

The Political and Financial Economics of Innovation

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Limited Scope of VC Investments

Amount (\$billion)	1980	1985	1990	1995	2000	2005	2010	2013
ICT	0.2 (44%)	1.9 (70%)	1.4 (53%)	4.0 (54%)	75.4 (75%)	13.6 (60%)	10.8 (49%)	20.0 (67.6%)
Healthcare/ Biotech	0.1 (16%)	0.4 (13%)	0.7 (26%)	1.8 (23%)	7.6 (8%)	6.6 (28%)	6.3 (29%)	6.9 (23.3%)
Other	0.2 (39%)	0.4 (16%)	0.5 (20%)	1.6 (21%)	17.6 (17%)	2.7 (12%)	4.9 (22%)	2.7 (9.5%)
Total	0.5	2.6	2.6	7.4	100.5	22.9	22.0	29.6

(Source: NVCA Yearbook, 2014)

US VC Fund-raising 1980-2013

(Independent VC Firms)

	<u># of Active VC Firms</u>	<u>\$B raised</u>	<u>\$B managed</u>
1980	52	2.0	2.1
1985	92	3.8	11.8
1990	100	3.2	22.7
1995	185	9.5	33.3
2000	1,053	105.0	187.4
2005	558	30.8	241.6
2010	509	13.8	174.7
2013	548	16.8	179.2

Source: National Venture Capital Association, 2014 Yearbook

Venture Fund Performance Summary

The following table summarises the performance of the 205 venture funds in the database by IRR. To highlight the skewness of the data and the influence of a select group of high performing funds, these metrics are also presented when the top decile and quintile of performing funds are excluded. Finally, the performance of the funds is summarised across different periods of time.

	Mean	Med.	St. Dev.	Skew	25 th Percent	75 th Percent	Max.	Min.
IRR	47%	24%	72%	2.74	9%	61%	515%	-94%
- Top decile only	215%	193%	92%	1.97	155%	254%	515%	133%
- Excluding top decile	27%	20%	35%	0.69	7%	41%	125%	-94%
- Excluding top quintile	18%	16%	24%	-0.46	6%	31%	76%	-94%
- 1980 – 1984	17%	9%	23%	2,10	4%	20%	92%	-5%
- 1985 – 1989	23%	19%	26%	2.06	11%	32%	155%	-57%
- 1990 – 1994	42%	37%	40%	-0.37	17%	64%	125%	-94%
- 1995 – 2006	86%	55%	107%	1.48	4%	136%	515%	-34%

VC Performance Relative to NASDAQ

	Mean	Med.	St. Dev.	Skew	25 th Percent	75 th Percent	Max.	Min.
Nasdaq PME	1.59	1.00	3.67	10.33	0.57	1.68	42.36	0.14
- Excluding top decile	1.02	0.93	0.57	0.66	0.57	1.33	2.48	0.14
- Excluding top quintile	0.88	0.83	0.43	0.44	0.54	1.19	1.85	0.14

“PME” = “Public Market Equivalent” from investing in Index versus investing in each VC fund.

Source: McKenzie and Janeway, “Venture Capital Funds and the Public Equity Market”

US VC Returns Relative to IPO Market

	<u>Mean</u>	<u>Median</u>
Exit conditions < 2	19%	9%
Exit conditions = 2-3	33%	24%
Exit conditions > 3	106%	76%

1 = less than 20 VC-backed IPOs per quarter

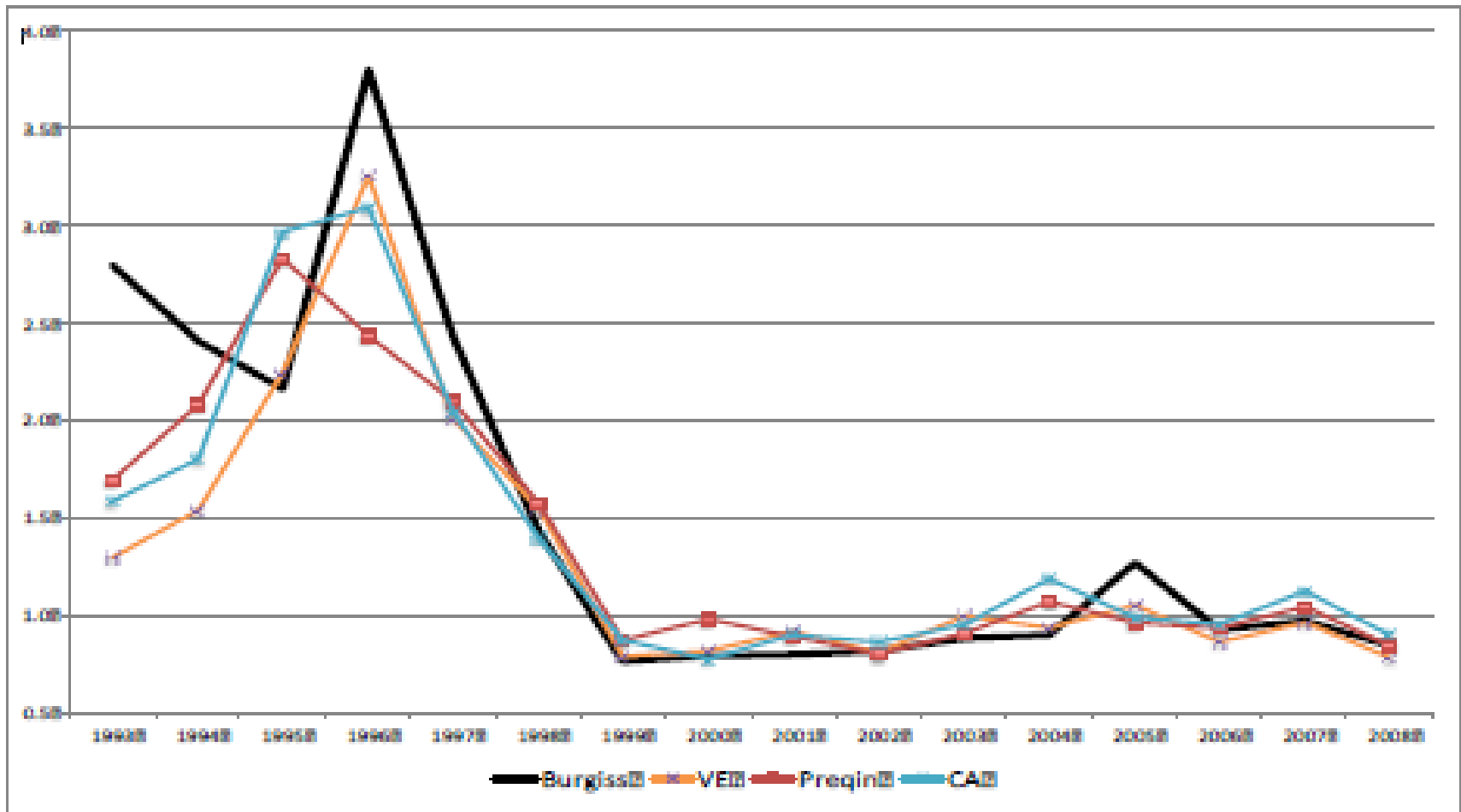
2 = 30 +/- 10 VC-backed IPOs per quarter

3 = more than 40 VC-backed IPOs per quarter

4 = more than 40 VC-backed IPOs per quarter/50%+ = unprofitable firms

Source, McKenzie and Janeway, "Venture Capital Funds and the Public Equity Market"

Harris, Jenkinson and Kaplan: Actual and Estimated PME



Keynes's Bridge

“The daily revaluations of the Stock Exchange . . . inevitably exert a decisive influence on the rate of current investment. For there is no sense in building a new enterprise at a cost greater than that at which a similar existing enterprise can be purchased; while there is an inducement to spend on a new project what may seem an extravagant sum, if it can be floated off on the Stock Exchange at an immediate profit.”

(The General Theory, p. 151)

The R&D Boom of the Late 1990s

(Brown, Fazzari and Petersen, “Financing Innovation and Growth”)

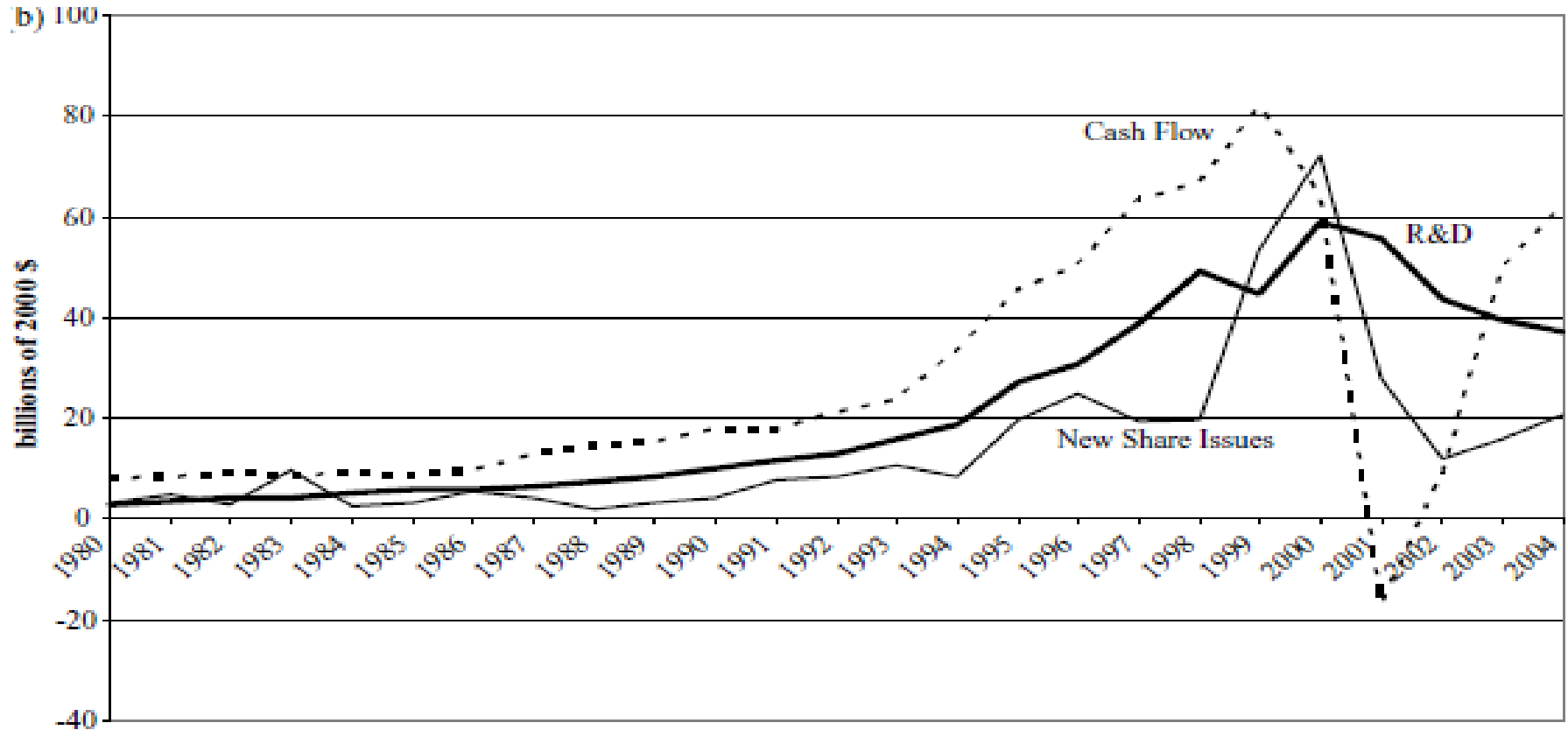
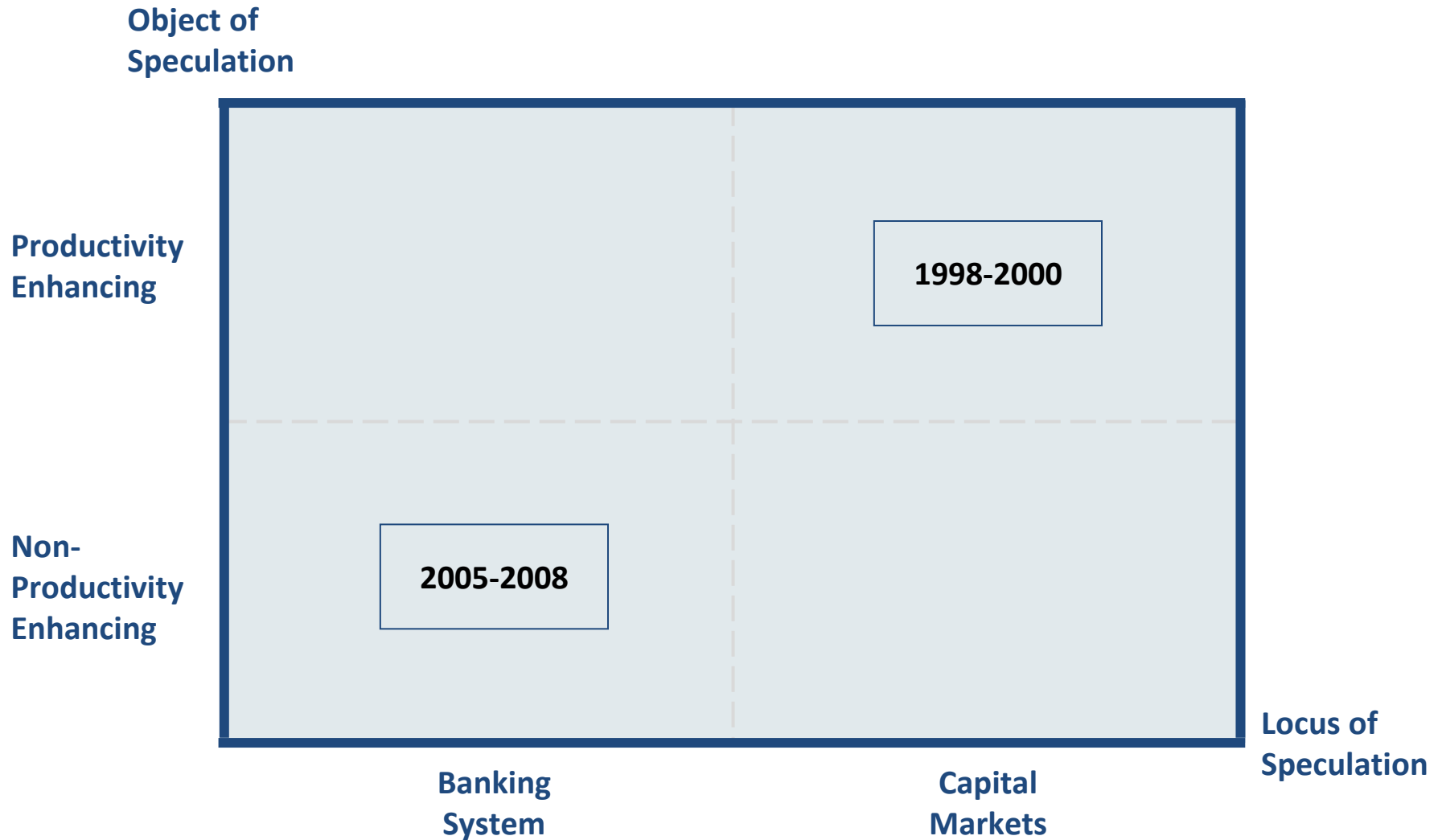


Figure 2b. High-tech R&D, cash flow, and new share issues (young firms). The sample is all young high-tech firms with coverage in Compustat. A firm is classified as young for the first 15 years following the year it first appears in Compustat with a stock price. The high-tech industries are SICs 283, 357, 366, 367, 382, 384, and 737. The heavy line plots the sum of R&D for all young high-tech firms, the dashed line plots the sum of gross cash flow, and the thin line plots the sum of net new stock issues with negative net issues set equal to zero.

Bubbles: A Typology



List and Laissez-Faire

“Had the English left everything to itself—laissez faire and laissez aller—the Belgians would be still manufacturing cloth for the English, England would still have been the sheepyard for the Hansards.”

(F. List, *National System*, p. 25)

National Security and the Innovation Economy

- “One mechanism through which defense-related R&D investments can aid innovation is **military funding for new bodies of scientific or engineering knowledge** that supports innovation in both defense-related and civilian applications....This channel...is likely to produce the greatest benefits...in basic and applied research, rather than development.
- “A second important channel through which defense-related R&D affects civilian innovative performance are the **classic ‘spin-offs,’**...[C]ivilian spin-offs...appear to be most significant in the early stages of development of new technologies...[before] civilian and military requirements...diverge....
- “A third important channel...is **procurement**....The US military services...have played a particularly important during the post-1945 period as **‘lead purchaser’**....
- “Defense-related research spending contributed to the creation of a **university-based US ‘research infrastructure’** during the postwar period that has been an important source of civilian innovations, new firms, and trained scientists and engineers....” (Mowery, pp. 1236-7

Open Environment for Innovation

“One of the most important long-term consequences of federal financing of innovation in IT was the creation of **a relatively weak intellectual property rights environment** and, in some cases, the direct encouragement of interfirm technology diffusion by federal agencies....Federal funding for procurement of the products of these new industries also **encouraged the entry of new firms and interfirm technology diffusion**. In addition, **federal procurement supported the rapid attainment by supplier firms of relatively large production runs**, enabling faster rates of improvement in product quality and cost than would otherwise have been realized. Finally, federal support for innovation in IT contributed to the creation of a large-scale R&D infrastructure in federal laboratories and, especially, in U.S. universities....” (Fabrizio and Mowery, pp. 286-7)

National Security Missions

“National Interstate and *Defense* Highways Act (1956)

Popularly known as the National Interstate and Defense Highways Act of 1956, the Federal-Aid Highway Act of 1956 established an interstate highway system in the United States.”

“National *Defense* Education Act of 1958”

The National Defense Education Act of 1958 (P.L. 85-864; 72 Stat. 1580) became law on September 2, 1958. This federal policy largely targeted collegiate education, authorizing both National Defense Fellowships and loans for students.”

(U. S. National Archives)

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Keynes: “Socialization of Investment”

“I conceive, therefore, that a somewhat comprehensive socialization of investment will prove the only means of securing an approximation to full employment; though this need not exclude all manner of compromises and devices by which public authority will co-operate with private initiative.”

(The General Theory, p. 378)

Gordon's Three Industrial Revolutions

“The first (IR #1) with its main inventions between 1750 and 1830 created steam engines, cotton spinning, and railroads. The second (IR #2) was the most important, with its three central inventions of electricity, the internal combustion engine, and running water with indoor plumbing, in the relatively short interval of 1870 to 1900. Both the first two revolutions required about 100 years for their full effects to percolate through the economy.

“The computer and Internet revolution (IR #3) began around 1960 and reached its climax in the dot.com era of the late 1990s, but its main impact on productivity has withered away in the past eight years....Invention since 2000 has centered on entertainment and communication devices that are smaller, smarter, and more capable, but do not fundamentally change labor productivity or the standard of....”

(Gordon, August 2012)

Gordon: The Four Headwinds

“The primary cause of this growth slowdown is a set of four headwinds, all of them widely recognized and uncontroversial. **Demographic shifts** will reduce hours worked per capita...**Educational attainment**, a central driver of growth over the past century, stagnates at a plateau as the U.S. sinks lower in the world league tables of high school and college completion rates. **Inequality continues to increase**, resulting in real income growth for the bottom 99 percent of the income distribution that is fully half a point per year below the average growth of all incomes. A projected **long-term increase in the ratio of debt to GDP at all levels of government will inevitably lead to more rapid growth in tax revenues** and/or slower growth in transfer payments at some point within the next several decades.”

(Gordon, February 2014)

Gordon: Technological Innovation Has Stalled

“There is no need to forecast any slowdown in the pace of future innovation for this gloomy forecast to come true, because **that slowdown already occurred four decades ago**. In the eight decades before 1972 labor productivity grew at an average rate 0.8 percent per year faster than in the four decades since 1972. While no forecast of a future slowdown of innovation is needed, skepticism is offered here, particularly about the techno-optimists who currently believe that we are at a point of inflection leading to faster technological change.”

(Gordon, February 2014)

Gordon: The Demise of U.S. Economic Growth

“The United States achieved a 2.0 percent average annual growth rate of real GDP per capita between 1891 and 2007. This paper predicts that growth in the 25 to 40 years after 2007 will be much slower, particularly for the great majority of the population. Future growth will be 1.3 percent per annum for labor productivity in the total economy, 0.9 percent for output per capita, 0.4 percent for real income per capita of the bottom 99 percent of the income distribution, and 0.2 percent for the real disposable income of that group.”

(Gordon, February 2014)

Summers: “Secular Stagnation?”

“Is it possible that the US and other global economies might not return to full employment and strong growth without the help of unconventional policy support?...

“...First, even though financial repair had largely taken place four years ago, recovery has only kept up with population growth in the US, and has been worse elsewhere in the industrial world. Second, manifestly unsustainable bubbles and loosening of credit standards during the middle of the past decade, along with very easy money, were sufficient to drive only moderate economic growth. Third, short-term interest rates are severely constrained by the zero lower bound: real rates may not be able to fall far enough to spur enough investment to lead to full employment. Fourth, in such situations falling wages and prices or lower-than-expected are likely to worsen performance by encouraging consumers and investors to delay spending, and to redistribute income and wealth from high-spending debtors to low-spending creditors.”

(L. Summers, *The Financial Times*, December 15, 2013)

Krugman Expands the Discussion

- “Larry’s formulation of our current economic situation is the same as my own...a situation in which the “natural” rate of interest – the rate at which desired savings and desired investment would be equal at full employment – is negative.
- “And as he also notes, **in this situation the normal rules of economic policy don’t apply.** As I like to put it, virtue becomes vice and prudence becomes folly. Saving hurts the economy – it even hurts investment, thanks to the paradox of thrift. Fixating on debt and deficits deepens the depression. And so on down the line.
- “This is the kind of environment in which Keynes’s hypothetical policy of burying currency in coalmines and letting the private sector dig it up – or my version, which involves faking a threat from nonexistent space aliens – becomes a good thing; **spending is good, and while productive spending is best, unproductive spending is still better than nothing.**”

(P. Krugman, *The New York Times*, November 16, 2013)

Keynes' Provocation

“If the Treasury were to fill old bottles with bank-notes, bury them at suitable depths in disused coalmines which are then filled up to the surface with town rubbish, and leave it to private enterprise on well-tried principles of *laissez-faire* to dig the notes up again, . . . there need be no more unemployment and, with the help of the repercussions, the real income of the community, and its capital wealth also, would probably become a good deal greater than it actually is. It would, indeed, be more sensible to build houses and the like; but if there are political and practical difficulties in the way of this, the above would be better than nothing.”

(*The General Theory*, p. 129)

Henderson's "Argument from Confidence"

"If you launch a . . . £200 million two year's programme . . . there are solid grounds at once for believing that that means that taxation is likely to be increased ever higher, year by year . . . I should say that **the alarm might quite easily serve to counter-act finally the employment benefits of the programme**, and you would then be in a vicious circle of requiring a still bigger programme, still more unremunerative in character, with an increasing hole in the Budget, and increasing apprehension, **until you were faced with either abandoning the whole policy or facing a real panic-flight from the pound.** (Henderson to Keynes, May 30, 1930)

"The scope and scale of the programme as a whole must be **such as to commend itself as reasonable and sensible to public opinion** . . . While . . . we do not believe that employment created by public works need involve a diminution of resources devoted to private investment, it might easily do so, if it took a form which aroused apprehension as to the stability of the public credit." (Report of Economic Advisory Council, October 1930)

Keynes' Rueful Reflection

“It is, it seems, politically impossible for a capitalist democracy to organize expenditure on the scale necessary to make the grand experiment which would prove my case—except in war conditions.”
(The New Republic, 1940)

“Political Will” and “Public Funds”

“Some of the most important sources of human progress over the 1870-1940 period were not new inventions at all. Running water had been achieved by the Romans, but **it took political will and financial investment** to bring it to every urban dwelling place. The first industrial revolution made possible steam-powered water pumps to distribute water within cities, and IR #2 soon replaced the steam pumps with more economical electricity-driven pumps. A separate system of sewer pipes was not an invention, but implementing it over the interval 1870-1930 required resources, dedication, and **a commitment to using public funds for infrastructure investment.**”

(Gordon, February 2014)

VC CleanTech Investing: 2004-2013



*Through Nov. 30, 2013

Source: PitchBook

“The ideas of economists and political philosophers...”

“...[T]he ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else....I am sure that the power of vested interests is vastly exaggerated compared with the power of idea. Not, indeed, immediately, but after a certain interval....But, **soon or late, it is ideas, not vested interests, which are dangerous for good or evil.**”

(The General Theory, p. 383-4)