

Emerging Implications of Broadband: Wrestling with Convergence and Communications Policy

Richard S. Whitt
Washington Telecom and Media Counsel



NARUC
Winter Meetings
“The Regulatory, Policy and Business Implications of Converged Networks”

February 15, 2009

Good morning.

Today I want to spend a few minutes talking about convergence, or at least how we at Google think about it, and then some business and policy ramifications.



We see convergence and emergence as two related but different concepts, centered on the role of the Internet as a growth and innovation platform.

Convergence of Networks



- Leveraging the “virtuous hourglass.”
 - The Net’s architectural norms.
 - The Net as a complex adaptive system.
 - The Net as a platform for innovation and growth.
 - Virtuous feedback loops.
- Services become applications.
- The “core” moves to the “edges.”

3

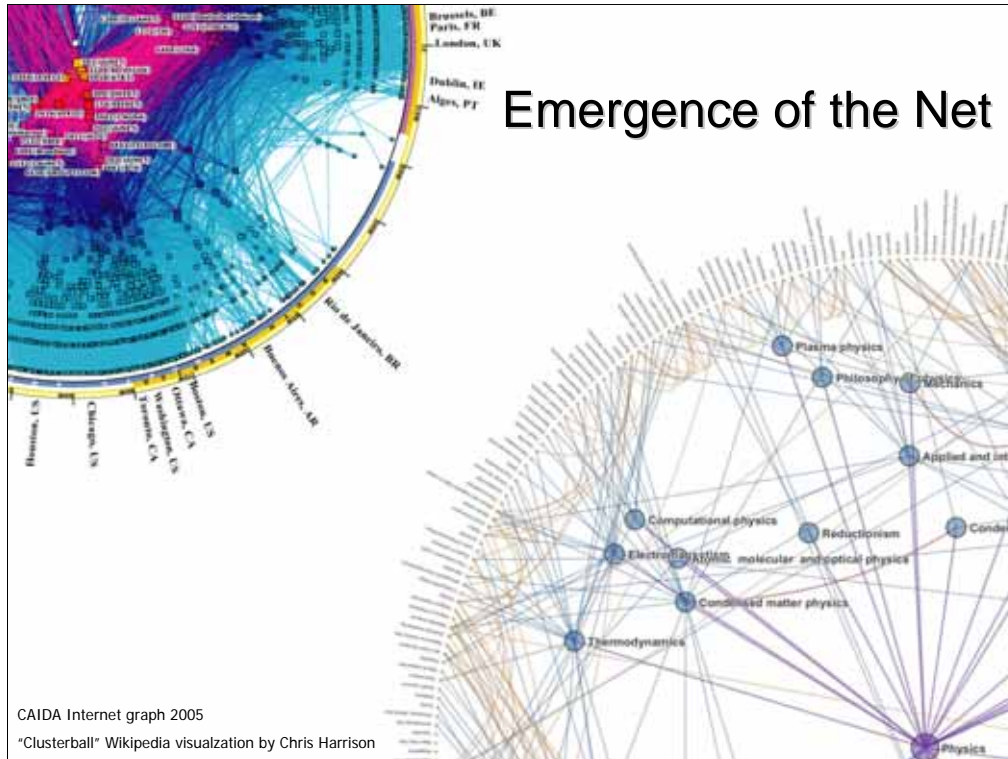
Convergence can be a misleading term, It suggests that everything in the telecom space is boiling down to a single service, or concept. As it turns out, that’s only partially true.

In reality, we are converging to a single platform: the Internet Protocol, and the public Internet itself.

But at the same time, we are diverging both in terms of the applications, content, and communities being supported, and the various last-mile network platforms that in turn support IP.

The virtuous hourglass, with IP at the middle (Vint Cerf: “IP on, and under, everything”).

We are also converging onto key elements of Internet architecture: modularity (layering), smart edges (e2e), universal interconnection (network of networks), and ubiquitous IP (agnostic bearer protocol).



This convergence has some important implications:

- First, the Net is a complex adaptive system; the whole is greater than the sum of the parts. Among other features, such systems have emergent properties, like feedback mechanisms.
- Second, the Net is a “general purpose technology,” meaning it acts as a ubiquitous bearer platform for growth and innovation.
- Third, services now are software applications, no longer bound inextricably to the network itself.
- Fourth, the Core moves to the Edges; “smart edges, dumb core.”

Here are two representations of the Internet, the organic “network of networks.”

The image on the right is the CAIDA Internet map.

The image on the left is a visualization called "Clusterball," a Wikipedia entry.



As a “general purpose technology,” the Internet generates tremendous positive externalities, or “spillovers” not captured by platform owners.

These emerging “Net effects” include all kinds of economic activity by innovators and entrepreneurs, leading to robust economic growth.

These Net effects also include less-tangible but still important values, not included in traditional economic models, including:

- Innovation “spillovers” (Brett Frischmann): some economic value “spills over” to benefit the larger society.
- Peer production (Yochai Benkler): user as producer of goods/services outside the traditional producer/consumer relationship
- Social production (Yochai Benkler): users as producer, operating under non-traditional economic incentives
- Social layer (Susan Crawford): human interaction and communication; diversity, freedom of expression, democracy

Business Implications

Increasingly, networks & users are going to battle over market and policy issues.

As networks and services separate, users are starting to gain the upper hand in a “value chain tug of war.”

Market and policy battles increasingly are shaping up between the networks and their users.

Blair Levin, an analyst for Stifel Nicolaus (who will be speaking here tomorrow) wrote a prescient piece more than two years ago, in which he describes what he calls “the value chain tug of war” between the network and the stuff riding on those networks.

As he explains it, in the past, the network held most of the value, because the voice or video or data service had been tied directly to the network.

Today, thanks to the Internet, that value is shifting away from the networks, and innovation and growth increasingly arises from the edges of the network, from its users.

Naturally network owners are not pleased with this development.

The battle over “network neutrality” is the end result.

A battle in what could become a protracted war.

But can't both sides still benefit from a growing pie?

Google's Mission



**Organizing the world's information and making it
universally accessible and useful.**



So what is Google's interest in all this?

Our corporate mission statement is to organize the world's information, and make it universally accessible and easy to use.

Two of those three elements are within the purview of our talented engineering and product teams, and our partners and vendors.

However, that middle concept – universal accessibility – is the crux of our interest, and our concern.

Unlike our ability to create a new software application, or tweak an algorithm, we have very little control over whether and how our users can reach us.

Accessibility is the world of communications providers, and in turn of communications policy.

As our roster of new applications grows, obviously we benefit from having more and bigger platforms available and open for our users to utilize our search, ads, apps, and content.

However, we also believe in the ecosystem of the Internet, the central premise of "innovation without permission." We were born and raised and found success in that ecosystem, and we believe that consumers are better off for it. So our fight for universal accessibility, while obviously serving our own pecuniary interests, also serves the larger interests of consumers and an open Internet.



So what does all this mean for communications policy?

I've written several papers which try to deal with this question. One answer is that we need to see the market and government with fresh eyes, not as standalone or even antagonistic entities, but as linked, co-evolving agents in the larger ecosystem. Market and State are conjoined. The workings of the economy rely on the government, and vice versa.

The question is not whether government necessarily is part of the market, but what that role should be.

The policymaker (legislator, regulator, court) should act as an adaptive agent, sensitive to its own cognitive constraints and the dynamism and unpredictability of the market. Thus, the first principle should be that the policymaker must take great caution in his or her actions in the market.

Challenges for Policy Makers

- **Outdated tools**
- **Outmoded concepts**
- **Old issue, new guise:**
**the role of network
infrastructure in
society**

```
[<c0294700>] nf_hook_slow+0x68/0xf0
[<f889e740>] br_handle_frame_finish+
[<f889e94a>] br_handle_frame+0xfa/0x
[<f889e740>] br_handle_frame_finish+
[<c028aa3d>] netif_receive_skb+0x13d
[<c0124586>] __group_complete_signal
[<f888b42e>] e1000_clean_rx_irq+0x15
[<f888b06a>] e1000_clean+0xba/0xf0 [
[<c028ad4f>] net_rx_action+0x6f/0x10
[<c011e909>] __do_softirq+0xb9/0xd0
[<c0104a8a>] do_softirq+0x4a/0x68
=====
[<c0104953>] do_IRQ+0x63/0xb0
[<c010e7d0>] smp_apic_timer_interrupt
[<c01030c2>] common_interrupt+0x1a/0
[<c0100012>] mwait_idle+0x52/0x80
[<c0100650>] default_idle+0x0/0x30
[<c010071b>] cpu_idle+0x5b/0x70
[<c03ad911>] start_kernel+0x161/0x1at
[<c03ad350>] unknown_bootoption+0x0/
Code: 00 00 31 c0 85 c0 0f 85 98 01 0f
52 8d 76 00 0d bc 27 00 00 00 00 0d :
64 89 44 24 04 0d 46 24 89 04 24 0b :
<0>Kernel panic - not syncing: Fatal
```

Well, for starters, it means that policymakers have been ill-equipped to deal with the numerous issues stemming from convergence and emergence and value-shifts.

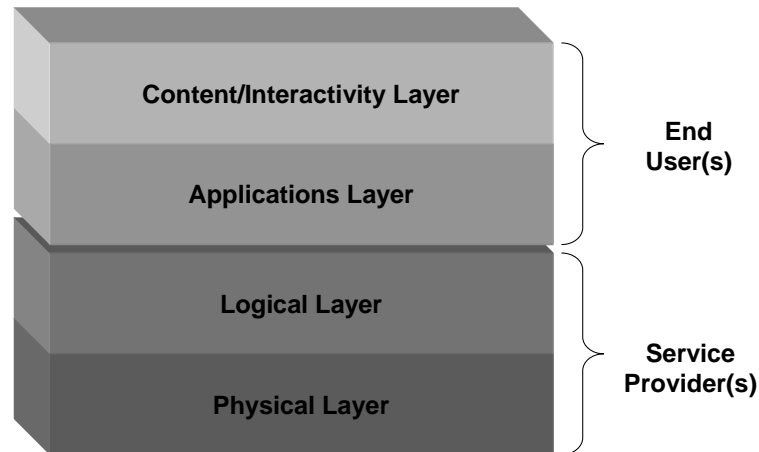
- Should use Layers, rather than Silos – the VoIP debacle in the U.S.
- Should encourage incentives to investment in innovation and growth, not just incentives to investment in networks.
- Should encourage, rather than discourage, positive spillovers.
- Should regulate last, rather than regulate first
- Should use less “command and control,” and more “soft power” (targeted actions, bully pulpits and raised eyebrows, self-regulatory bodies, etc.).

Moreover, because access to the Internet requires connectivity by a network provider, network-based market power now means much more than it used to (we’re moving up the protocol stack, from competitive LD, to competitive CLECs, to competitive ISPs, and now apps and content providers).

A Modular Framework



One overarching conceptual tool for policymakers is the “layered” approach to communications policy.



10

Here is one conceptual tool better equipped to deal with converged networks, and emergent phenomena: the layers model.

I wrote a small paper about this in 2005, and I think it still makes sense today.

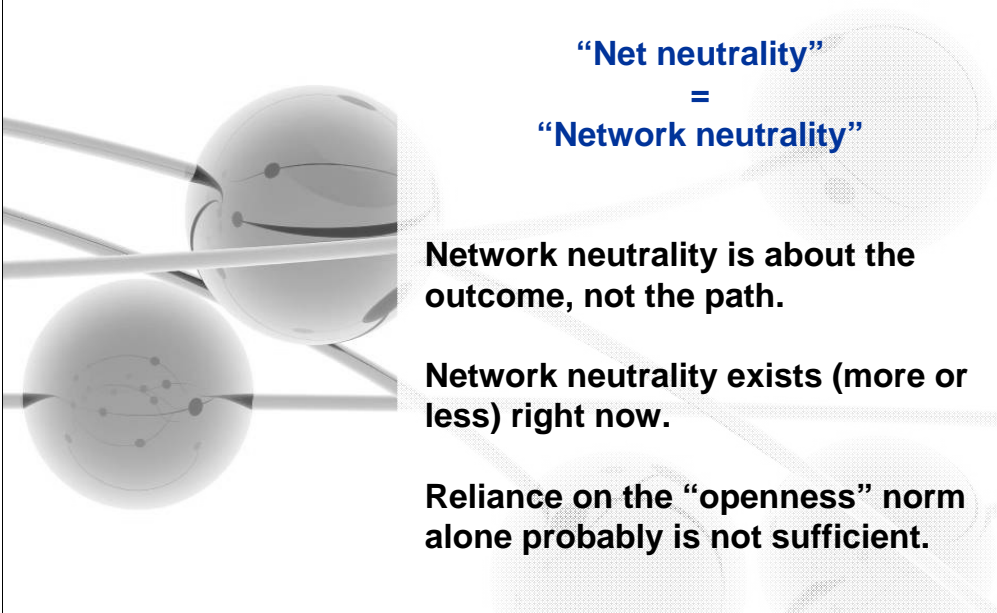
Among other virtues, this model mirrors the actual market economy that has been built around the Internet, allowing policymakers to focus on the right issues at the right level.

Of course, as state regulators, you are familiar with the battles over the physical layer, the interconnection and unbundling regime instituted by the Telecom Act of 1996.

The FCC’s ISP open access regime – the Computer Inquiry, ONA, and CEI requirements -- constituted the battle over the logical layer, culminating in the Brand X decision and the Wireline Broadband Order.

Now, with network neutrality, we are focusing on broadband business models affecting the applications and content layers.

“Net Neutrality” Deconstructed



**“Net neutrality”
=
“Network neutrality”**

Network neutrality is about the outcome, not the path.

Network neutrality exists (more or less) right now.

Reliance on the “openness” norm alone probably is not sufficient.

So now that I’ve gone and said it, I will touch on network neutrality and broadband policy in my presentation. My hope is to bring some new perspectives on both.

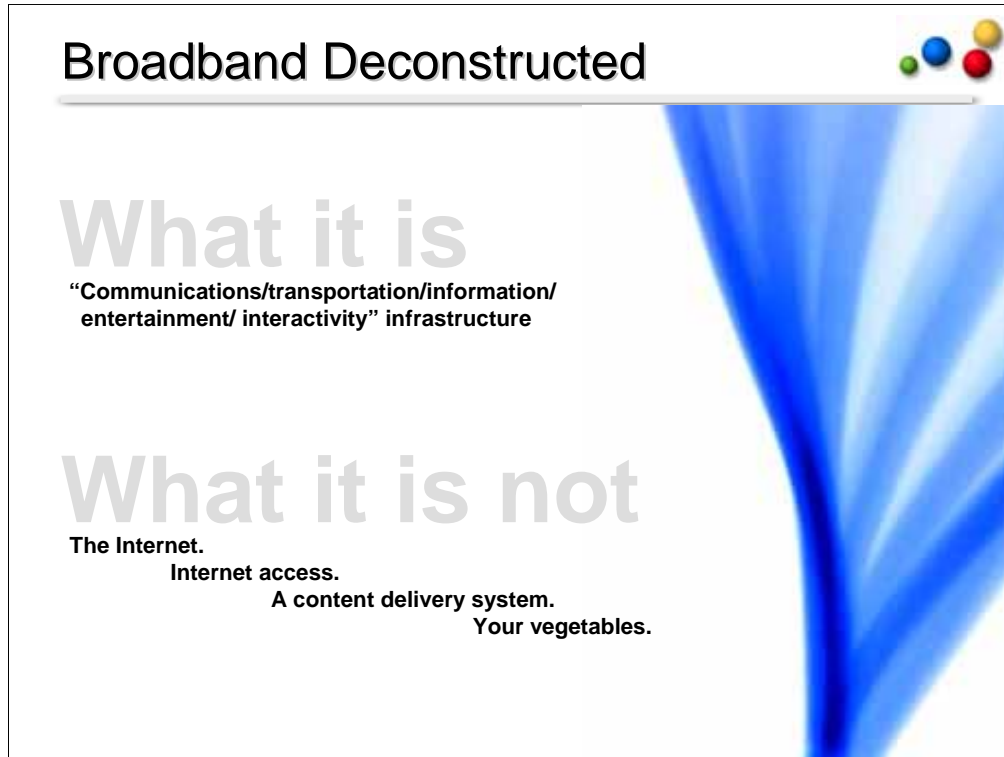
I believe there are several misnomers that need to be addressed about NN.

First, NN is about the broadband network, not the Net. The Net is neutral in its basic architecture, particularly the e2e principle and agnostic IP protocol. However, there are many non-neutral structural and business overlays, which is OK given the competitive forces there.

Second, NN is all about the ends, not the means. We had a world on NN in the dial-up environment. But first we lost broadband facilities-based competition, and then independent ISP competition. So NN is the next stage in the ongoing struggle between networks and their users.

Third, without laws or regulations, norms and bully pulpits and unenforceable principles so far have accomplished a sort of network neutral environment.

Fourth, we can’t trust that this environment will last; see Comcast situation. The carriers still have the incentives and the means to discriminate. The question is what to do about it.



There are also a lot of misnomers about broadband.

Broadband is infrastructure for both transportation (of bits) and communications (of people), of conveying content (information) and establishing relationships (interactivity). We value bb for what it enables, not for what it is.

Broadband is not:

The Internet: to regulate broadband is not to “regulate the Internet.”

Internet access: broadband infrastructure provides access to the Internet as one of its functionalities; Justice Clarence Thomas didn’t get it.

A content delivery system: one-way video streaming is but one possible functionality; rich two-way interactivity promises far greater benefits.

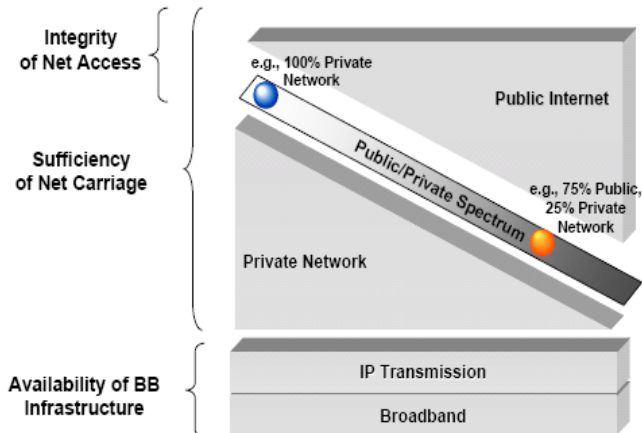
Your vegetables: we all assume that consumers should want a ton of broadband, but that is only an assumption. We need to consider the demand side of the equation just as much as the supply side.

Three Dimensions of Broadband



Broadband offers three different ways of serving as an Internet platform:

- availability of infrastructure
- sufficiency of carriage
- integrity of access



THREE DIMENSIONS OF BROADBAND
AS AN OPTIMAL INTERNET PLATFORM

13

When focusing on broadband as a platform for the Internet, there are three dimensions that warrant attention:

Availability of broadband infrastructure: the need for a national broadband policy?

Sufficiency of Net carriage: adequate network capacity for robust Internet access; how much bb capacity is given to the best efforts, public Internet, versus closed, proprietary network offerings?

Integrity of Net access: open Internet, or traditional NN

All three dimensions are necessary for an optimal Internet experience for end users.

Public Policy Goals & Objectives



One Policy Goal

more good ideas

One Policy Objective

**broadband as optimal
internet platform**



Here is one way to translate these larger economic and technology considerations into a more concrete set of policy goals and objectives.

-- One Suggested Policy Goal: More Good Ideas

(Susan Crawford: “cognitive diversity”)

More ideas fuel innovation and economic growth and other emergent benefits, which in turn fuels more ideas.

The market should provide both the fodder of ideas, and the evolutionary mechanisms for sorting out the good from the not-so-good.

-- One Suggested Policy Objective: Broadband as an optimal Internet platform; the three dimensions of availability, sufficiency, and integrity, which will enable richer uses of the Net and broadband as its own innovation platform.

A Clash of Incentives?



What could hold back broadband companies from providing optimal Internet platforms to consumers?

Ruinous Competition

Positive Externalities

Incentives to Prioritize Traffic

Existing Mindsets



So what factors could hold back broadband companies from providing optimal Internet platforms to consumers?

Ruinous Competition:

Rob Atkinson explains this as the engineer's view of competing broadband pipes. In a high up-front fixed cost business like broadband infrastructure, competition may not be enough of an incentive, and could even be harmful, as multiple players divide the limited pie.

Positive Externalities:

There is a notable "wedge" between broadband provider's private interests, and the social interests in positive spillovers.

Incentives to Prioritize Traffic:

Investing in broadband networks, versus investing in Internet access.

Existing Mindsets:

The value chain tug of war
mistrust between the market players

The Legal Conundrum



The heart of the issue is whether and how traditional communications law should be applied to broadband networks.

The Current Legal Situation

- Common Law
- Title II
- Title I

Strands of Common Carriage

- Private concentration.
- Public callings
- Voluntary bailment

Antitrust Law

- Necessary but not sufficient

16

So given what's at stake, what should be the appropriate legal framework for broadband?

The FCC certainly has made a mess of things, culminating in the Brand X decision, the Wireline Broadband Order, and now the Comcast decision.

The FCC is conflating networks and the stuff that rides on them.

Title I? Title II? Title VI? A new Title VII?

One idea is to go back to basics, and look at the common law of common carriage (Eli Noam paper); there are three distinct strands.

Market Concentration: the usual one; evidence is mixed, but no clear signs of new competition emerging

Public callings: the importance of infrastructure to society (roads, bridges, railroads), and the use of public resources (ROW, spectrum) together creates a public interest in broadband; correlates to agnostic bearer protocol?

Bailment: voluntarily holding oneself out as provider of services; duty of care under tort law; correlates to end-to-end principle?

Competition law: necessary, but not sufficient; among other things, doesn't account for the positive spillovers, economic and non-economic, from broadband networks and the Net.

Now is the time to consider these and other factors, as we fashion a new approach to broadband policy.

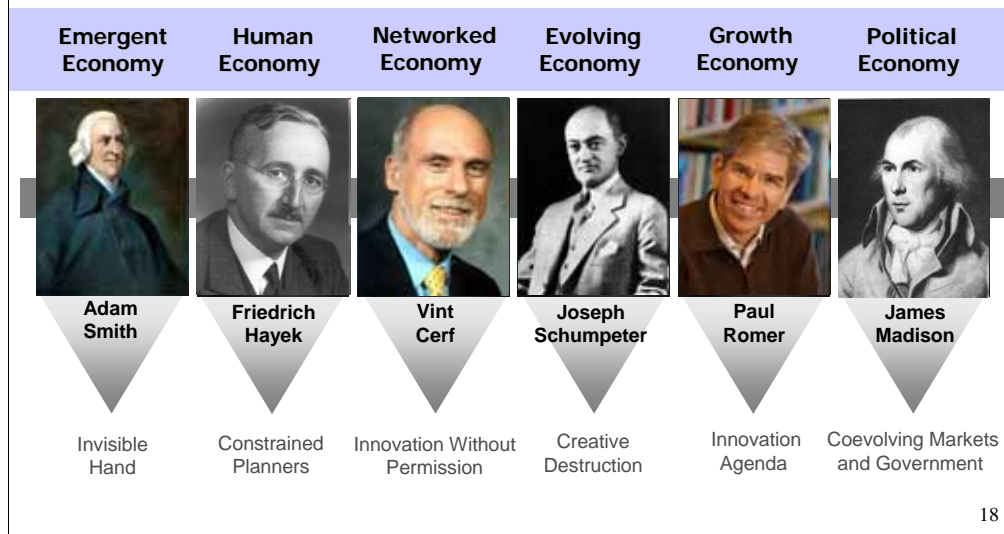


So finally, I want to give you the 90 seconds preview of a paper I have written that will be published in a few months, on what I call “Emergence Economics.”

Our Many-Sided Markets



Emergence Economics helps us understand often-overlooked aspects of how markets really work.



18

The purpose of the paper is to pull together a number of sometimes disparate strands of newer economic thinking -- from work in areas like network science, new growth theory, behavioural economics, innovation theory, competition theory, and positive externalities – and bring them under the rubric of “Emergence Economics.” We demonstrate how collectively these schools of thought support a common framework for how policymakers should begin to think about their involvement in the market.

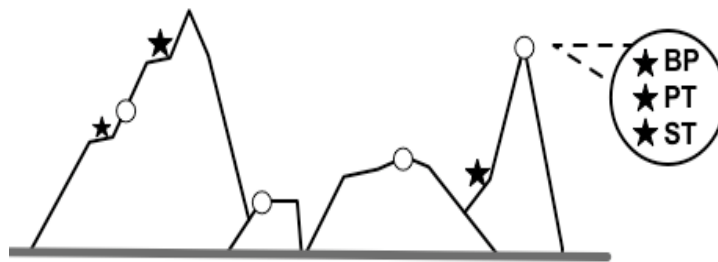
In particular, the market itself is an unpredictable complex of cascades, competition is rarely perfect, and people normally operate under cognitive constraints and a lack of information.

This has enormous implications, not just for economic theory, but the public policy world that has rested on those assumptions for so long. Indeed, the public policy environment in the US has yet to appreciate the significant undermining of orthodox economic assumptions. We need a corrective to that situation.

Tools and Technologies



Dynamic market processes, such as differentiating, selecting, and amplifying business plans and technologies, generate a host of positive emergent economic phenomena.



Physical Technologies (PTs) + Social Technologies (STs) = Business Plans (BPs)

19

Biological and environmental systems provide powerful metaphors for economic activity. The ecosystem can be seen as existing in a “fitness landscape,” comprised of peaks and valleys of competitive challenges. Eric Beinhocker, author of The Origin of Wealth, explains that evolution operates on two broad types of technologies: what he calls Physical Technologies (recipes for producing objects or ideas), and Social Technologies (methods for organizing people).

These two types of technologies evolve in relation to each other, and with concrete Business Plans (BPs) that incorporate one or both.

Agents employ a mix of BPs, PTs, and STs to navigate a market landscape of possible growth trajectories – like a map of mountains. There are several possible “peaks” of high productivity, which can be reached via different “fitness functions.”

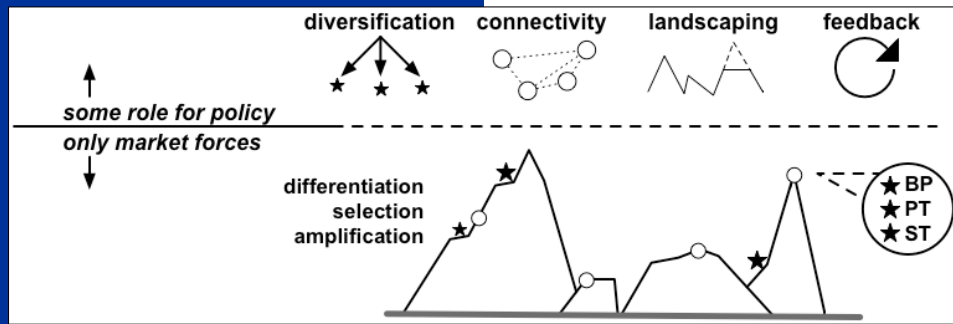
Some initial lessons:

- There is no balance or equilibrium or predictability here.
- Also, no one firm can hope to out-compete the market; “Evolution is more clever than you are.”

Policy vs. Markets



The dichotomy between appropriate “tinkering” ...



... and unacceptable “tampering.”

20

So the first rule for the adaptive policymaker is caution.

Policymakers generally should foster the market’s evolutionary processes, rather than interfere with or attempt to replace them.

The basic workings of the evolutionary process – agents differentiating, selecting, and amplifying certain business plans and technologies -- should be left to the effectiveness, merits, and complexity of the open market.

In other words, in contestable markets, policymakers should avoid dictating, or “tampering” with, the evolutionary processes.

At the same time, potentially there are important roles for the policymaker to consider in filling various gaps in the market. This leads the adaptive policymaker to enable the ecosphere, by tinkering with components of the emergence algorithm. Four leading examples are:

- Feed the algorithm (maximize diversity of market inputs);
- Promote connectivity (encourage networking between agents);
- Shape fitness landscapes (use market incentives to achieve larger objectives); and
- Enhance market feedback (user transparency/accountability).

The fundamental point is to improve the market’s ability to formulate and present different options (quantity function), while leaving the selection processes themselves undisturbed (the quality function).



Thank you very much.