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The principle of comparative advantage has long been at the center stage of most models of trade. In the new evolving economy, with the conventional firm-centric view rapidly losing its relevance, the vision of this principle weakens without the lens of co-creation. We provide a framework that can align economic thinking on the principle of comparative advantage with co-creation experience embedded at the core. We show how patterns of specialization and the resultant gains from trade, within or across borders, must be sensitive to co-creation experiences. In particular, an individual's experience from co-creation is at the foundation of what we posit as the principle of *co-creative* comparative advantage.

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“Ricardo was the greatest mind that found economics worthy of its powers.” *Roy Harrod* (1951)

1. Introduction

The Principle of Comparative Advantage was the quick pick, from the most celebrated of economic theories, when Paul Samuelson was challenged to identify one law of economics that is both true and non-trivial. This widely used principle, originally proposed a couple of centuries back by David Ricardo and subsequently reformulated by neoclassical economists in ways that fit into their frame of marginal analyses, provides the basis for most established models of trade.¹ Much work on international trade continues to glorify this principle by illustrating gains from trade that are attributable exclusively to specialization in production along the lines of comparative advantage. A variety of adaptations of this principle, identifying sources of gains from trade due to asymmetries ranging from countries to firms, have gained significant mileage.²

Looking at the new evolving economy through the lenses of conventional adaptations of the principle of comparative advantage, however, blurs visibility since value, in the economy as it is becoming, is no longer confined to goods or services but stems from the unique *co-creation experience* of individuals.³ The conventional formulations of Ricardo's principle of comparative advantage, which took a cue from Adam Smith's (1776) magnum opus *Wealth of Nations*⁴, hinge on an artificial assignment of distinct roles to firms and consumers, with the firm creating

¹ See Sraffa and Dobb (1952).

² Ruffin (2002) offered a historical account engaging careful introspection and a logical re-examination of Ricardo's discovery of the principle of comparative advantage, as well as thought-provoking analyses of later reconstructions of the principle that have often led to "misunderstandings" stemming from "a confused tangle of claims of priority, error, incompleteness, and attribution".

³ Note that co-creation is not confined to endogenous product creation that is driven by close interaction with consumer experiences, but rather endogenous and joint human experience creation that is driven by close individual desirable interactions. See Prahalad and Ramaswamy (2000, 2004a, 2004b), Ramaswamy and Gouillart (2010a, 2010b), and Ramaswamy and Ozcan (2014).

⁴ Chipman's (1965) account, which attributed the first complete statement of Ricardo's principle to Mill (1844), was reflective of the sentiment contained in a historic remark by Torrens (1815): "Adam Smith is, with the single exception of Ricardo, our highest authority on economical questions."

value through production and the consumer generating demand. This “nirvana approach” portrays the market as an interface for firms and consumers to engage exclusively in exchange of commodities.⁵ In sharp contrast, with the advent of the web, mobile technologies of expression, communication, and information, value is being *created jointly* by the individual and the firm, in the new co-creative economy.

Our work stems from the conception of *Co-creation Experience Economics* as distinct from the conventional firm-centric view in which consumers become relevant only at the point of exchange.⁶ Conventional economic thinking presumes that the market can be separated from the value creation process. In sharp contrast, the vision of value creation as co-creation unlocks novel ways to generate value as individuals and the enterprise engage through purposeful interactions through co-creation platforms of engagements.⁷ Value is jointly created by the consumer and the firm through interactions that enable an individual to create unique co-creation experiences of value with open and social resources, as well as enterprise network resources. The opportunities to add value expand through individuated co-creation experiences.

Consider, for illustration, a website that allows access to tools for designing toys. This can enable an engagement platform for individuals to generate value through the experience of designing toys. This can, also, potentially add to product variety. However, limiting attention to product variety (artifact) would overlook the essence of co-creation experiences that transcend the artifact. The designing of a toy, by an individual on a manufacturer's platform, need not necessarily lead to a new variety of a toy being manufactured. The experience of co-creating a

⁵ The expression “nirvana approach” was used by Harold Demsetz, as early as 1969, to characterize the typical fallacy inherent in conventional economic thinking when comparing an imperfect existing arrangement to a hypothetical idealized system.

⁶ See Chakrabarti and Ramaswamy (2013) for the foundations of *Co-creation Experience Economics*.

⁷ See Ramaswamy and Ozcan (2014) for an elaborate discussion of the concept of engagement platforms and value creation as a co-creation.

new design still generates value. The traditional distinction between the consumer and the producer remains valid only at the point of exchange, but is of no relevance when an individual shares the same platform with another individual to co-create an experience with or without an eventual exchange of an artifact. A toy manufacturer is a producer only of the toys it produces. The customer is a consumer only of the toys it purchases. An individual, who *neither* labors in the manufacturing of the toy *nor* purchases it, still generates value through the experience of co-creating a design on the platform provided by a toy manufacturer. The distinction between value generated through the experience of co-creation through an engagement platform and value generated through the provision of artifacts (goods and/or services) draws the boundaries of conventional business interaction. Further, the toy itself, as an artifact, can become part of an assemblage of persons, interfaces, and processes, e.g., through embedded software and interactive applications, and as a result, a designed platform of new types of engagements that generate new value to individuals (e.g., Build-A-Bear). Or further still, the platform can become the offering, the toy as it were. A good example is LEGO Mindstorms NXT, a toy platform which features programmable “intelligent LEGO bricks” and new capabilities for motion and touch, as well as a range of new sensors, gyroscopes and accelerometers, and the ability for the Mindstorms community to share both new interactive applications and their play experiences.⁸

In essence, through the world of co-creation, all points of interaction between the enterprise and the individual are emergent opportunities for co-creating personalized experiences that generate value. In what follows, we recognize the seminal contribution of Ricardo and embrace the concept of co-creation to take a small step forward that can lead to a paradigmatic leap in

⁸ See Ramaswamy and Ozcan (2013).

economic thinking on fundamental principles that govern gains from trade in a co-creative economy.⁹

2. Revisiting Ricardo

Ricardo's¹⁰ original exposition of the principle of comparative advantage was in terms of 2 countries (England and Portugal) which could make 2 goods (cloth and wine) using only 1 factor (labor) of production.¹¹ In this 2x2x1 world, production of each good required a fixed amount of labor per unit of output and labor could move freely between industries but not between countries. Comparative advantage would correspond to a cross-country comparison of the ratio of unit labor requirements (i.e. how many workers each country needed to make a unit of each good, as summarized in the table 1 below).

Table 1: Unit Labor Requirements for Cloth and Wine

	Cloth	Wine
England	100	120
Portugal	90	80

England would have needed 100 laborers to produce the same amount of cloth that Portugal could produce with 90 laborers, in Ricardo's world, while Portugal would have needed 80

⁹ See Chakrabarti and Ramaswamy (2013).

¹⁰ See Ricardo (1817).

¹¹ Haberler (1930) was among the first to visualize that opportunity cost, at the margin, was at the heart of the principle of comparative advantage.

laborers to produce the same amount of wine that England could produce using 120 laborers. Ricardo then demonstrated how it could be to the advantage of both nations to follow his principle of comparative advantage if each were to specialize and trade: exchanging 1 unit of cloth for 1 unit of wine, for illustration, would allow England to import each unit of wine with the effort of only 100 workers (instead of 120) and Portugal to obtain import each unit of cloth with the effort of only 80 workers (instead of 90).

Beyond these “four magic numbers”¹², in a 2x2x1 Ricardian world, $\frac{p_g}{p_{-g}} \in \left(\frac{a_g^c}{a_{-g}^c}, \frac{a_g^{-c}}{a_{-g}^{-c}} \right)$ would yield mutual gains from trade between countries c and $-c$, through complete specialization in the production of goods g and $-g$, respectively, where a_g^c is the unit labor requirement for good g in country c and $\frac{p_g}{p_{-g}}$ is the price of good g relative to $-g$ in an Integrated World Equilibrium (IWE) which each country would face with free and frictionless trade allowing perfect mobility of goods. An IWE would yield gains from trade for country c , through complete specialization in the production of good g , since

$$p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) > \frac{1}{a_{-g}^c}$$

which compares the quantity of the other good ($-g$) country c can purchase from the proceeds of what it can produce of good g using one unit of labor, with what it can produce of good $-g$ using the same unit of labor. Analogously, the same IWE would yield gains from trade for c 's trading partner ($-c$), through complete specialization in the production of good $-g$, since

$$p_{-g} \left(\frac{1}{a_{-g}^{-c}} \right) \left(\frac{1}{p_g} \right) > \frac{1}{a_g^{-c}}$$

¹² See Samuelson (1972).

This laid the foundation for mutual benefits from specialization in production and consequent trade along the lines of comparative advantage that conventional economic thinking claims as inevitable in Ricardo's world as he is construed to have envisaged an increase in the "amount and variety of the objects on which revenue may be expended."

3. Rethinking Ricardo

Let us now pause to think: Would David Ricardo have formulated the principle of comparative advantage any differently in the new co-creative economy? It is important to clarify, at the outset that, in posing this question, we are not challenging the view that trade can lead to mutually beneficial gains. Instead, we are questioning the relevance of keeping the principle of comparative advantage tied to an obsolete theory of value, restricted to the relational property of goods and services, the deficiencies of which are becoming increasingly apparent in the context of value generated as a function of co-creation experiences.¹³ This conspicuous neglect inevitably attracts more skepticism about the relevance of the principle of comparative advantage than it deserves.

Consider re-constructing Ricardo's example¹⁴ with the cognition that value need not be constricted to production possibilities of goods (or, for that matter, production-sharing arrangements in occupations and/or tasks) but can be expanded through co-creation experiences via engagement platforms. To fix our ideas, through illustration, let us infuse *co-creating*

¹³ See Chakrabarti and Ramaswamy (2013).

¹⁴ Although Ricardo's world may appear incomplete, in this millennium, his example provides a natural benchmark due to the simplicity with which it allows us to draw a comparison between the real and the counterfactual.

experiences through co-creation platforms afforded by Apple’s Smart Phones¹⁵ in an otherwise Ricardian world replacing England by China.

Table 2: Unit Labor Requirements for Cloth, Wine, and Smart Phone with Co-Production Engagement Platform

	Cloth	Smart Phone <i>with</i> Co-Creation Platform	Wine
China	100	110	120
Portugal	90	85	80

While the economics of co-creation experiences encompasses the value generated through co-creation experiences on “*co-production*” engagement platforms (e.g., Apple’s opening up of smart phone application development) as well as “*co-consumption*” engagement platforms (e.g., Apple’s iPhone as a platform for a consumer to monitor diabetes together with a company such as Johnson & Johnson), for simplicity of exposition, let us focus on the infusion of Smart Phones with the former type of platform. To motivate the far reaching implications of this infusion, it is incumbent to underscore that the vision of the emerging field of Co-creation Experience Economics reaches beyond an enterprise (e.g. Apple) “selling the experience” of using an artifact (e.g Smart Phone). It is important to recognize that the experience of using a smart phone supports an engagement platform that generates value through co-creation experiences that are distinct from an enterprise (Apple) selling the experience of using the same artifact (Smart Phone). Limiting attention to selling an experience (from the use of an artifact) would conspicuously overlook the essence of co-creation experiences that transcend traditional trading

¹⁵ We thank Michele Tertilt for motivating this example. While it would not be a stretch to conceptualize co-creation experiences on engagement platforms involving Wine and/or Cloth, for ease of comparison, we choose to retain Ricardo’s characterization of these goods.

between an artificially differentiated consumer and producer, which remains valid only at the point of exchange, but is of no relevance when individuals choose to share the same engagement platform with or without an eventual exchange of an artifact. As such, the implications of Co-creation Experience for Economics, in general, and the Principle of Comparative Advantage, in particular, cannot be conceptualized through considerations of production functions (or utility functions) which have been reduced to tools that isolate distinctive roles for the consumer from the firm and, in doing so, have blurred the vision of the real co-creative economy as it is evolving. Individual co-creation experiences are generated on a continuum, through engagement platforms for co-creating both consumption and production experiences (in traditional economics parlance) that are inextricably interrelated. In comparison, existing extensions of the Ricardian principle would involve constructing a chain of comparative advantage by sorting the productivity of Chinese labor relative to Portuguese labor in the production of Cloth, Smart Phones, and Wine respectively:¹⁶

$$\frac{90}{100} \text{ Cloth} > \frac{85}{110} \text{ Smart Phone} > \frac{80}{120} \text{ Wine}$$

Under free and frictionless trade, the hourly wage (ω) in China relative to Portugal would be used to break this chain by identifying the efficiency gains from specialization in production. For instance, $\omega = 0.8$ would suggest that China gains from specializing in the production of Cloth, and Portugal gains from specializing in the production of Smart Phones and Wine. Does this

¹⁶ See Neary (2003, 2007) for recent innovations in identifying patterns of specialization and trade, consistent with the Dornbusch, Fischer, Samuelson (1977) extension of the Ricardian principle of comparative advantage, in a general oligopolistic equilibrium.

pattern of specialization exhaust all possible gains for China and Portugal? To answer this question, in what follows, we embrace co-creation experiences in economics recognizing that value can be, and *is* being generated in the new evolving economy, on engagement platforms that are not limited to producing *more* of a good.

3. The Principle of Co-Creative Comparative Advantage

Consider, following Chakrabarti and Ramaswamy (2013), the element of value as generated from co-creation experiences resulting from individual interactions through engagement platforms, in the principle of comparative advantage. Suppose V_i is the value derived by an individual i as a function of C_{ij} , representing the vector of individual i 's co-creation experiences on engagement platform j , as well as on the conventional vector of i 's actions (A_i), others' actions (A_{-i}), and controls (c_i) that entail all else affecting the value i derives:

$$V_i = V_i(C_{ij}, A_i, A_{-i}, c_i).$$

The arguments of the value function $V_i(\cdot)$ are not only sufficient to capture the standard economic role of own actions and externalities but incorporates co-creation experience as a motivation for individual economic behavior.¹⁷ Consider the following representation of individual i 's co-creation experience on engagement platform j :

$$C_{ij} = C_{ij}(R_{ij}, R_{-ij}, T_{ij}, T_{-ij}, A_i, A_{-i}, c_i),$$

¹⁷ A fruitful approach of parsimoniously modifying preferences, to show how economics can be applied to study the forces that shape behavior, dates back to the seminal contribution of Becker (1957). While many economists have followed Becker's footsteps, in this direction, relatively recent applications can be found in Becker and Murphy's (2009) insightful analysis of the role of social interactions in enriching the domain of inquiry of economists as well as the way economists conceptualize individual decision making.

where T_{ij} and T_{-ij} represent time and R_{ij} and R_{-ij} represent resources invested by individual i and others $-i$ (including, though not necessarily limited to, those on platform j), respectively, in the engagement specific to platform j .

Conventional economic thinking would introspect that a typical individual i chooses its actions A_i in a way that maximizes V_i , ceteris paribus. This apparently draws the boundaries of the market where the goal of each firm, given its own resource constraints, is reduced to a) the maximum extraction of surplus from individual consumers, and b) the minimum expense of the extracted surplus on individual workers, that specific market structures allow.

Now visualize the vast potential of co-creative surplus¹⁸ that conventional economic thinking leaves out by simply ignoring the fact that an enterprise can and does, even more so in the modern Internet networked age, release its resource constraints by investing in engagement platforms that co-create value by enhancing the diverse experience of individuals. In a world of co-creation, the objective of the enterprise(s) providing platform j is to

$$\begin{array}{ll} \text{Maximize:} & V_j = V_j(C_{ji}, C_{-ji}, A_j, A_{-j}, c_j) \\ \{R_{ji}, T_{ji}, a_j\} & \\ \text{subject to} & \bar{T}_j = \sum_i T_{ji} + T_j(R_{ji}) \end{array}$$

while each individual's objective is to

$$\begin{array}{ll} \text{Maximize:} & V_i = V_i(C_{ij}, C_{-ij}, A_i, A_{-i}, c_i) \\ \{R_{ij}, T_{ij}, a_i\} & \\ \text{subject to} & \bar{T}_i = \sum_j T_{ij} + T_i(R_{ij}) \end{array}$$

where C_{ji} is the vector of co-creation experiences of all individuals engaged on platform j ; C_{-ji} is the vector of co-creation experiences of all individuals engaged on platforms other than j ; A_j is

¹⁸ See Chakrabarti and Ramaswamy (2013).

the vector of actions of the enterprise(s) providing platform j , A_{-j} is the vector of others' actions; and c_j is the vector of controls entailing all else affecting the value generated on platform j . The singular binding constraint is imposed by the arrow of time $T = \{\bar{T}_i, \bar{T}_j\}$ on the optimal choice of any individual or enterprise (participant) with a finite horizon, where \bar{T}_i represents the vector time horizons of individuals and \bar{T}_j represents the vector time horizons of enterprises, within which T_{ji} represents time and R_{ji} represents resources invested, in the co-creation experiences of participating individuals i , by the enterprise(s) providing platform j ; $T_i(R_{ij})$ represents the time invested by individual in acquiring resources R_{ij} ; and $T_j(R_{ji})$ represents the time invested by the enterprise(s) providing platform j in acquiring resources R_{ji} . This optimization exercise yields a set of co-creation possibilities $C^g(T) = [C_{ij}^g \ C_{ji}^g]$, $\forall g$. It follows, for any individual i located in country c , $\frac{p_g}{p_{-g}} \in \left(\frac{a_g^c}{a_{-g}^c}, \frac{a_g^{-c}}{a_{-g}^{-c}}\right)$ would not suffice for gains from specialization in the production of g unless

$$V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right) > V_i \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right)$$

Analogously, for any individual $-i$ located in country $-c$, $\frac{p_g}{p_{-g}} \in \left(\frac{a_g^c}{a_{-g}^c}, \frac{a_g^{-c}}{a_{-g}^{-c}}\right)$ would not suffice for gains from specialization in the production of $-g$ unless

$$V_{-i} \left(p_{-g} \left(\frac{1}{a_{-g}^{-c}} \right) \left(\frac{1}{p_g} \right) \right) > V_{-i} \left(\frac{1}{a_g^{-c}}, C_{-ij}^g \left(\frac{1}{a_g^{-c}} \right) \right)$$

This leads to the conception of our Principle of Co-Creative Comparative Advantage: an IWE would support mutual gains from trade for countries c and $-c$, irrespective of the location

of the engagement platform j , through complete specialization in the production of goods g and $-g$, respectively, *iff*

$$\sum_{i \in c} V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right) > \sum_{i \in c} V_i \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_g^c} \right) \right)$$

$$\sum_{-i \in -c} V_{-i} \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right) > \sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^c}, C_{-ij}^g \left(\frac{1}{a_{-g}^c} \right) \right)$$

The Principle of Co-Creative Comparative Advantage not only embeds co-creation in Ricardo's vision of a rise in "the sum of enjoyments" through an increase in the "amount and variety of the objects on which revenue may be expended", but also identifies distinct possibilities where mutual benefits from specialization in the production of goods g and $-g$ (in line with the conventional concept of comparative advantage) will not be ensured by $\frac{p_g}{p_{-g}} \in \left(\frac{a_g^c}{a_{-g}^c}, \frac{a_{-g}^c}{a_g^c} \right)$. This Principle, cognizant of the fact that value is jointly created through individuated co-creation experiences, thus expands our vision to identify mutual gains from co-creative specialization as well as diversification.

No less critical, for a complete understanding of this Principle of Co-Creative Comparative Advantage, is the observation that deviations from conventional lines of specialization leave sufficient room for gains from co-creative trade. An individual i located in country c gains, from co-creation on the engagement platform engagement platform j of $-g$ as long as

$$V_i \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_g^c} \right) \right) > V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

and

$$V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right) > V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_{-g}^c} \right) \right)$$

An individual $-i$ located in country $-c$ gains from co-creation on the engagement platform j of g as long as

$$V_{-i} \left(\frac{1}{a_g^{-c}}, C_{-ij}^g \left(\frac{1}{a_g^{-c}} \right) \right) > V_{-i} \left(p_{-g} \left(\frac{1}{a_g^{-c}} \right) \left(\frac{1}{p_g} \right) \right)$$

and

$$V_{-i} \left(p_g \left(\frac{1}{a_g^{-c}} \right) \left(\frac{1}{p_{-g}} \right) \right) > V_{-i} \left(\frac{1}{a_g^{-c}}, C_{ij}^{-g} \left(\frac{1}{a_g^{-c}} \right) \right)$$

Consequently, contrary to a conventional interpretation of the principle of comparative advantage, an IWE relative price $\frac{p_g}{p_{-g}} \in \left(\frac{a_g^c}{a_g^{-c}}, \frac{a_g^{-c}}{a_g^c} \right)$ would support mutual co-creative gains from trade, through complete co-creative specialization of country c in $-g$ and country $-c$ in g , as long as

$$\sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^{-g} \left(\frac{1}{a_g^c} \right) \right) > \sum_{i \in c} V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

$$\sum_{i \in c} V_i \left(p_{-g} \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_g} \right) \right) > \sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right)$$

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^{-c}}, C_{-ij}^g \left(\frac{1}{a_g^{-c}} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_{-g} \left(\frac{1}{a_g^{-c}} \right) \left(\frac{1}{p_g} \right) \right)$$

and

$$\sum_{-i \in -c} V_{-i} \left(p_g \left(\frac{1}{a_g^{-c}} \right) \left(\frac{1}{p_{-g}} \right) \right) > \sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^{-c}}, C_{ij}^{-g} \left(\frac{1}{a_g^{-c}} \right) \right)$$

Country c gains from specializing in the production of good $-g$ while the other country stands to gain from co-creative diversification *iff*

$$\sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^{-g} \left(\frac{1}{a_g^c} \right) \right) > \sum_{i \in c} V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

$$\sum_{i \in c} V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right) > \sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right)$$

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^c}, C_{-ij}^g \left(\frac{1}{a_g^c} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right)$$

and

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

Analogously, country c stands to gain from co-creative diversification while the other country gains from specializing in the production of good g iff

$$\sum_{i \in c} V_i \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right) > \sum_{i \in c} V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

$$\sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right) > \sum_{i \in c} V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right)$$

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^c}, C_{-ij}^g \left(\frac{1}{a_g^c} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right)$$

and

$$\sum_{-i \in -c} V_{-i} \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right) > \sum_{-i \in -c} V_{-i} \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right)$$

Finally, both countries gain from co-creative diversification iff

$$\sum_{i \in c} V_i \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right) > \sum_{i \in c} V_i \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

$$\sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right) > \sum_{i \in c} V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right)$$

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_g^c}, C_{-ij}^g \left(\frac{1}{a_g^c} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right)$$

and

$$\sum_{-i \in -c} V_{-i} \left(\frac{1}{a_{-g}^c}, C_{ij}^{-g} \left(\frac{1}{a_{-g}^c} \right) \right) > \sum_{-i \in -c} V_{-i} \left(p_g \left(\frac{1}{a_g^c} \right) \left(\frac{1}{p_{-g}} \right) \right)$$

Let us now revisit the example of Smart Phones with co-production engagement platform (g). Apple's production of Smart Phones in Portugal would impose foregone gains for China (c)

if $\sum_{i \in c} V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right) < \sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right)$ as well as foregone gains for Portugal if

$\sum_{i \in -c} V_i \left(p_{-g} \left(\frac{1}{a_{-g}^c} \right) \left(\frac{1}{p_g} \right) \right) > \sum_{i \in c} V_i \left(\frac{1}{a_g^c}, C_{ij}^g \left(\frac{1}{a_g^c} \right) \right)$ even when Portugal reveals a "Ricardian"

comparative advantage in producing Smart Phones i.e. $\omega > \frac{a_g^c}{a_g^c}$. When leveraging resources in a

country for co-creating experiences on an engagement platform, even if that country produces a good for which it does not possess the "Ricardian" comparative advantage, it can generate a higher value than can be supported by the production of the good for which it possesses the "Ricardian" comparative advantage. By conventional economic thinking, which overlooks any distinction between the value generated through an experience of co-creation on an engagement platform and the value extracted from selling an experience generated through the use of an artifact (smart phone), the Principle of Comparative Advantage has been construed to imply that a country will gain from specializing (if it specializes) in the production of an artifact (smart phone) when the relative price at which that artifact can be exchanged with a consumer exceeds the opportunity cost at which that artifact can be produced by the firm(s) located in that country. This is reminiscent of the conventional firm-centric view in which consumers become relevant only at the point of exchange and, in effect, the market is artificially separated from the process of value creation.

In sum, an understanding of the principle of comparative advantage remains incomplete without the cognizance of co-creation. Conventional adaptations of this principle has left us with normative rules that are increasingly becoming obsolete, and often misleading "as is", and the

way it “ought to be” in the evolving co-creative economy. As we have shown, the relevance of Ricardo’s vision can be restored through co-creation thinking. By recognizing that value is generated as a function of co-creation experiences, our Principle of Co-creative Comparative Advantage provides a foundation for identifying gains from trade *beyond the conventional segregation of the role of the individual* (employee/consumer) from that of the firm in the process of value creation.

4. Concluding Remarks

In this paper, we have made an effort to bridge the widening gap between economic thinking on the principle of comparative advantage and the trading economy as it is evolving. Unlike the pre-internet industrial era, value is no longer viewed as a creation of the firm through its product and service related activities. Instead, the rapidly changing elements of our economy place the individual at the center in sharp contrast with the firm-centric view that conventional economic theory is hesitant to let go. We have shown that the transition from a firm-centric view to a co-creation view has non-trivial implications for the principle of comparative advantage. We provide a framework that can align economic thinking on the principle of comparative advantage with complete cognizance of co-creation experience. We show how patterns of specialization and the resultant gains from trade, within or across borders, must be affected by co-creation experiences. A natural outcome of our analysis is the Principle of Co-Creative Comparative Advantage, that can guide trade with co-creation at the core, expands our vision to identify mutual gains from co-creative specialization as well as co-creative diversification. We hope our contribution will form the foundation for a new generation of forward-looking economists with a shared vision of the increasingly Internetnetworked world of trade.

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