggregate efficiency improvements. On the other hand, cost of property registration, costs contract enforcement and costs of insolvency proceedings matter a great deal for TFP improvements. Whereas greater procedural duration in contract enforcement and property registration is associated tends to downgrade factor accumulation, it does not appear to stifle TFP improvements whilst rising costs of contract enforcement duration of property registration procedures significantly weigh against TFP growth over time. Depending on the preferred specification, transaction costs explain between 17 percent and 52 percent of the cross-country per capita output differences and up to 20 percent of the cross-country TFP differentials.

In Table 5, the estimated parameters from the cross-country growth regression models in Eq. (4.8) and E1. (4.9) are presented using the sample-sized based weighing scheme to address the excessive sampling variance in the built indicators of transaction costs. The parameter estimates with weighted transaction cost covariates confirm generally confirm earlier results. Once the aggregate uncertainty and excessive variation is netted out of transaction cost covariates, the evidence unveils somewhat stronger and statistically significant effects of the costs of starting business on TFP and an equally stronger effects of property registration procedures on TFP. Using the weighing scheme renders the effects of dealing with construction permits weak and marginally significant whereas the effects of the costs of international trade in columns (9) and (10) remain basically intact. The costs of contract enforcement tend to influence the efficient vs. inefficient growth path in the opposite direction. Lengthier enforcement procedures and greater duration of such procedures are associated with a marked and disproportionate drop in per capita output suggesting a non-negligible and peculiar role in the speed of factor accumulation. On the other hand, the cost of contract enforcement appears to be the underlying force behind the differential patterns of TFP across and within countries whereas the procedural complexity and duration are not. In column (12), decreasing the cost of contract enforcement by 10 percentage points relative to the baseline level is associated with 12 percent permanent increase in TFP performance over time. The point estimate is statistically significant at 10% and does not appear to be driven by outliers or sample selection. A similar dissimilarity is indicated by the comparison of effects of costs of resolving insolvent firm in columns (13) and (14) where greater duration of resolving insolvent firms tends to foster TFP while costlier resolution of insolvency proceedings does not.

Table 5: Effects of Transaction Costs on Economic Growth and Total Factor Productivity, 2003-2014 (Weighted)

	Cost of Starting Business		Cost of Dealing with Construction Permits		Cost of Property Registration		Cost of Paying Taxes		Cost of International Trade		Cost of Contract Enforcement		Cost of Resolving Insolvency	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP	Log GDP Per Capita	TFP
# Procedures to start business	-.721*	-.101												
	(.417)	(.280)												
# Days to start business	-1.493**	-.775*												
	(.665)	(.423)												
Cost of starting business (% per capita income)	-3.528***	-1.208***												
	(.962)	(.441)												
Paid-in minimum capital (% per capita income)	-18.92***	1.995												
	(5.783)	(2.779)												
# Procedures to deal with construction permits			.464	-.055										
			(.379)	(.257)										
# Days to deal with construction permits			-1.754***	-.653*										
			(.605)	(.374)										
Cost of dealing with construction permits (% warehouse value)			-4.540***	-1.123*										
			(1.070)	(.666)										
# Property registration procedures					-1.106***	-.628**								
					(.436)	(.326)								
# Days to complete property registration procedures					-2.289**	-1.274**								
					(.969)	(.550)								
Cost of property registration (% property value)					-2.653***	-.324								
					(.449)	(.298)								
# Hours to pay taxes per annum							-.922	-.365						
							(.880)	(.525)						
Total tax rate (% commercial profit)							-2.344**	-.610						
							(1.099)	(.727)						
# Documents to export									-.112	-.617***				
									(.571)	(.249)				
# Days to export									-.046	-.024				
									(1.676)	(.654)				
Cost to Export (USD per standardized cargo container)									4.218***	-.270				
									(1.415)	(1.018)				
# Documents to import									-2.542***	-.444				
									(.832)	(.488)				
# Days to import									-3.534**	-1.642***				
									(1.512)	(.662)				
Cost to import (USD per standardized cargo container)									-3.256**	1.550				
									(1.539)	(1.228)				
# Procedures to enforce a contract											-1.781***	-.494		
											(.539)	(.393)		
# Days to enforce a contract											-3.624***	.060		
											(.578)	(.266)		
Contract enforcement cost (% claim)											-.616	-1.275***		
											(.392)	(.283)		
# Years to resolve an insolvent firm													.546	.680***
													(.364)	(.251)
Cost of resolving an insolvent firm													-.689***	-.155
													(.609)	(.470)

(% estate)														
Recovery rate (cents per USD)													-3.223***	-1.574***
													(.284)	(.221)
Constant Term	9.254***	.227**	9.320***	.241**	9.967***	.427***	9.354***	.184	10.243***	.542***	10.599***	.490***	10.812***	.822***
	(.159)	(.107)	(.159)	(.098)	(.180)	(.129)	(.181)	(.121)	(.138)	(.097)	(.196)	(.149)	(.107)	(.079)
Firm-Level Observations	63,981	68,630	63,981	63,830	63,981	63,830	63,981	63,830	63,981	63,830	63,981	63,830	63,981	63,830
Country-Level Observations	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713	1,716	1,713
Adj. R2	0.18	0.05	0.16	0.03	0.24	0.07	0.05	0.01	0.45	0.19	0.41	0.11	0.46	0.23
Wald Test (p-value)	0.000	0.003	0.000	0.048	0.000	0.001	0.000	0.512	0.000	0.000	0.000	0.000	0.000	0.000

Notes: the dependent variables are real GDP per capita (2005 $Geary-Khamis) in natural log and total factor productivity (TFP) index computed from the augmented growth model with human capital as Solow residual. The table presents the effects of transaction costs on economic growth and TFP using the sample size-weighted indices of transaction costs to address the potentially excessive sampling variation and uncertainty in the built indices of transaction costs driven by low sample sizes upon which the indices are constructed. Standard errors are adjusted for serially correlated stochastic disturbances and heteroskedastic distribution of error variance allowing for intra-class residual correlation into 143 country-specific clusters and 12 time-specific clusters using Cameron, Gelbach and Miller (2011) non-nested multi-way clustering scheme for finite-sample adjustment of the empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Two-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant sample regression coefficients at 10% (*), 5% (**), and 1% (***), respectively.

5.3 Robustness Checks

The results so far highlight the peculiar and systematic influence of transaction costs on the paths of technology-driven growth and accumulation-driven growth. While the former captures aggregate efficiency improvements, the latter captures factor accumulation. The evidence from Table 4 and Table 5 suggests the costs associated with administrative burden tend to enhance factor accumulation whereas the costs associated with procedural mechanisms such as contract enforcement, property registration and insolvency framework are relatively more important in fostering TFP improvements over time. It remains less clear whether the underlying effects are driven by the individual indicators or by broader latent classes of transaction costs. Furthermore, the established effects could be driven by the separate tails of the cross-country output per capita and TFP distribution masking the full effect unclear. And it remains somewhat unclarified how robust is the contribution of specific transaction costs to TFP improvements when more stringent assumptions are imposed upon the cross-country growth and TFP model. In this section, we present the set of robustness checks focusing on (i) cross-country growth and TFP regression with latent indices of transaction costs, (ii) distributional effects of transaction costs on TFP and growth, (iii) extreme bounds analysis, and (iv) analysis of departure from and entry to efficient vs. inefficient growth regime.

5.3.1 Latent Indices of Transaction Costs and Distributional Effects

The evidence based on individual normalized indices of transaction costs suggests some transaction costs systematically shape the paths of growth and TFP over whilst others do not. The first caveat suggests it follows immediately that the underlying effects can possibly be triggered by a broader latent indices of transaction costs rather than by individual indicators. As a robustness check, we construct latent indices of transaction costs by using the factor analysis on all 24 different indices of transaction costs to establish latent clusters of transaction costs and re-examine the effects on TFP and economic growth across and within countries. As a rule of thumb, we eliminate seemingly weak components by restricting the size of the eigenvector to unity to derive the rotated components with the maximum extent of common variation behind the latent indices. In particular, three dominant classes of transaction costs are identified from the 24 pooled indices where the factor loading with the absolute value below 0.2 are eliminated to enhance the strength and internal consistency of the latent indices:

$$\begin{pmatrix}\text{Cross Border}\\ \text{Transaction Costs}\end{pmatrix}_{j,t} = .457\begin{pmatrix}\text{\#Documents}\\ \text{to Export}\end{pmatrix}_{j,t} + .812\begin{pmatrix}\text{Time to}\\ \text{Export}\end{pmatrix}_{j,t} + .924\begin{pmatrix}\text{Export}\\ \text{Cost}\end{pmatrix}_{j,t} +$$
$$+ .512\begin{pmatrix}\text{\#Documents}\\ \text{to Import}\end{pmatrix}_{j,t} + .844\begin{pmatrix}\text{Time to}\\ \text{Import}\end{pmatrix}_{j,t} + .917\begin{pmatrix}\text{Import}\\ \text{Cost}\end{pmatrix}_{j,t}$$

$$\begin{pmatrix}\text{Administrative}\\ \text{Transaction}\\ \text{Costs}\end{pmatrix}_{j,t} = .340\begin{pmatrix}\text{\#Procedures}\\ \text{to Start Business}\end{pmatrix}_{j,t} + .380\begin{pmatrix}\text{\#Days to Start}\\ \text{Business}\end{pmatrix}_{j,t} + .423\begin{pmatrix}\text{Incorporation}\\ \text{Cost}\end{pmatrix}_{j,t}$$
$$+ .258\begin{pmatrix}\text{\#Days to Obtain}\\ \text{Construction Permit}\end{pmatrix}_{j,t} + .373\begin{pmatrix}\text{Cost of Obtaining}\\ \text{Construction Permit}\end{pmatrix}_{j,t}$$

$$\begin{pmatrix}\text{Procedural}\\ \text{Transaction}\\ \text{Costs}\end{pmatrix}_{j,t} = .331\begin{pmatrix}\text{\#Days to Enforce}\\ \text{a Contract}\end{pmatrix}_{j,t} + .480\begin{pmatrix}\text{Enforcement}\\ \text{Cost}\end{pmatrix}_{j,t} + .470\begin{pmatrix}\text{\# Enforcement}\\ \text{Procedures}\end{pmatrix}_{j,t}$$
$$+ .621\begin{pmatrix}\text{\# Years to Resolve}\\ \text{Insolvent Firm}\end{pmatrix}_{j,t} + .480\begin{pmatrix}\text{Cost of Resolving}\\ \text{Insolvent Firm}\end{pmatrix}_{j,t} + .808\begin{pmatrix}\text{Creditor}\\ \text{Recovery Rate}\end{pmatrix}_{j,t}$$

where the first component scores strongly on cross-border transaction costs emphasizing the costs of export and import together with the associated international trade compliance and duration of procedures. The synthetic index appears to be internally strongly consistent with $\alpha = 0.92$ which is above the acceptable threshold $\alpha = 0.5$ (Cronbach 1951). The second second component captures the administrative class of transaction costs emphasizing the costs of starting business and the costs of obtaining construction permits where $\alpha = 0.62$ while the third component scores substantially on procedural transaction costs associated with the costs of property registration, costs of contract enforcement and costs of resolving insolvent firms with sound internal consistency since $\alpha = 0.72$.

The second caveat suggests the established effects from Table 4 and Table 5 might be driven by the differential distributional effects of transaction costs on TFP improvements and factor accumulation since the effects of transaction costs hold on average but may change at different tails of the TFP- and per capita output distribution across countries. We tackle the distributional effect by constructing a quantile regression function to break down and decompose the average effects into the distributional quantiles to examine whether the effects of transaction costs on TFP and growth are similar across various tails of the cross-country distribution. Considering the distributional effect of transaction costs on TFP, define the conditional quantile regression function

$$Q_\tau\left(\varepsilon_{j,t} \mid \mathbf{X}_{j,t}\right) = F_\varepsilon^{-1}\left(\tau \mid \mathbf{X}\right) \tag{5.1}$$

where Q is the underlying quantile regression function per τ-th quantile for a given number of right-hand side (RHS) covariates $\mathbf{X}$. The quantile specific effect of transaction costs on TFP is derived by solving the following minimization problem:

$$Q_\tau\left(\varepsilon_{j,t} \mid \mathbf{X}_{j,t}\right) = \arg\min_{Q(\mathbf{X})} E\left[\rho_\tau\left(\varepsilon_{j,t} - q\left(\mathbf{X}_{j,t}\right)\right)\right] \tag{5.2}$$

where $\rho_\tau(e) = 1(e > 0)\cdot\tau|e| + 1(1 \le 0)\cdot(1-\tau)|e|$ is a check function allowing for backward- and forward-location shifts in the effect of transaction costs on TFP which admits the differential effects across various tails of the distribution. Substitute a linear model for $q(\mathbf{X})$ in (5.2) and the corresponding quantile regression estimator is:

$$\lambda_\tau \equiv \arg\min_{\lambda} E\left[\rho_\tau\left(\varepsilon_{j,t} - \mathbf{X}'_{j,t}\gamma\right)\right] \tag{5.3}$$

where $\mathbf{X}'_{j,t}\gamma$ is a short hand for the RHS covariates other than transaction costs from Eq. (4.8) and Eq. (4.9). In the next step, we combine the three synthetic indices of transaction costs and allow the effect to differ across various tails of the distribution to gauge the robustness of the underlying methods to the replacement of original indicators and to the full set of distributional effects.

In Table 6, the full set of distributional effects of transaction costs on efficiency-driven growth and accumulation-driven growth is presented using the three synthetic indices of transaction costs. Panel A features the cross-country OLS regressions with multiway-clustered standard errors without the distributional effects emphasizing the robustness check on the established results from Table 4 and Table 5. Panel B displays the distributional effects of transaction costs on TFP and growth using synthetic indices while Panel C presents the re-estimated effects of transaction costs on income-specific subsamples. In each separate specification, we allow for time-fixed effects to control for the persistence of common technology shocks over time and compare the estimates to the ones without time-fixed effects. In columns (1) through (4), the effects of synthetic administrative transaction costs on per capita output and TFP are presented. Strong and negative effects of rising administrative transaction costs which hold after time-fixed effects are controlled for although the size of the effect is noticeably smaller on TFP compared to per capita output. The set of distributional effects in Panel B suggests the effect of rising administrative transaction costs is not uniform. Slightly milder effects are detected for the lowest per capita output quantile while the effect accelerates throughout the mid-tail of the overall distribution and tends to diminish in the upper tail of the TFP and per capita output cross-country distribution. Such a pattern clearly suggests the countries most heavily affected by administrative transaction costs are the ones in the middle-income category. Such pattern is further reinforced by Panel C where the negative effect of rising transaction costs appears to be marginally significant on upper-middle income subsample but once time-fixed effects are taken into account, the effect of rising administrative transaction costs on TFP disappear and is not discernable from zero across the whole set of income-specific subsamples across countries.

In columns (5) through (8) the structural and distributional effects of cross-border transaction costs on per capita output and TFP are presented. The negative effect of higher transaction costs of long-distance trade on per capita output is confirmed and holds once common technology shocks are controlled for. The full effect of rising cross-border costs on TFP is both negative and significant and does not appear to be driven by the specification bias. In Panel B, the decomposition of the distributional effects clearly indicates the importance of cross-border transaction costs for growth and TFP in the lower tails of the distribution. The size of the effects tends to diminish once countries become richer and sustain higher TFP levels while the negative effect disappears beyond the 90th TFP percentile. Such pattern is further confirmed in Panel C where the negative effect of rising cross-border transaction costs is robust and significant in low-income and lower-middle income countries, whilst it is not statistically discernable from zero in upper-middle income and high-income country subsamples. Columns (9) through (12) present the effects of procedural transaction costs related to property rights, creditor protection and contract enforcement on TFP and growth. Negative effects of higher procedural types of transaction costs are confirmed with and without the full set of time-fixed effects. The distributional effects in Panel B uncover a similar pattern to the one observed for cross-border costs. The size of the negative effect tends to be strong and persistent in the lower tails of TFP and per capita output distribution while the effect gradually tends to diminish in the upper tails of the distribution. The effect on TFP appears to be particularly powerful and statistically significant at 1% up until the 75th percentile. In Panel C, replicating the core cross-country TFP regression model on income-specific subsamples confirm the negative effect on TFP in high-income subsample but not elsewhere suggesting such costs are unique in shaping the TFP paths across the broad spectrum of the distribution. The full set of distributional effects is presented in Figure 4

Table 6: Effects of Transaction Costs on Growth and Total Factor Productivity Using Synthethic Indices, 2003-2014

	Administrative Transaction Costs (Shleifer and La Porta)				Cross-Border Transaction Costs (North)				Procedural Transaction Costs (Coase)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Log GDP Per Capita		TFP		Log GDP Per Capita		TFP		Log GDP Per Capita		TFP	
Panel A: Cross-Country OLS Regressions with Multiway-Clustered S.E.												
Full Effect	-3.684***	-3.827***	-1.028***	-1.120***	-1.215***	-1.212***	-.339***	-.341***	-2.120***	-2.127***	-.692***	-.698***
	(.527)	(.569)	(.352)	(.378)	(.174)	(.174)	(.125)	(.127)	(.112)	(.115)	(.108)	(.110)
Constant Term	9.668***	9.775***	.265**	.372***	9.907***	9.928***	.332***	.305***	11.236***	11.506***	.822***	.778***
	(.168)	(.139)	(.109)	(.108)	(.166)	(.170)	(.122)	(.120)	(.112)	(.115)	(.116)	(.095)
Obs	1,716	1,716	1,713	1,713	1,716	1,716	1,716	1,716	1,716	1,716	1,713	1,713
Adj. R2	0.19	0.19	0.04	0.04	0.36	0.36	0.07	0.07	0.53	0.53	0.15	0.15
Wald Test (Prob> χ^2)	0.000	0.000	0.000	0.000	0.000	0.040	0.006	0.006	0.000	0.000	0.000	0.000
Time-Fixed Effects (p-value)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)
Panel B: Cross-Country Quantile Regressions with Robust S.E.												
τ=0.10	-2.975***	-.514	-2.975***	-.514	-1.810***	-1.782***	-.713***	-.735***	-2.809***	-2.784***	-1.370***	-1.2***
	(1.014)	(.952)	(1.014)	(.952)	(.265)	(.270)	(.177)	(.207)	(.165)	(.118)	(.457)	(.240)
τ=0.25	-4.061***	-4.148***	-1.421*	-1.607**	-1.753***	-1.764***	-.695***	-.698***	-2.624***	-2.639***	-1.069***	-1.080***
	(.846)	(.872)	(.787)	(.824)	(.314)	(.313)	(.258)	(.265)	(.132)	(.139)	(.169)	(.158)
τ=0.50	-4.202***	-4.430***	-1.371***	-1.422***	-1.599***	-1.592***	-.430***	-.430**	-2.142***	-2.133***	-.853***	-.868***
	(.931)	(1.033)	(.440)	(.470)	(.233)	(.234)	(.174)	(.189)	(.108)	(.103)	(.098)	(.099)
τ=0.75	-4.119***	-4.214***	-1.510***	-1.490***	-1.187***	-1.169***	-.389***	-.385***	-1.723***	-1.719***	-.624***	-.631***
	(.468)	(.505)	(.350)	(.371)	(.210)	(.221)	(.092)	(.092)	(.136)	(.143)	(.087)	(.086)
τ=0.90	-3.127***	-3.096***	-1.044**	-1.111**	-.907***	-.895***	-.162	-.139	-1.407***	-1.401***	-.251	-.284*
	(.415)	(.479)	(.438)	(.479)	(.188)	(.246)	(.208)	(.200)	(.150)	(.141)	(.167)	(.160)
Parente-Santos Silva Intra-Correlation Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Median R2	0.19	0.20	0.04	0.04	0.36	0.36	0.07	0.07	0.53	0.53	0.15	0.15
Panel C: Cross-Country Fixed-Effects Regression Across Income Groups												
Full Effect on Subsamples												
Low-Income	-.354***	-.201	.030	-.261	-.204***	-.014	.145**	.126*	-.129	-.276*	.294	.243
	(.120)	(.129)	(.174)	(.266)	(.069)	(.061)	(.060)	(.075)	(.262)	(.148)	(.181)	(.206)

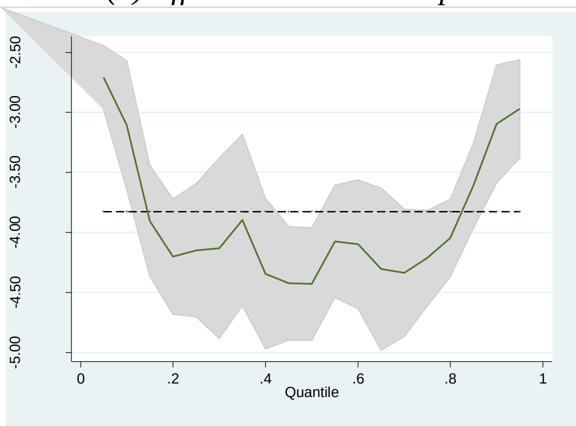
Lower-Middle Income	-.162	.428	.356	.225	-.317***	-.136**	-.145*	-.235***	.016	-.225	-.182	-.316
	(.337)	(.345)	(.268)	(.280)	(.090)	(.066)	(.085)	(.090)	(.206)	(.137)	(.187)	(.208)
Upper-Middle Income	-1.282***	-.651**	-.608*	-.610	-.144	.027	-.030	.022	-.324**	.052	.062	.211
	(.194)	(.256)	(.344)	(.444)	(.117)	(.044)	(.060)	(.048)	(.140)	(.126)	(.109)	(.159)
High-Income	-.458**	-.053	.802	.808	.007	.093	-.245	-.225	-.213***	-.101	-.079	-.216**
	(.191)	(.199)	(.936)	(.905)	(.118)	(.060)	(.166)	(.181)	(.062)	(.075)	(.086)	(.111)
Time-Fixed Effects (p-value)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)	NO	YES (0.000)

Notes: the table presents the effects of administrative, cross-border, and procedural transaction costs on per capita output and TFP using the latent (synthetic) indices of transaction costs. The dependent variables are real per capita GDP (2005 $Geary-Khamis) and the Solow residual computed from the augmented growth model with human capital. Panel A displays the baseline OLS estimates using Cameron, Gelbach and Miller (2011) non-nested multi-way clustering scheme for finite-sample adjustment of the empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Panel B presents the cross-country quantile regression estimates with the full set of distributional effects for five respective tails of the distribution. Panel C presents the effects of synthetic transaction costs on income-specific subsamples across countries. The standard errors are robust to arbitrary heteroskedasticity and serially correlated stochastic disturbances using the two-way clustering scheme across and within countries. In Panel B, quantile standard errors are asymptotically valid and robust against heteroskedasticity, serially correlated stochastic disturbances and misspecification using the robust variance-covariance matrix computed following Power (1984), Chamberlain (1994), and Angrist et. al. (2006), and against the potential intra-country residual correlation to provide cluster-robust inference on the underlying parameters. Asterisks denote statistically significant effects at 10% (*), 5% (**), and 1% (*), respectively.

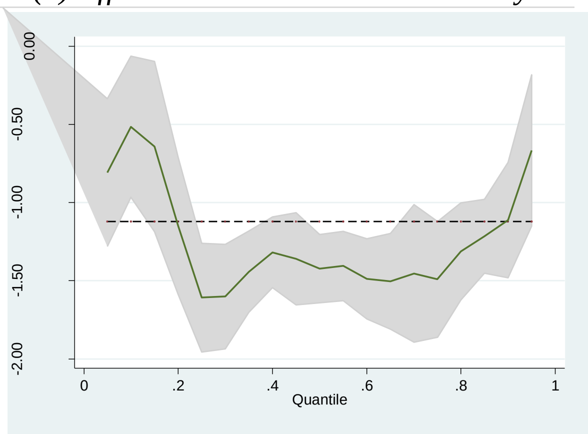
Figure 4: Distributional Effects of Transaction Costs on Growth and Total Factor Productivity

Administrative Transaction Costs
(La Porta and Shleifer)

(a) Effect on GDP Per Capita

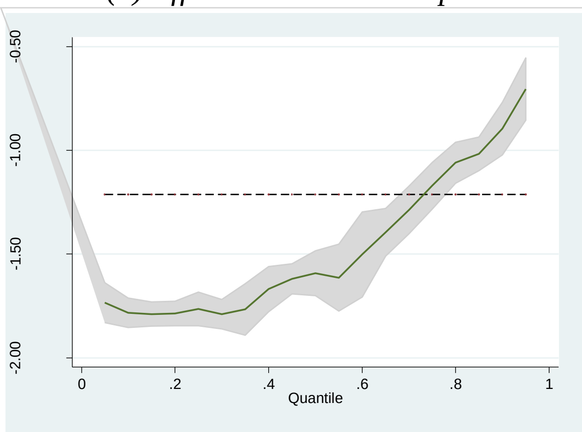


(b) Effect on Total Factor Productivity

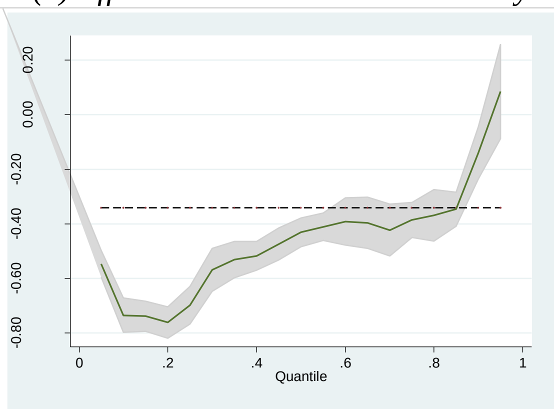


Cross-Border Transaction Costs
(North)

(a) Effect on GDP Per Capita

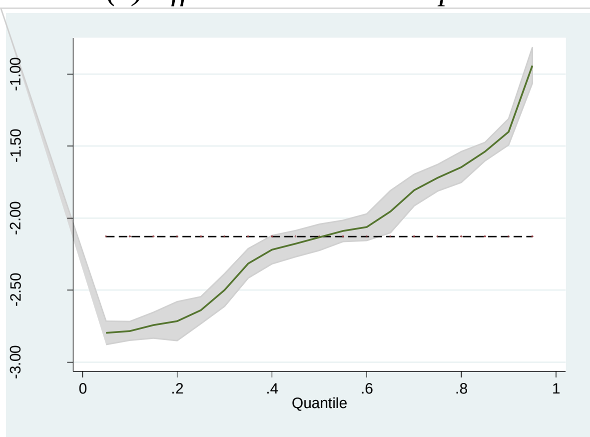


(b) Effect on Total Factor Productivity

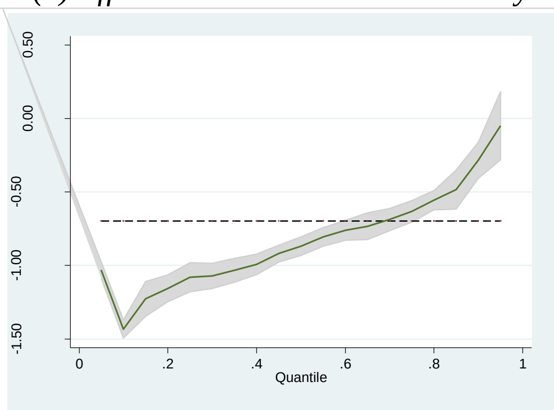


Procedural Transaction Costs
(Coase)

(a) Effect on GDP Per Capita



(b) Effect on Total Factor Productivity



5.3.3 Extreme Bounds of Transaction Costs

Are transaction costs robust determinants to TFP? The evidence so far clearly highlights the distinctive peculiarity of transaction costs in shaping the paths of TFP. The established results could be driven by the model misspecification given the aggregate uncertainty about the true model of efficient growth captured by the TFP. We further assess the robustness of the transaction costs in accounting for TFP disparities across countries and perform extreme bounds analysis to gauge the significance and potential fragility of transaction costs in explaining TFP differences across countries. Following Sala-i-Martin (1997), we examine the entire range of point estimates from Table 4 by focusing on the original rather than synthetic indices of transaction costs. Instead of focusing on the upper and lower extreme bounds (Leamer 1985, Levine and Renelt 1992) of the underlying parameters, our approach is based on examine the full distribution of parameters to gauge the significance of transaction costs indices in explaining cross-country TFP behavior.

We replicate the core TFP cross-country regression model from (4.2) by performing the maximum number of empirical model combination, and construct the underlying density function for each transaction cost parameter. Specifically, for $k = 1, 2, \ldots K$ transaction cost covariates, we compute the integrated likelihood function $L_k(\cdot)$, the parameter estimates $\hat{\lambda}_{C,k}$ from the underlying TFP model, and the respective standard deviation $\sigma_{Z,k}$, and construct the mean point estimate $\bar{\lambda}_{C,k}$ as the weighted average of K point estimates:

$$\tilde{\lambda}_{C,k} = \sum_{k=1}^{K} w_{C,k} \cdot \lambda_{C,k} \tag{5.4}$$

where the weights w are proportionate to the integrated likelihood ratio:

$$w_{C,k} = \frac{L_{C,k}}{\sum_{k=1}^{K} L_{C,k}} \tag{5.5}$$

and where our strategy is to attach more weight to the regression specifications based on the true underlying model of TFP behavior across countries. The likelihood ratio of the k-th regression model simply reflects an indication of the probability of the true model. In a similar fashion, we compute the variance of the transaction cost covariates as the weighted average of K estimated variances:

$$\sigma_C^2 = \sum_{k=1}^{K} w_{C,k} \cdot \sigma_{C,k}^2 \tag{5.6}$$

where the weights are derived using the likelihood ratio which implies that higher weight will be driven from variance of the given covariate with the higher likelihood ratio given the increased likelihood of estimating the true model. Using the weighted mean point estimates of *k*-th transaction cost covariate from (5.4) and the corresponding variance from (5.6), we use the standard normal distribution to compute the cumulative distribution function (CDF) which indicates the fraction of replicated regression when the underlying point estimate lies inside or outside the given range. Four transaction costs are allowed to enter the regression model simultaneously for a total of 24 different covariates which, for our sample size, yields more 12,950 univariate regressions or more than 3.5 million total regressions to be estimated in gauging the robustness of transaction costs in explaining TFP differentials across countries.

In Table 7, the extreme bounds of transaction costs are presented. The table reports the mean point estimate (λ), its lower and upper bound, the standard deviation (σ) and the corresponding CDF indicating the fraction of replicated core regression model where the point estimate across the whole set of regression specifications is negative and significant at 5%. The evidence from extreme bounds approach to the robustness of transaction costs in explaining TFP paths across countries suggests most transaction costs are robust determinants of TFP performance although there are notable and non-ignorable differences between different types of transaction costs. Panel A exhibits the extreme bounds of administrative transaction costs. The total tax rate, and procedural complexity in dealing with permits and starting business appear to be either weak or fragile forces behind the TFP paths across countries while the number of hours to pay taxes is statistically significant at 5% and negative in more than 90 percent of regressions. On the other hand, the parameter estimate on the number of days to start business is negative in more than 98 percent of replicated regressions, the cost of starting business tends to downgrade TFP in 74 percent of replications while minimum capital requires stimulate TFP in more than 99 percent of the the estimated regressions. The evidence from Panel B highlights the importance of cross-border transaction costs in shaping the paths of TFP performance across countries. The duration of export and import procedures as well as the number of necessary documents submitted to customs and border authorities appears to be strongly robust in accounting for TFP gaps between countries since the parameter estimates of these subset of cross-border cost covariates are negative and statistically significant at 5% in more than 90% percent of replicated regressions while the monetary costs of import and export are not.

In Panel C, the extreme bounds and the associated CDF(0) of procedural transaction costs associated with property rights, creditor protection and contract enforcement are reported. The evidence indicates a very robust contribution of such procedural transaction costs to TFP paths across and within countries. The effect of procedural complexity and the duration of property registration procedures on TFP is both negative and statistically significant at 5% in more than 99 percent of the replicated regressions compared to 84 percent of the time for the cost of property registration. In a similar vein, the effect of procedural complexity and the duration of contract enforcement procedures is negative and significant at 5% in 83 percent and 85 percent of the replicated regressions, respectively. The extreme bounds clearly suggest the most robust and powerful transaction cost determinant of TFP gaps is the cost of contract enforcement since the effect on TFP is negative and significant at 5% in 100 percent of the replicated regressions. Equivalently powerful effect is found for the creditor recovery rate as well as for the cost of resolving insolvent firms, suggesting higher costs and lower recovery rate largely impede TFP performance. On the broader level, the extreme bounds suggest the relatively greater importance of the property- and contracts-related transaction costs compared to administrative and cross-border costs in explaining large TFP gaps across countries. The key implication of the extreme bounds is that countries with shorter duration of property registration procedures, less complex and costly access to international markets, low-cost enforcement of contracts and stronger creditor protection in resolving insolvent firms are significantly more likely to embark on the path of TFP growth over time. The failure to keep such costs low reflects the institutional channels behind the inability of countries to achieve levels of TFP comparable to the frontier where such costs are kept low. In addition, the extreme bounds and the associated CDF(0) suggests reducing administrative transaction costs whilst failing to reduce property-related and contractual costs is bound to the weak and uncertain TFP growth.

Table 7: Extreme Bounds of Transaction Costs

	# Model Replications	λ	λ_{min}	λ_{max}	σ	CDF (λ<0)	Verdict
Panel A: Administrative Transaction Costs							
# Procedures to start business	12,950	-0.05	-0.42	0.53	0.09	64.45	Weak
# Days to start business	12,950	-0.59	-1.00	0.02	0.12	98.12	Very Robust
Cost of starting business (% per capita income)	12,950	-0.30	-1.19	0.67	0.26	74.12	Robust
Paid-in minimum capital (% per capita income)	12,950	2.04	1.24	2.76	0.68	0.36	Robust
# Procedures to deal with construction permits	12,950	0.09	-0.23	0.54	0.11	38.97	Fragile
# Days to deal with construction permits	12,950	-0.23	-0.74	0.36	0.15	78.01	Robust
Cost of dealing with construction permits (% warehouse value)	12,950	-0.20	-0.83	0.44	0.17	70.62	Weakly Robust
# Hours to pay taxes per annum	12,950	-0.42	-0.84	0.29	0.16	91.07	Very Robust
Total tax rate (% commercial profit)	12,950	0.04	-0.42	0.58	0.16	42.75	Weak
Panel B: Cross-Border Transaction Costs							
# Documents to export	12,950	-0.99	-1.67	-0.23	0.140	99.15	Very Robust
# Days to export	12,950	-0.96	-1.96	-0.034	0.138	98.95	Very Robust
Cost to Export (USD per standardized cargo container)	12,950	-0.04	0.16	-1.495	1.495	56.60	Weak
# Documents to import	12,950	-1.16	-1.88	0.288	0.158	99.28	Very Robust
# Days to import	12,950	-1.02	-2.06	0.196	0.140	99.08	Very Robust
Cost to import (USD per standardized cargo container)	12,950	0.36	-0.72	1.812	0.187	37.03	Fragile
Panel C: Property and Contracts (Procedural) Transaction Costs							
# Property registration procedures	12,950	-0.652	-0.923	-0.322	0.106	99.99	Very Robust
# Days to complete property registration procedures	12,950	-0.991	-1.458	-0.418	0.195	99.97	Very Robust
Cost of property registration (% property value)	12,950	-0.189	-0.577	0.153	0.107	84.22	Robust
# Procedures to enforce a contract	12,950	-0.221	-0.650	0.450	0.107	83.30	Robust
# Days to enforce a contract	12,950	-0.167	-0.366	0.169	0.095	86.49	Robust
Contract enforcement cost (% claim)	12,950	-1.010	-1.360	-0.547	0.104	100.00	Very Robust
# Years to resolve an insolvent firm	12,950	-0.303	-0.886	0.925	0.118	85.51	Robust
Cost of resolving an insolvent firm (% estate)	12,950	-0.948	-1.381	0.054	0.127	99.12	Very Robust
Recovery rate (cents per USD)	12,950	-1.266	-1.76	-0.907	0.080	100.00	Very Robust
Total Number of Regressions	3,729,600						

Notes: the table presents the extreme bounds of the estimated effects of transaction costs on TFP for the core sample of 143 countries in the period 2003-2014. Specifically, the weighted beta coefficient mean, the minimum and maximum bound, weighted standard error of the beta coefficient and the cumulative distribution function are reported. Beta coefficients in the cumulative distribution function are derived from the generic model where the non-normality of the coefficient distribution is permitted. The total count of replicated TFP regressions takes into account the number of model replications, the number of covariates and the length of the time series.

5.3.4 Efficient Growth Acceleration and Collapse

Finally, we re-examine the robustness of transaction costs in explaining the paths of TFP across and within countries by asking why some countries enter the efficient growth regime, manage to improve TFP while others remain trapped in accumulation-driven inefficient growth. Examining the contribution of transaction costs to the probability of entry into the efficient growth regime ultimately bears upon the major turning points in TFP performance and whether such TFP breaks are driven by transaction costs. Our approach is complementary to the earlier work by Ben-David and Papell (1998), Pritchett (2000), Jones and Olken (2005) and Jerzmanowski (2005) who employed similar statistical techniques to identify the major breaks in the paths of economic growth. Rodrik et. al. (2005) highlight the significance of trade, investment, real exchange rate depreciatiations and political regime changes in producing growth accelerations while Jerzmanowski (2005) highlights four different growth regimes and suggests institutional quality helps predict the transition probability among the four growth regimes.

We distinguish efficient growth regime from the inefficient one based on the dynamics of TFP over time. Specifically, we look for instances of stationary vs. non-stationary TFP growth. The former implies that the underlying mean and variance of TFP per country do not change over time while the former the TFP mean and variance change over time producing a non-stationary growth episode. Non-stationary growth episode can be further decomposed into two major paths: (i) acceleration where TFP moves upward, and (ii) collapses where TFP shifts downward. Identifying such regime switches is far from straightforward. The standard unit root tests provide some indication of stationary vs. non-stationary behavior of the underlying time-series but neglect the potential occurrence of the structural break which can shift the TFP change in either direction. Our approach combines the testing for the unit root with the structural break test to detect the stationary vs. non-stationary TFP episodes.

First, we compute the augmented Dickey-Fuller unit root test for country $j=1,2,...J$ to determine whether j-th country's TFP series contains a unit root which implies whether the series is subject to a non-stationary process or whether the j-th country's TFP series is trend-stationary. If TFP series contains a unit root, its mean and variance change over time $t=1,2,...T$ which implies that the TFP trend can be plausibly detected. An upward trend therefore indicates efficient growth, generated by TFP improvements, while a downward trend is perceptible to inefficient growth indicating TFP decline, and the growth path driven by factor accumulation. Alternatively, a trend-stationary process with no unit rot should indicate neither of these. However, the underlying TFP path is likely to be affected by both common and idiosyncratic shocks which implies that a structural break in TFP path is possible. This implies that for $t=1,2,...T$, j-th country may enter different growth regimes depending on the structural break taking place at $t \in T$.

Our strategy in identifying efficient vs. inefficient growth regimes comprises several steps. First, compute the augmented Dickey-Fuller test for $j=1,2,...J$ across $t=1,2,...T$ time period to detect the potential presence of the non-stationary TFP behavior:

$$\Delta\varepsilon_{j,t} = \alpha + \beta \cdot t + \chi_1 \cdot \varepsilon_{j,t-1} + \delta_1 \cdot \Delta\varepsilon_{j,t-1} + ... + \delta_{p-1} \cdot \Delta\varepsilon_{j,t-p+1} + \zeta_{j,t} \qquad (5.7)$$

where $\Delta\varepsilon$ is the first-differenced TFP level, α is the intercept, β is the coefficient on the time trend, and p is the lag order of the autoregressive process where p=1 is assumed, and ζ is the error term. Imposing the constraints $\alpha = 0$ and $\beta = 0$ follows the model with a random walk while $\beta = 0$ indicates a random walk model with a drift. Under the null hypothesis, the underlying TFP is characterized by the unit root, and follows a non-stationary process. Under alternative hypothesis, the residual is trend-stationary and does not contain a unit root. Second, how do common or idiosyncratic shocks shift the TFP path upward, downward, or push it into a stationary regime? Following Perron (1984), and Zivot and Andrews (1992), we allow for a structural break in the underlying TFP series at an unknown date within $t = 1, 2, ...T$ to shift the TFP course while still allowing for stationary vs. non-stationary TFP variance behavior before and after the break. Such an assumption leads to three variants of the parametrized TFP models:

$$\text{A: } \varepsilon_{j,t} = \hat{\mu}^{A} + \hat{\theta}^{A} \cdot \tau^{\bar{\varepsilon}}_{j,t} + \beta^{A} \cdot t + \hat{\alpha}^{A} \cdot \varepsilon_{j,t-1} + \sum_{p=1}^{P} \hat{\varphi}^{A}_{p} \cdot \Delta\varepsilon_{j,t-p} + \upsilon_{j,t} \tag{5.8}$$

$$\text{B: } \varepsilon_{j,t} = \hat{\mu}^{B} + \hat{\theta}^{B} \cdot \tau^{Trend}_{j,t} + \beta^{B} \cdot t + \hat{\alpha}^{B} \cdot \varepsilon_{j,t-1} + \sum_{p=1}^{P} \hat{\varphi}^{B}_{p} \cdot \Delta\varepsilon_{j,t-p} + \upsilon_{j,t} \tag{5.9}$$

$$\text{C: } \varepsilon_{j,t} = \hat{\mu}^{C} + \hat{\theta}^{C} \cdot \tau^{\bar{\varepsilon}}_{j,t} + \hat{\pi}^{C} \cdot \tau^{Trend}_{j,t} + \beta^{C} \cdot t + \hat{\alpha}^{C} \cdot \varepsilon_{j,t-1} + \sum_{p=1}^{P} \hat{\varphi}^{C}_{p} \cdot \Delta\varepsilon_{j,t-p} + \upsilon_{j,t} \tag{5.10}$$

where model A allows for a mean-shift in TFP denoted by $\tau^{\bar{\varepsilon}}$ occurring at each possible structural break. In model B, τ^{Trend} is a trend shifter allowing for a structural break in the trend. Both models are combined into model C which is characterized as a more parsimonious one where we allow for a simultaneous shift in the TFP mean and trend occurring at each possible date. Under the null hypothesis in model C, the underlying TFP series is subject to non-stationary behavior with no structural break. Alternatively, the TFP seris is described by the stationary behavior with the structural break occuring at an unknown year.

Hence, we construct three distinctive growth regimes based on the underlying behavior of the TFP before the break, after the break or without the break. First, the efficient growth acceleration is defined as an uninterrupted increase in TFP lasting more than one year which implies that efficient growth is sustained if TFP increases without interruption for $t > 1$. Second, stationary growth equilibrium is defined as no change in TFP for more than $t > 1$ which highlights random variation. And third, efficient growth collapse is defined as an uninterrupted decline in TFP lasting for more than one year, i.e. $t > 1$. Although such definition is largely arbitrary, the short span of our time series precludes the choice of greater time horizon, compared to Rodrik et. al. (2005), to identify the structural shifts in TFP and its path. Three growth regimes are described by the following dichotomous distribution scheme:

$$\text{Regime}_{i,j,t} = \begin{cases} D^{Acceleration}_{j,t} = 1 & \forall \Delta^{+} \varepsilon^{\tau \in \{T-t\}}_{j,t.T} > 1 \\ D^{Stationary}_{j,t} = 1 & \forall \Delta^{0} \varepsilon^{\tau \in \{T-t\}}_{j,t.T} = 0 \\ D^{Collapse}_{j,t} = 1 & \forall \Delta^{-} \varepsilon^{\tau \in \{T-t\}}_{j,t.T} < 0 \end{cases} \tag{5.11}$$

where $D^{Acceleration}$ is a dummy variable indicating whether *j*-th country across $t = 1, 2, ...T$ is in the efficient growth regime, $D^{Stationary}$ is a dummy variable indicating whether *j*-th country is in the stationary TFP growth regime while $D^{Collapse}$ is a dummy variable indicating TFP collapse across $j = 1, 2, ...J$ countries and $t = 1, 2, ...T$ time horizon.

Using two binary measures of efficient growth acceleration and collapse, we examine the probability of transition to TFP growth acceleration based on the variation in transaction costs. Specifically, we use the logit estimator to establish transition probabilities for efficient growth acceleration and collapse based on two separate specifications ignoring potential non-linearities:

$$\Pr\left(D_{j,t}^{Acceleration} = 1 | C, \mathbf{X}\right) = \Lambda\left(\tilde{\theta}_0 + \tilde{\lambda}_1 C_{j,t} + \sum_{j=1}^{J} \tilde{\delta}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varphi}_t \mathrm{T}_t + u_{j,t}\right) =$$

$$= \frac{\exp\left(\tilde{\theta}_0 + \tilde{\lambda}_1 C_{j,t} + \sum_{j=1}^{J} \tilde{\delta}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varphi}_t \mathrm{T}_t + u_{j,t}\right)}{1 + \exp\left(\tilde{\theta}_0 + \tilde{\lambda}_1 C_{j,t} + \sum_{j=1}^{J} \tilde{\delta}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varphi}_t \mathrm{T}_t + u_{j,t}\right)} \tag{5.12}$$

$$\Pr\left(D_{j,t}^{Collapse} = 1 | C, \mathbf{X}\right) = \Lambda\left(\tilde{\theta}_0 + \tilde{\lambda}_2 C_{j,t} + \sum_{j=1}^{J} \tilde{\omega}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varsigma}_t \mathrm{T}_t + u_{j,t}\right) =$$

$$= \frac{\exp\left(\tilde{\theta}_0 + \tilde{\lambda}_2 C_{j,t} + \sum_{j=1}^{J} \tilde{\omega}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varsigma}_t \mathrm{T}_t + u_{j,t}\right)}{1 + \exp\left(\tilde{\theta}_0 + \tilde{\lambda}_2 C_{j,t} + \sum_{j=1}^{J} \tilde{\omega}_j \Theta_j + \sum_{t=1}^{T} \tilde{\varsigma}_t \mathrm{T}_t + u_{j,t}\right)} \tag{5.13}$$

where $\tilde{\theta}$ is the constant term, C is the measure of transaction costs, Θ is the full set of country-fixed effects, T denotes the full set of time-fixed effects, $\mathbf{X}$ is a short hand for the RHS covariates, u captures the idiosyncratic error, and $\Lambda(\cdot)$ is the corresponding logistic estimator. The standard errors are clustered simultaneously on country and year-level to allow for arbitrary heteroscedasticity and serially correlated stochastic disturbances across and within countries, and are robust to misspecification. The key coefficients of interest are $\tilde{\lambda}_1$ and $\tilde{\lambda}_2$ which denote the contribution of the change in transaction costs to the probability of efficient growth acceleration and collapse. As further check on the potential misspecification and sample selection, we replace the acceleration and collapse outcomes in (5.12) and (5.13) with the dummy variables indicating whether *j*-th country's TFP level is on the frontier, i.e. located within the 75th and 90th percentile of the global distribution:

$$D_{.75}^{Frontier} = 1\left[\varepsilon_{j,t} > \Pr(.75)\right] \tag{5.14}$$

$$D_{.90}^{Frontier} = 1\left[\varepsilon_{j,t} > \Pr(.90)\right] \tag{5.15}$$

Replacing the outcome variables in (5.12) and (5.13) with the TFP frontier dummy variables from (5.14) and (5.15) leads to the following logit-based empirical specification of the transition probabilities:

$$\Pr\left(D_{.75}^{Frontier}=1\,|\,C,\mathbf{X}\right)=\Lambda\left(\tilde{\theta}_0+\tilde{\lambda}_1 C_{j,t}+\sum_{j=1}^{J}\tilde{\delta}_j\Theta_j+\sum_{t=1}^{T}\tilde{\varphi}_t\mathrm{T}_t+u_{j,t}\right) \tag{5.16}$$

$$\Pr\left(D_{.90}^{Frontier}=1\,|\,C,\mathbf{X}\right)=\Lambda\left(\tilde{\theta}_0+\tilde{\lambda}_1 C_{j,t}+\sum_{j=1}^{J}\tilde{\delta}_j\Theta_j+\sum_{t=1}^{T}\tilde{\varphi}_t\mathrm{T}_t+u_{j,t}\right) \tag{5.17}$$

which indicates the contribution of transaction costs to the entry into the TFP frontier conditional on the common technology shocks and unobserved country, and serves as a check on the stability of the parameter estimates from (5.12) and (5.13). The underlying coefficient of interest $\tilde{\lambda}_1$ denotes the contribution of the change in transaction costs to the entry into the 75^{th} and 90^{th} percentile of the global TFP distribution. Figure 5 presents the set of selected TFP growth acceleration episodes for a panel of six countries characteristic of the three different growth regime espoused by (5.11).

The world distribution of growth regimes is presented in greater depth in Table 8. The table reports several elements describing the three TFP growth regimes: (i) efficient growth acceleration, (ii) stationary growth regime, and (iii) efficient growth decline: the augmented Dickey-Fuller test statistics with the appropriate p-value indicating the rejection of the non-stationarity assumption underlying the TFP growth behavior, the estimated break year ascribed from the year with the maximum t-statistics on the mean- and trend-related shift in TFP, the size of the maximum t-statistics in the year of the structural break along with the critical values as a part of Zivot-Andrews structural break test. In addition, the table reports the diagnostic of growth regime for 143 countries such as whether the structural break t-statistics lies within the 10% statistical significance threshold, the direction of TFP change after the structural break, the verdict on whether the break has been sustained and pre-break TFP acceleration, and the general pattern of TFP behavior before the break.

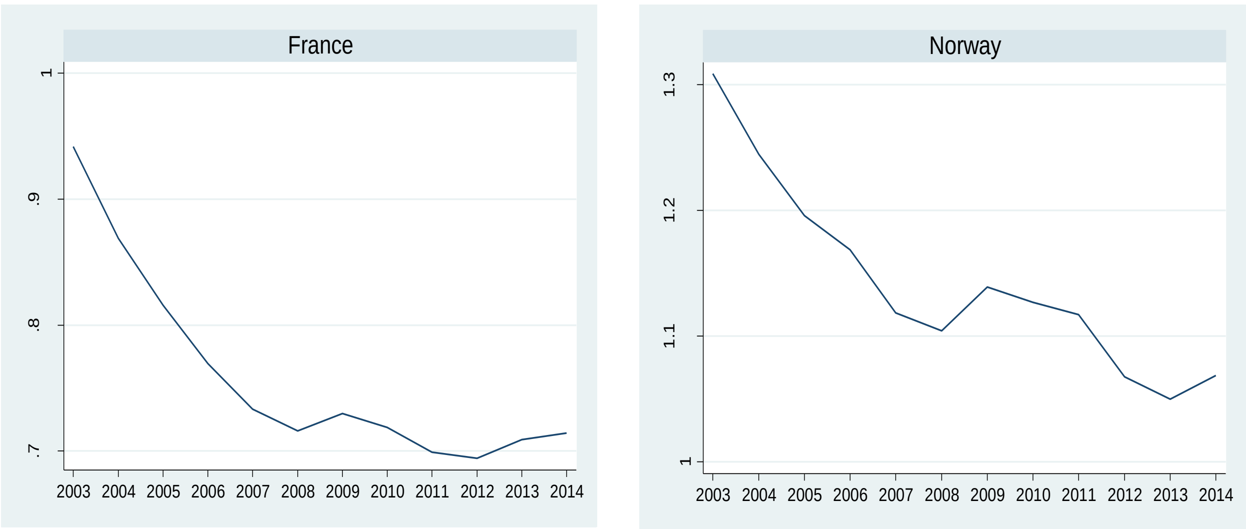
A brief overview of TFP growth regime suggests growth accelerations and collapses are a fairly frequent phenomena. The structural break in TFP within 10% significance threshold occurred in 73 out of 143 countries comprising 51 percent of the whole sample. In 75 percent of the sample (comprising 108 countries), the TFP accelerated upward after the structural break while TFP shifted downward in post-break years in 23 percent of the countries included in our sample (roughly 23 percent of the total). A total of 62 countries (43 percent) managed to sustain the upward shift in TFP after the structural break while 80 countries (55 percent) failed to sustain the upward change in TFP in post-break years. Before the structure break, 38 countries experienced an upward trend in TFP or roughly 25 percent of the sample while the remaining 104 experienced either stationary or declining TFP path which clearly suggests that stationary and collapse-based TFP growth regime are much more frequent phenomena than efficient growth regime. In particular, 31 countries before the structural break were part of the stationary growth regime, 40 countries in pre-break years were in the efficient growth regime while 71 countries in the same period experienced either a decline or a collapse of TFP.

In Table 9, the marginal effects of transaction costs on the entry into the efficient growth regime based on the empirical distribution function in (5.12) are presented. Each specification is estimated using the Cameron et. al. (2011) logit estimator with multiway clustering scheme and a probit estimator to check whether the parameter estimates in both binary response models are driven by the different assumptions on the distribution of residuals.

Figure 5: TFP Growth Acceleration Episodes

(a) Stationary TFP Growth

(b) Non-Stationary Sustained TFP Decline Episode



(c) Non-Stationary Sustained TFP Acceleration Episode

Table 8: World Distribution of Growth Regimes, 2003-2014

Country	ADF Unit Root Test (MacKinnon p-value)	Zivot-Andrews Structural Break Test					Efficient Growth Regime Diagnostic				
	Random Walk with or without Drift	Break Year	t-stat	Critical values 10%	5%	1%	Break Occured	Post-Break TFP Change	Break Sustained (t>1)	Pre-Break TFP Acceleration	Pre-Break TFP Pattern
Albania	0.555	2010	-7.23	-4.82	-5.08	-5.57	Yes	+	No	Yes	Growth
Algeria	0.213	2009	-4.31	-4.82	-5.08	-5.57	No	+	No	No	Decline
Angola	0.070	2009	-3.52	-4.82	-5.08	-5.57	Yes	+	Yes	Yes, Partial	Growth
Argentina	0.006	2010	-6.3	-4.82	-5.08	-5.57	Yes	+	Yes	Yes, Partial	Stationary
Armenia	0.436	2009	-4.39	-4.82	-5.08	-5.57	No	+	Yes	Yes	Growth
Australia	0.938	2009	-4.39	-4.82	-5.08	-5.57	No	+	No	Yes	Decline
Austria	0.994	2011	-7.35	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Azerbaijan	0.452	2012	-2.91	-4.82	-5.08	-5.57	Yes	-	Yes	No	Growth
Bangladesh	0.989	2012	-2.15	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Belarus	0.279	2011	-4.8	-4.82	-5.08	-5.57	Yes	-	Yes	No	Growth
Belgium	0.980	2011	-4.67	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Benin	0.990	2011	-4.23	-4.82	-5.08	-5.57	No	+	No	No	Decline
Bolivia	0.996	2011	-4.62	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Bosnia and Herzegovina	0.015	2012	-5.408	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Botswana	0.988	2009	-3.83	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Brazil	0.991	2011	-1.68	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Bulgaria	0.204	2010	-3.19	-4.82	-5.08	-5.57	No	-	No	No	Decline
Burkina Faso	0.996	2011	-2.63	-4.82	-5.08	-5.57	No	-	No	Yes	Growth
Burundi	0.792	2012	-4.42	-4.82	-5.08	-5.57	Yes	-	Yes	No	Stationary
Cambodia	0.883	2012	-3.53	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Cameroon	0.993	2011	-4.38	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Canada	0.945	2011	-2.96	-4.82	-5.08	-5.57	No	+	Yes	No	Stationary
Central African Republic	0.234	2011	-5.2	-4.82	-5.08	-5.57	Yes	-	Yes	No	Decline
Chad	0.22	2012	-8.2	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Stationary
Chile	0.77	2008	-5.97	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
China	0.789	2007	-2.48	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Colombia	0.005	2008	-6.48	-4.82	-5.08	-5.57	Yes	+	No	No	Stationary

Congo, Dem. Rep.	0.942	2012	-4.59	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Congo, Rep.	0.786	2007	-4.18	-4.82	-5.08	-5.57	Yes	-	No	No	Decline
Costa Rica	0.712	2012	-4.34	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Cote d'Ivoire	0.091	2011	-5.5	-4.82	-5.08	-5.57	Yes	-	No	No	Decline
Croatia	0.991	2009	-4.99	-4.82	-5.08	-5.57	Yes	+	No	No	Decline
Czech Republic	0.894	2010	-4.7	-4.82	-5.08	-5.57	Yes	-	No	Yes	Growth
Denmark	0.858	2012	-3.53	-4.82	-5.08	-5.57	No	-	No	No	Decline
Dominican Republic	0.704	2009	-19.09	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Ecuador	0.984	2010	-5.06	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Stationary
Egypt	1	2011	0.24	-4.82	-5.08	-5.57	No	+	No	No	Decline
El Salvador	0.608	2009	-5.53	-4.82	-5.08	-5.57	Yes	+	No	No	Decline
Estonia	0.015	2012	-6.19	-4.82	-5.08	-5.57	Yes	-	No	No	Growth
Ethiopia	0.893	2007	-3.26	-4.82	-5.08	-5.57	No	+	No	No	Decline
Fiji	0.218	2012	-5.52	-4.82	-5.08	-5.57	Yes	+	No	No	Decline
Finland	0.002	2005	-4.44	-4.82	-5.08	-5.57	No	-	No	No	Decline
France	0.688	2007	-2.39	-4.82	-5.08	-5.57	No	-	No	No	Decline
Georgia	0.965	2009	-6.11	-4.82	-5.08	-5.57	Yes	-	Yes	Yes	Growth
Germany	0.305	2006	-2.74	-4.82	-5.08	-5.57	No	+	No	No	Decline
Ghana	0.995	2012	-3.94	-4.82	-5.08	-5.57	No	+	No	No	Decline
Greece	0.324	2008	-13.45	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Guatemala	0.429	2012	-4.33	-4.82	-5.08	-5.57	Yes	-	Yes	No	Decline
Guinea	1	2011	-3.67	-4.82	-5.08	-5.57	No	+	Yes	No	Decline
Guyana	0.288	2005	-2.97	-4.82	-5.08	-5.57	No	-	No	No	Decline
Haiti	0.836	2012	-7.34	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Honduras	0.345	2012	-3.67	-4.82	-5.08	-5.57	No	+	No	No	Decline
Hong Kong	0.537	2009	-3.94	-4.82	-5.08	-5.57	No	+	No	No	Growth
Hungary	0.646	2011	-3.91	-4.82	-5.08	-5.57	No	-	No	No	Stationary
Iceland	0.453	2009	-3.5	-4.82	-5.08	-5.57	No	-	No	No	Stationary
India	0.789	2012	-5.61	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Indonesia	0.732	2007	-4.86	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Iran	0.332	2012	-2.91	-4.82	-5.08	-5.57	No	+	No	No	Decline
Ireland	0.538	2009	-2.05	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Israel	0.458	2011	-8.64	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Italy	0.774	2009	-2.81	-4.82	-5.08	-5.57	No	+	No	No	Decline
Jamaica	0.387	2009	-4.1	-4.82	-5.08	-5.57	Yes	-	Yes	No	Stationary
Japan	0.132	2005	-3.77	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Jordan	0.103	2009	-3.37	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Kazakhstan	0.079	2011	-5.79	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Kenya	0.987	2012	-4.36	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline

Korea Rep.	0.988	2011	-4.03	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Kuwait	0.371	2009	-3.27	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Kyrgyzstan	0.753	2012	-4.4	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Laos	0.963	2007	-4.17	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Latvia	0.427	2011	-2.69	-4.82	-5.08	-5.57	No	+	No	No	Decline
Lebanon	0.055	2005	-3.65	-4.82	-5.08	-5.57	No	+	No	No	Decline
Lesotho	0.144	2011	-4.21	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Liberia	0.206	2011	-3.72	-4.82	-5.08	-5.57	No	+	No	No	Decline
Lithuania	0.338	2009	-6.69	-4.82	-5.08	-5.57	Yes	-	No	Yes	Growth
Macedonia FYRO	0.509	2008	-3.4	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Madagascar	0.975	2008	-8.99	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Malawi	0.994	2011	-1.71	-4.82	-5.08	-5.57	No	+	No	No	Decline
Malaysia	0.867	2010	-3.31	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Mali	0.54	2010	-3.29	-4.82	-5.08	-5.57	No	-	No	No	Decline
Mauritania	0.125	2008	-4.06	-4.82	-5.08	-5.57	Yes	-	Yes	No	Stationary
Mauritius	0.926	2009	-3.08	-4.82	-5.08	-5.57	No	-	No	No	Decline
Mexico	0.995	2011	-3.37	-4.82	-5.08	-5.57	No	-	No	No	Decline
Moldova	0.714	2009	-3.44	-4.82	-5.08	-5.57	No	+	No	No	Growth
Mongolia	0.286	2006	-2.5	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Morocco	0.987	2007	-3.95	-4.82	-5.08	-5.57	No	+	No	No	Decline
Mozambique	0.94	2011	-3.94	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Namibia	0.91	2011	-4.05	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Nepal	0.995	2010	-8.94	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Netherlands	0.166	2006	-2.6	-4.82	-5.08	-5.57	No	-	No	No	Decline
New Zealand	0.972	2009	-9.07	-4.82	-5.08	-5.57	Yes	-	Yes	Yes	Growth
Nicaragua	0.993	2012	-1.98	-4.82	-5.08	-5.57	No	+	No	No	Decline
Niger	0.69	2009	-3.23	-4.82	-5.08	-5.57	No	+	No	No	Decline
Nigeria	0.036	2009	-6.84	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Norway	0.446	2009	-3.53	-4.82	-5.08	-5.57	No	-	No	No	Decline
Oman	0.004	2007	-5.35	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Pakistan	0.018	2005	-3.92	-4.82	-5.08	-5.57	No	+	No	No	Decline
Panama	0.0002	2012	-6.71	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Papua New Guinea	0.115	2009	-3.47	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Paraguay	0.363	2011	-3.67	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Peru	0.401	2010	-6.67	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Phillippines	0.57	2009	-3.16	-4.82	-5.08	-5.57	No	+	No	Yes	Stationary
Poland	0.662	2010	-3.19	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Portugal	0.949	2011	-3.902	-4.82	-5.08	-5.57	No	+	No	No	Decline
Puerto Rico	0.053	2012	-4.55	-4.82	-5.08	-5.57	No	+	No	No	Decline

Romania	0.085	2012	-3.19	-4.82	-5.08	-5.57	No	-	No	No	Stationary
Russia	0.788	2012	-146.07	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Rwanda	0.989	2008	-3.87	-4.82	-5.08	-5.57	No	+	No	No	Decline
Sao Tome and Principe	0.978	2010	-4.1	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Saudi Arabia	0.751	2010	-4.39	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Senegal	0.49	2009	-3.11	-4.82	-5.08	-5.57	No	+	No	No	Decline
Serbia	0.512	2009	-5.05	-4.82	-5.08	-5.57	Yes	+	No	No	Stationary
Sierra Leone	0.021	2006	-3.74	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Singapore	0.97	2008	-9.62	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Slovakia	0.826	2009	-3.58	-4.82	-5.08	-5.57	No	+	Yes	Yes	Growth
Slovenia	0.47	2012	-6.81	-4.82	-5.08	-5.57	Yes	-	No	Yes	Growth
Solomon Islands	0.942	2010	-10.02	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
South Africa	0.385	2009	-2.94	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Spain	0.42	2007	-3.87	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Sri Lanka	0.567	2007	-3.11	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Sweden	0.379	2009	-6.79	-4.82	-5.08	-5.57	Yes	-	No	No	Decline
Switzerland	0.033	2007	-4.45	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Syria	0.163	2010	-3.55	-4.82	-5.08	-5.57	No	+	No	No	Stationary
Taiwan	0.924	2012	-5.77	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Tanzania	0.993	2012	-2.73	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Thailand	0.532	2006	-2.97	-4.82	-5.08	-5.57	No	+	No	No	Growth
Togo	0.966	2010	-3.29	-4.82	-5.08	-5.57	No	+	No	No	Decline
Tonga	0.906	2010	-3.62	-4.82	-5.08	-5.57	No	-	No	No	Decline
Tunisia	0.927	2010	-5.37	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Turkey	0.877	2011	-5.08	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
Uganda	0.977	2012	-3.42	-4.82	-5.08	-5.57	No	+	No	No	Decline
Ukraine	0.054	2006	-5.27	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
UAE	0.471	2009	-15.82	-4.82	-5.08	-5.57	Yes	-	No	No	Decline
United Kingdom	0.543	2011	-4.93	-4.82	-5.08	-5.57	Yes	+	Yes	No	Decline
United States	0.911	2009	-4.52	-4.82	-5.08	-5.57	Yes	-	Yes	Yes	Growth
Uruguay	0.564	2010	-3.66	-4.82	-5.08	-5.57	No	+	No	Yes	Growth
Uzbekistan	0.081	2009	-33.33	-4.82	-5.08	-5.57	Yes	+	Yes	Yes	Growth
Vanuatu	0.843	2008	-3.32	-4.82	-5.08	-5.57	No	+	No	No	Decline
Venezuela	0.988	2012	-4.07	-4.82	-5.08	-5.57	Yes	+	No	No	Decline
Vietnam	0.964	2010	-3.95	-4.82	-5.08	-5.57	Yes	+	Yes	No	Stationary
Yemen	0.163	2005	-3.09	-4.82	-5.08	-5.57	No	-	No	No	Decline
Zambia	0.637	2012	-4.61	-4.82	-5.08	-5.57	Yes	+	Yes	No	Growth
Zimbabwe	0.671	2009	-3.32	-4.82	-5.08	-5.57	No	+	No	No	Stationary

Panel A presents the marginal effects of administrative transaction costs on the probability of transition to efficient growth regime. The evidence suggests not all types of administrative transaction costs are created equal. In columns (1) and (2), the effects of the costs of starting business on the transition probabilities are estimated. The underlying parameter estimates succinctly suggests greater procedural complexity in starting business tends to improve the probability of entering the efficient growth regime which implies that such costs tend to deter moral hazard and opportunism and hence facilitate technology improvements rather than unproductive rent-seeking. On the other hand, greater duration of starting business is associated with a marked drop in the transition probability since a 10 percentage point increase in the duration of starting business tends to drop the probability of entering the efficient regime by 3.3 percentage points on average. In a similar vein, columns (3) and (4) confirm the deterring effects of procedural complexity in dealing with construction permits upon moral hazard and opportunism since increasing such costs is associated with a marked increase in the probability of entering the efficient growth regime which holds across logit and probit estimation setup. In addition, there appears to be no significant marginal effects of the cost of paying taxes on the probability of entering the efficient growth regime. In columns (5) and (6), no effects of the administrative and fiscal burden of paying taxes on the efficient growth regime entry are found regarding of the residual distribution assumption and the choice of binary response estimator. Columns (7) and (8) suggest the cross-border transaction costs matter for the efficient growth acceleration, especially the cost to import (*Panel B*). In particular, decreasing the cost to import in column (7) by 10 percentage points is associated with an increase in TFP by 0.14 percent, and the effect is statistically significant at 1%. Changing other types of cross-border transaction costs does not appear to systematically enhance TFP acceleration. Columns (9) and (10) feature the effects of property registration costs on TFP acceleration, and the evidence clearly suggests higher monetary cost of property registration is associated with a notable and discernable deceleration of TFP which implies that increasing such costs tend to stifle technology improvements over time shifting the growth regime towards inefficient factor accumulation.

In Panel C, the marginal effects of procedural transaction costs on efficient growth acceleration are examined. Despite its distinctive importance in shaping TFP levels across countries, columns (11) and (12) unveil weak effects of the contract enforcement costs on TFP growth acceleration whereas columns (13) and (14) indicate sizeable effects of the cost of resolving insolvent firms on efficient growth acceleration. Although the length of insolvency procedures does not seem to foster TFP acceleration, increasing the cost of resolving insolvent firm by 10 percentage points is set to trigger TFP growth slowdown by 4.8 percent, respectively based on our preferred logit specification. The goodness-of-fit criteria for our model specification suggests it predicts major episodes of efficient growth acceleration surprisingly well despite having found few indices of transaction costs with a significant influence on TFP acceleration. Our estimation strategy successfully predicts between 69 percent and 70 percent of TFP acceleration episodes, and the estimated marginal effects of transaction costs on the transition probabilities appear to be jointly significant at 1% and 5% across the broad spectrum of empirical specifications. The general pattern from the estimated acceleration models implies that among procedural transaction costs, higher monetary costs of property registration procedures and of resolving insolvent firms are associated with a marked slowdown of TFP growth. Among the administrative transaction costs, the evidence suggests that increasing some types of such costs, primarily the number of procedures to start business and number of procedures to deal with construction permits yields a systematic TFP growth acceleration which

Implies that such costs are the potential sources of moral hazard and opportunism setting a backlash against TFP improvements..

Table 9: Marginal Effects of Transaction Costs on Efficient Growth Acceleration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Administrative Transaction Costs						Cross-Border Transaction Costs		Procedural, Property- and Contractual Transaction Costs					
	Cost of Starting Business		Cost of Dealing with Construction Permits		Cost of Paying Taxes		Cost of International Trade		Cost of Property Registration		Cost of Contract Enforcement		Cost of Resolving Insolvency	
	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit
Panel A: Marginal Effects of Administrative Transaction Costs														
# Procedures to start business	.076 (.160)	.241* (.149)												
# Days to start business	-.043 (.168)	-.337* (.186)												
Cost of starting business (% per capita income)	-.373 (.315)	.147 (.163)												
Paid-in minimum capital (% per capita income)	-1.532 (2.192)	.225 (.214)												
# Procedures to deal with construction permits			.712*** (.219)	.373** (.163)										
# Days to deal with construction permits			.065 (.218)	.139 (.209)										
Cost of dealing with construction permits (% warehouse value)			-.417 (.308)	.249 (.163)										
# Hours to pay taxes per annum					.116 (.147)	.129 (.395)								
Total tax rate (% commercial profit)					-.241 (.206)	.215 (.182)								
Panel B: Marginal Effects of Cross-Border Transaction Costs														
# Documents to export							.541*** (.229)	.414 (.263)						
# Days to export							.626 (.438)	-.065 (.427)						

Cost to Export (USD per standardized cargo container)							.582	.430						
							(.504)	(.407)						
# Documents to import							-.397	-.267						
							(.336)	(.308)						
# Days to import							-.352	-.191						
							(.422)	(.345)						
Cost to import (USD per standardized cargo container)							-1.493***	-.627*						
							(.575)	(.368)						
Panel C: Procedural and Contractual Transaction Costs														
# Property registration procedures									.221	.720***				
									(.171)	(.240)				
# Days to complete property registration procedures									.096	.140				
									(.274)	(.301)				
Cost of property registration (% property value)									-.597***	-.164				
									(.186)	(.163)				
# Procedures to enforce a contract											-.010	.333		
											(.177)	(.238)		
# Days to enforce a contract											-.039	-.321		
											(.201)	(.262)		
Contract enforcement cost (% claim)											-.196	-.057		
											(.189)	(.142)		
# Years to resolve an insolvent firm													.001	.187
													(.254)	(.254)
Cost of resolving an insolvent firm (% estate)													-.488**	-.963***
													(.224)	(.287)
Recovery rate (cents per USD)													.163	.539***
													(.180)	(.189)
Constant Term	-.275	-.382**	-1.705***	-.775***	-.257	-.385**	-.601***	-.362*	-.282	-1.011***	-.154	-.387	-.362	-.737**
	(.287)	(.175)	(.426)	(.250)	(.200)	(.187)	(.291)	(.207)	(.347)	(.271)	(.379)	(.348)	(.339)	(.350)
Time-Fixed Effects (p-value)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716
Count R2	0.69		0.70		0.69		0.70		0.69		0.69		0.69	
Wald χ^2 Test (p-value)	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.15	0.00

Log-Likelihood (p-value)	0.00	0.00	0.12	0.00	0.00	0.00	0.00

Notes: the table presents the marginal effects of transaction costs on entry into the efficient growth regime. The dependent variable is a binary measure of acceleration-based efficient growth regime. Standard errors are adjusted for arbitrary heteroskedasticity and serially correlated stochastic disturbances across and within countries using a non-nested multi-way clustering scheme from Cameron et. al. (2011)for finite-sample adjustment of the empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Cluster-robust standard errors are denoted in the parentheses. Asterisks denote statistically significant marginal effects at 10% (*), 5% (**), and 1% (***), respectively.

Table 10: Marginal Effects of Transaction Costs on Efficient Growth Collapse

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Administrative Transaction Costs						Cross-Border Transaction Costs		Procedural, Property- and Contractual Transaction Costs					
	Cost of Starting Business		Cost of Dealing with Construction Permits		Cost of Paying Taxes		Cost of International Trade		Cost of Property Registration		Cost of Contract Enfrocement		Cost of Resolving Insolvency	
	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit	Logit with Multiway-Clustered S.E	Probit
Panel A: Marginal Effects of Administrative Transaction Costs														
# Procedures to start business	.048	-.029												
	(.149)	(.166)												
# Days to start business	.190	.253*												
	(.186)	(.154)												
Cost of starting business (% per capita income)	.001	-.059												
	(.329)	(.248)												
Paid-in minimum capital (% per capita income)	1.182	.124												
	(1.641)	(.285)												
# Procedures to deal with construction permits			-.750***	-.950***										
			(.238)	(.323)										
# Days to deal with construction permits			.509**	.051										
			(.218)	(.213)										
Cost of dealing with construction permits (% warehouse value)			-.326	-.035										
			(.283)	(.197)										
# Hours to pay taxes per annum					.191	-.076								
					(.183)	(.359)								
Total tax rate (% commercial profit)					-.056	-.181								
					(.208)	(.192)								
Panel B: Marginal Effects of Cross-Border Transaction Costs														
# Documents to export							-.771***	-.843***						
							(.267)	(.377)						
# Days to export							-.344	-.313						
							(.397)	(.435)						
Cost to Export (USD per standardized cargo container)							-.296	-.667						
							(.520)	(.541)						

# Documents to import							1.064*** (.335)	.890** (.422)						
# Days to import							.092 (.396)	.395 (.428)						
Cost to import (USD per standardized cargo container)							.535 (.512)	.587 (.496)						
Panel C: Marginal Effects of Procedural and Contractual Transaction Costs														
# Property registration procedures									-.159 (.187)	-.362 (.260)				
# Days to complete property registration procedures									.322 (.259)	.268 (.258)				
Cost of property registration (% property value)									.265** (.132)	-.021 (.159)				
# Procedures to enforce a contract											.059 (.151)	-.087 (.242)		
# Days to enforce a contract											.091 (.142)	.438** (.195)		
Contract enforcement cost (% claim)											-.043 (.147)	.132 (.205)		
# Years to resolve an insolvent firm													-.236 (.229)	-.300 (.339)
Cost of resolving an insolvent firm (% estate)													.385* (.219)	.586** (.297)
Recovery rate (cents per USD)													-.040 (.159)	-.234 (.170)
Constant Term	-2.261*** (.268)	-1.245*** (.223)	-1.115*** (.379)	-.188 (.361)	-2.061*** (.379)	-1.060*** (.216)	-2.151*** (.340)	-.976*** (.289)	-2.133*** (.357)	-.814*** (.305)	-2.240*** (.377)	-1.501*** (.373)	-1.862*** (.352)	-.827*** (.337)
Time-Fixed Effects (p-value)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)	YES (0.000)
Observations	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716	1,716
Count R2	0.71		0.72		0.70		0.71		0.71		0.70		0.70	
Wald $\chi2$ Test (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Log-Likelihood (p-value)	0.00		0.00		0.00		0.00		0.00		0.00		0.00	

Notes: Notes: the table presents the marginal effects of transaction costs on entry into the efficient growth collapse. The dependent variable is a binary measure of collapse-based inefficient growth regime. Standard errors are adjusted for arbitrary heteroskedasticity and serially correlated stochastic disturbances across and within countries using a non-nested multi-way clustering scheme from Cameron et. al. (2011)for finite-sample adjustment of the empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Cluster-robust standard errors are denoted in the parentheses. Asterisks denote statistically significant marginal effects at 10% (*), 5% (**), and 1% (***), respectively.

In Table 10, the estimated parameters from efficient growth collapse model are presented. The evidence clearly suggest the unambiguous importance of transaction costs in affecting the probability of TFP growth collapse. Although there appears to be no discernable and straightforward relationship between administrative transaction costs and TFP growth collapse, the evidence suggests greater duration of starting business (rather than the associated monetary cost and procedural complexity) weighs against TFP growth and is more likely to offset the efficient growth collapse. In addition, more complex administrative procedures in dealing with construction permits tend to systematically decrease the probability of efficient growth collapse. For instance, expanding the procedural complexity in obtaining construction permits hypothetically by 10 percentage points is likely to decrease the probability of efficient growth collapse between 7.5 percent and 9.5 percent, depending on the underlying residual distribution. Moreover, the fiscal and regulatory burden on the firm-level cost of paying taxes does not seem to influence the probability of efficient growth collapse. In columns (7) and (8), the estimated marginal effects advocate few discernable effects of the cross-border transaction costs on efficient growth collapse. For instance, requiring more export documents to be submitted to the customs authority is associated with a discernable decrease in the probability of efficient growth collapse indicating the potential source of adverse selection weighing against TFP improvements. On the other hand, requirement greater number of import documents to be submitted to customs authority suggests increasing such costs is more likely to produce efficient growth collapse, and the estimated marginal effect is quantitatively large and statistically significant at 5% (probit) and 1% (logit), respectively.

More burdensome and costlier property registration procedures typically stifle TFP productivity improvements, and the estimated parameters from columns (9) and (10) advocate quantitatively large and statistically significant effects of costlier property registration procedures on the collapse of efficient growth regime. The point estimate implies that increasing the cost of property registration by 10 percentage points tends to increase the probability of efficient growth collapse by 2.65 percent in our preferred logit specification. In addition, increasing the duration of contract enforcement, in column (12), by the equivalent 10 percentage points is associated with 4.38 percent increase in the probability of efficient growth collapse which indicates the potential source of inefficient growth. Similarly large and comparable marginal effects are confirmed in columns (13) and (14) on the cost of resolving insolvent firms where a similar 10 percentage points cost increase tends to increase the probability of efficient growth collapse between 3.8 percent and 5.8 percent, respectively. The obtained results confirm the importance of procedural transaction costs for efficient growth acceleration and collapse, and suggest rising such costs might clearly deter efficiency improvements and set economies on the paths of inefficient growth. The established marginal effects of transaction costs on efficient growth collapses are not sensitive to common technology shocks over time. The general pattern from the efficient growth acceleration and collapse episodes clearly suggests that increasing the administrative transaction costs, especially the number of procedures in starting business and dealing with permits, can yield sizeable gains in TFP and may also help countries avoid the efficient growth collapse. Whereas greater duration of procedures in either transaction cost category weighs against TFP acceleration, the effects of administrative transaction costs on efficient growth episodes are clearly limited and somewhat ambiguous. On the other hand, increasing the costs of property registration, cost of contract enforcement and cost of resolving insolvent firms tend to increase the odds of efficient growth collapse or, at best, involves a sizeable deceleration of efficient growth bound to the stationarity trap. Although the effects of contract enforcement costs are somewhat limited, greater duration of contract enforcement procedures, rather than the sheer number of procedures, tends to increase the probability of efficient growth collapse.

Table 11: Marginal Effects of Transaction Costs on Entry to and Exit from TFP Frontier with Fixed Effects, 2003-2014

	Panel A: Entry into 75th Percentile				Panel B: Entry into 90th Percentile			
	β (Logit with Multiway Clustered S.E)	β (Probit)	Count R2	Log Likelihood (p-value)	β (Logit with Multiway Clustered S.E)	β (Probit)	Count R2	Log Likelihood (p-value)
Panel C: Marginal Effects of Administrative Transaction Costs								
# Procedures to start business	-.389** (.161)	.037 (.046)	0.74	0.000	-.143 (.093)	-.025 (.060)	0.89	0.000
# Days to start business	-1.012*** (.309)	-.006 (.031)	0.74	0.000	-.354** (.169)	-.045 (.039)	0.89	0.000
Cost of starting business (% per capita income)	-.764 (.700)	-.089** (.040)	0.74	0.000	-.018 (.205)	.082 (.062)	0.89	0.000
Paid-in minimum capital (% per capita income)	2.049 (1.936)	-.010 (.044)	0.74	0.000	1.405 (.933)	.262*** (.075)	0.89	0.000
# Procedures to deal with construction permits	-.742*** (.263)	.051 (.060)	0.74	0.000	-.144 (.123)	-.008 (.079)	0.89	0.000
# Days to deal with construction permits	-1.172*** (.340)	.065 (.048)	0.74	0.000	-.574*** (.192)	.020 (.046)	0.89	0.000
Cost of dealing with construction permits (% warehouse value)	-.620 (.830)	-.0001 (.023)	0.74	0.000	-.017 (.262)	-.055* (.028)	0.89	0.000
# Hours to pay taxes per annum	-2.393*** (.534)	.011 (.062)	0.78	0.000	-.827** (.364)	-.011 (.122)	0.89	0.000
Total tax rate (% commercial profit)	-.410 (.311)	.011 (.029)	0.74	0.000	-.545 (.432)	-.0007 (.031)	0.89	0.000
Panel D: Marginal Effects of Cross-Border Transaction Costs								
# Documents to export	-1.120*** (.219)	-.110* (.059)	0.77	0.000	-.240** (.126)	-.015 (.064)	0.89	0.000
# Days to export	-.820** (.386)	-.015 (.079)	0.74	0.000	-.192 (.217)	-.071 (.062)	0.89	0.000
Cost to Export (USD per standardized cargo container)	-.355 (.365)	-.021 (.057)	0.74	0.000	-.112 (.290)	-.070 (.098)	0.89	0.000
# Documents to import	-1.181*** (.235)	-.093* (.050)	0.77	0.000	-.249* (.139)	-.011 (.067)	0.89	0.000
# Days to import	-.879** (.380)	.142 (.099)	0.75	0.000	-.211 (.232)	-.018 (.048)	0.89	0.000
Cost to import (USD per standardized cargo container)	-.387 (.418)	-.046 (.065)	0.74	0.008	-.048 (.283)	-.041 (.095)	0.89	0.023
Panel E: Marginal Effects of Procedural and Contractual Transaction Costs								
# Property registration procedures	-.697*** (.216)	-.049 (.039)	0.75	0.000	-.383*** (.097)	-.109** (.053)	0.89	0.000
# Days to complete property registration procedures	-1.766** (.790)	.084 (.070)	0.74	0.000	-.916*** (.343)	.002 (.035)	0.89	0.000
Cost of property registration (% property value)	-.161 (.184)	.057 (.087)	0.74	0.000	-.063 (.136)	-.157* (.090)	0.89	0.000
# Procedures to enforce a contract	-.407* (.231)	-.021 (.152)	0.74	0.000	-.103 (.181)	-.113 (.117)	0.89	0.000
# Days to enforce a contract	-.341* (.212)	.063 (.075)	0.74	0.000	-.215* (.129)	-.036 (.078)	0.89	0.000
Contract enforcement cost (% claim)	-.945** (.391)	-.076** (.025)	0.74	0.000	-.372 (.281)	-.268** (.122)	0.89	0.000
# Years to resolve an insolvent firm	-.918*** (.252)	-.090** (.044)	0.77	0.000	-.239* (.148)	-.069 (.053)	0.89	0.000
Cost of resolving an insolvent firm (% estate)	-1.077*** (.426)	-.187*** (.061)	0.74	0.000	-.306 (.292)	-.185* (.104)	0.89	0.000
Recovery rate (cents per USD)	-.783*** (.112)	-.053 (.060)	0.85	0.000	-.200*** (.058)	-.091 (.062)	0.89	0.000

Notes: the table presents the marginal effects of transaction costs on the probability of entering the 75th and 90th percentile of the world TFP distribution. The dependent variables are the dummy variables indicating whether the countries are inside or outside the 75th and 90th percentile of global TFP distribution. Standard errors in Logit-based specifications are adjusted for arbitrary heteroskedasticity and serially correlated stochastic disturbances across and within countries using Cameron et. al. (2011) non-nested multiway clustering scheme for the underlying empirical distribution function allowing for cluster-robust parameter inference to remove the structural inconsistencies arising from biased OLS covariance matrix estimator. Cluster-robust standard errors are denoted in the parentheses. For probit estimator, semi-robust country-clustered standard errors are reported. Asterisks denote statistically significant marginal effects at 10% (*), 5% (**), and 1% (***), respectively.

Do lower transaction costs improve the odds of joining the world TFP frontier? In Table 11, the marginal effects of transaction costs on the entry into 75th and 90th percentile of world TFP distribution are presented based on estimating (5.16) and (5.17). In Panel C, the effects of administrative transaction costs are presented. The estimated parameters clearly suggest greater duration of business registration procedures, greater procedural complexity in dealing with construction permits, greater duration of obtaining permits and increased number of hours to pay taxes deter the entry into the 75th percentile. In Panel B, the estimated effects on entering the 90th percentile are slightly less strong and suggest that countries are more likely to enter the frontier when the duration of business registration procedures and duration of obtaining construction permits is low. In addition, increasing paid-in minimum capital requirements tends to improve the odds of joining TFP frontier. The probit estimates in Panel B and Panel C in imply that tightening minimum capital requirements by 10 percentage points leads to the increase in the probability of joining the TFP frontier by 2.62 percentage points, and the estimated response coefficient is statistically significant at 1%. Greater number of hours to pay taxes and longer duration of obtaining permits is associated with a lower probability of entering the 90th percentile although the size of the effect is quantitatively smaller compared to the entry into 75th percentile in Panel A. Consider the cross-border transaction costs in Panel D. The evidence outright suggests such costs clearly determine the entry rate for the upper tail of the global TFP distribution. Greater amount of export documents tends to deter the entry into both 75th and 90th percentile although for the latter the effect is quantitatively smaller. Greater duration of export procedures tends to lower the probability of entering the 75th percentile while there appears to be no association at all in the 90th percentile threshold. In a similar vein, greater number of documents in import procedures and longer duration of import procedures stifle the entry into 75th percentile but do not matter for the entry into the 90th percentile. In essence, lower cross-border transaction costs can offset the path towards the 75th TFP percentile upward but do not guarantee the entry into the 90th percentile of the distribution.

In Panel E, the marginal effects of property-related and contractual transaction costs on the entry rate are presented. The evidence suggests the fundamental importance of such transaction costs in shaping the paths of TFP growth over time. An increased amount of property registration procedures weakly predicts the entry into the 75th percentile but tends to matter a great deal for the entry into the 90th percentile where higher property registration costs tend to downgrade the odds of entering the TFP frontier club. In a similar fashion, greater duration of property registration procedures pushes the odds of entering both upper percentiles downward suggesting low-cost property registration affects TFP performance at all respective tails of the global distribution. The effect of contract enforcement costs on the entry into the 75th and 90th percentile is slightly weaker. Greater duration of contract enforcement procedures tends to discourage the entry into the TFP frontier club, and the baseline marginal effect is only borderline significant at 10%. On the other hand, costlier enforcement of contracts impairs the odds of joining the TFP frontier both at 75th and 90th percentile cutoff. The point estimates imply that a hypothetical 10 percentage point increase in the cost of contract enforcement drops the odds of the underperforming country of joining the TFP frontier by 9.4 percentage points for the 75th percentile and by further 2.6 percentage points for the entry into the 90th percentile. In addition, higher costs of resolving insolvent firms tend to depress the odds of joining the 75th percentile whereas lower costs might not be a sufficient condition for an underperforming country to join the TFP frontier club. The highest magnitude of the observed decrease in the probability of joining the TFP frontier is observed for the monetary cost of resolving insolvent firms followed by the duration of resolving insolvency proceedings and, finally, by the recovery rate. In the baseline scenario, pushing the costs of resolving insolvent firms upward hypothetically by 10 percentage points is set to downgrade the odds of joining the 75th TFP percentile by 10.7 percentage points which suggests that the strength of creditor protection plays a vital role in encouraging sustained and stable TFP growth.

Conclusion

In this paper we examine the effects of transaction costs on the efficient vs. inefficient growth using the variation in total factor productivity for a large panel of countries in the period 2003-2014. Building the neoclassical growth model augmented by transaction cost parameter, our parameter-calibrated model implies that the non-zero transaction cost assumption leads to the suboptimum allocation of resources under the constant returns to scale and diminishing marginal returns in the production function. Our model predicts the agents with higher transaction costs will achieve persistently slower path of economic growth compared to the counterfactual scenario. It also predicts the agents with lower transaction costs are substantially more likely to embark on the path of technology improvements pushing it production function outward. High transaction costs directly discourage technology adoption and set the agents on the path of inefficient factor accumulation which is bound by the diminishing marginal products and constrained by the long-run stationary equilibrium. The underlying model predicts lower transaction costs encourage the convergence of per capita across countries although the convergence pattern depends on the temporal evolution of transaction costs and the strength of the change over time. Higher transaction costs predict divergence of per capita output across countries in either rapid or gradual fashion which is somewhat mediated by the presence of external shocks.

We construct the measure of TFP, i.e. Solow residual, for 143 countries in our time period from the augmented growth model with human capital and unobserved effects, and examine the contribution of transaction to the differential TFP paths across and within countries. The results suggest higher transaction costs are significantly more likely to discourage TFP growth. The baseline effects are stable across various operationalized categories of transaction costs and do not appear to be driven by the measurement error and excessive sampling variation in the underlying indices. Employing a latent factor model, we construct three synthetic indices of transaction costs to examine broader effects on TFP and the evidence suggests administrative transaction costs tend to encourage inefficient growth with the exception of stricter minimum capital requirements which strongly encourage TFP growth by addressing the potential sources of moral hazard, opportunism and adverse selection. Lower cross-border transaction costs and lower procedural (property rights and contracts) transaction costs tend to discourage accumulation-driven growth, and encourage the aggregate efficiency improvements, and thus directly contribute to TFP growth. The negative effects of rising transaction costs are stable across various parts of global TFP distribution although the size of the effect tends to decrease among TFP high performers. Relatively greater importance and robustness of property rights-related and contractual transaction costs over administrative and cross-border transaction costs in explaining TFP gaps across countries is further evident in the extreme bounds analysis where we employ more than 3.5 million regressions to tackle the robustness of various transaction costs in explaining TFP paths.

Finally, our evidence suggests higher transaction costs restrain the entry into the efficient growth regime while encourage the entry in the regime based on inefficient resource accumulation. Employing a combined test of stationarity and structural break, we show that most countries are characterized by either declining or stationary TFP performance while only a handful of countries managed to embark on the path of stable and sustained TFP growth. Our results suggests lower property rights-related and contractual transaction costs are associated with TFP breakthroughs and turning points in TFP performance across countries whereas the role of administrative transaction costs as well as cross-border transaction costs in facilitating TFP breakthrough is ambiguous. Lower transaction costs are associated with TFP acceleration whereas higher costs of contract enforcement and property registration correlate strongly with collapses of efficient growth although our evidence implies that increasing the administrative transaction costs to deter moral hazard and opportunistic behavior can yield substantial gains in TFP performance over time. Countries which fail to decrease transaction costs related to low-cost enforcement of contracts and secure property rights are highly unlikely to enter the TFP frontier whereas lowering property rights-related and contractual transaction costs is directly associated with substantially improved odds of entering the 75th and 90th percentile of the distribution.