Towards a Competency-based Economics of Differentiation

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Abstract: The motivation for this paper is to investigate the policy implications of recent work focusing on the relative potential for economic growth as evidenced by the relative performance of one nation in comparison with another. As such, this investigation sets to one side consideration of the contribution that effective demand might make to growth in productivity and income. Instead, emphasis will be placed on growth in both the specialisation and diversification of industrial capabilities. To this end, the paper attempts to weave together Veblen’s (1898) conception of cumulative causation with Herbert Simon’s (1991) notions of generalized liquidity preference, Erik Reinert’s arguments about the importance of diversified artisanal skills, and César Hidalgo’s competency-based network analysis of international trade. The latter provides the vehicle for integrating theoretical insights with empirical analysis by treating competencies as a kind of latent variable, whose effects can be inferred but not directly measured.

Introduction

In a recent paper questioning neoliberal approaches to economic development in the wake of the Global Financial Crisis, Robert Wade calls for a return to a more interventionist industry policy regime. In opposing the stance of the World Bank and IMF on issues such as good governance and the desirability of unconstrained foreign direct investment, Wade (2010) makes some insightful observations about the dangers of a market-driven policy, which, he observes, largely ignores the evidence in favour of import substitution strategies targeted at local producers of intermediate inputs and components. He also raises doubts about the neoliberal claim that an open market system provides the greatest opportunity for upward mobility. Nevertheless, the reader is left unsure about why (and how) domestically-based suppliers should be subsidised by government.

The motivation for this paper is to investigate the policy implications of recent empirical work focusing on the relative potential for economic growth as evidenced by the relative performance of one nation in comparison with another. As such, this investigation sets to one side consideration of the obvious contribution that effective demand can make to growth in innovation-related activity, productivity and income. Instead, emphasis will be placed on growth derived from both the specialisation and diversification of industrial capabilities. More specifically, it will examine the developmental consequences of persistent differences in the set of competencies possessed by different nations. Any convincing ‘competency-based’ explanation of relative performance must confront the empirical problem of dealing with the unobservable or latent character of the variables deemed responsible for economic growth and competitive advantage.

Early post-World War II development economists such as Nurske, Prebisch and Hirschman were export pessimists, who believed that open trade could not serve as an engine of growth for developing nations due to what they saw as an enduring and profound secular decline in terms of trade for primary export commodities. In the 1970s development theory took a notable laissez-faire turn with economists such as Little, Scitovsky and Scott, Donges and
Balassa arguing that import-substitution was only appropriate during the early stages of industrialization, and then, only when directed at the production of non-durable consumer goods. Along neoliberal lines, they cautioned about the inefficiencies of government intervention itself, especially when accompanied by minimum wage laws, interest rate controls, tariffs on imported capital goods, high and multiple exchange rates, tax concessions on investment and capital and other price distortions\(^1\).

Meanwhile, the Evolutionary Economics tradition was “lurking in the background” while these debates in trade and development theory unrolled. Nelson and Winter trace the roots of their theoretical framework back to its roots both in Schumpeter’s aristocratic reinterpretation of the Marxist notion of innovation as a process entailing the extraction of (dead and living) labour out of production, and in Thorstein Veblen’s institutionally-grounded notion of cumulative causation. Three additional components discernible in contemporary approaches to the economics of strategy include the concept of a competency, as first conceived by George Richardson; and, Michael Polanyi’s notion of tacit inference. Nelson and Winter draw all of these notions together in their concept of a constellation of routines, which operate at a level below that of sophisticated rule-based judgement, yet somewhere at or above the level of standard operating procedures.

In the ‘competency-approach’ emphasis is placed on the development, accumulation, combination, and protection of unique skills and capabilities; alongside the coordination, renewal, and deployment of competencies congruent with changes in the environment (Teece, Pisano, and Shuen, 1997). As such, routines or competencies are conceived as integrated clusters operating across product lines, extending beyond individual firms, changing more slowly than products, and serving as the only effective locus of competitive rivalry.

More specifically, the ‘dynamic competency theory of David Teece (2000), views competitive advantage as largely based on tacit knowledge, which operates as a barrier to replication on the part of rival firms. These competencies—conceived to be embodied in individuals and organizations—become ever more critical as trade barriers are reduced, and copyrights are strengthened by virtue of their unique, non-imitable qualities. While their impact can only be amplified by network economies, customer ‘lock-in’, and the consolidation of dominant technology and product standards, the tacit knowledge that grounds them can only be transferred through face-to-face interaction, and learning-by-doing.

While evolutionary theories do well in explaining how competencies can develop at the level of firm routines they suffer, in a strictly empirical sense, from the absence of any convincing metrics for the measurement of competencies (or the related concept of capabilities) insofar as these competencies, in turn, are seen to exert an influence over sustainable competitive advantage at the level of the firm, region, or nation. This is especially the case for tacit knowledge, with almost all proposed metrics focusing, of necessity, on those particular aspects of knowledge (i.e. codifiability) which can be measured with relative ease.

This paper will examine the recent development of a technical approach that seeks to explain sustainable competitive advantage in such a way that it can overcome the problem of having to measure competency by proxy due to the fact that it is effectively an unobservable or latent variable. These techniques, associated with the work of the mathematical physicist, Césare Hidalgo are, nevertheless, unaccompanied by a fully convincing theoretical explanation for the effectiveness of competencies in determining competitive advantage in trade. In an attempt to overcome this weakness, the paper turns to an unusual source: the work of Reinert on economic thought in the Renaissance, which is compared with the Classical political economy of Adam Smith. From this Renaissance perspective, the Classical interpretation of advantages in trade is found to be wanting.
As a precursor to this examination in Section 1, we first review the notion of cumulative causation as defined by Thorstein Veblen. Here, emphasis will be placed on the evolutionary aspects of Veblen’s (1898) theory of institutional development. In this section we also introduce Herbert Simon’s (1991) conception of generalized “liquidity preference”. Reinert’s views on the role of the state are considered in Section 2. Hidalgo’s network-theoretic interpretation of trade data is described in Section 3. A critical evaluation of Hidalgo’s approach and an attempt at a synthesis follows in the concluding Section 4 of the paper.

The Influence of Veblen and Simon

Cumulative causation, as Veblen (1898) interprets it, is linked to the Darwinian notion of a process of cumulative change resulting from a continuity of cause and effect, where there is no trend, no final term, and no consummation or achievement of repose and settled equilibrium (Hodgson, 2004).

Veblen (1898) complains that the hedonistic conception economics is predicated on a conception of human nature as being passive, substantially inert and immutably given so that the decision-maker is conceived as an isolated individual in a stable equilibrium except for the continual buffeting of impinging forces, which he deals with like some “lightning calculator of pleasures and pains”. In contrast Veblen asserts that what is true of the individual is true of the group, and habits of thought are transformed when there is a change in a “community’s methods of turning material things to account”. Moreover, the base of action is “an entire organic complex of habits of thought” that are shaped by past process, and are only “vaguely isolable” from their context of teleological activity, being affected by habits of life that are formed under guidance of all interests (economic, aesthetic, sexual, humanitarian and devotional) acting in concert. Although human persons are purposeful, for Veblen, human intentionality itself is a capacity that has evolved through natural selection. Intentions can be causes but intentions are always caused.

While Thorstein Veblen was a major influence over Nelson and Winter’s conception of evolutionary economics, another important influence emanated from Herbert Simon’s conception of satisficing behaviour under conditions of bounded rationality. This conception bolstered their arguments that rational, law-governed behaviour only covered a small domain of the entire set of economically relevant procedures and practices.

In his (so-called) Nobel prize speech, Simon (1991) comments favourably on his work developing a generalized notion of liquidity preference, which was applied to an analysis of the labour contract. For our purposes, however, this notion is gainfully applied to networks of industrial production and trade. Simon’s (1991) explanation for the advantages of flexible labour contracts is closely analogous to one Marschak had proposed (1949) for liquidity preference: “[u]nder conditions of uncertainty it is advantageous to hold resources in liquid, flexible form”. In explaining these advantages Simon suggests that “a combination of two factors could account for preference for the employment contract over other forms of contracts: uncertainty as to which future behaviors would be advantageous to the employer, and a greater indifference of the employee as compared with the employer (within the former’s area of acceptance) as to which of these behaviors he carried out.”

Needless to say, this kind of flexibility is not restricted to labour market contracts. From a broader asset-theoretic perspective, the first of Simon’s factors could be described in terms of robustness in the face of uncertainty, achieved through promotion of a diversity of potential activities that might eventually become advantageous, while the second could be described in terms of a willingness both to invest in such capacity building and to openly confront these uncertainties. It would seemingly underlie the kinds of competency that Reinert and Hidalgo
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consider of crucial importance in explaining the relative development of nations, regions, and industrial districts.

Reinert on the ‘Renaissance State’

Reinert (1999) introduces the notion of the “Renaissance State” to advantageously compare it to the approach championed by economists who adhere to the “standard assumptions” of neoclassical theory, with that favoured by their Renaissance counterparts, especially in relation to the formative role of the state.

For him, the Renaissance state is both “activist” and “idealistic” in “bringing the nation into economic activities creating a common weal through increasing returns and self-reinforcing feedback mechanisms” (Reinert, 1999: 269). The standard neoclassical assumptions, he suggests (Reinert, 1999: 270), are: (a) that a “natural harmony” operates in a world void of any systemic effects; which, (b) will make all players equally rich if only we can provide a “level playing field” and “get relative prices rights”. To this end, Reinert introduces a distinction between classical and ‘collusive modes of economic growth. Collusive modes of economic growth lead to high growth of wages in local labour markets, whereas classical modes spread benefits internationally through a sustained fall in the prices of goods and services. He argues that “increasing return activities” are spread in the collusive mode.

In Section 3 of his paper, Reinert sets out an inventory of the various roles that, in historical terms, have been adopted by the State in promoting the common weal. He observes (Reinert, 1999: 279-4) that the State provides institutions (for education, science, charity, sanitation etc.), manages income distribution and insurance of income (especially through boosting the price and health of labour), and provides economic growth (by getting the nation into the right positive-feedback businesses, creating skill-based comparative advantages in these businesses, supplying essential infrastructure, setting standards for industry, providing skilled labour and entrepreneurship where necessary, creating a strong and robust legal system, and acting as a capitalist of last resort.

Reinert (1999: 295) next introduces a crucial distinction between symmetrical and asymmetrical trade. Where asymmetrical trade characterises the Third World and involves trade with diminishing returns or negative feedback loops of decumulative causation, symmetrical trade characterises the First World and involves trade with increasing returns or positive feedback loops of cumulative causation and path dependency. Symmetrical trade is an argument for free trade and no intervention. The New Growth Theory combines increasing returns with perfect competition (in reality most models allow for monopolistic competition with no barriers to entry or exit, but this conception differs markedly from the world that Reinert envisages).

In section 9 of his paper Reinert examines Adam Smith’s arguments against the value-creating potential of skills and knowledge. According to Reinert (1999: 310), Adam Smith denies the importance of knowledge, institutions or systemic effects. Accordingly, other reasons must be adduced for why some people are paid more than others. Reasons adduced by Smith include: that higher wages are paid for less agreeable, or low status employment, those with higher cost of acquiring skills, those with inconstancy of employment, those where higher levels of trust must be vested in the workers, and those with a lower probability of successful completion of the requisite professional training (Reinert, 1999: 311-12).

Briefly, Reinert draws on his distinction between cumulative and decumulative causation based on diversification and specialisation of skills to discredit Smithian political economy and to bolster the role of the state in promoting the former over the latter. This, however,
raises the obvious question of how economic analysis could inform these interventions on the part of the activist state. This is precisely where Hidalgo and Hausmann’s network-theoretic empirical analyses can come into play.

**Hidalgo and Hausmann on the Building Blocks of Economic Complexity**

Hidalgo and Hausmann (2009) observe that for Adam Smith, wealth-creating capacity was related to the division of labour and specialization of labour and economic activities. This approach focusing on relative factor proportions was continued by neoclassical trade theorists. More recently, they acknowledge that New Growth Theorists have placed more emphasis on varieties or quality differentials within a given category of tradeable goods. In contrast Hidalgo and Hausmann (2008: 5) adopt a “network view” emphasising the importance of the increasing complexity of interactions between specialized economic agents. They interpret the data connecting countries to the products that they export as a bipartite network (the Product Space), which is assumed to be the result of a larger tripartite, but unobservable network linking countries to capabilities to the products that are produced and exported. The distance between any two products in the Product Space is proportional to the probability that a country exports both of them. Furthermore, they argue that levels of income in each country are associated with the capacity level available in them.

*What the Product Space reveals is that some sets of products cluster very close to each other, while others are located further away in the space. This road map of development has important consequences for economic growth. For example, countries exporting products that lie mainly in the periphery of the Product Space will have serious difficulties in adapting their economy to new products that lie elsewhere in the diagram, resulting in a limited ability to upgrade their exports and grow.* [2008: 34]

In contrast, traditional growth theory views available product opportunities much like the trees in a forest, where each product is a tree, the set of all products is a forest, and firms can be conceived as monkeys jumping from tree to tree (Hidalgo, Klinger, Barabasi, and Hausmann, 2007). The conventional assumption is that there is always a tree within reach so that monkeys can jump from tree to tree to reach more productive parts of forest (i.e. via marginal variations in factor intensity). Even the product-ladder models of Aghion & Howitt (1992) & Grossman & Helpmann (1991), presume that slightly more advanced products on the higher rungs of the ‘quality ladder’ are always available at close proximity.

Hidalgo and Hausmann (2008: 7) suggest that “clues about the nature of the links connecting different products can be gathered by looking at how products are discovered and rediscovered by different populations”. Often, the move from one product type into another requires simultaneous technological improvements that open the door to other developments (e.g. in the domestication of apples, grafting techniques subsequently lead to the domestication of pears and plums). In addition, they observe that industries may be connected through input-output relationships and shared infrastructure.

Hidalgo et al. (2007: 482) recognise that the causes of proximity are manifold embracing differences in factor intensity and levels of technological sophistication, variations in the strength of input-output relations along the value chain, and differences in the complex of existing institutions. Nevertheless, they prefer to adopt an ‘agnostic’ assumption that if two goods are related they will tend to be produced in tandem (hence, ‘revealed proximity’ metric). It will be argued below, however, that this data-driven assumption ignores the crucial importance of artisanal skill and collaborative learning in the development of competencies, thus implying a similarly attenuated conception of the role for government.
Their research findings provide compelling evidence that proximity effects are of vital importance\(^3\). They reveal that their hierarchically clustered 775 \(\times\) 775 matrix of revealed proximities (with RCA > 1) is modular and sparse rather than being uniform (suggesting a smooth, homogeneous product space) or diagonally weighted (as with product-ladder model); (Hidalgo et al., 2007: 484). Figure S2 reveals a broad distribution (with 5% cells zero; 32% smaller than 0.1; and 65% below 0.2), while their Figures S5 and S6 for the whole network of 1525 links (with proximity \(\phi > 0.55\)) is characterized by both a clearly discernible core (metal products, machinery, chemicals) and a periphery (fishing, agriculture, garments, textiles…) (Hidalgo et al., 2007: 484).

The data (see the network depicted in fig. 2 of 775 SITC-4 product class links for the years 1998-2000, where links are colour-coded by proximity; with the size of nodes proportional to world trade; the colour of nodes reflecting Leamer’s classification of industries by relative factor intensity; and nodes with black squares implying a RCA > 1) show that the structure of the product space affects both a country’s specialization and the evolution of its ‘comparative advantages’ (in particular, see the fig. 3a data, which reveals Columbia and Malaysia’s 1980-2000 reliance on the electronics and garments sectors, respectively.

In fig. 3B, the authors consider the probability density of transition products (with \(RCA_{cl} < 0.5\) in 1990 and > 1 in 1995) benchmarked against that of non-transition products. Fig. 3C demonstrates a relative increase in density for products undergoing transition with respect to the same products when they remain underdeveloped. Fig. 3D shows that the probability of development (given that the closest connected product is at proximity \(\phi\)) is monotonic (i.e. the probability is almost nil at \(\phi = 0.1\), rising to 15% at \(\phi = 0.8\)). The authors use the calculated densities to simulate the resulting diffusion process (Fig. 4A simulates development in Chile and Korea if network transition is allowed for \(\phi > 0.55\). Korea is able to reach the richer part of product space sooner due to its positioning) (Hidalgo et al. 2007: 486). Fig. 4B depicts a clearly bimodal distribution of average \(\text{PRODY}\) (weighted GDP per capita of top \(N = 50\) countries with RCA in particular good after \(M = 20\) iterations at \(\phi = 1\) (green), 0.65 (yellow), 0.55 (red).

These results lead Hidalgo et al. (2008) to conclude that active intervention is necessary for those countries locked into peripheral regions, in recognition of need for large jumps.

**Conclusions**

The fairly weak conclusion arrived at by Hidalgo et al. (2008) is reached despite the obvious value of the empirical analysis along with its emphasis on the importance of sophistication and richness of competencies, along with both their diversity and ubiquity. The evidence provides a useful supplement to conjectures based largely on theoretical notions of causal ambiguity or tacitness serving as both sources of uniqueness and barriers to replication. To a large extent, though, the relatively modest policy stance reflects the initial agnosticism on the part of the authors about the nature of competencies. This agnosticism ignores the crucial importance of untraded tacit knowledge and detracts from a richer and more informed understanding of the potential for policy interventions grounded in notions of ‘metaroutines’, artisanal skill and processes of collaborative learning. Theoretical insights of the kind outlined by Eric Reinert could be supplemented by more practical and detailed knowledge of industry policy practitioners to remove competency-based barriers to national and regional development.

In this light, Robert Wade’s (2010) general prescriptions for successful industry policy along the lines of the East Asian Developmental State serve as a useful guide. He points to four main conditions. First, state and business groups should be ‘evenly balanced’ such that
patronage is always applied with political challenge (otherwise we end up like the Phillipines or S. Korea after its ‘democratization’). Second, an active public service mind-set should be inculcated (in stark contrast to the current UK public service culture, and other sites for ‘do no harm’ neoliberal pundits). Third, there should be a clear bifurcation between political and economic patronage like the Korean New Community (Saemaul), which comes under the jurisdiction of the President, being thus separated from economic considerations. Finally, the recommendations of public officials should be ratified and resourced by autonomous external body.

Closer to home, Hidalgo’s results for Australia show a revealed preference for activities mainly confined to the periphery. In the network diagram for the year 2000, for example, most of the nodes with black squares reflecting a Revealed Comparative Advantage greater than one, are in industries such as agriculture, mining, and petroleum products. This stands in marked contrast to the network diagram for countries such as the US for the same year’s trade data. This should lead us to ask serious questions about whether we can afford to lose what little manufacturing activity still remains after such a long period of high commodity prices. Despite arguments to the contrary, it would seem that the liberalization of market structures during and after the Hawke-Keating and the long, global boom in commodity prices have reduced the adaptability and resilience, specifically in Herbert Simon’s sense of generalized liquidity preference, of Australian industry.

References


1 These effort to ‘tilt’ a supposedly level ‘playing field’, it was suggested, would promote excessively capital intensive development, high unemployment, an anti-export culture, secular declines in agricultural productivity, and associated budget blowouts, along with high external debt and inflation. Moreover, the monopoly or scarcity...
rents created through intervention would encourage rent-seeking activities and thus entrench vested interests. In contrast, an export-oriented approach based on existing comparative advantage and the exploitation of economies of scale, supported by, and supporting the import of foreign know-how, would result in higher income and savings, and less distorted factor markets.

2 Here, Reinert seems to be referring to W. B. Arthur’s notions of increasing returns that are achieved through virtuous circles of uptake (i.e. based on time-varying likelihoods of uptake that change in response to changes in market share and prominence).

3 Hidalgo, Klinger, Barabasi, & Hausmann (2008) construct a measure of proximity based on revealed comparative advantage which is captured by the following formulae:

\[ \text{Proximity} \] between products \( i \) and \( j \) is minimum of pairwise conditional probabilities of a country exporting a good given that it exports another:

\[ d_{ij} = \min \{ \frac{\sum x(c,i)}{\sum \sum x(c,i)} \} \]

4 Specific examples of core product categories include aluminium, pharmaceutical products, leather, glass mirrors, rails and railway track, while non-core categories, which are far more numerous and extensive, include steel and iron forging, meat of bovines, aluminium ores, regenerated cellulose products, live sheep and goats, gold, copper ores, crustaceans and fish, beans, pulses and lentils, petroleum and gas, and sugars and beet.