INVENTIVE BILLION DOLLAR FIRMS

A Faster Way to Grow

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Robert E. Litan[1]

One of the questions or challenges we constantly wrestle with at Kauffman is "how could annual U.S. economic growth be increased by one additional percentage point?" It is not an idle question. If, for example, the economy grew at 4 percent annually rather than 3 percent, GDP would double six years faster (eighteen years versus twenty-four years). Given the magic of compounding, this extra one percent would cumulate over a century to produce roughly *three times* the level of GDP than would otherwise exist.

Such a world would be a far more comfortable one than many of us may be able to imagine. It would mean a dramatically lower level of poverty, while the average American would have a living standard that is three times as comfortable as one that he or she would otherwise enjoy (imagine today, for example, the average family income being roughly $135,000 rather than its current level of about $45,000). A richer society also would have more resources to address the public challenges—upgrading our infrastructure, doing more to clean the environment, and so on—that would make life in America even more comfortable for all our citizens.

So what is the key to faster growth? A series of recent studies establishes clearly that, at least in the U.S. economy, growth in output and employment is driven strongly by the creation and growth of *new firms*.[2] It thus may be tempting to answer the "How do we get one percent faster growth?" question by figuring out how many more total firms need to be started each year. But this is a shotgun approach, the proverbial equivalent of throwing a lot of "mud" (firms) against the wall and hoping that some of it sticks.

A nuanced, and I believe more useful, inquiry is to try to estimate how many very successful, rapidly growing new firms it would take each year to lift the economy-wide growth rate by one percent. The firms to which I specifically refer are those truly innovative or inventive enterprises that bring to the market something *new*—a product, service or process—that generates substantially more benefits for society as a whole than any single entrepreneur, inventor, or firm can capture alone. Think, for example, of General Electric and the electric light, which literally opened up new horizons for all

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[1] Vice President, Research and Policy, Ewing Marion Kauffman Foundation. I am grateful for insightful comments on earlier drafts provided by my Kauffman colleagues Paul Kedrosky, Brink Lindsey, Munro Richardson, and Dane Stangler, and for excellent research assistance provided by Jared Konczal.

[2] See Dane Stangler and Robert E. Litan, "Where Will the Jobs Come From?" Kauffman Foundation, November 2009, http://www.kauffman.org/uploadedFiles/where_will_the_jobs_come_from.pdf;
John Haltiwanger, Ron Jarmin, and Javier Miranda, "Jobs Created from Business Startups in the United States," Ewing Marion Kauffman Foundation, January 2009, http://www.kauffman.org/uploadedFiles/BDS_Jobs_Created_011209b.pdf; and
Tim Kane, "The Importance of Startups in Job Creation and Job Destruction," Ewing Marion Kauffman Foundation, July 2010, http://www.kauffman.org/uploadedFiles/firm_formation_importance_of_startups.pdf.

humanity to work and experience new forms of leisure when it is dark outside. Or, more recently, consider breakthrough computer programs, such as the Microsoft or Linux operating systems, that have established a platform on which tens of thousands of other productivity enhancing applications can run. The same is true of other platforms, such as Apple's iPhone or Google's Droid, or new technologies, such as genetic sequencers or cloud computing, which facilitate the formation and growth of other companies, many with complementary technologies.

Not all innovations generating social gains in excess of private rewards find their way into measured GDP, however. Many health care innovations—new pharmaceuticals, medical devices, and treatments—both lengthen and improve the quality of life for millions, if not billions, of people. To be sure, the inventors of these marvels reap handsome rewards (though not always), but they surely do not capture the health benefits enjoyed by all the beneficiaries of these technologies. Economists may attempt to put a price on these gains in health, and thus quantify the overall improvement in social welfare, but these gains generally are not traded on the open marketplace. Still, they are very real, and in some respect they do translate into additional GDP (since healthier individuals are more productive and can work longer). However they are considered, health benefits should be treated as if they added to GDP, and for purposes of this essay, they essentially are.

If very innovative firms are the drivers of growth in both output and jobs—largely because of the excess societal gains they generate beyond the private reward their founders, shareholders, and employees reap—then it stands to reason that the steady creation of more such firms will increase growth in the long run. In this essay, I focus for illustrative purposes on one particular class of such firms—those inventive firms whose revenues grow to an average of $1 billion—and ask: How many such new firms would the U.S. economy have to create, in a steady state, to generate an additional one percentage point in annual economic growth?

The billion dollar revenue threshold is an admittedly arbitrary way of focusing on only the most inventive successful firms. It is based, however, on what I believe to be a plausible assumption: that the products, services, or processes whose social benefits *substantially* exceed their private benefits are most likely to be brought to market by "home run" firms whose revenues grow to some significant level, such as an average of $1 billion. This is not to say that *all* billion dollar firms generate social gains far in excess of their private gains; only that, *on average,* firms of this size are likely to have been more inventive (as demonstrated by their revenue success) and exhibit higher ratios of social to private gains than firms in smaller size cohorts. But I also don't want to be interpreted as denying the important contribution of smaller but successful new and existing firms, or the "singles" and "doubles" whose ratio of social to private gains are likely to be somewhat lower than the "home runs." Indeed, the home runs will need services and supplies from the singles and doubles, and the latter firms surely will purchase some of the outputs of the home runs.

Thus, to the extent that the singles and doubles generate additional productivity growth for the economy, this will reduce the numbers of billion dollar companies required to generate an additional one percent in economy-wide growth. Put another way, the order-of-magnitude estimates that follow—ranging from thirty to 150 new billion dollar companies each year, with a more probably estimate of sixty—are likely to overstate the numbers required. This should make it a bit less daunting to achieve the one percent extra growth target than the following estimates may suggest.

Some Arithmetic of Growth

With U.S. GDP currently nearing $15 trillion, one percent extra growth would require an additional $150 billion in output annually.[3] Economists typically would say that the way to generate that additional growth is for society to somehow increase its "productivity" growth—the rate at which outputs increase for given inputs (labor in particular). This is a truism, of course. However, it doesn't translate at all into how many additional firms, and of what kinds, it would take to achieve such an outcome.

To dig deeper, I use the results of a pathbreaking analysis of several years ago, in which Yale economist William Nordhaus estimated that inventors, which I will assume here to be proxies for innovative entrepreneurs, capture only 4 percent of the total social gains from their innovations. [4] The lion's share of inventors' gains "leak out" to benefit many other firms and industries that use the inventions in some manner.

The 4 percent figure implies that, in order for society to benefit from an additional $150 billion in output, inventors (read: entrepreneurs) must develop new products, services, and processes that collectively earn for themselves only $6 billion a year ($150 billion multiplied by 0.04) after taxes. If, as seems reasonable, the average inventive firm returns 10 percent on its sales, it would take $60 billion in sales to generate $6 billion in profits.[5] If this $60 billion were spread evenly across all billion dollar firms, we have our answer! *The economy needs sixty inventive companies to be formed each year whose revenues eventually mature to an average of $1 billion (because the figure is an "average," some new companies' sales can exceed $1 billion, while other successful enterprises with large social benefits can fall short of this benchmark).*

This is an order-of-magnitude estimate, and one that easily could be lower or higher than this level depending on the assumptions. For example, it is my impression that the

[3] Technically, consistent with the qualification in the section immediately above, I should be using potential rather than actual GDP as the base of the calculation. At the current writing, given the Great Recession and slow recovery since, actual GDP is probably about 10 percent below potential GDP, which implies a GDP base level of more than $16 trillion. For illustrative purposes only, however, I use here the current level of GDP as the base from which to make the following calculations.

[4] William D. Nordhaus, "Schumpeterian Profits and the Alchemist Fallacy" (Yale Working Papers on Economic Applications and Policy, Discussion Paper No, 6, 2005) www.econ.yale.edu/ddp/ddp00/ddp00006.pdf.

[5] This 10 percent ratio may be a conservative estimate. Many of the most successful U.S. companies have returns well in excess of this ratio; see the most profitable companies of the Fortune 500 at http://money.cnn.com/magazines/fortune/fortune500/2010/performers/companies/profits/revenues.html.

successful high-tech companies—or those most likely to qualify for our required list of inventive billion dollar companies—have higher margins. Say, for example, that the net profit-to-sales ratio for these companies is 20 percent rather than 10 percent. In that event, generating $6 billion in annual profits would require a much-lower $30 billion in collective revenue, implying the need for *just thirty billion-dollar companies to be created a year.*

Conversely, it is possible that Nordhaus's 4 percent estimate is too low for the purpose here, since it reflects only the most successful inventions. If the ratio of private gains were somewhat higher than 4 percent—say, 10 percent—to reflect some mix of billion dollar companies whose external benefits are not as large as the Nordhaus average, then the "billion dollar club" would need to earn $15 billion in profits collectively. At a 10 percent earnings-to-revenue ratio, this implies the need for an additional $150 billion in annual revenue, or 150 companies whose average revenues grow to $1 billion.

Several fundamental points about this range of estimates—anywhere from thirty to 150 new billion dollar companies per year—are noteworthy. First, the estimated numbers of additional billion dollar companies required are *incremental.* That is, these are the *additional* successful companies that must be launched *each year*—over and above the numbers of such companies that already are being formed (a subject I will address shortly)—to generate the sustained increase in growth of one percent. Actually, the required incremental figure is an *average* figure over time since, as in the baseline now (also discussed shortly), the number of new companies that grow up to be home runs quite clearly does—and will—continue to vary from year to year.

Second, the required number of new successful companies will need to grow by roughly 4 percent a year to account for the steadily expanding economy. Recall that the calculations began with an estimated $150 billion increase in GDP being required in the first year. This additional amount will grow at the economy-wide growth rate and, thus, so will the required number of billion dollar companies. Alternatively, one could adjust the billion dollar threshold upward by 4 percent a year (with sales measured in real terms and adjusted for inflation, since all the growth rates discussed here are in real terms). If that were done, the required numbers of successful new inventive companies to be created each year would remain constant, but their level of required success would grow over time, surpassing an average of $2 billion in roughly eighteen years, $4 billion in thirty-six years, and so on.

Third, as noted already, the estimates here pertain to economy-wide growth in a *steady state*—or once the average successful company reaches a successful milestone (again, because I am referring to averages, that milestone will exceed a billion dollars for some of these companies, and for others the benchmark will be somewhat less). I have no hard data on the likely duration of this steady state, but it bears noting that the length of this period only influences the initial transition length required to reach the steady state of incremental 1 percent growth (say ten or twenty years, or whatever the right figure is). That is, the calculations refer to the number of companies that must be created each year that *eventually* will mature into the billion dollar average. It is possible, of course,

that with continued advances and diffusion of technology, this transition period will grow shorter over time, and indeed may already have shortened compared to earlier periods in U.S. history.

Fourth, as noted in the introduction, the calculations here, by design, put all the weight of added GDP growth on new billion dollar companies, when in fact we know that new and existing companies of lesser size can certainly contribute to faster economy-wide growth. Furthermore, successful billion dollar companies surely rely on smaller companies to supply materials and services—and also, in many cases, to sell to smaller companies. Nonetheless, I have chosen to focus on the billion dollar enterprises since they are likely to have the largest ratio of social to private gains, and so the economy is likely to get its largest "growth bang for the buck" from the formation and growth of these home run firms.

Finally, the exercise here—also by design—is a "supply side" one, in that it implicitly assumes that any additional output generated by the incremental billion dollar firms is purchased, either by domestic or foreign consumers, businesses, or governments. Put differently, the calculations assume that actual GDP grows at the rate at which *potential GDP* (increased by one percentage point) increases. This may not be a realistic assumption at all times since some of the new billion dollar companies will displace existing companies or reduce their sales—and thus their employment—adding to the baseline amount of "job churn" already in the economy and perhaps temporarily aggravating mismatches between the requirements of the new jobs generated by the new companies and other growing firms and the skills of the displaced workers. However, over the long run, with sufficient aggregate demand, workers are reallocated to other firms or start their own, which enables actual GDP to catch up to—and eventually grow at the same rate as—potential GDP.

What Is a Good Benchmark?

One natural question to ask is: How do the estimates of required billion dollar companies per year compare to the number of such companies that already are launched? That is, what is the baseline number of companies started each year that eventually will mature to sales averaging $1 billion?

Here, too, the answer may depend on the time period. At this point, although I have no hard data to provide a precise baseline estimate, there is one way to make an order-of-magnitude stab at the benchmark.

Using a database of publicly held companies whose stocks are traded on U.S. exchanges, I have identified a total of 1,544 U.S.-founded companies whose current (2009) sales exceed $1 billion. This admittedly lowers the baseline, since it does not account for firms with lower revenues that have the same ratio of social to private gains as those firms with revenues above $1 billion. However, I had no other way to make the cutoff and so this is the benchmark I chose.

Unfortunately, I have no database that permits me to calculate this baseline number of billion dollar companies. So, instead, I resort to the following simplistic calculation. Assume the 1,544 billion-dollar companies today were formed over a roughly 150-year period (going back to 1860). In that event, the average number of such companies formed in any given year was, and is, roughly ten. It is plausible that, because of advances in communications and transportation technologies—specifically the Internet—that permit companies to reach both internal and non-U.S. markets more quickly, companies formed in more recent cohorts take less time to reach the billion dollar benchmark, and thus the average number of such companies formed in recent decades—say, since 1980—may be somewhat higher than ten.

There are other reasons why the benchmark is likely to be a bit higher. For one thing, there are substantial numbers of privately held companies—perhaps several thousand—with revenues exceeding $1 billion. In addition, the current numbers of billion dollar companies reflect a survivor bias; that is, the current numbers by definition do not include companies that in the past may once have reached $1 billion in sales (in today's dollars), but then fell back from that figure, merged with other companies with sales below that threshold, or even went out of business altogether. In any event, however the benchmark is computed, as presented here it is unrealistically steady in that it assumes, as a baseline, that the number of new companies growing up to be billion dollar enterprises is constant. In reality, this number changes from year to year: Some years produce a bunch of winners, others a dearth.

Taking all these considerations into account, let's say the annual benchmark of billion dollar companies is roughly fifteen. Whatever the precise figure, it is evident that an incremental sixty billion-dollar companies per year would represent a huge increase over the current status quo.

Looked at another way, however, the incremental figure is not as daunting. Every year, roughly 500,000 startups are born.[6] If sixty of them "grow up" to be billion dollar companies, that's only 0.012 percent of the annual number of business starts. Moreover, if the formation and growth of new billion dollar companies encourages the formation and growth of more somewhat smaller but highly successful companies, then we wouldn't need the sixty home runs to hit the 1 percent extra growth target.

Expanding the Billion Dollar Club

Whatever the "magic number" of additional billion dollar companies may be, the obvious question is: How do we generate that number, or even some lesser figure that still would please many citizens and policy makers?

Is better government policy part of the answer? It is true that a number of currently successful companies got their start through government contracts (such as any

[6] See Dane Stangler and Paul Kedrosky, "Exploring Firm Formation:
Why is the Number of New Firms Constant?" Ewing Marion Kauffman Foundation, January 2010, http://www.kauffman.org/uploadedFiles/exploring_firm_formation_1-13-10.pdf.

number of defense contractors, or even technology superstars such as Intel) or by benefitting from government funding of basic R&D. But this fact does not mean additional spending on various items automatically would lead to more successful large companies.

For example, although basic government-provided or government-financed infrastructure—education, roads, and the like—remains important and certainly bears improvement, it is not readily apparent how spending more on such services or making them more efficient (which is desirable for its own reasons) would directly, or even indirectly, translate into additional successful inventive companies. The same is true of more government R&D spending. In the long run, such additional spending should improve scientific understanding that should, in turn, permit the formation of more and new kinds of companies. But the connection between any additional government R&D spending and more billion dollar companies also is remote. This is especially true given the imperfections in our systems for commercializing government-funded research in our universities and federal labs.[7]

The same reasoning holds for more government spending on education. As many analysts have noted, spending per pupil has increased dramatically in the United States in recent decades, with no noticeable improvement in test scores or average educational attainment, and generally consistently poor results in inner-city schools. The educational challenge instead is primarily organizational—how to get better "bang for the buck" through reforms in traditional public school management and teacher hiring and pay, and the growth of "public" charter schools. Although there clearly is a strong link between having a skilled workforce and long-run economic growth, perhaps the best thing we can do to promote the growth of future billion dollar companies is encourage public schools to be more innovative in the way they teach science, technology, engineering, and math (STEM) subjects to students, since successful inventive companies of the future—those that generate large positive externalities—surely will depend on advances in science and developing workers skilled in STEM subjects.

What about federal tax policy? Clearly, taxes have incentive effects on all private actors, including entrepreneurs. Nonetheless, the linkage between taxes and the "billion dollar club" is loose. On the one hand, it is doubtful that many would-be founders of large enterprises will be influenced one way or the other by changes in the tax system of the sort recently implemented or contemplated. Such superstar companies today, including Microsoft, Apple, Federal Express, Southwest Airlines, and Intel(to name just a few) were started in the 1970s, when marginal income tax rates and capital gains tax rates were well above what they are today or are likely to be any time soon. On the other hand, even though marginal income tax rates have come down since the 1970s, the

[7] See Robert E. Litan and Lesa Mitchell, "A Faster Path from Lab to Market" featured in "The HBR List: Breakthrough Ideas for 2010," *Harvard Business Review* (January/February 2010): 6–7.

current income tax structure still very likely penalizes entrepreneurship to some degree.[8] In any event, we are not currently in a political environment where personal marginal income tax and capital gains tax rates for the most successful upper-bracket entrepreneurs—those that matter for most entrepreneurs, at least in the early stages of their ventures (which tend to be organized as limited liability corporations whose income is taxed at the personal level) —are likely to be lowered any time soon. (To the contrary, at this writing, one of the most hotly contested tax policy issues is whether the 2001 and 2003 tax cuts should be permitted to expire for taxpayers in the highest tax bracket.)

In short, although government policy surely affects the overall environment in which all businesses operate, it would be a mistake to put a lot of stock in government policy to help increase the numbers of new billion dollar companies. Rather, our hopes for achieving that very specific objective must lie in the private sector, specifically in *entrepreneurial ecosystems* that foster the growth of new successful companies that generate large social benefits in excess of the riches they produce for their founders.

This statement may immediately conjure up the notion of *clusters*—those geographical "hot spots" that seem to generate an outsize number of large, successful new companies: Silicon Valley, San Diego, Austin, Research Triangle Park (RTP), Seattle, Boulder, and so on. There is no denying the importance of clusters, since there clearly are positive feedback loops between successful companies in particular industry segments (or "verticals"), venture and angel capital, cashed-out entrepreneurs (who become angel investors and often serial entrepreneurs), accountants, lawyers, suppliers, and skilled workforces. But with the possible exception of RTP, none of the regions we think of today as high-tech clusters were the product of deliberate government planning. Instead, they formed around one, two, or several successful entrepreneurial companies, and good fortune—combined perhaps with some sound local and regional government policies that helped facilitate growth—thereafter produced the successful clusters we know today.

This observation suggests, therefore, that efforts by the federal government, states, or localities to try to foster *new* clusters are unlikely, individually or collectively, to generate the billion dollar companies we need for faster growth. Governments may have somewhat greater success, however, in nurturing *existing* clusters—by improving local school systems, roads, amenities, and the like that will help both attract new entrepreneurial talent and retain the talent that is already there.

Still, something more—likely much more—is seemingly necessary. In particular, the trick to getting more billion dollar companies above the numbers that would normally be generated—that is, producing the necessary incremental improvements in the numbers of successful companies launched—is to find, help launch, and nurture individuals and teams who would not otherwise be or choose to be successful entrepreneurs. In other words, we need to find ways of changing the career paths of individuals with great ideas

[8] See, e.g. William M. Gentry and R. Glenn Hubbard, "Success Taxes, Entrepreneurial Entry, and Innovation," National Bureau of Economic Research, Inc, *Innovation Policy and the Economy* 5 (2005): 87–108.

capable of producing social gains well in excess of private rewards and turn them into company founders or co-founders. How can the United States do *that*?

The Kauffman Foundation is engaged in a major effort that tries to do precisely this. Launched last year, Kauffman Laboratories for Enterprise Creation aims to find—or more accurately, recruit—highly motivated individuals with promising commercial ideas that have the potential to produce billion-dollar-plus companies. Kauffman Labs surrounds the successful candidates, who are chosen in a highly competitive process (think *American Idol*), with entrepreneurial instruction and mentoring from some of the nation's leading experts and entrepreneurs in the same industry or "vertical." The first "class" of Kauffman Labs consisted primarily of outstanding post-doctoral scientists, mostly in their late twenties, who have developed promising medical technologies. The second class, about to be formed at this writing, will consist of potential entrepreneurs across a wide number of educational and work backgrounds and ages who have promising commercial ideas in the educational field. Future classes or cohorts will be centered on other verticals.

Given communication technologies today, Labs is testing the validity of the old view that clusters need to be geographically based. Both the participants and mentors in Labs come from, and work in. many locations throughout the United States. The common thread that binds them together is industry experience in a specific vertical, which knows no geographic boundaries.

Kauffman Labs is not the only entrepreneurial ecosystem that is seeking out and attempting to nurture successful new companies, although it may be one of the few whose explicit aim is to launch and help grow billion dollar enterprises. Many research universities have mentoring programs for faculty, alumni, and student entrepreneurs. There also are a few commercial "accelerators" that use a competitive selection process to nurture new potential breakthrough companies in specific verticals (The Foundry in medical devices and YCombinator in Web-based businesses and software). Hopefully, we will see more of these successful accelerators over time.

Indeed, America's great challenge is to scale the successful ecosystems and to create others to bring about a substantial increase in the numbers of highly successful new companies (whether or not they reach a billion dollars in sales). Nothing less than the future welfare of America and its citizens is at stake.