Taxonomies and typologies: starting to reframe economic systems [1]

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1. Introduction

In its heyday during the 1950s to 1980s, the field of comparative economic systems primarily focused on two economic systems, capitalist and socialist[2]. The former was characterised as being based on resource allocation through decentralised markets; the latter using a centralised resource allocation mechanism, planning, in order for the political authorities to determine the allocative and distributive outcome. The prime examples of these systems were the United States and Soviet Union respectively, though other economies, mainly European but also some developing countries such as China, were sometimes also considered. There was also allowance for some variation within each economic system. Thus, "market socialism" was put forward as an alternative to systems of Soviet-type planning (Brus and Laski, 1991; Kornai, 1992), and, when combined with workers' self-management of firms, was treated virtually as an economic system in its own right, represented by Yugoslavia under Marshall Tito (Estrin, 1984). Some distinction was also made between red-blooded US-type capitalism and the more welfare-oriented version operating in, for example, Sweden (Montias, 1976).

The relative performance of capitalism against socialism was the main subject of analysis in comparative economic systems; would one system consistently outperform the other or could they achieve comparable outcomes. Measures of performance used in this debate included static technical efficiency and allocative efficiency (Pareto efficiency); growth; and indicators of welfare such as the distribution of income and wealth (Wiles, 1977). At a theoretical level, Marxists believed that the capitalist market economy was fundamentally flawed and subject to intermittent and ever deepening crises (Marx, 2007). In contrast, for critics of socialism such as von Hayek (1944), the market economy provided the only resource allocation mechanism capable of providing economic efficiency. From the 1920s, much of the

[2] See for example the textbooks by Montias (1976), Wiles (1977), Gardner (1997); Gregory and Stewart (1999).

debate was therefore about whether a socialist system could be designed that would outperform the capitalist system (Levy and Pert, 2008). At its heart was the question of whether two fundamentally different economic systems could perform equally well; that is, whether there could be *equifinality* of economic outcomes. The tenor of the argument in the literature for the most part did not support the notion of equifinality (Kornai, 1992), though Lange (1936) posited that a planned economy could replicate the outcomes of a market economy. But the bulk of the Western literature was focused towards identifying in theory and in practice the shortcomings of the socialist system (Wiles, 1977; Ellman, 2014; Brus and Laski, 1991; Kornai, 1992; Gregory and Stewart, 1999). Perhaps more importantly, the actual outcome appeared to refute the possibility of equifinality because the Soviet and Eastern European models of socialist systems, in all their variants, abruptly collapsed between 1989 and 1990, a cataclysmic system failure associated with long-term poor economic performance (Lavigne, 1995; Blanchard, 1997; Sachs and Warner, 1995). Though several economies remained under communist rule, notably but not exclusively China, the perceived failure of socialism as an economic system was interpreted by many as "proof "that one economic system – capitalism – was superior in terms of performance and would therefore predominate globally; referred to by Fukuyama (1989) as the end of history!

The economic superiority of a single system is obviously an existential threat to the field of comparative economic systems. In the face of that, recent literature has made several attempts to reposition the subject, for example moving from an analysis of mechanisms of allocating resources, and the flows of information along the lines of Montias (1976) or Koopmans (1957) towards institutional economics by building on the work of North (1990; 1994) and Olstrom (2009). Thus, Djankov, Laporta, Lopez-de-Silanes and Shleifer (2003) proposed that comparative systems as a field should align itself with the ides of the New Institutional Economics (Williamson, 2000).

However, such realignment has proven difficult. First, the notion of an economic system itself was often surprisingly underdeveloped in the comparative systems literature. As we have seen, the emphasis was on the identification of typologies of economic system, defining socialism and capitalism at a theoretical level (Friedman, 1962) and exploring whether these systems were equifinal across economic outcomes. By typology, we refer to the classification of economic system based on theoretical or conceptual differences, for example state versus private ownership of the means of production (Nuti, 2018) while taxonomies refer to configurations based on empirical classification (Hotho, 2014). Therefore, despite the huge cross-country heterogeneity in history, culture, geographical factors, institutional arrangements and economic performance, economic systems have not, for the most part, been empirically determined taxonomies: groupings of countries that share close historical and institutional similarities. In this chapter, we make a preliminary investigation into the potential of developing the latter approach, in terms of its ability to explain observed outcomes in terms of performance.

The move from considering economic systems as taxonomies rather than typologies could represent an important research development. For example, it could improve our understanding of emerging and understudied economies, in comparison with more advanced ones. We have recently seen the emergence and sustained growth of many countries with economic systems that cannot be fitted easily into the coarse bilateral distinction between capitalism and socialism, yet whose behaviours can be grouped into categories that are distinct from each other. Some models already exist to distinguish between different forms of capitalist economies, most notably the Varieties of Capitalism (VOC) framework (Hall and Soskice, 2001) that focuses on the patterns of coordination between firms and other major economic actors on labour and capital markets. This framework identifies two broad forms of coordination – through the market, namely liberal market economies (LME) – and through

centralised organisations, whether voluntary or the state, notably coordinated market mechanisms (CME). The categorization has been shown to provide significant taxonomic content, in that similar actors behave very differently in these different institutional contexts (Hall and Gringerich, 2009; Hancke, 2009; Schneider and Paunescu, 2012), and, importantly, the system-level analysis is equifinal; there is no presumption about the superiority of one system over another, nor is there convincing evidence to that effect (Hancke, 2009). However, the VOC approach has remained largely Eurocentric, primarily focused to understand how supportive labour and capital market institutions have permitted the development of a flourishing social capitalism in, for example, Germany.

However, the world economy has changed fundamentally since the 1960s, when the US and Soviet were the world's two economic as well as political superpowers (O'Neill, 2011). Take the example of China, a country that fits uncomfortably into a crude capitalist-socialist framework, yet whose economic successes derive from the long-term enactment of economic policies based around a combination of the market economy, entrepreneurship, state led innovation and state ownership (Chow, 2017); sometimes termed "state capitalism". Equally, it is unclear how to fit rising countries like Indonesia, forecast to be fourth largest economy in the world by 2050 (PWC, 2019), into traditional framing around state versus private ownership of firms or planning versus markets as resource allocation mechanisms. More generally, while many of the recently emerging economies of the past twenty years do not fit into the category of socialist, they are also clearly not capitalist in the traditional sense. For example, the ownership structures and governance arrangements of their firms are different in relying on Business Group or state ownership (see Aguilera and Crespi-Cladera, 2016; Carney, Estrin, van Essen, and Shapiro, 2018; Khanna and Palepu, 2000a, b; Khanna and Yafeh, 2007).

We therefore provide in this chapter some preliminary evidence in support of the idea that research in comparative economic systems might begin to cover a wider variety of

countries and be more empirically based; a shift from typologies to taxonomies. Thus, we suggest to extend the field of analysis beyond the traditional focus on North America and Europe to begin considering in a systematic way the large number of developing, emerging and transition economies. As noted by Estrin, Mickiewicz, Stephan and Wright (2019), an important but hitherto under-explored characteristic of developing and emerging economies is their heterogeneity in terms of political economy, institutions and resource endowments. Furthermore, we provide preliminary evidence of the research value of a new approach to comparative economic systems in which the standard typological framework defining "systems" through underlying concepts, such as resource allocation mechanism or ownership of firms, is replaced by a taxonomy in which countries are put into groupings based on empirical observations.

The research value of comparing economic systems is based on the notion that the system itself will exercise a systematic influence on the behaviour of individuals and firms within it. Thus, in the traditional typological approach, it was posited that enterprise behaviour would be fundamentally different when firm motivation was plan targets rather profitability and resource allocation was through markets as against via plans (Wiles, 1977, Ellman, 2014). In this chapter, we argue that it is an important ongoing research agenda to devise a new classification of economic systems based on empirical observation rather than abstract reasoning, and then subject this to the test of empirical validity by exploring whether this taxonomy explains observed behaviour. However, we do not attempt in this chapter the massive task of developing an empirically based and new classification of economic systems. We are fortunate in that a group of researchers has already started work on that task. Fainshmidt, Judge, Aguilera, and Smith (2018) employed a wide variety of institutional data on many emerging, developing and transition economies, using expert panel input to obtain institutional profiles on 68 economies, as a basis for two step cluster analysis (Ronen and Shenkar, 2013) to identify

nine groupings (configurations) of countries. Their taxonomy, the Varieties of Institutional Systems (VIS) configuration system, is the basis for our empirical work.

Our objective in this chapter is therefore quite narrow; we report the first attempt to *validate* a typology of economic systems empirically on a large number of understudied economies, using the system of configurations devised by Fainshmidt et al (2018). Our research question is therefore whether, holding country-specific institutional factors and sector-specific technological characteristics constant, enterprise performance is contingent on the economic system, or configuration, as identified by Fainshmidt et al (2018). To explore this issue, we develop a dataset that combines the seven VIS configurations in the developing world with firm-level data from the World Bank Enterprise Survey (WBES), resulting in a sample of around 30,000 firms from 57 countries.

We find that the taxonomy of countries does indeed provide an independent and statistically significant explanation of firm level performance, even when controlling for standard national, sectoral and firm level characteristics. We also find some evidence for equifinality, at least among some of the systems. While this is only a preliminary study, this finding provides some support for the view that a shift from a typological to a taxonomic approach represents a potentially valuable way forward for the field of comparative economic systems.

In the following section, we discuss the development of the Fainshmidt et al (2018) configuration. We present the data and methods in the third section and the results in the fourth. Finally, we draw our conclusions.

2. A New Approach to Classifying Economic Systems

National institutional systems provide the formal and informal rules of the game to which domestic and foreign firms must adapt their governance and ownership structures (North, 1994). However, why should differences in institutional systems explain firm performance (Aguilera & Crespi-Cladera, 2016)? The VOC literature (Hall & Soskice, 2001) proposes two mechanisms linking firm performance and institutional system. The first concerns institutional complementarity (Amable 2016). An economy has several institutional spheres, notably the financial sector, the labour, and industrial relations regime, and the educational and skills training systems, etc. Institutional variation arises from the way different national institutional systems combine to form different patterns of coordination and to achieve cohesion. These institutional complementarities within countries can co-evolve with those of other countries to produce distinct governance configurations. The VOC model identifies two systems (Deeg and Jackson, 2008), the first of which is the Coordinated Market Economies (CME); a social democratic economic model of capitalism in which coordination occurs through local or national state activity in collaboration with institutions representing the main actors in each sphere. This contrasts with the standard Liberal Market Economies (LME), in which coordination occurs market by market through the process of competition. The CME is viewed as a viable alternative architecture of national competitiveness to the LME; thus, CME and LME are potentially equifinal.

The second key concept is isomorphism. Each variety of capitalism is said to produce an 'emblematic firm' (Boyer, 2005), an organisational form particularly well adapted to its national institutional system. The emblematic firm in the Liberal Market Economy (LME) is the managerially controlled firm (Estrin, Hanousek, Kočenda and Svejnar, 2009). Coordination between the conflicting ambitions of owners and managers and the asymmetry in the information they control is achieved by market disciplines: for example, from capital markets

through the market for corporate control, or from managerial markets and incentive payments. In contrast, the CME emblematic firm is characterised by a dual board system, whereby strategic shareholders coordinate directly to address the agency problems, with capital and often labour also directly represented at board level. The institutional system, therefore, supplies firms with 'institutional capital' so that firms fit, or become isomorphic with, prevailing modes of institutional functioning. Thus, as firms strive to access resources in their local environment, they are likely to develop similar practices adapted to their institutional configuration (Hall & Soskice, 2001).

This implies that economic systems and the firms within them will perform differently depending on the institutional arrangements within each country, and one can, in principle, identify empirically groups of countries with distinct economic systems. For example, the VOC literature distinguished between country-specific factors and systemic or configuration wide factors influencing firm level competitive advantage in capitalist economies in Europe and North America. Authors have also raised questions about the relevance of complementarity amongst the institutional contradictions and frictions of less developed economies and in the cases of dysfunctional varieties of capitalism (Hancké, Rhodes & Thatcher, 2007; Peck & Zhang, 2013). Once we widen the geographic lens to include the increasingly significant economies of Asia, Latin America and Africa, we observe that most countries are formally capitalist, in the sense that private ownership of firms usually predominates, and markets are the main mechanism for allocating resources. However, in these economies an even more variegated range of capitalisms can be identified than across Europe, including dynamic 'rising powers', some with significant state direction like China (Sinkovics, Yamin, Nadvi and Zhang, 2014); slower growing capitalist economies mired in a middle-income trap and low skill equilibria (Schneider, 2009); and even outright failures (Wood and Frynas, 2006).

Given the large number of possible relevant historical, cultural and institutional characteristics, Fainshmidt et al (2018) use empirical methods to identify from an institutionally and culturally heterogeneous set of countries a small number of economic systems. They employ a two-stage method. First, they developed a cross-country qualitative dataset, based on the role of five institutional dimensions of economic activity stressed previously in the VOC framework as defining the economic system. These are: (1) the state's role in the economy, (2) financial markets, (3) human capital, (4) social capital, and (5) corporate governance institutions. They collected detailed country level data on each dimension and used experts' qualitative inputs to construct a qualitative evaluation of each dimension. They then used a generalization model to transform qualitative data into categorical data for quantitative analysis (e.g., Putnam & Jones, 1982). Thus, the institutional profiles were subjected to a two-step cluster analysis in order to uncover natural groupings in the data. The Bayesian Information Criterion (BIC) is first calculated for each potential cluster, with cases grouped into pre-clusters. In the second step, the pre-clusters are used as input for a hierarchical clustering algorithm which reduces the range of solutions based on the BIC (Rundle-Thiele, Kubacki, Tkaczynski, and Parkinson, 2015). This method creates a set of nine configurations of economic system for the understudied institutional contexts of Asia, Africa, Latin America, Middle East, and Eastern Europe.

The way that enterprises might resolve internal contradictions and internalise external effects might be very different, for example, in the emerging LME, where reliance is placed on the market, and in the state-led, where the state retains high ownership or control of enterprises. Thus, the standard Western corporation probably represent the emblematic firms in the emerging LME and state-owned firms within the state led. Other VIS configurations may also have settled into a stable institutional equilibrium; for example, the family-led configuration may be dominated by powerful rent-seeking business groups, which resist institutional

developments that challenge their rents. Our proposition is that firm performance will be influenced by the configuration to which a country belongs, in addition to standard performance effects at the firm, national and sectoral level.

The full VIS classification of nine national configurations is presented in Fainschmidt et al. 2018 as Table A1 page 319 in their paper; the first two configurations can be clearly identified as the standard LME and CME economies, containing developed European and Anglo-Saxon economies. We do not consider these in our work, which only focuses on understudied economies and therefore considers only firms in some of the latter seven configurations. These are the so-called *state-led*; *fragmented* with fragile state; *family-led*; *emergent LME*; *collaborative agglomerations*; *hierarchically coordinated configurations* respectively. We exclude the Fainshmidt et al. (2018) configuration of "centralised tribe" because we do not have any countries in this configuration in our dataset.

Our research question is basic: we only ask whether, holding country-specific institutional factors and sector-specific technological characteristics constant, enterprise performance is contingent on the configuration. Thus, our proposition will be supported if we find that the configuration to which a firm in a country belongs exercises an independent and significant effect on enterprise performance, even when a full set of firm, sector and country controls have been taken into account. The null hypothesis is that this taxonomy of economic systems does not matter for firm performance, in which case the coefficient on the VIS dummy variables will all be insignificant.

We do not at this early stage of this line of research have well-formed expectations as to the character of the differences between the VIS configurations. But there are some important issues that we are testing, nonetheless. If the coefficients on the VIS systems are all the same, then this taxonomy of economics systems does not affect firm performance outcomes

and hence we have complete equifinality. It seems more likely that some systems will be better than others, though there may also be some that support similar levels of firm level performance. If two systems have the same level of efficiency, they are equifinal. As to which systems we might expect to perform better, for a sample of understudied countries it is hard to have strong priors without reverting to a typological approach. A large literature attests that particular institutional forms that would be inefficient in a developed market economy emerge as a functionalist response to ubiquitous market failures (Khanna and Yafeh, 2007) so parallels from advanced economies may be misleading. The evidence indicates that both models based on free market logic (emergent LME) as well as state capitalist economies (state-led) have done especially well in recent years, while systems allowing rent-seeking and cronyism (Acemoglu and Robinson (2012) may be less efficient (e.g. hierarchical, collaborative, family led).

3. Data and Methods

We use the World Bank Enterprise Survey (WBES)[3], an enterprise database collected by surveys of over 120,000 firms in more than 130 countries across Asia, Latin America, Eastern and Central Europe, and Africa between 2006 and 2016 (World Bank, 2011). The World Bank conducted the surveys at different dates (i.e. waves) with some countries having only one wave (e.g., Brazil and India), most having two waves and a few having three (e.g., Bulgaria and DR Congo). The dataset therefore covers a wide variety of firms; countries and time. The Varieties of Institutional Systems (VIS) taxonomy includes many of the countries surveyed by WBES. For example, of the 68 countries in the VIS taxonomy, the WBES dataset covers a remarkable sample of 57 countries. Table 1 shows their classification into six VIS configurations, it also

[3] http://data.worldbank.org/data-catalog/enterprise-surveys.

provides information about the number of firms in each country sample. Using these 57 countries gives us a sample of around 30,000 firms[4].

[Tables 1 about here]

3.1 Measuring Total Factor Productivity: Capital-Labour Substitution

Our empirical analysis focuses on the question of whether membership of the VIS configuration to which the country in which the firm is based significantly influences enterprise level efficiency, when we include a large variety of controls for country, sector and time, ownership and size category. We do this using total factor productivity (TFP), as our measure of company performance. However, TFP is measured as the residual in a production function and is therefore sensitive to specification of that function. This issue is of particular relevance when we are considering firm in economies where there has previously been little or no micro-economic analysis of enterprise performance. Choosing to impose standard specifications of the production function derived from developed economies may lead to errors in the calculation of the TFP residual, and these may be correlated with the characteristics of the economic system, thus leading to bias in our conclusions about the empirical validity of the taxonomic approach. This leads us to experiment with alternative specifications of technology in our empirical work.

We first derive estimates from the workhorse of firm-level analysis; the Cobb-Douglas (CD) production function (Solow, 1957); in this specification, the log of output is a function of the logs of labour and capital input and the constant (residual) indicates TFP. Note that the

[4] The stratified sample provided by the World Bank comprises 86,323 firms-data point in total for 57 countries worldwide. However, the coverage –non-missing values- of the variables of interest (e.g. labour fixed assets sales, etc.) for our empirical exercise reduces the number of observations to around 30,000. The latter sample still includes firms for all 57 countries, both foreign and domestic, state and private, for all size categories, within 15 sectoral decomposition and 11-year time-span in all our specifications.

Cobb-Douglas function is homogenous, and the specification allows for returns to scale not necessarily equal to unity: an important assumption in developing economies, which, because of factor synergies in the growth process, may display increasing returns. Thus, the sum of the coefficients on capital and labour, which indicate returns to scale, are not constrained to unity but do not vary with output; Much more restrictive is the assumption concerning the elasticity of substitution. In the Cobb-Douglas function, this is always assumed to be equal to unity. This is an especially strong assumption for firms in developing economies where the possibilities for factor substitution may be substantially lower. Indeed, Weitzman (1970) in part explained the slowdown in economic growth in the Soviet Union by a low elasticity of substitution, so that high levels of capital accumulation did not contribute in the same way over time to continued growth. Therefore, in this chapter, we consider a more flexible functional form, namely Kmenta's constant elasticity of substitution (CES) function (Kmenta 1967). In Kmenta's formulation, the Cobb-Douglas specification is nested within the CES function so we can test between them.

What are the common approaches to estimate the substitution between capital and labour? Hicks (1932) defined the elasticity of factor substitution as a ratio of ratios: the percentage change of the ratio of the two production factors as a ratio of the percentage change of the ratio of their marginal products. Fully competitive factor and product markets entail that inputs are paid their respective marginal products. We can then proceed to build the elasticity of substitution as a ratio of ratios, namely:

$$\sigma = d(K/L)/(K/L)/\ d(k^r/l^w)/(k^r/l^w)$$

and exploiting the properties of the logarithmic function

$$\sigma = -\ d\log(K/L)/d\log(k^r/l^w)$$

K and L are capital and labour, k^r and l^w are the former's rental price and the latter's wage rate. Suppose we have a quasi-concave production function; then the elasticity lies in the interval [0;1]. On the one hand, if the elasticity of substitution happens to be exactly zero (absence of substitution), $\sigma = 0$, and capital and labour result are perfect complements or used in a fixed proportion. The Leontief production function has such a property. If the elasticity lies in the interval (0;1), capital and labour are *gross* complements. On the other hand, if the elasticity of substitution is one (perfect substitutability) $\sigma = 1$, the relative change in quantity of factors is exactly proportional to the relative change in prices. As noted, the Cobb-Douglas (CD) has such property. Finally, if the elasticity lies in the interval $(1;\infty)$, capital and labour are gross substitutes.

Empirical estimates of the constant elasticity of substitution (CES) production function were developed by Solow (1956) and diffused by Arrow et al. (1961). Let's see its structure:

$$Y_t=C[\pi(A^K_tK_t)^{(\sigma-1)/\sigma}+(1-\pi)(A^L_t L_t)^{(\sigma-1)/\sigma}]^{\sigma/(1-\sigma)}$$

As before, σ is the elasticity of substitution while C is "the" efficiency parameter, and π is a measure of how the inputs are distributed within the production function. $(\sigma-1)/\sigma$ is ρ, a transformation of the elasticity called the substitution parameter. A^K_t and A^L_t denote the level of inputs' efficiency. If they vary over time, they show capital- and labour-augmenting technological change[5].

The nonlinearity of the CES production function curtails linearization. This why scholars have tended to resort to the simpler (but more rigid) Cobb-Douglas function, where there exists a simple analytical linearization. How could the CES production function be estimated other than in its nonlinear form. Kmenta (1967) suggested a linearized form that we

[5] Technological change can be Hicks-neutral, the condition to be satisfied being that $A^Kt=A^Lt$, so the marginal rate of substitution does not change when an innovation occurs.

follow. We follow this approach following. Kmenta (1967) who introduced a logarithmic form version of CES production function with Hicks-neutral technological change:

$$\log Y_t = \log C + \sigma/(1-\sigma) \log [\pi K_t^{(\sigma-1)/\sigma}+(1-\pi) L_t^{(\sigma-1)/\sigma}]$$

This is still not linear. Next, Kmenta suggested a second-order Taylor series expansion to the term log[.] around the point $\sigma = 1$ in order to allow to estimate a fully-fledged function linear in input factors:

$$\log Y_t = \log C + \pi \log K_t + (1 - \pi) \log L_t – (\sigma-1) \pi (1- \pi)/2\sigma (\log K_t - \log L_t)^2 \qquad (1)$$

We therefore test the efficiency of different configurations – the parameter C across groups of countries - by starting with the CD production function and then extending to Kmenta CES. Note that equation (1) collapses from CES to a CD function if $\sigma=1$.

3.2. Empirical Model

We estimate the empirical model on a rich firm-level dataset, which covers many "understudied" countries. In Table 1, we report the firms' sample for each of the six available VIS configurations. For example, Chile and South Africa have the highest number of firms in the "Emergent Liberal Market Economies" configuration; China, India and Indonesia account for a good proportion of "State-led" one; Egypt Ghana and Kenya are relatively more numerous in the "Fragmented Fragile state" configuration; Mexico Colombia and Brazil firms represent about 50% of the "Family led" configuration; "Collaborative agglomerations" present a quite good spread of Central and East European Countries; and finally Bulgaria, Turkey and Ukraine cover around 65% of the firms in the "Hierarchically coordinated" configuration.

In order to tackle omitted variable bias, which may occur when working with a varied dataset across countries, sectors, sub-national locations, and survey-years[6], we employ an extensive and granular set of fixed effects:

- Sector within sub-national Location Fixed Effects (location as city/town);
- Country Fixed Effects
- Sector Fixed Effects
- Year Fixed Effects
- Country-sector Fixed Effects
- Country-year Fixed Effects
- Sector-year Fixed Effects
- Country-sector-year Fixed Effects
- Size categories Fixed Effects
- Foreign ownership Fixed Effects
- State ownership Fixed Effects
- Size-categories-Foreign Ownership Fixed Effects
- Size-categories-State Ownership Fixed Effects

We cannot include configurations fixed effects in a direct way because they are perfectly collinear with the full set of the country dummies. However, we can predict their average value after running the regressions (Table 4) as averages of countries' linear prediction values. Therefore, the empirical model is based on the following estimating equation [7] (note that $\alpha = \log C$):

[6] We do not have any panel component in this dataset, though.

[7] We omit the subscript of sub-national location city/town for simplicity.

$$\log Y_{icst} = \alpha + \beta_1 \log K_{icst} + \beta_2 \log L_{icst} + \beta_3 (\log K_{icst} - \log L_{icst})^2 + \beta_4 \log Age_{icst} + \sum\sum D^{Sector} D^{Location(sub\text{-}national)} + \sum D^{Country} + \sum D^{Sector} + \sum D^{Year} + \sum\sum D^{Country} D^{Year} . + \sum\sum D^{Country} D^{Sector} .+ \sum\sum D^{Sector} D^{Year} + \sum\sum\sum D^{Country} D^{Sector} D^{Year} + \sum D^{size\_cat} + \sum D^{foreign} + \sum D^{state} + \sum\sum D^{size\_cat} D^{foreign} .+ \sum\sum D^{size\text{-}cat} D^{state} .+ \varepsilon_{icst} \quad (2)$$

Log Y_{tics} is the dependent variable expressed as log deflated sales in constant 2010 prices[8] for firm "i" in country "c", in sector "s" at time "t". We denote α the efficiency parameter on which "equifinality" will be tested; $\beta_1 = \pi$, parameter of capital (expressed as net deflated cost of repurchase of the entire fixed assets of a company at constant 2010 prices) on which the distribution of capital is measured; $\beta_2 = (1 - \pi)$ parameter of labour (expressed as full time employees) on which the distribution of labour is measured. The more general functional form entails the existence of further "functional form" parameter, $\beta_3 = -(\sigma\text{-}1)\ \pi\ (1\text{-}\ \pi\ )/2\sigma$, also known as the Kmenta correction parameter that is assumed to be zero when estimating the CD production function; finally, β_4 is the elasticity of sales to the age of the firm and ε_{icst} is the idiosyncratic error term.

4. **Results**

In Table 2, we report the results of estimating equation (2) for both the CD and CES specifications and where the sample is for all countries. The first two columns (left panel) report the traditional Cobb Douglas function, with no Kmenta "correction", whereas the latter two columns (right panel) show the Kmenta CES production function. In turn, columns 1 and 3 look at the whole sample of firms for CD and CES respectively (we call it full sample), whilst columns 2 and 4 are estimates based on a sub-sample (we call it reduced sample) of firms that excludes all small firms with less than 20 employees, as well excludes all state-owned and

[8] Deflators from the World Development Indicators linked-adjusted time series.

foreign-owned firm (regardless their size). In other words, the reduced sample includes firms with more than 20 employees that are only privately-owned domestic firms. This is to ensure that the results are not driven by outliers: small firms, very large ones or foreign owned firms with much higher productivity. The comparison within panels -column 1 vs. 2 and column 3 vs. 4- indicates the impact of different samples of firms on the estimation of efficiency, keeping the production functional form constant. The comparison between panels -column 1 vs. 3 and column 2 vs. 4- indicates the impact of different functional forms on the estimation of firm level efficiency, keeping the firms' sample of firms. Within the CES functional form, if the Kmenta correction coefficient - $\beta_3 = -(\sigma-1)\,\pi\,(1-\pi)/2\sigma$ - is significantly different from zero then the elasticity of substitution is statistically different (less than) 1. In our case, the Kmenta CES is preferred to the CD functional form.

[Tables 2 about here]

The functional form of the CD vs. the CES function is found to be important for the estimated coefficients. When we allow for elasticity of substitution different to unity, (CES) we notice a change in the labour and capital coefficients: the former increases and the latter decreases if the CES is adopted. This signals a key role played by the labour inputs in "understudied" countries, where capital is relatively less abundant. The Kmenta methodology allow us to flag this finding. However, in the CD regressions, returns to scale are estimated to be slightly above unity, implying slight increasing returns to scale. However, CD is not the preferred specification of technology: Kmenta correction coefficient is clearly always significant (at 1% level), leading us to reject the CD specification and indicating the need for a more complex specification of the relationship between labour and capital inputs.

From its theoretical foundation, we know $\beta_3 = -(\sigma-1)\,\pi\,(1-\pi)/2\sigma$ so we can compute the *implied* elasticity of substitution in our regressions: it oscillates between 0.87 and 0.92,

clearly and statistically[9] less than one. The conclusion is therefore that the estimated elasticity of substitution for the production function of a large sample of firms in understudied countries is less than 1. The gross complementarity we identify between capital and labour in these understudied economies may be a consequence of rigidity in the functioning of factor markets. Incidentally, this result cannot be driven by an embedded technological feature (e.g. k/l ratio) since the regressions control for sector and sector-time dummies. Suppose that one sector is intrinsically a high K/L ratio sector, then the sector dummies will capture that; furthermore, suppose that the K/L ratio has changed through time (e.g. robotisation in some manufacturing sectors), the sector-year dummy would capture that too. In other words, the sector and sector-time dummies variables allow for a control of the Hicks-neutrality assumption.

Next we note that TFP is not related to the age of the firm, at least in the regressions with all firms (column 1 and 3). The age variable only plays a role in the reduced sample (excluding small, state and foreign companies), indicating that the "attribute of time" might impinge differently (possibly in different directions) on different categories of firms (e.g. a state firm might not "suffer" by being too young if subsidised).

Finally, in Table 3 and 4 we test our hypothesis by considering the independent effect of configurations of TFP. To do this, we calculate for each configuration an *efficiency parameter*, which we construct by taking the average of the relevant individual country's efficiency values within each of the six configurations. Thus, after the estimation of the equations in Table 2, we predict the level of efficiency in each country given the estimated coefficients, using Angola as the reference point (see Table 3). On this basis, we calculate the average efficiency of each configuration given the country groupings, with the LME configuration as the reference point,

[9] The null hypothesis that is equal to 0.87 column 3 or 0.92 columns 4 in not rejected, see table.

see Table 4[10]. On this basis, we find clear support for our hypothesis: we identify a significant and independent effect from the VIS of the country in which the firm is located. Hence our result indicate that this taxonomy of economic systems does influence economic outcomes.

As noted, we do not have strong priors about the rank order of configurations in terms of TFP; it is precisely to this question that an analysis of system taxonomy could be devoted. But, we identify equifinality between several of the systems. Thus, as expected, the most market oriented economic system, the Emergent Liberal Market Economy configuration, is found to outperform most of the others in terms of efficiency. Unsurprisingly, the state capitalist (state-led) economies where growth has been so pronounced in recent years, also performs very well. Indeed, these two systems are equifinal, belatedly suggesting a modicum of empirical support for Lange's view of effectively run socialist systems! Also as expected, all the other systems are much less efficient than these two though rather similar to each other. Each of the four is not significantly different from the one below or above, though there is a small significant difference between the top and bottom configuration. The hierarchically coordinated configuration is found to be the least efficient one. This is consistent with the traditional argument in comparative economic systems that, while coordinated economies (e.g. Ukraine, Kazakhstan, etc.) may be very effective at marshalling resources – labour and capital – they perform less well one considers total factor productivity (Wiles, 1977; Ellman, 2014).

[Table 3 about here]

[Table 4 about here]

[10] The conditional expected values of the dependent variable (Log Sales) of Table 2 are averaged across countries (Table 3) and, in turn, are averaged across configurations (Table 4). All 57 countries in the sample are used for the prediction and therefore averages.

We conclude that when estimating TFP for developing and emerging markets, it is important to relax the standard assumption common in work on developed economies that the elasticity of substitution between capital and labour is one; in fact, rigidities in these systems mean that it is estimated to be below one, suggesting that there is gross complementarity between inputs. Our estimates therefore provide well specified and robust indicators of average firm level TFP in each of our understudied countries. Even with a variety of fixed effects and controls, we are still able to identify empirically significant effects from our empirically determined taxonomy of countries, following a logic that is perhaps consistent with priors about the advantages in efficiency terms of market economies.

5. Conclusions

We have argued in this paper for a new approach to comparative economic systems in which the traditional typological approach is replaced by a taxonomic one in which empirical analysis of characteristics is used to place countries into configurations. We have also called for an extension of the field of study to include heterogeneous group of developing, emerging and transition economies.

This is a preliminary piece of work and subject to several important limitations. Most significantly, we did not propose our own classification of economic systems; rather we used a pre-existing typology developed for a different purpose. This has made some of our results, notably the rankings of different systems in terms of efficiency, difficult to interpret. It has also limited the scope of our research question as to whether the VIS taxonomy of the major new emerging economies has explanatory power over firm-level economic behaviour. Nonetheless, our empirical work, based on estimating Cobb Douglas and Kmenta Constant Elasticity of

Substitution production functions across around 30,000 firms in 57 countries, finds that this taxonomy of understudied economies does significantly explain average firm level performance, even when a granular set of national, sectoral, temporal and firm level fixed effects are taken into account. We also find evidence for some degree of equifinality, both between the top two systems and among the bottom four. While tentative , the result of equifinality between Emergent Liberal Market and State-Capitalist economies might be interpreted as supporting mildly Lange's view that socialist regimes can be effective-an indicator of the promise of this approach. Even so, future work one might to consider additional indicators of firm performance, for example growth, employment creation, or internationalisation. These are important items for future work.

Our empirical work allows us tentatively to conclude that a shift from a typological to taxonomic approach represents a potentially valuable way forward for the field of comparative economic systems. This opens quite a large research agenda. In the first place, there is a need for further research to begin to establish a more robust and defensible configuration system from the perspective of comparative economic systems. While the Fainshmidt et al (2018) approach represented a valiant first step, the set of institutional variables they used was perhaps more restricted, and the underlying methodology more qualitative, than comparative economic systems scholar might prefer. Thus, one might wish to base the identification of appropriate institutional parameters on the work of North (1990) and Williamson (2000), and to identify taxonomies using small sample empirical methods such as fuzzy set analysis (Ragin, 2008). One might also wish to extend the reach of the work to cover developed as well as developing economies, to provide a global classification of economic systems. Once such a taxonomy has been created, the real work can begin - identifying empirically the areas of strength and weakness of different systems, and the institutional arrangements supportive of key organisational forms in each configuration.

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Table 1: Summary Stats of Countries' Samples (following Carney, Estrin, Liang, Shapiro 2019)

Configuration 1 State Led			Configuration 2 Fragmented/fragile			Configuration 3 Family-led			Configuration 5 Emergent LME			Configuration 6 Collaborative Agglomerations			Configuration 7 Hierarchically coordinated		
Country	Freq.	Percent	Country	Freq.	Percent	Country	Freq.	Percent	Country	Freq.	Percent	Country	Freq.	Percent	Country	Freq.	Percent
Argentina	986	8.09	Angola	242	4.89	Azerbaijan	92	1.3	Botswana	172	7.7	Czech Republic	115	13.63	Bulgaria	545	20.94
Bangladesh	1,095	8.99	Cameroon	74	1.5	Brazil	1,125	15.89	Chile	1,104	49.44	Estonia	108	12.8	Georgia	124	4.76
Belarus	97	0.8	DR Congo	357	7.21	Colombia	1,140	16.1	Israel	147	6.58	Hungary	101	11.97	Jordan	258	9.91
China	1,344	11.03	Egypt	1,498	30.27	Mexico	1,887	26.66	Namibia	133	5.96	Latvia	66	7.82	Kazakhstan	153	5.88
India	2,940	24.14	Ethiopia	332	6.71	Morocco	133	1.88	South Africa	677	30.32	Lithuania	119	14.1	Lebanon	125	4.8
Indonesia	1,632	13.4	Ghana	506	10.22	Nigeria	1,350	19.07				Poland	112	13.27	Romania	168	6.45
Malaysia	337	2.77	Kenya	664	13.42	Peru	842	11.89				Slovak Republic	79	9.36	Turkey	867	33.31
Mongolia	192	1.58	Rwanda	59	1.19	Tunisia	322	4.55				Slovenia	144	17.06	Ukraine	363	13.95
Pakistan	262	2.15	Senegal	353	7.13	Yemen	188	2.66									
Philippines	709	5.82	Sudan	10	0.2												
Russia	698	5.73	Tanzania	433	8.75												
Sri Lanka	258	2.12	Uganda	421	8.51												
Thailand	563	4.62															
Vietnam	1,068	8.77															
Total	12,181		Total	4,949		Total	7,079		Total	2,233		Total	844		Total	2,603	

Table 2 Estimating Productivity in Cobb-Douglas and Kmenta (1967)

	(1)	(2)	(3)	(4)
	Cobb Douglas Full sample	Cobb Douglas Reduced sample	Kmenta (1967) Full sample	Kmenta (1967) Reduced Sample
Log(Labour)	0.790***	0.792***	0.941***	0.905***
	(0.015)	(0.019)	(0.029)	(0.039)
Log(Fixed Assets)	0.251***	0.250***	0.099***	0.135***
	(0.007)	(0.009)	(0.025)	(0.036)
$[\text{Log(Fixed Assets)-Log(Labour)}]^2$	Not applicable	Not applicable	0.007***	0.005***
			(0.001)	(0.001)
Log(Age)	0.017*	0.036**	0.015	0.035**
	(0.010)	(0.014)	(0.010)	(0.014)
Test Const. Ret. Scale	$\alpha^k + \alpha^l = 1$	$\alpha^k + \alpha^l = 1$	$\alpha^k + \alpha^l = 1$	$\alpha^k + \alpha^l = 1$
F (Prob > F)	9.26 (0.0024)***	6.45 (0.0111)**	8.71 (0.0032)***	6.16 (0.0131)**
Test Implied Elasticity of Substitution	1 (Assumed)	1 (Assumed)	0.87	0.92
Chi (Prob > Chi)			0.01 (0.9290)	0.01 (0.9064)
Observations	29111	16195	29111	16195
Adjusted R-squared	0.88	0.87	0.89	0.88
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country-sector FE	YES	YES	YES	YES
Country-year FE	YES	YES	YES	YES
Sector-year FE	YES	YES	YES	YES
Country-sector-year FE	YES	YES	YES	YES
State firms FE	YES	YES	YES	YES
Foreign firms FE	YES	YES	YES	YES
Size Category FE	YES	YES	YES	YES
Size Category-State FE	YES	YES	YES	YES
Size Category-Foreign FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Linear Prediction of Countries efficiency parameter

	Cobb Douglas Full sample	Cobb Douglas Reduced sample	Kmenta Full sample	Kmenta VIS Reduced sample
Angola (omitted)	16.315***	17.538***	16.282***	17.518***
	(0.098)	(0.199)	(0.098)	(0.200)
Argentina	0.714***	0.112	0.696***	0.095
	(0.109)	(0.206)	(0.110)	(0.206)
Azerbaijan	-0.005	-0.775**	0.03	-0.746**
	(0.192)	(0.316)	(0.193)	(0.317)
Bangladesh	1.248***	0.785***	1.232***	0.768***
	(0.108)	(0.204)	(0.109)	(0.204)
Belarus	1.750***	1.190***	1.852***	1.258***
	(0.193)	(0.292)	(0.194)	(0.293)
Botswana	0.332**	0.017	0.316**	-0.001
	(0.152)	(0.267)	(0.152)	(0.267)
Brazil	0.351***	-0.173	0.375***	-0.161
	(0.108)	(0.205)	(0.109)	(0.205)
Bulgaria	0.079	-0.503**	0.096	-0.492**
	(0.118)	(0.212)	(0.119)	(0.212)
Cameroon	1.641***	0.990***	1.699***	1.029***
	(0.205)	(0.282)	(0.205)	(0.282)
Chile	1.932***	1.273***	2.029***	1.340***
	(0.108)	(0.205)	(0.109)	(0.205)
China	1.439***	0.544***	1.425***	0.530***
	(0.107)	(0.203)	(0.107)	(0.203)
Colombia	1.680***	1.315***	1.816***	1.411***
	(0.108)	(0.205)	(0.108)	(0.206)
Czech Republic	1.092***	0.29	1.086***	0.274
	(0.184)	(0.268)	(0.184)	(0.268)
DR Congo	0.426***	0.314	0.461***	0.351
	(0.127)	(0.259)	(0.128)	(0.259)
Egypt	0.300***	0.003	0.301***	-0.006
	(0.106)	(0.204)	(0.106)	(0.204)
Estonia	0.553***	0.367	0.568***	0.363
	(0.183)	(0.295)	(0.184)	(0.295)
Ethiopia	0.656***	0.359	0.645***	0.341
	(0.131)	(0.221)	(0.131)	(0.222)
Georgia	-0.365**	-0.533**	-0.327*	-0.517*
	(0.179)	(0.270)	(0.180)	(0.271)
Ghana	0.193	0.333	0.316***	0.416*
	(0.120)	(0.226)	(0.120)	(0.226)
Hungary	1.659***	0.788***	1.684***	0.794***
	(0.190)	(0.278)	(0.191)	(0.279)
India	0.879***	0.223	0.864***	0.208

	(0.102)	(0.201)	(0.102)	(0.201)
Indonesia	1.799***	1.641***	1.920***	1.739***
	(0.105)	(0.203)	(0.105)	(0.204)
Israel	0.366**	-0.056	0.355**	-0.076
	(0.163)	(0.250)	(0.164)	(0.250)
Jordan	0.246*	-0.224	0.287**	-0.201
	(0.137)	(0.226)	(0.138)	(0.226)
Kazakhstan	1.571***	0.984***	1.600***	1.002***
	(0.159)	(0.237)	(0.160)	(0.238)
Kenya	1.488***	0.927***	1.498***	0.929***
	(0.115)	(0.209)	(0.115)	(0.209)
Latvia	0.34	-0.569*	0.376	-0.527
	(0.230)	(0.345)	(0.231)	(0.346)
Lebanon	1.607***	1.350***	1.805***	1.516***
	(0.178)	(0.267)	(0.179)	(0.267)
Lithuania	0.272	0.055	0.273	0.046
	(0.178)	(0.270)	(0.179)	(0.271)
Malaysia	0.717***	0.076	0.741***	0.094
	(0.129)	(0.215)	(0.129)	(0.215)
Mexico	0.674***	0.442**	0.662***	0.428**
	(0.104)	(0.203)	(0.105)	(0.203)
Mongolia	1.749***	1.106***	1.858***	1.179***
	(0.148)	(0.231)	(0.149)	(0.232)
Morocco	1.042***	0.268	1.086***	0.311
	(0.166)	(0.237)	(0.167)	(0.238)
Namibia	0.153	0.102	0.139	0.081
	(0.168)	(0.288)	(0.168)	(0.288)
Nigeria	-0.319***	-0.296	-0.290***	-0.28
	(0.107)	(0.209)	(0.107)	(0.210)
Pakistan	0.231*	-0.052	0.251*	-0.033
	(0.137)	(0.226)	(0.137)	(0.226)
Peru	0.532***	0.05	0.533***	0.046
	(0.111)	(0.207)	(0.112)	(0.207)
Philippines	1.009***	0.258	1.006***	0.252
	(0.114)	(0.209)	(0.114)	(0.210)
Poland	-0.008	-0.024	-0.02	-0.032
	(0.181)	(0.282)	(0.182)	(0.282)
Romania	0.223	-0.129	0.227	-0.131
	(0.167)	(0.264)	(0.168)	(0.265)
Russia	1.155***	0.699***	1.155***	0.694***
	(0.116)	(0.209)	(0.116)	(0.209)
Rwanda	1.288***	0.475	1.359***	0.527*
	(0.226)	(0.300)	(0.227)	(0.300)
Senegal	0.409***	0.528**	0.440***	0.556**
	(0.128)	(0.243)	(0.128)	(0.243)
Slovak Republic	0.825***	0.326	0.829***	0.318

	(0.212)	(0.303)	(0.213)	(0.303)
Slovenia	0.23	-0.092	0.235	-0.086
	(0.163)	(0.257)	(0.164)	(0.258)
South Africa	0.813***	0.252	0.798***	0.237
	(0.114)	(0.209)	(0.115)	(0.209)
Sri Lanka	0.455***	0.631***	0.445***	0.615***
	(0.138)	(0.233)	(0.139)	(0.233)
Sudan	-0.669	-1.841**	-0.305	-1.570*
	(1.075)	(0.891)	(1.079)	(0.892)
Tanzania	1.164***	1.209***	1.252***	1.289***
	(0.123)	(0.222)	(0.124)	(0.223)
Thailand	0.824***	0.264	0.823***	0.26
	(0.117)	(0.209)	(0.118)	(0.209)
Tunisia	0.872***	0.12	0.897***	0.139
	(0.130)	(0.216)	(0.131)	(0.217)
Turkey	0.703***	0.121	0.712***	0.127
	(0.111)	(0.205)	(0.111)	(0.206)
Uganda	1.009***	0.893***	1.109***	0.972***
	(0.124)	(0.232)	(0.124)	(0.232)
Ukraine	0.317**	0.149	0.314**	0.142
	(0.127)	(0.220)	(0.127)	(0.220)
Vietnam	3.092***	2.126***	3.385***	2.335***
	(0.109)	(0.205)	(0.109)	(0.205)
Yemen	0.215	0.723***	0.231	0.748***
	(0.150)	(0.269)	(0.150)	(0.270)

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Angola reference value.

Table 4: Linear Prediction of Configuration groupings efficiency

		Cobb Douglas Full sample	Cobb Douglas Reduced sample	Kmenta Full Sample	Kmenta Reduced Sample
Constant (LME)	**1st**	**17.585*** **	**18.331*** **	**17.592*** **	**18.341*** **
		(0.035)	(0.039)	(0.035)	(0.039)
State-led	1st/2nd	0.024	-0.103**	0.02	-0.110***
		(0.038)	(0.042)	(0.038)	(0.042)
Fragmented	3rd	-0.630***	-0.372***	-0.635***	-0.387***
		(0.042)	(0.049)	(0.043)	(0.050)
Family-led	4th/5th	-0.689***	-0.481***	-0.699***	-0.492***
		(0.040)	(0.045)	(0.041)	(0.046)
Collaborative	5th/4th	-0.683***	-0.623***	-0.718***	-0.655***
		(0.070)	(0.086)	(0.071)	(0.088)
Hierarchically	*6th*	*-0.780****	*-0.760****	*-0.800****	*-0.777****
		(0.048)	(0.053)	(0.049)	(0.054)

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Reference Liberal Market Economies