Beliefs and the Persistence of Inefficient Institutions

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Abstract

This paper examines the emergent process through which institutions arise in the process of development by focusing on the evolution of the shared beliefs that guide a society's choice of institutions. Beliefs are anaylzed using fitness landscapes where evolution is treated as a search algorithm for fit design. While the persistence of sub-optimal institutions is primarily due to vested interests that impede the changes and reforms that would induce growth and prosperity, the difficulty of revising and updating misguided beliefs is additionally responsible for the surprisingly small number of countries that have transitioned from underdevelopment to sustained growth in history.

Keywords: Beliefs; institutions; development; evolution; fitness landscapes.
JEL: O10, O43, B15.

Crenças e a Persistência de Instituições Ineficientes

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Este trabalho analisa o processo emergente através do qual instituições surgem no processo de desenvolvimento econômico, focando na evolução das crenças compartilhadas que guiam a escolha de instituições pela sociedade. Crenças são analisadas através de paisagens adaptativas (*fitness landscapes*) onde evolução é tratada como um algoritmo de busca por desenhos adaptados. A persistência de instituições ineficientes é em grande medida devida à grupos de interesse que conseguem bloquear reformas que induziriam crescimento e prosperidade. No entanto, a dificuldade de adaptar e alterar crenças equivocadas contribui para que um número surpreendentemente pequeno de países tenha feito a transição para desenvolvimento e crescimento econômico sustentado.

Palavras chave: Crenças; instituições; desenvolvimento; evolução, *fitness landscapes*.
JEL: O10, O43, B15.

Beliefs and the Persistence of Inefficient Institutions

I.   Introduction

Cross-country data on GDP per capita shows that there is a small group of high-income countries and a large group of low-income countries, with few transitioning countries in between. In 2012 there were 26 countries with GDP per capita above US$25,000 – excluding oil producers and tax havens.[1] At the same time there were 143 countries with GDP per capita under US$15,000 and only 12 countries making the transition in the US$15,000 to US$25,000 range. Furthermore, most of the countries in the high-income group achieved this relative prominence in the 19th century, with few new countries joining the high-income group in the past century. Although economic theory presents many theoretical reasons why there should be a convergence of poorer countries towards higher incomes, such as diminishing returns and second-mover advantages, there is very little evidence of catch-up as of yet. On the contrary, both GDP per capita as well as more specific indicators of economic development indicate that most countries have not been making significant strides towards closing the gap. Most countries in this lower group seem to go through cycles of booms and busts where bad policies, missed oportunities and inefficiencies are endemic, suggesting that development is not just a matter of time. Why is it that development is so elusive despite widespread new technologies and greater knowledge as well as the example from countires that have manged to make the transition?

The nature and causes of the wealth of nations has been a major issue in Economics at least since Adam Smith. Many different hypotheses about the fundamental determinant of long term growth and development have been suggest, including; tecnology (Solow, 1957); capital and savings (Harrod, 1939; Rostow, 1959); human capital (Romer, 1990, Glaeser et al. 2004); geography (Sachs and Warner, 1995); culture (Landes, 1998); factor endowments (Engerman and Sokoloff, 2000); institutions (North, 1990; Acemoglu and Robinson, 2012); among others. Currently it seems as if the instiutions-as-the-fundamental-determinant-of-long-term-growth hypothesis has come out on top. As noted by Jones and Romer (2010: 20):

> There is very broad agreement that differences in institutions must be the fundamental source of the wide differences in growth rates observed for countries at low levels of income and for the low income and TFP levels themselves.

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[1] Data in current US$ from World Bank national accounts data, and OECD National Accounts data files available at http://data.worldbank.org/indicator/NY.GDP.PCAP.CD.

But if weak institutions are in fact such a major impediment to long term growth and development, why is it that so many countries systematically fail to set up growth-enhancing institutions and maintain instead institutions that perpetuate inefficiencies and backwardness? The standard answer to this question is that elites in these countries purposefully choose inefficient institutions due to the political risk inherent in putting into place different institutions. The new arrangements may empower opponents and bring about scenarios where the current elites would be worse off. Although compensating payments or Coasean bargaining could make the changes Pareto optimal, political transaction costs and the general difficulty in making credible commitments makes the current winners prefer a large slice of a smaller but more certain pie, than a uncertain slice of a larger pie. These arguments centered on political power and the inherent difficulty of transacting away inefficiencies are the basis of much of the political economy literature and in many cases are a sufficient explanation for the diversity of performance among nations. However, in some cases there may be other forces that contribute to the persitence of inefficiency and lack of progress and prosperity. Ricardo Hausmann (2014), for example, suggest that in some cases the standard political economy explanation is incomplete:

> I do not doubt that there have been many instances in human history during which those in power have prevented progress. But I am also struck by how often governments that embrace the goal of shared growth – post-apartheid South Africa is a good example – fail to achieve it. Such governments promote schooling, free trade, property rights, social programs, and the Internet, and yet their countries' economies remain stuck.

Similarly Dani Rodrik (2014: 197) notes that:

> While the claim that elites block enhanced economic opportunities so that they can maintain their own power seems to make sense, it too may imply an unreasonable restriction on feasible strategies. In particular, it denies elites the creativity to devise strategies that would allow them to take advantage of enhanced economic opportunities without losing power.

In other words, he is arguing that just like economic entrepreneurs have incentives to seek technological innovations to relax resource constraints, political entrepreneurs don't have to take the impediments to political transactions as given, but can seek innovations in the area of political ideas that may allow the inefficiencies to be removed without threatening their political power. That is, he is arguing that beliefs about how the world works are fundamental determinants of which institutions get put into place. In this paper I too argue for the central role of beliefs in determining economic performance through the choice of institutions, but I will suggest a different model of the emergence and evolution of beliefs that seeks to explain why beliefs that

promote inefficiencies and lack of development predominate. The argument is based on a fitness landscape model of the evolution of beliefs.

If institutions crucially determine outcomes, how do countries choose which formal institutions to set in place? Most of the literature has addressed this issue by focusing on the relative power and interaction of the configuration of groups in a given society. The choice of insitutions is determined by the interplay as those groups with more power seek to put in place rules conducive to their own view of society, usually assigning most of the benefits to themselves and perpetuating their own political ascendency. But achieving the intended objectives is not usually that simple, for besides the intergroup struggle to prevail in the choice of institutions, there remains the serious difficulty in knowing which set of institutions will actually promote those outcomes. Before knowing what rules to strive for, a group has to have a notion of what set of institutions will produce the kind of outcomes they desire. I define this perception of cause and effect between institutions and outcomes as 'beliefs.'[2] This is similar to what Denzau and North (1994: 4) have called shared mental models: "The mental models are the internal representations that individual cognitive systems create to interpret the environment and the institutions are the external (to the mind) mechanisms individuals create to structure and order the environment."

For the purposes of this paper a 'shared' or collective belief held by most of society emerges during periods of uncertainty and disruption when the previous set of beliefs has disspated due to poor fit to realized outcomes. The process through which this happens will be discussed below. I graphically illustrate the punctuated process of change through which beliefs evolve by using fitness landscapes that simultaneously depict institutions, beliefs and outcomes. Although this evolutionary process is a powerful mechanism for searching fit designs in the case of biology, technology, culture and language, in the case of beliefs, institutions and development this 'algorithm' has not guided most countries to sustained development. While the persistence of sub-optimal institutions may be primarily due to vested interests that impede the changes and reforms that would induce growth and prosperity, the difficulty of revising and updating misguided beliefs is additionally responsible for the surprisingly small number of countries that have transition from underdevelopment to sustained growth in history. Thus even in those rare cases where a middle-income country reaches a situation where the fight for rents is kept in check and government policy is primarily interested in

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[2] For a more detailed definition of beliefs along these lines see Alston et al. (2015).

promoting the common good, there are still formidable impediments for achieving the transition.

The next section describes fitness landscapes which will be used subsequently as a heuristic to understand economic development as a search process. Section III shows how the fitness landscapes can be used to portray both institutions and beliefs and especially the possible disconnect between the two. Section IV portrays the standard political economy explanation of elites blocking progress through fitness landscapes. Section V describes what is specific to the evolution of beliefs and institutions and why that process so infrequently leads to development.

II.   *Beliefs, Institutions and Fitness Landscapes*

As defined in this paper beliefs are a mapping from institutions to outcomes. Elites know what outcomes they desire but they do not know which institutions are most conducive to those outcomes. Therefore they have to have a view of how the world works that will tell them the cause and effect relation between each conceivable set of institutions and each set of outcomes. Suppose that institutions can be formulated as composed of N different dimensions. Acemoglu nd Robinson (2012) have popularized the classification of institutions into two dimensions – economic and political - that can be either extractive or inclusive. But in principle there can be several other dimensions, such as, markets vs. state, secular vs. spiritual, progressive vs. conservative, centralized vs. decentralized, public vs private regarding, role of the army, trust, race, gender, traditional vs. forward looking, etc. If there are N dimensions, and assuming for simplicity (as did Acemoglu and Robinson (2012)) that each dimension can take on two levels, then each set of institutions can be written as a bit-string of zeros and ones (which facilitates computation). If there are N dimensions, then there will be 2^N different institutions. Even if N is a relatively small number, this means that there is an inordinately large number of possible permutations of institutions for a country to choose from. If $N=15$ then there are 32,768 alternatives. If one defines each dimension more finely, allowing for say $N=30$, the total number of alternatives would be over 1 billion.

Take a given bit-string defining a specific set of institutions and plot on a plane this point and all of its $N-1$ one bit mutation neighbors, that is, all the adjacent set of institutions that are identical to it except for one dimension that is flipped from zero to one (or vice-versa). This plane containing all the possible combinations of institutions is

known as the space of institutions.[3] This stylzied space of institutions is shown as the base of the landscapes in Figure 1. It is also shown from a top-down perspective as contour maps in the lower squares. Because institutions affect performance and outcomes, each point in the space of institutions is associated with a different level of fitness,[4] which I take to be the overall level of social welfare given the current configuration of power.[5] In a subsequent section I will address the issue of the distribution of welfare across different social groups. The three dimensional graphs plot the level of fitness for each combination of institutions producing a landscape of outcomes. Two different graphs are shown to illustrate the variety of landscapes that can exist. There can be very large numbers of combinations of institutions, so in principle the landscapes strech out towards infinity, yet I will use a more restricted space without loss of generality. The shape of the landscape is specific to a given society at a given point in time. I will take the landscapes as stable for now and address the fact that they dance over time subsequently.

The bottom square in each graph shows the contour lines that make it easier to compare the fitness of different permutations of institutions. They can be interpreted somewhat analogously to indifference curves in standard microeconomic theory. For the top landscape the best choice of institutions would be that marked with an *x* in the countour space. For the bottom landscape there are two different sets of institutions that yield high fitness (also marked with an *x*).

Why were the fitness functions in Figure 1 drawn as continuous yet non-monotonic surfaces? That is, why were they not assumed to be either single-peaked and well-behaved like utility functions in standard microeconomic theory, or as a random jumble of spikes and troughs. The actual shape of an institional fitness landscape cannot really be observed, yet we can try to infer the characteristics of the shapes they can take from what we know about the impact of institutions on social welfare. Evolutionary biologists have done this exercise for biological fitness functions, where the landscapes map the reproductive success of different genotypes, and have concluded that they are neither single-peaked nor random, but rather rugged and multipeaked, yet with several flat spots (Kauffman, 1995; Crutchfiled and Schuster, 2003)

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[3] For a technical treatment of fitness landscapes see Kauffman (1995).

[4] In biological applications fitness measures the entity's capacity to reproduce given the environment. In the case of institutions, fitness refers to the capacity of the current set institutional arrangements to promote the expected outcomes and thus to perpetuate into the future.

[5] Institutions are the general rules of the game and can affect outcomes directly. But more generally they affect outcomes by shaping policy, programs and laws, and even by having an impact on norms. For conciseness we will usually omit these important intermediary steps.

Figure 1 – Fitness Landscapes for the Space of Institutions.
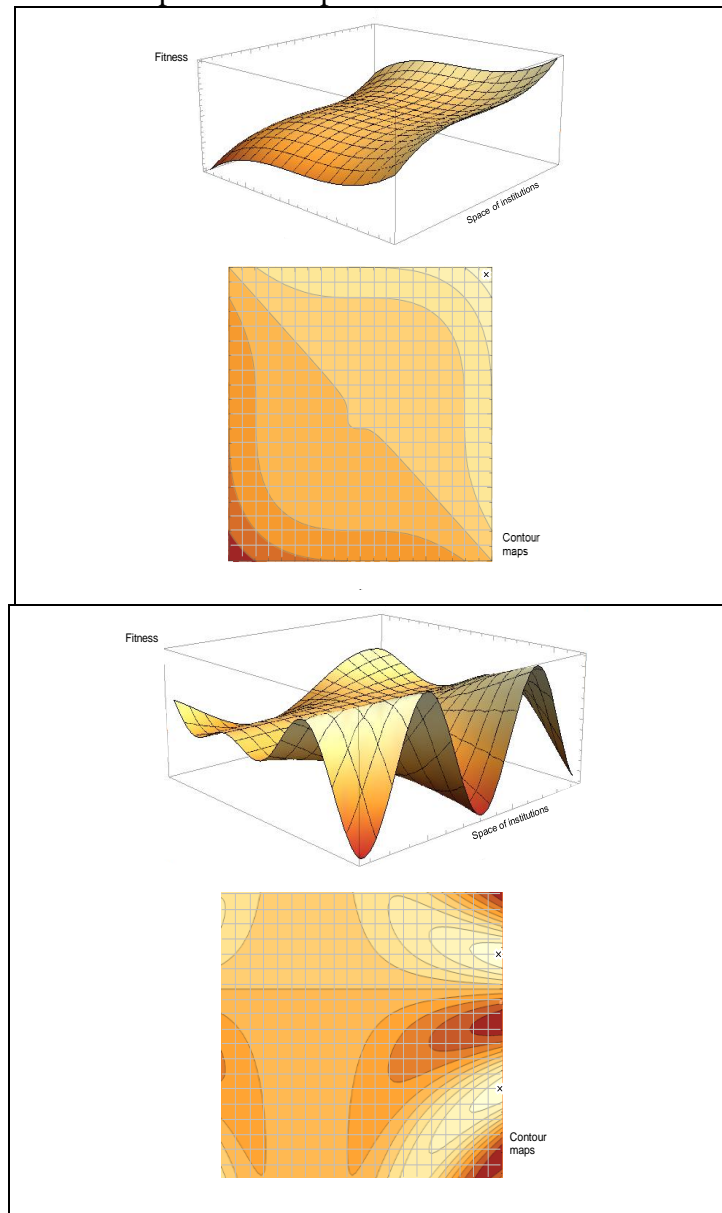
The flat spots arise when small changes in the genotype have no consequences for survival and reproduction. Nevertheless there are small changes in DNA that can lead to sharp drops or increases in fitness. Mokyr (1993: chap. 11; 2000) and Beinhocker (2006: chap. 11) have also considered technology and technological change through a similar lens. In this case the design space at the base contains all the infinite possible permutations of techniques, even if most are useless and absurd. The fitness landscape then measures the usefulness of each design for a given society at a point in time. Here too there is reason to believe that the landscape will be rugged, with similar designs

having the same or comparable levels of fitness, and with some isolated peaks where there are particularly useful specific technologies.[6]

Under similar logic, it seems reasonable to expect institutional fitness landscapes to also be rugged and multipeaked, as there can conceivably be two or more different combinations of institutions that work well in a given country at a given time. Also, although small changes in institutions usually don't lead to big changes in performance, there can be some small but crucial changes that lead to big discontinuous drops or spikes in performance (e.g. the elimination of a simple but crucial check on the power of the Executive). Nevertheless it seems reasonable to speculate that unlike biology or technology there will not be extremely sharp and discontinuous peaks or holes as the design of institutions are less constrained by physical and chemical laws than biology and technology.

In all three cases – biological, technological and institutional – the number of possible permutations in the design space is near infinitely large. In addition, the fitness landscapes are not observed *ex-ante*, so that the only way to really know the fitness of each specific designs is to actually try it out. This means that it is not possible to simply scan the landscape and choose the highest peak. The inordinate difficulty of the task and the *ex-ante* unobservability implies that a means to search the design space for fit designs is required. The different possible means for performing this search can be thought of as search algorithms (that is, a step by step set of instructions). Different algorithms are better or worse suited for different types of landscapes. In the case of a standard single-peaked utility function, for example, a simple optimizing algorithm that always takes the steepest next step will always reach the best design. For rugged landscapes, however, this algorithm has a tendency to get stuck in local optima, that is, small peaks, thus foregoing the chance to reach nearby higher peaks. Landscapes with these characteristics are generally better searched by evolution, which can be thought of as an algorithm that relies on variation, selection and amplification. Beinhocker (2006: 474) argues that for problems with rugged landscapes, such as biological, technological and institutional problems, evolution not only describes well the actual process through which change takes place, but is in fact the best known search algorithm:

> Mathematicians and evolutionary theorists have explored a variety of alternative search algotihms on different landscape shapes. Some are better for searching perfectly random landscapes, and some are better for searching highly ordered and regular landscapes. But for landscapes that are in between, are rough-correlated, and have complex features such

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[6] For further discussion on the determinants and the implication of the shape of fitness landscapes see Kauffman (1995), Beinhocker (2006: chap. 9) and Page (2011: chap.3)

as platteaus, holes, and portals, evolution is hard to beat. And when the landscape is constantly changing, when the search problem is a dynamic one, when one must balance the tension between exploring and exploiting - evolution truly is the grand champion. (Beinhocker, 2006: 213)

This does not mean that evolutionary processes are in any way efficient and bound to find the global optimal point. It is well known that in biology evolution is tremendously wasteful and subject to path dependence that can lock it in to inferior designs, trying many different things that do not work and failing to try other things that would clearly be better. What is being claimed here is that such a Darwinian-like process, based on variation, selection and retention, is a good description of how beliefs emerge and change and of how they affect institutions. The fact that dysfunctional institutions have been vastly more frequent throught history than more efficient arrangements, is compatible with the notion that institutional change follows an evolutionary process. Mokyr (1993: chap. 11; 2000: 4-5) warns about loose analogyzing from biological evolution to other areas such as culture, scientific progress, language among others. Each of these areas has many similarities with biological evolution, making the use of these models tempting and natural. Yet each area also has many differences and idiosyncracies that forestall a direct one-to-one application of the evolutionary approach. Mokyr proposes that:

Such an approach will only be fruitful if it can shed light on historical problems and explain outcomes of historical processes. Its test will be if it stimulates more research, raises new question, or at the very least revives old debates. If it does not do that, it will be a clever but sterile exercise in mapping from one science into another. (Mokyr, 2000: 5)

With such caveats in mind I propose in this paper an evolutionary approach to understanding beliefs and their impacts on institutions and ultimately on outcomes. I argue that this approach is fruitfull because beliefs share many of the characteristics of other epistemic substrates, such as technology, culture and language, to which variants of this approach have been successfully applied. In particular, beliefs - defined as society's understanding of how institutions map into outcomes - can be argued to go through variation, selection and replication, much in the same way as has been proposed for culture (Boyd and Richerson, 1988; Cavalli-Sforza and Feldman, 1981) and for technology (Mokyr, 1993; 2000), though with adaptations of the argument to the specificities of beliefs.

III.   *What is the Unit of Selection?*

Perhaps the most controversial aspect of applying an evolutionary approach to any specific area is determining what is the unit of selection on which evolution operates. In

biology the original Darwinian theory took the unit of selection to be the individual or the organism, that is, the phenotype. This is the way that most people tend to think about evolution. An animal which, through mutation or breeding, becomes better/faster/stronger than the others with which it competes for resources, will have greater reproductive success leading to more of its kind. But this view was eventually challanged by the notion that evolution acts instead on the genotype, that is, on the set (or even a subset) of genes in an organism (Dawkins, 1976). In this view the individual is just the vehicle for the change and it is instead the genes that code the information for replicating the phenotype that should be the unit of analysis as they are the entity of which copies are made and passed along. Other have argued that, in fact, any entity that goes through heritable variation and selection can be subject to an evolutionary process, so that the unit of selection can be the genes, chromosomes, genomes, individuals, groups, demes, populations, species or even ecosystems. Evolutionary biology has been through fierce disputes over which is the proper unit of selection (known as the 'units of selection debates') and it is probably the case that different units of selection are important for analyzing different questions.

One of the most appealling applications of evolutionary logic to epsitemic substrates has been that of technology and technological change. In evolutionary accounts of the process of variation, selection and amplification of technology it is tempting to think of the artifacts that arise from the efforts at invention and innovation as the unit of selection. However, Mokyr (2000: 6-7) proposes instead that the proper unit of analysis is the technique, that is, "the set of instructions, much like the if-then algorithms of a computer program, that tells someone how to produce, that is how to manipulate the forces of nature in the interest of material well-being of people". In a similar manner, when it comes to analyzing economic development of nations one may be tempted to consider that it is a country that goes through the process of variation, selection and replication. Alternatively one might see the country's institutions as the unit of selection. However, I follow the logic of the variants of the biological and the technological analyses that put the 'set of instructions' as the unit on which evolution operates. The 'set of instruction' on what institutions to put in place in order to produce the sought after material well-being is precisely what this paper has defined as beliefs. Beliefs are thus akin to the genotype in biology and to the technique in technological change, while the institutions are the vehicle, that is the rendition of those beliefs.

In order to explore how beliefs emerge and change let us return to the landscapes representations and suppose a situation where a nation has just undergone a major disruption due to poor performance that ousts the ruling elite creating a window of opportunity for a change in the configuration of power and in institutions. Eventually a configuration of groups will rise to power forming an elite and will be confronted with the choice of which formal institutions to put in place. In order to do this they would like to examine the landscape that shows the fitness of each possible combination of institutions and choose the set that corresponds to highest point. But unfortunately the landscape is not observable. The only way to know the landscape is to test each combination of institutions to ascertian what outcomes would result. But that is too costly and difficult, even for a small subset of the entire set of possible institutional arrangements. Even relying on historical experience or that of other countries would not work as the landscape is specific to a given circumstance and time.

Nevertheless a decision has to be made: some set of formal institutions has to be put in place. To make that choice a society necessarilly has to infer what they think is the shape and location of the current instituional fitness landscape. In order to do so they will use their perception of how they think the world works, which will have been shaped by uncountable factors, such as historical experience, recent traumas, national charcater, culture, religion, fads, global trends, etc. This perception of how the world works is what I call beliefs. Note that by this definition beliefs can also be represented by a landscape that maps from institutions to expected fitness.[7] In fact, beliefs can be represented simultaneously on the same graph as the actual outcome surface. If the perception of how the world works actually fits reality closely, then the two landscapes will be very similar to each other. But in general this perception will be distorted by all sorts of uncertainties, unknowables and biases so that the two landscapes can diverge markedly.

Figure 2 shows an example where the beliefs and actual outcomes diverge. In this example beliefs are always above what will really materialize if those institutions are put into practice, that is, those beliefs are overly optimistic. According to the discussion above, the beliefs are the set of instructions on how to set up the institutions.

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[7] For now assume that all members of society agree on a set of beliefs about institutions. Below I will address the important issue of competing beliefs.

Figure 2 – Beliefs and the actual relationship between institutions and outcomes
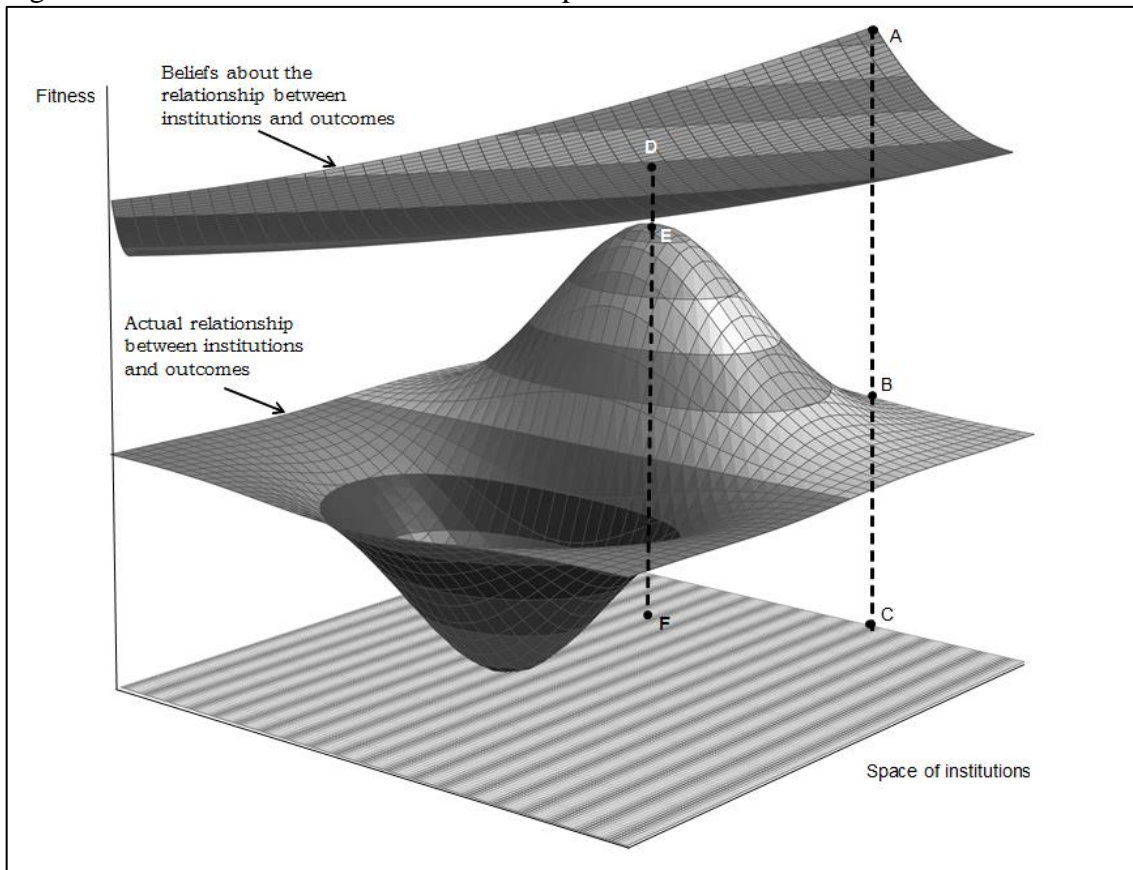
Given the beliefs in the upper landscape in Figure 2, the best possible outcomes that can be expected would reach a fitness at point *A*, measured vertically. This could be achieved by putting into place institutions corresponding to point *C* in the design space of institutions. According to the classification these institutions would be highly inclusive politically and modertately inclusive economically. Yet in making this choice this society is setting itself up for disappointment because rather than outcomes with fitness at height *A* what will actually emerge are outcomes corresponding to fitness level *B*. If the effect of institutions were readily observable, this society would realize that the best possible outcomes which they could aspire at this point in time correspond to point *E* which can be reached through institutions at point *F*, that is, much less inclusive politically and economically than what they are actually trying and more towards the center of the design space. Given their beliefs, however, they see no point in trying institutions at *F*, which they erroneously expect to yield outcomes *D,* lower than those at *A* which they think that they can achieve.

Note that societies never really see the entire landscape of actual outcomes. All they see are the outcomes of those institutions that they actually try out. So in Figure 2 society sees only distance *AB*. This distance is a measure of the selective pressure in this

evolutionary process. The greater the disconnect between beliefs and outcomes, the greater the disappointment and frustration of that society with the institutions they have adopted. This disappointment puts pressure to revise beliefs and can lead to incremental adjustments. But feedback in these systems is slow and societies might hang on to their beliefs for a long time before they realize that things are just not going to turn out as expected. Cognitive dissonance often leads societies to conjure up justifications for why things haven't yet turned out as expected given their beliefs rather than admitting those beliefs were wrong. For these reasons the poor outcomes might persist for a long time, until an event takes place which triggers a sudden demand for change by large parts of society. Such events are 'windows of opportunity', which might take the form of a revolution or a coup, but also myriad other forms such as an electoral upset, a new constitution or even something more subtle.

IV.   *Rents, Beliefs and Suboptimal Institutions*

If we accept that beliefs emerge and evolve in a punctuated manner, one question that arises is why this process is so systematically suboptimal, in the sense that most societies seem to jump over time from one set of beliefs that does not induce development and prosperity to another that similarly fails in this regard. As noted by Denzau and North (1994: 12) "that society's development have been sub-optimal is certainly not open to question." Only a small handful of countries has managed to break this cycle. This pattern indicates that there is no inbuilt mechanism that eventually sees to it that development is achieved. The notion that it is only a matter of time before technology and innovation will spread and allow most countries catch up with the rich economies seems intuitive, but the historical evidence has not confirmed this trend with few countries making the transition in recent decades. The interest here is not so much on those countries that are so poor and dysfunctional that a transition would be truly remarkable, but instead on those middle income countries that seem to have most of what it takes to make that transition, and where what is truly remarkable is that so few seem to embark on that trajectory. In this section I use the landscape representation to portray the standard political economy explanation for why so many nations fail. This explanation involves the conscious choice of suboptimal institutions by the elite as a means to sustain their position in power.

For most countries in the world this class of explanation for why suboptimal institutions are systematically chosen is probably sufficient. Yet for those few societies that are more advanced and have already achieved much of what it takes to make the

transition, there are additional impediments related to searching for beliefs and adapting them to changing circumstances. These are societies where the gains to Coasian bargaining are large and institutions are sufficiently developed to envision these inter-temporal political transaction being struck. In the next section, therefore, I will focus on the nature of the punctuated mechanism through which beliefs evolve as an additional obstacle to prosperity. That is, the nature of the problem of searching for beliefs that yield more efficient institutions and the characteristics of the search mechanism used by societies to solve this problem are explored. Together these two explanations - rents and beliefs - contribute to the understanding of why development is so hard and so rare, and it helps us to understand in what sort of circumstances we can expect a country to actually make the transition.

In order to show how the dispute for rents can lead to suboptimal institutions consider the configuration of beliefs in the upper panel of Figure 3. Following the previous discussion I assume that those beliefs are shared across most of the population and at this point they can be taken as given. That is, the aggregation process through which the beliefs emerge is complete and now they are what they are, so that the only way to try to capture rents is by affecting the choice of institutions and not by attempting to manipulate beliefs. I do not discard the possibility that in the process of aggregating beliefs different groups looked ahead and tried to mold them in ways that would be beneficial to themselves in the future (that is, there is not a veil of ignorance in that process).

Given that the landscape of outcomes in Figure 3 is not observable, this society will use beliefs to guide that choice. Three sets of potential institutions have been indicated in the figure at *B*, *C* and *F*. In my earlier examples I assumed that the society would always choose those institutions that yield the highest level of fitness, given its beliefs. But this expectation involved some implicit assumptions; namely that it is in the elite's interest to choose those institutions. But often that will not be the case and the elite might prefer some other arrangements that allow it to remain in power and wield it with fewer constraints. Even when that is the case there are situations when nevertheless the elite will be constrained or incentivized to pick the best overall arrangements.

Figure 3 – Beliefs, Rents and Inefficient Institutions
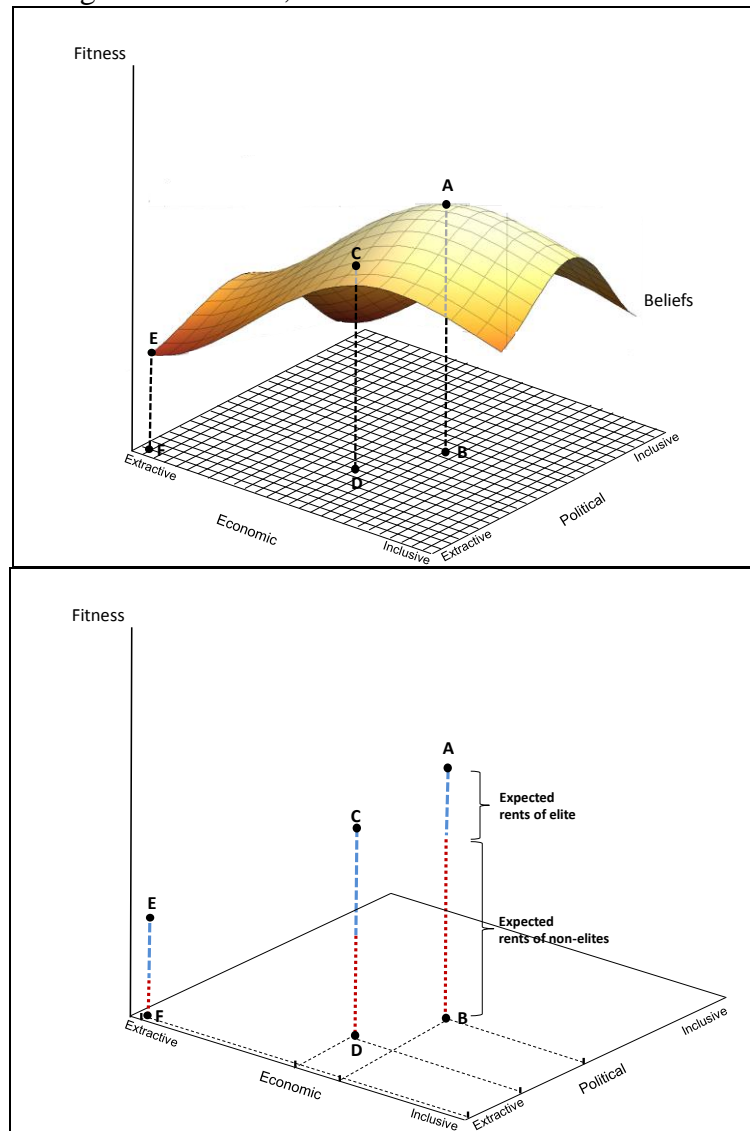
In Figure 3, for example, institutions at *B* yielding expected fitness of *AB*, will be chosen if the elite which is making that choice is either sufficiently enlightened and altruistic, or is in some way constraint to do so, for example by checks and balances and electoral incentives (which of course they can try to affect as they are setting institutions). Alternatively, the optimal expected institutions may be chosen if the current institutions are sufficiently evolved to support the necessary Coasian bargaining for making the necessary side payments.

But these necessary conditions are by no means guaranteed to hold, especially in less developed countries. The middle panel in Figure 3 breaks down the expected fitness of each set of institutions into the rents that the elite expects to capture under those arrangements and the rents that accrue to the rest of society. In the figure all parties want to avoid institutions at *F* which are clearly in no one's interest. However, although the total fitness at institutions *D* is lower than that at *B*, the share that is expected to go to the

elite is larger, thus leading to the choice and perpetuation of sub-optimal institutions. Because the beliefs are shared, it will be known to society that sub-optimal institutions have been chosen, which will create resentment. The extent to which the elite can pull institutions away from the expected optimal set will depend, of course, on its ability to resist and contain that resentment. Countries that are in the extractive regions of the institution space, that is autocracies, will typically be in a better position deviate from the best expected institutions.

Although it is easy to understand why it is hard for very backward or autocratic countries to break out of persistent sub-optimal institutions and underdevelopment, the same is not true for a series of middle income countries that have already gone a long way towards sustained development but have not yet managed to make the transition. These are countries like Brazil, Russia, India, China, South Africa, Chile, Turkey, among others, where income per capita has grown substantially and a fairly complex social and physical infrastructure is already in place. Nevertheless, despite some false starts and boom periods, the transition proper seems to be continuously elusive. For many of these countries the standard political economy rent redistribution explanation may be sufficient. For others that have approximated situations were institutions are chosen with the preponderant goal of maximizing social welfare, there might be other impediments still at play. In the following sections I investigate some of these impediments related to the difficulty in achieving prosperity-enhancing beliefs.

### V.   Beliefs as the Unit of Selection

The interaction of beliefs, institutions and outcomes that I am proposing contains the basic elements of an evolutionary process. The variation comes as the old beliefs are discredited by recent events and outcomes and a new set of beliefs is adopted. Even after the big punctuated change in beliefs takes place, there can be incremental adjustments over time, as adaptations take place in reaction to revealed outcomes. Note that unlike biological evolution where the variation is blind (mutation, crossover and other processes), change in epistemological evolution has intentionality and direction. This does not invalidate the approach, however, as there are still errors, surprises and accidents that create unintended variation. In making this point for the case of technological change Mokyr (1993: pp. 286) states that "there is a large accidental component in long-term change, and the record suggests that serendipity, opportunism, and the 'King Saul effect' (which occurs when the search for the solution of a specific problem inadvertently leads to a totally new opportunity set) plays an important role."

To see this point simply consider how frequently institutional development programs go array, no matter how many of the best local minds and international consultants are involved.

If the units of selection in the case of institutional development are beliefs, and not the country or the institutions, then how do the forces of selection operate? I noted above that the survival of a set of beliefs depends on its capacity to deliver on its promises. When institutions implemented based on a set of beliefs come up short in terms of the realized social welfare there will be pressure for replacing the beliefs and consequently the institutions. The form that this pressure takes and the consequences it leads to is contextual and will vary from country to country and over time and circumstance. The process of change is not usually smooth and linear but exhibits self-organized criticality where change comes at hard to predict tipping points. The current institutions can affect the way this pressure manifests itself, so authoritarian regimes might go through very long periods of discontent before beliefs are displaced while other countries might exhibit high sensitivity of beliefs to disappointment.

In order to illustrate why the feedback from realized outcomes to changes in beliefs can be slow and imprecise, the top panel in Figure 4 portrays the information that a society has after it has acted upon its beliefs and implemented institutions at point *C*. The beliefs are known and the fitness of realized outcomes at point *A* are known, but the counterfactual outcomes, had any other set of institutions been chosen instead, are not known. The distance *AB,* from the beliefs *B* to the realized outcomes at *A*, is quite small, which should reinforce the confidence in those beliefs. It will lead this society to assume that the entire belief landscape is basically correct. That is, it will believe that it is in a situation similar to the middle panel in Figure 4, where there is a close coincidence between outcomes and beliefs. This confirmation of beliefs acts as a stabilizing force indicating to the society that all is as should be. But note that it cannot really be ascertained that this is the case, as the outcomes from other possible beliefs and institutions are not known. To see this consider the bottom panel in Figure 4, which represents a situation where the same beliefs and outcomes from the top panel would indicate that this society is actually underperforming terribly. Its beliefs are completely misguided, as the expected outcomes given any set of institutions are below the actual outcomes that will emerge. As drawn the beliefs have lead this society to pick *C,* the worst possible set of institutions, yielding outcomes *B* when better outcomes, such as *E*, could have been achieved through institutions at *D*. Despite this misguided situation, the

Figure 4 – Mistaken Beliefs and Outcomes
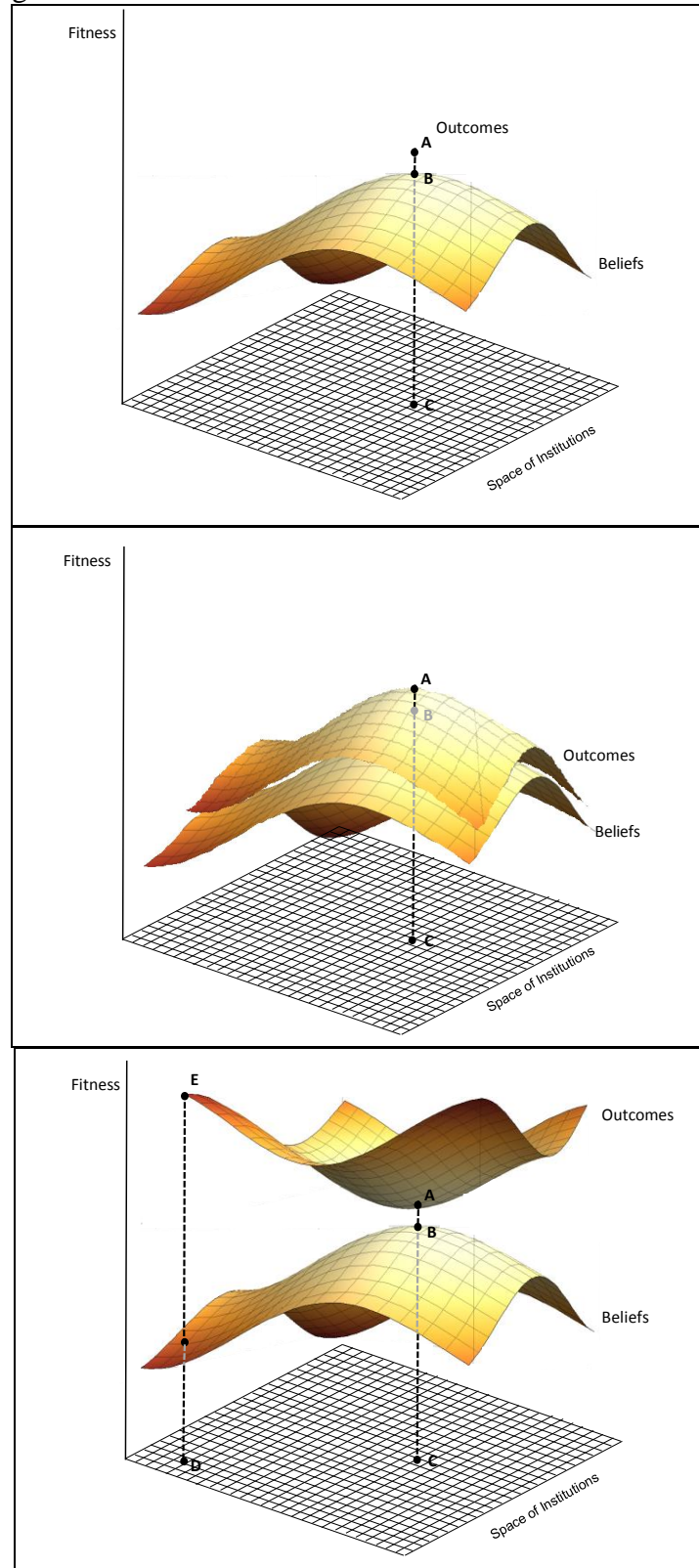
proximity of *A* to *B*, which is the same as in the other panels, will signal that the current beliefs are almost on target, so there is insufficient feedback for moving to a more appropriate set of institutions. Actually, the process of interpreting how to adjust beliefs and institutions is even harder than this, for as we will see later, the outcome landscape

dances over time so that even positions that have already been tried may have shifted, making the information from past experience obsolete.

Clearly the lower panel in Figure 4 was an extreme case where the beliefs were overly pessimistic. But historical experience suggests that countries do get it wrong more often than not and that they can persist in error for long periods of time. The point of the example above is that the combination of a rugged landscape and the non-observability of the outcomes landscape mean that choosing and adapting beliefs is a complex task that has important consequences for a country's development. If the consequences of institutions for growth and development were known, then one would expect more countries to transition from poverty to prosperity, despite the additional problems of social conflict and credible commitment that hinder those efforts. We can thus ask how beliefs emerge and change over time. Thinking in terms of landscapes this question involves figuring out what kind of search algorithm countries use to determine the beliefs that then determine the institutions. In addition we would like to consider whether the nature of the search strategies used can tell us anything about the nature of development across countries.

In other evolutionary processes, such as biological, technological and cultural, it has been suggested that the search strategy used by evolution is one that balances exploration with exploitation (Holland, 1975 and 1995; Page, 2011; Beinhocker, 2006). At any point in time a species that has reached a relatively high point in its fitness landscape would want to perpetuate the current genotype in order to exploit that fitness to the environment. There is however a tradeoff that must be considered. It is possible that the current point is a local maximum and there may be preferable peaks nearby that can be reached through some viable variation. In addition it is always possible that the landscape will dance, as other species, such as predators, prey or competitors change/mutate their characteristics, making the current setup suddenly not so fit. It would thus be wise to dedicate some efforts to exploring the landscape for fitter designs. The evolutionary process of variation, selection and replication has the characteristic of seeking a balance in this trade-off. Exploitation takes place as fit designs that have been selected by environmental pressures replicate. Yet because this replication happens through recombination and involves errors, i.e. mutations and other processes, there is continual exploration. A mutation can be seen as a jump from one point in the landscape, possibly a local peak, to another non-contiguous point. Most jumps will lead nowhere, but eventually some might land on higher ground. Furthermore, evolution is

such that this balancing act dynamically adjusts itself to circumstances, exploiting more when the current set up is particularly fit for the environment and exploring more when fitness decreases (Holland, 1975).

In non-biological evolutionary processes too the trade-off between exploitation and exploration is at play. Technological invention and innovation, for example, can exploit the current set of knowledge by seeking to improve on already existing techniques, or to explore by seeking (often inadvertently) for new techniques that increase the set of useful knowledge in society. Mokyr (1993: chap. 11) acknowledges the sub-optimality of evolution as an algorithm for searching for technological innovation, but nevertheless takes a very positive view of what it has achieved:

> Natural selection may at times have thrown up an anomaly, or given way to a fad or superstition. Not everything that ever was, was good. But by and large there was order and logic in the evolvement of techniques, and when necessary the shackles of the past could be broken. (Mokyr, 1993: pp. 285).

Another area where evolution as a search algorithm has a long tradition is in the literature of organizations. In an influential paper March (1991) has modelled the process through which organizations deal with the exploration/exploitation trade-off in the process of acquiring new capabilities. Interestingly the main conclusion of this literature has been that in this type of system evolution has some undesirable properties:

> The essence of exploitation is the refinement and extension of existing competences, technologies, and paradigms. Its returns are positive, proximate, and predictable. The essence of exploration is experimentation with new alternatives. Its returns are uncertain, distant, and often negative. Such features of the context of adaptation lead to a tendency to substitute exploitation of known alternatives for the exploration of unknown ones, to increase the reliability of performance rather more than its mean. This property of adaptive processes is potentially self-destructive. (March, 1991: 85)

This differential performance of evolution as a search algorithm in different systems raises the question of how it performs when it comes to beliefs and institutions in the development of nations. The exploration and exploitation trade-off is clearly present in this system. Exploitation of current beliefs takes place when a country's realized outcomes match those beliefs and there is little pressure to change. This situation validates and strengthens the beliefs inducing the society to stick to its current institutions. Exploration takes place in two ways. Learning and feedback can lead to small incremental adjustment in beliefs and institutions over time when things turn out as expected and new information is used for minor adjustments. But when there are large disconnects between outcomes and beliefs there will be pressure for change, which can lead to a tipping point, that is, a window of opportunity in which a discontinuous change in beliefs and institutions can take place. This punctuated change can be seen as

a jump in the landscape, analogous to a mutation in biology. When it comes to beliefs the jump is actually less constrained than in biological systems, which are constricted by some physical laws, i.e. a tiger cannot acquire wings in a single step. Changes in beliefs might be inhibited by some forces, such as custom, culture, tradition or received biases, but it can still happen that a country will leap across the landscape to something very different, such as when a society adopts beliefs based on equality and inclusion as it liberates itself from dictatorship or apartheid.

So, how well does the evolutionary process balance exploitation and exploration in the case of beliefs? Similarly, how well does it deal with the fact that in development, like in some other systems, the landscape dances? Do beliefs respond rapidly to changes in selective pressure and adapt to new circumstance as biological systems seem to do, producing wondrous new agents and ingeniously filling in niches? Or do they respond less nimbly to the evolutionary pressures as some have argued is the case for organizations and innovation (Foster and Kaplan, 2001; Beinhocker, 2006: 330-331).

In order to address these issues it bears remembering that the unit of selection is beliefs, and not countries. Countries are simply the vehicles in which beliefs replicate. Also, there is only a small and relatively fixed set of countries, and countries do not tend to die. Beliefs on the other hand are infinitely varied and do go extinct. They have exhibited throughout history the amazing variation and adaptability that one would expect from an evolutionary process. Although our graphical portrayal of institution may make the space of all possible beliefs seem limited, actual beliefs involve many more dimensions and can vary in complex and nuanced ways. Following Mokyr (2000: 44) we could then ask whether there is 'progress' in the system, a question which he breaks down into two separate issues: (i) whether there is a trend over time, and (ii) how can this trend be assessed? When comparing the variety of beliefs that exist today across the world with that in previous centuries one may feel tempted to conclude that there is an inexorable trend towards more democratic, open and humanist beliefs as there are less regimes today based on openly oppressive beliefs such as those that gave rise to Nazism, Fascism, slavery and apartheid (Pinker, 2011). It is certainly not the case, however, that all one has to do is wait a few more decades and most countries in the world will have beliefs that promote open access, equality and inclusion. Although humanity seems to have renounced some of the most grievous varieties of beliefs, there seems to be no discernable trend, with different societies moving in different directions with no apparent pattern.

Even if there is no general trend there is still the issue of whether the evolution of beliefs has made progress, in the sense of increasing the welfare of large fraction of the world's population. Such a question is naturally controversial and depends on what criteria and what counterfactuals one uses. A premise of this paper is that transitions from poverty to prosperity have been rare in history, especially in the last hundred years. When it comes to nations and their beliefs over how to set their institutions, the evolutionary process has a tendency to perpetuate suboptimal results, only in exceptional cases promoting transitions from underdevelopment to development and prosperity. This is not to say that GDPs haven't increased over time and poverty hasn't been reduced, but rather that the changes generally referred to as development, that go beyond what GDP measures, have still eluded most of humanity. Whereas a handful of countries have reached remarkable levels of social welfare and quality of life for their population, most countries seem unable to break through the barrier and follow suit, despite the example of those rich countries that should indicate what can be done.

Why would it be that the evolution of beliefs seems to be so less effective in finding higher fitness and adapting to changes than evolution in other systems such as biology and technology? I noted earlier that even in these other areas outcomes are not efficient and many sub-optimal results emerge and persist. Nevertheless beliefs still seem less agile in finding better point in the landscape. Cox, North and Weingast (2013) show that from 1840 to the present the median regime went through violent regime change once in every eight years. Because beliefs, like some other epistemological and creative systems, have direction and intentionality, we might expect them to be more adept at finding points of higher fitness. In addition beliefs can use the experience of history and of other countries as a guide of how the world works. Also, beliefs can take great leaps across the landscape, which should give it more choices and more agility to find good solutions. It may be, however, that these characteristics may sometimes be a disadvantage, especially if there are biases and cultural blinders that impede some solutions from being considered and lead to path dependence that forestalls movement in some directions (Page, 2011: 125). But perhaps the biggest handicap in the evolution of beliefs is the fact that each attempt at variation is a single-shot on which all bets are concentrated. In contrast, a biological species takes a shotgun approach that simultaneously makes a large number of experiments, most of which will lead nowhere, but some of which can occasionally uncover higher fitness designs. In technology and innovation too there are many simultaneous explorations going on all the time, and once

something new and useful has been uncovered it can easily replicate and be adopted by many other agents. In both cases there are obstacles and path dependence can make the process less agile, but it works remarkably well.

With beliefs, meanwhile, a given society experiments with one set at a time. The feedback is slow, so that a cycle that starts with a punctuated change of beliefs and goes through the process of determining if those beliefs pay out as expected, can take many years, even decades. In addition to path dependence, cognitive dissonance and vested interests can delay the process and blunt the effectiveness of the selection procedure, condemning that society to persist for long periods in suboptimal arrangements before trying another experiment. Because the unit of selection is beliefs, one might suppose that the information gathered by a given nation in each turn of this cycle will benefit all other nations, so that a common set of beliefs would eventually evolve. But beliefs are specific to a given society, so that although one country's experience is informative to all others, in the end each country has to search its own landscapes and find its own contextual path to development.

VI.   *Conclusion: Development as adapting to dancing landscapes*

Because the landscapes in the approach I have been using measure the fitness of the outcomes, we can consider what the process of development is like in terms of these concepts. Fitness measures social welfare, so development has to involve higher levels of fitness over time. A society can achieve this in two ways. The first involves a move from points of lower fitness on a given landscape to points of higher fitness. This is done by moving to institutions that are welfare enhancing. Much of the discussion above has been about the processes through which societies perform this search given that the landscapes are not observable and they therefore have to form beliefs about its shape. I suggested that beliefs emerge and change through an evolutionary process that involves variation, selection and replication. And although this process has many powerful properties as a search mechanism, the problem of development is such that most countries nevertheless systematically fail to reach higher levels of fitness, i.e. development and prosperity.

A second way in which landscapes can reflect the process of development is through vertical shifts that take place when something causes the same set of institutions to lead to higher fitness. This would be caused by exogenous changes that increase or reduce that country's set of possibilities, such as new technologies and opportunities that expand that set, or climate change that can reduce it. These changes would not shift the

whole landscape maintaining its shape but rather cause it to deform, as some sets of institutions allow a country to take better advantage, or be better able to deal with negative consequences, of a given shock.

But more importantly the landscapes dance because of the interdependence of each country with all other countries. A globalized world means that markets in finance, capital, credit, goods, services, labor, talent, ideas, and a host of other things are interconnected, so that one country's search along its own landscapes affects the outcomes that can be achieved by other countries. These effects can be tectonic shifts, such as the recent global financial crisis, or minor ripples from myriad other causes. The result of this dancing is that what was already a difficult problem becomes even harder. It leads to what is known as the Red Queen's Race, that is, a situation where the evolution of a trait by one species (e.g. a predator) requires other species (e.g. its prey) to evolve countervailing traits just to survive. That is, it is a race in which "it takes all the running you can do, to keep in the same place," as noted the Red Queen in Lewis Carroll's *Through the Looking Glass* (1871). It means that development is actually a problem of coupled landscapes and coevolution in which a country never really reaches a finish line where it has made it into the club forever, but rather that the game goes on endlessly requiring constant adaptation. This key role played by the ability to adapt to changing circumstances gives us a clue of what might be the essential feature of development. Of course development requires higher levels of wealth and income, and the economics literature has explored a long list of factors that are necessary, conducive or in some way or another can affect the ability to reach growth and prosperity, such as specialization, the size of the market, natural resources, geography, human capital, social capital, and perhaps most fundamentally, institutions. But given that reaching and staying at regions of high fitness involves constantly adapting to new circumstances, perhaps the key to development is reaching beliefs that produce a robust system, where robustness is understood as "the ability to maintain functionality in the face of some change or disturbance, which could be internal or external to the system" (Jen, 2005). As noted by Page (2011: 149) robustness is not the same as stability, which involves going back to a given equilibrium, but rather the ability to deal with the changing circumstances so as to relocate quickly on the new changed landscape.

In terms of countries, being robust and able to adapt to shocks involves being able to take collective action, solve prisoner's dilemmas and coordination problems, reduce free-rider problems, make inter-temporal transactions across various groups in

society, promote cooperation and trust, generate sufficient consensus and legitimacy for creating and implementing ideas for change, etc. For a society to have these capabilities it must have the appropriate institutions in place: that is in a nutshell the main message of new institutional economics (North, 1990; Coase, 1960; Ostrom, 1990). So, if robustness depends on institutions, and institutions are determined by beliefs, then development-inducing beliefs must be those that yield the appropriate institutions.

Can we say anything about what kind of beliefs these might be? We noted earlier that each country faces a different outcome landscape so clearly the challenge faced by each country requires different beliefs. Nevertheless there might be some general properties of beliefs that hold across most societies. In the past decade a thriving literature has made the hypotheses that development requires open access (North, Wallis and Weingast, 2009) and inclusive institutions (Acemoglu and Robinson, 2006; 2012). The idea is that although each country will face its own outcome landscape, and although the landscapes dance over time due to interconnections to the rest of the world, they would nevertheless have a general shape, where arrangements with open and inclusive institutions tend to have higher fitness than institutions that have characteristics of limited access and extractive features. The idea under this hypothesis is that even when these landscapes dance they retain the general characteristic of being sloped upwards towards the inclusive regions of the graph. This is, however, just a hypothesis, albeit one that has gained much traction recently. There are many different hypotheses of the general shape that development can take. One such alternative hypothesis is that there are some extractive political institutions and somewhat extractive economic institutions (perhaps something like Chinese state-led capitalism) that can yield high levels of fitness. The further exploration of fitness landscapes may help the search for some general properties of development.

References

Acemoglu, Daron, and James Robinson. 2006. *Economic Origins of Dictatorship and Democracy*. New York: Cambridge University Press.

Acemoglu, Daron, and James Robinson. 2012. *Why Nations Fail; The Origins of Power, Prosperity and Poverty*. New York: Random House.

Alston, Lee J., Marcus A. Melo, Bernardo Mueller and Carlos E. Pereira. 2015. *Beliefs, Leadership and Critical Transitions: Brazil 1964-2014*. Princeton Univ. Press.

Beinhocker, Eric D. 2006. *The Origin of Wealth: The Radical Remaking of Economics and What it Means for Business and Society*. Harvard Business School Press.

Boyd, Robert and Peter J. Richerson. 1988. *Culture and the Evolutionary Process*. The University of Chicago Press.

Carroll, Lewis. 1871. *Through the Looking-Glass and What Alice Found There*. Macmillan & Co.

Cavalli-Sforza, L., and Feldman, M., 1981, *Cultural Transmission and Evolution: A Quantitative Approach*, Princeton: Princeton University Press.

Coase, Ronald H. 1960. "The Problem of Social Cost." 3 Journal of Law and Economics: 1–44.

Cox, Gary W., and Douglass C. North, and Barry R. Weingast. 2013. "The Violence Trap: A Political-Economic Approach to the Problems of Development." Working Paper, Hoover Institution, Stanford University, August.

Dawkins, Richard. 1976. *The Selfish Gene.* New York: Oxford University Press.

Denzau, Arthur, and Douglass C. North. 1994. "Shared Mental Models: Ideologies and Institutions." *Kyklos* 47: 3–31.

Engerman, Stanley and Kenneth Sokoloff. 2000. "Institutions, Factor Endowments, and Paths of Development in the New World", *Journal of Economic Perspectives*, 14(3): 217-32.

Foster, R. and S. Kaplan. 2001. *Creative Destruction*. New York, Doubleday.

Glaeser, Edward L., Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer (2004). Do Institutions Cause Growth? *Journal of Economic Growth*, v9, n3, September 2004, 271-303.

Gould, Stephen J. 2002. *The Structure of Evolutionary Theory*. Harvard Univ. Press.

Harrod, Roy F. 1939. "An Essay in Dynamic Theory". *The Economic Journal* **49** (193): 14–33.

Hausmann, Ricardo. 2014. "The Mismeasure of Technology." http://bigthink.com/project-syndicate/the-mismeasure-of-technology

Holland, John .H. 1975. *Adaption in Natural and Artificial Systems*, MIT Press.

Holland, John H. 1995. *Hidden Order*. Addison-Wesley.

Jen, Erica. 2005. "Robust Design: a Repertoire of Biological, Ecological, and Engineering Case Studies." In *Santa Fe Institute Studies on the Sciences of Complexity*, Oxford University Press.

Jones, Charles I., and Paul M. Romer. 2010. "The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital." *American Economic Journal: Macroeconomics*, 2(1): 224-45.

Kauffman, Stewart. 1995. *At Home in the Universe*. New York: Oxford Univ. Press.

Landes, David S. 1998. *The Wealth and Poverty of Nations: Why Some are so Rich and Some so Poor*, W.W. Norton & Company.

March, J. G. 1991. "Exploration and Exploitation in Organizational Learning." *Organization Science*, 2: 71–87.

Mokyr, Joel. 2000. "Natural History and Economic History: Is Technological Change an Evolutionary Process?" Northwestern University, draft lecture http://faculty.wcas.northwestern.edu/~jmokyr/papers.html.

Mokyr, Joel. 1993. *The Lever of the Riches: Technological Creativity and Economic Progress*. Oxford: Oxford University Press.

North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*, Cambridge University Press.

North, Douglass C., John Joseph Wallis and Barry R. Weingast. 2009. *Violence and Social Orders: A Conceptual Framework for Interpreting Recorded Human History*. New York: Cambridge University Press.

Ostrom, Elinor, 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press.

Page, Scott E. 2011. *Diversity and Complexity*. Princeton University Press.

Pinker, Steven. 2011. *The Better Angels of Our Nature: Why Violence has Declined*. Viking Books.

Rodrik, Dani. 2014. "When Ideas Trump Interests: Preferences, Worldviews, and Policy Innovations." *Journal of Economic Perspectives*, 28(1): 189-208.

Romer, Paul M. 1990. "Endogenous Technological Change," *Journal of Political Economy*, October, 98(5), S71–S102.

Rostow, Walt W. 1959. "The Stages of Economic Growth." *The Economic History Review*, Vol.12, No. 1: 1-16.

Sachs, Jeffrey and Andrew M. Warner, 1995. "Natural Resource Abundance and Economic Growth," NBER Working Paper No. 5398.

Solow, Robert M. 1957. "Technical Change and the Aggregate Production Function". *Review of Economics and Statistics* The MIT Press **39** (3): 312–320.