

Notes on “Wealth Happens” by Mark Buchanan

Harvard Business Review, April 2002

Mark Buchanan describes, from a complexity theory perspective, that disparities in wealth happen due to natural dynamics, *even when everyone starts out with equal ability and resources.*

The dynamic he describes is called “path dependence” in system dynamics and “success to the successful” in systems thinking. It is the result of two interacting positive feedback loops. In “Chapter 10: Path Dependence and Positive Feedback” of *Business Dynamics*,¹ John Sterman begins:

For unto every one that hath shall be given, and he shall have abundance; but from him that hath not shall be taken away even that which he hath. — Matthew XXV:29

This chapter explores path dependence, a pattern of behavior in which small, random events early in the history of a system determine the ultimate end state, even when all end states are equally likely at the beginning. Path dependence arises in systems whose dynamics are dominated by positive feedback processes. The chapter explores the circumstances in which positive feedback can create path dependence, the role of random events early in the history of a path-dependent system, and the ways in which a path-dependent system can lock in to a particular equilibrium. Feedback theories of path dependence and lock in are developed for a number of important examples in business, technology, and economics.

10.1 Path Dependence

Why do clocks go clockwise? Why do people in most nations drive on the right? Why is the diamond business in New York concentrated into the area around west 47th Street? Why do nearly all typists learn the inefficient QWERTY keyboard layout? How did Microsoft’s Windows² and Intel’s processors come to dominate the market for personal computers? Why are there so many winner-take-all markets — situations where success accrues to the successful, where the rich get richer and the poor get poorer? And what do these questions have to do with each other? All are examples of systems exhibiting *path dependence*. Path dependence is a pattern of behavior in which the ultimate equilibrium depends on the initial conditions and random shocks as the system evolves. In a path-dependent system, small, unpredictable events early in the history of the system can decisively determine its ultimate fate.

Buchanan points out that low capital gains taxes and high sales taxes make this dynamic more powerful in increasing disparities in the distribution of wealth. This is even without the Federal Reserve’s policy that creates a game of “musical chairs” for jobs that makes the “added value” of any one worker approach zero (See *The Tangle of Growth*, Appendix II). It’s to counteract this natural dynamic that we need lower sales taxes, higher capital gains taxes, and more progressive income taxes.

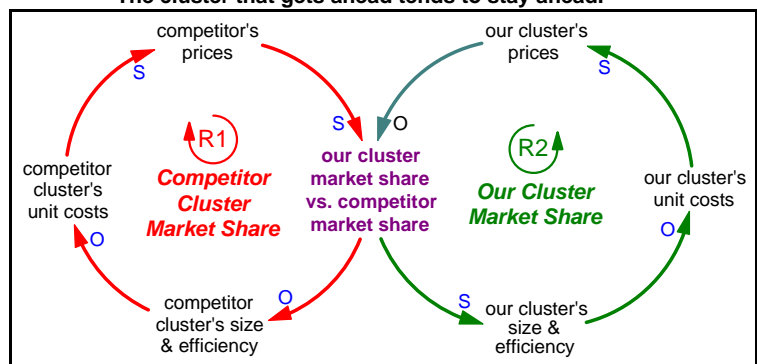
The diamond business is an example of an economic cluster; path dependence drives the formation of economic clusters. Figure 1 shows the structure. Reading the loops along a path that forms a “figure 8” makes it clear why the structure is in an unstable equilibrium.

Sterman describes how the equations that describe the dynamic are equivalent to those that describe a ball on top of an upside-down, round bowl. A minor random perturbation can start the ball moving in some direction. While it’s possible that a subsequent random perturbation can push the ball back, that is not likely. Once the ball begins moving in one direction, it tends to keep moving in that direction. This is path dependence. Those who have the ball “roll their way” are “fortunate;” others with equal ability that don’t have the ball “roll their way” are “unfortunate.”

Figure 2 shows the same structure for the “experience curve”: a company with the most cumulative production learns to produce at lower cost to

“The whole process of industrialization within the United States was marked by ... small accidents leading to the establishment of one or two persistent centers of production. ... What is important ... here is ... not the initial accident, but the nature of the cumulative process that allows such accidents to have large and long-lasting effects.”
 “... there is a circularity that tends to keep a geographic cluster in existence once it is established.”
 Paul Krugman, “Location and Competition: Notes on Economic Geography,”
 Rumelt, Schendel, & Teece, *Fundamental Issues in Strategy - A Research Agenda*, Harvard Business School Press, 1994

Figure 1: Path dependence example - economic cluster formation.
The cluster that gets ahead tends to stay ahead.



¹ John Sterman, *Business Dynamics, Systems Thinking for a Complex World*, Irwin McGraw-Hill, 2000, pp. 66 - 79
<http://web.mit.edu/jsterman/www/>

² The New York Times reported on 11/17/02 (<http://www.nytimes.com/financialtimes/business/FT1035873352050.html>) that Microsoft “revealed for the first time that it has made profit margins of 85 per cent on its Windows system while its remaining businesses made losses”

win market share. Whichever company gets ahead, tends to stay ahead. Many companies enter the market at a price below actual cost in the hope, often realized, that this structure will build market share and result in enough production that it can actually produce at a cost that justifies the price.

Figure 3 shows the same structure applied to the accumulation of personal success (or wealth).

This structure also operates in determining the relative effort on improvement initiatives in manufacturing versus engineering, as shown in Figure 4. It's a great example of the perversity of systems.

This is a portion of the structure described in **A Systems Thinking Perspective on A Manufacturing Base Restoration Initiative**. It's based on the dynamics described in "Unanticipated Side Effects of Successful Quality Programs: Exploring a Paradox of Organizational Improvement" by John Sterman, Nelson Repenning, and Fred Kofman at MIT.³ It describes how successful quality initiatives at Analog Devices almost sank the company due to the tight coupling between manufacturing and engineering.

In this structure the disequilibrium is not initiated by random disturbance, but by a natural desire of those pursuing TQM initiatives to show early results in order to build enthusiasm. Because of the greater organizational and technical complexity of engineering/design processes, their half-life (~ 36 months) is longer than that for production processes (~ 12 months). More emphasis on the improvement of manufacturing processes does improve manufacturing efficiency. This results in significant idle production capacity. A greater flow of designs could fill that idle capacity, but the emphasis is not on engineering/design improvements ... and, even if it were, such improvements would not show up for years.

The excess production capacity means there are too many employees; and when the company downsizes, it kills enthusiasm for improvement. It also puts pressure on engineering/design to produce more products, so engineering doesn't even have time to improve efficiency. Perverse indeed.

Figure 2: Path dependence example - the "experience curve." The company that gets ahead tends to get even further ahead.

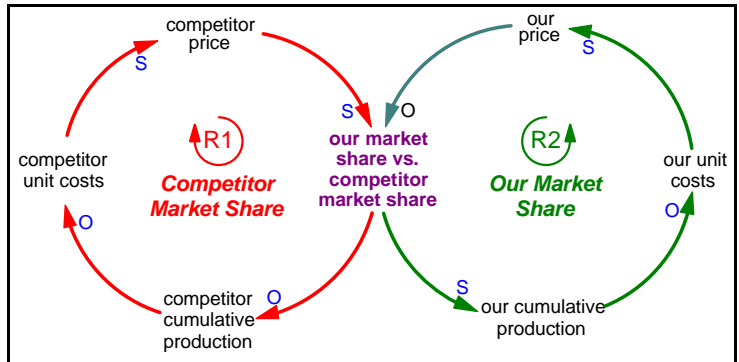


Figure 3: Path dependence example - the "rich get richer." Persons that get ahead tend to get further ahead.

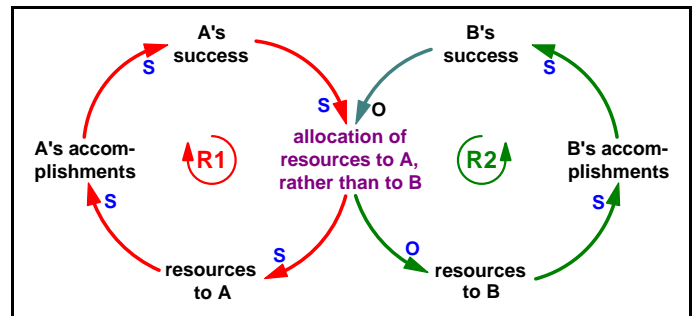
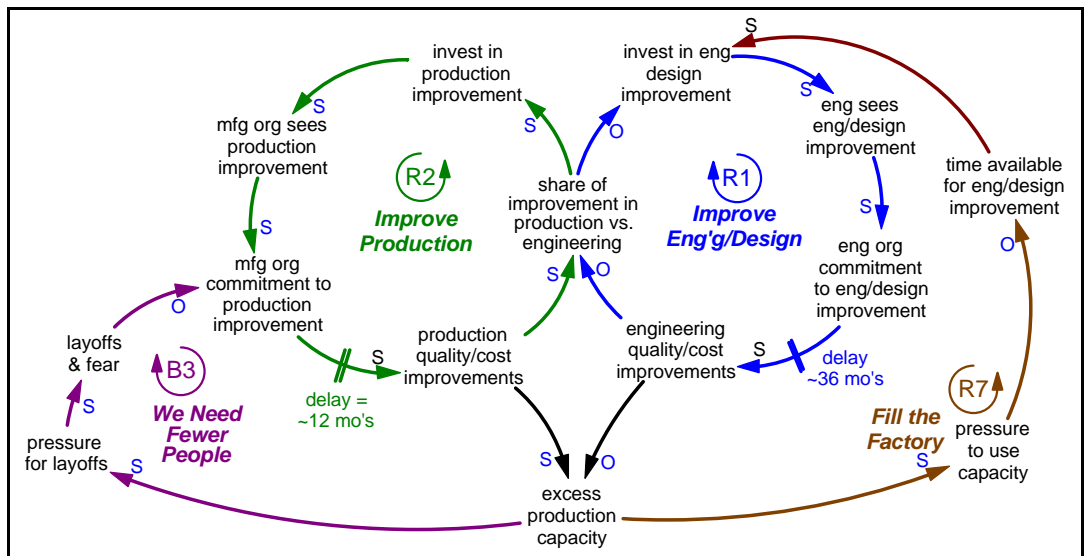


Figure 4: The coupling between improvement initiatives in production and in engineering/design.



³ March 1994 (revised August 1994). Download at <http://web.mit.edu/jsterman/www/ADI/ADI.html>.

The Sons Also Rise By PAUL KRUGMAN The New York Times, November 22, 2002
<http://www.nytimes.com/2002/11/22/opinion/22KRUG.html>

America, we all know, is the land of opportunity. Your success in life depends on your ability and drive, not on who your father was.

Just ask the Bush brothers. Talk to Elizabeth Cheney, who holds a specially created State Department job, or her husband, chief counsel of the Office of Management and Budget. Interview Eugene Scalia, the top lawyer at the Labor Department, and Janet Rehnquist, inspector general at the Department of Health and Human Services. And don't forget to check in with William Kristol, editor of *The Weekly Standard*, and the conservative commentator John Podhoretz.

What's interesting is how little comment, let alone criticism, this roll call has occasioned. It might be just another case of kid-gloves treatment by the media, but I think it's a symptom of a broader phenomenon: inherited status is making a comeback.

It has always been good to have a rich or powerful father. Last week my Princeton colleague Alan Krueger wrote a column for *The Times* surveying statistical studies that debunk the mythology of American social mobility. "If the United States stands out in comparison with other countries," he wrote, "it is in having a more static distribution of income across generations with fewer opportunities for advancement." And Kevin Phillips, in his book *"Wealth and Democracy,"* shows that robber-baron fortunes have been far more persistent than legend would have it.

But the past is only prologue. According to one study cited by Mr. Krueger, the heritability of status has been increasing in recent decades. And that's just the beginning. Underlying economic, social and political trends will give the children of today's wealthy a huge advantage over those who chose the wrong parents.

For one thing, there's more privilege to pass on. Thirty years ago the C.E.O. of a major company was a bureaucrat — well paid, but not truly wealthy. He couldn't give either his position or a large fortune to his heirs. Today's imperial C.E.O.'s, by contrast, will leave vast estates behind — and they are often able to give their children lucrative jobs, too. More broadly, the spectacular increase in American inequality has made the gap between the rich and the middle class wider, and hence more difficult

to cross, than it was in the past.

Meanwhile, one key doorway to upward mobility — a good education system, available to all — has been closing. More and more, ambitious parents feel that a public school education is a dead end. It's telling that Jack Grubman, the former Salomon Smith Barney analyst, apparently sold his soul not for personal wealth but for two places in the right nursery school. Alas, most American souls aren't worth enough to get the kids into the 92nd Street Y.

Also, the heritability of status will be mightily reinforced by the repeal of the estate tax — a prime example of the odd way in which public policy and public opinion have shifted in favor of measures that benefit the wealthy, even as our society becomes increasingly class-ridden.

It wasn't always thus. The influential dynasties of the 20th century, like the Kennedys, the Rockefellers and, yes, the Sulzbergers, faced a public suspicious of inherited position; they overcame that suspicion by demonstrating a strong sense of noblesse oblige, justifying their existence by standing for high principles. Indeed, the Kennedy legend has a whiff of Bonnie Prince Charlie about it; the rightful heirs were also perceived as defenders of the downtrodden against the powerful.

But today's heirs feel no need to demonstrate concern for those less fortunate. On the contrary, they are often avid defenders of the powerful against the downtrodden. Mr. Scalia's principal personal claim to fame is his crusade against regulations that protect workers from ergonomic hazards, while Ms. Rehnquist has attracted controversy because of her efforts to weaken the punishment of health-care companies found to have committed fraud.

The official ideology of America's elite remains one of meritocracy, just as our political leadership pretends to be populist. But that won't last. Soon enough, our society will rediscover the importance of good breeding, and the vulgarity of talented upstarts.

For years, opinion leaders have told us that it's all about family values. And it is — but it will take a while before most people realize that they meant the value of coming from the right family.

The Apple Falls Close to the Tree By ALAN B. KRUEGER The New York Times, November 14, 2002
<http://www.irs.princeton.edu/krueger/intergen2.htm>

It seems increasingly apparent that the secret to success is to have a successful parent. Consider some prominent examples: George H. W. Bush and George W. Bush; Bobby Bonds and Barry Bonds; Henry Fonda and Jane Fonda; Estée Lauder and Ronald Lauder; Julio Iglesias and Enrique Iglesias; Sam Walton and Jim, John, S. Robson and Alice Walton.

As more recent and better data have become available, economists have marked up their estimate of the impact of parents' socioeconomic status on their children's

likelihood of economic success.

It turns out that the famous line attributed to Andrew Carnegie — "from shirt-sleeves to shirt-sleeves in three generations" — is an understatement. Five or six generations are probably required, on average, to erase the advantages or disadvantages of one's economic origins.

This represents a marked departure from past thinking. In the 1980's, when Gary S. Becker of the University of

Chicago pioneered the economic theory of intergenerational transmission of economic status, it was believed that the correlation between a father's and son's income was only around 0.15 — less than half the correlation between fathers' and sons' heights.

The early studies suggested that if a father's income was twice the average, his son's expected income would be 15 percent above average, and his grandson's just 2 percent above average. This is fast "regression to the mean," a concept Sir Francis Galton used to describe the progression of offspring toward the average height.

Landmark studies published by Gary Solon of the University of Michigan and David J. Zimmerman of Williams College in *The American Economic Review* a decade ago, however, led economists to revise substantially upward the estimate of the similarity of fathers' and sons' incomes. They noted that income fluctuated for idiosyncratic reasons from year to year — an employee could lose a job, for example — so estimates that depended on a single year were based on "noisy" data. Also, the samples previously analyzed represented only a narrow slice of the population at different points in individual careers. These factors caused the correlation in annual incomes to understate the correlation in "lifetime" incomes.

Averaging earnings over five years produced a correlation of around 0.40 for fathers' and sons' earnings — the same as the correlation between their heights. If people's incomes were represented by their heights, the similarity in income between generations would resemble the similarity observed in the heights of fathers and sons.

New studies by Bhashkar Mazumder of the Federal Reserve Bank of Chicago suggest that the similarity in income is even greater. Using Social Security records, he averaged fathers' earnings over 16 years (1970 through 1985) and sons' earnings over four years (1995 through 1998), and found that around 65 percent of the earnings advantage of fathers was transmitted to sons. The wider window provides a better reflection of lifetime earnings.

The relationship between fathers' and daughters' earnings was just as strong.

So that grandson (or granddaughter) mentioned previously could expect to earn 42 percent more than average. After five generations, the earnings advantage would still be 12 percent.

Furthermore, the degree of persistence across generations is strong for both rich and poor. Thomas Hertz of American University finds that a child born in the bottom 10 percent of families ranked by income has a 31 percent chance of ending up there as an adult and a 51 percent chance of ending up in the bottom 20 percent, while one born in the top 10 percent has a 30 percent chance of staying there and a 43 percent chance of being in the top 20 percent.

In another study, David I. Levine of Berkeley and Dr. Mazumder found that the impact of parental income on

adult sons' income increased from 1980 to the early 1990's.

Why is there such a strong connection between parents' socioeconomic status and their children's? A large part of the answer involves intergenerational transmission of cognitive ability and educational level.

But these factors can "explain at most three-fifths of the intergenerational transmission of economic status," Samuel Bowles and Herbert Gintis of the University of Massachusetts wrote in the latest issue of *The Journal of Economic Perspectives*. They suggest that the intergenerational transmission of race, geographical location, height, beauty, health status and personality also plays a significant role.

Arthur S. Goldberger of the University of Wisconsin has long questioned whether knowledge of the "heritability" of income is of much use. Even if the father-son correlation is high because traits that affect earning power are inherited, well-designed interventions could still be cost effective and improve the lot of the disadvantaged.

To take an extreme example, the correlation in incomes between fathers and sons was high in South Africa under apartheid because race is an inherited trait. The abolition of apartheid reduced the correlation. The organization of society matters.

Perhaps the only legitimate use of the intergenerational correlation in income is to characterize economic mobility. The data challenge the notion that the United States is an exceptionally mobile society. If the United States stands out in comparison with other countries, it is in having a more static distribution of income across generations with fewer opportunities for advancement.

Anders Björklund of Stockholm University and Markus Jäntti of the University of Tampere in Finland, for example, find more economic mobility in Sweden than in the United States. Only South Africa and Britain have as little mobility across generations as the United States.

Luke Skywalker and Darth Vader are an unusual father-son pair; in most families, the apple does not fall so far from the tree.

GRAPHIC: Chart: "Like Parent, Like Child"

Recent studies find that there is less income mobility from one generation to another than previously believed.

PARENTS INCOME QUINTILE: Top 20%
CHANCE OF CHILDREN ATTAINING EACH INCOME LEVEL
Top quintile: 42.3 %
Middle quintile: 16.5
Bottom quintile: 6.3

PARENTS INCOME QUINTILE: Middle 20%
CHANCE OF CHILDREN ATTAINING EACH INCOME LEVEL
Top quintile: 15.3
Middle quintile: 25.0
Bottom quintile: 17.3

PARENTS INCOME QUINTILE: Bottom 20%
CHANCE OF CHILDREN ATTAINING EACH INCOME LEVEL
Top quintile: 7.3
Middle quintile: 18.4
Bottom quintile: 37.3

(Source: Thomas Hertz, American University)