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## How Angel Investors Help Startup Firms

Angels — wealthy individuals who often are actively involved in the startups they back, and who typically are not professional investors — have surpassed venture capitalists as a funding source for startup enterprises in the United States. They are estimated to have had \$24.1 billion of capital deployed in 2014, up from \$17.6 billion in 2009. Investments by angels and angel groups grew even faster in other countries during this period, nearly doubling in Europe and tripling in Canada, starting from a much lower level.

Angel investors, like venture capitalists, fund early-stage entrepreneurs and serve as mentors or outside directors of startups. They are often more idiosyncratic than venture capitalists and uniquely focused on the firms they back.

According to research by Josh Lerner, Antoinette Schoar, Stanislav Sokolinski, and Karen Wilson presented in *The Globalization of Angel*

**Investments: Evidence across Countries** (NBER Working Paper No. 21808), angels are beneficial to the growth, performance, and survival of startups, even if they are located in economies that are not friendly to entrepreneurs. Startups that have angel

backing are at least 14 percent more likely to survive for 18 months or more after funding than firms that do not. Angel-backed firms hire 40 percent more employ-

ees, and angel backing increases the likelihood of successful exit from the startup phase by 10 percent, to 17 percent. In coun-

Canada, China, Germany, Italy, Mexico, New Zealand, Switzerland, the United Kingdom, and the U.S. They gathered data on 295 startups funded by these angel

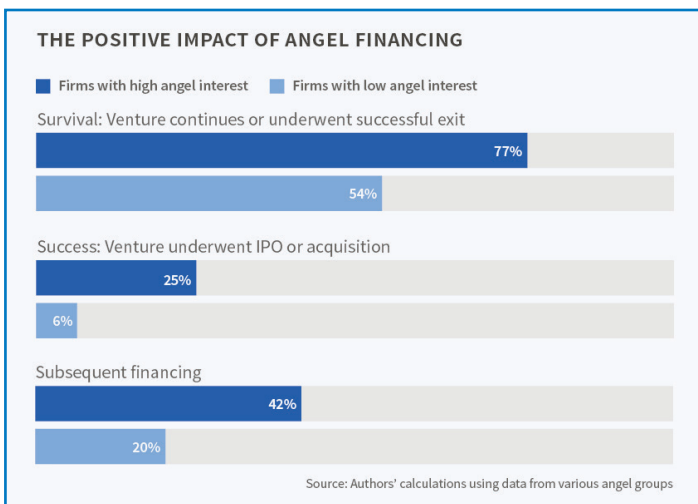
Firms which are backed by angel investors are more likely to survive, create more jobs, and have a greater chance of successfully exiting the startup phase than otherwise comparable firms without this support.

groups and 1,287 that they did not fund. These startups were based in the nations for which the authors had information on angel groups, as well as nine other nations. The average firm in the sample had 10 employees and was seeking to raise \$1.2 million. Four in 10 firms were already generating revenue.

By using regression discontinuity analysis and comparing firms that had similar ex ante likelihood of receiving angel investor support, but that differed in their ex post funding outcomes, the authors determine not only whether angel investors add value but also how

their impact and the types of transactions they undertake vary with the development of a nation's venture market. The authors note that because their data on angel investors is likely to come from comparatively prominent and organized groups, their find-

tries other than the United States, angel-funded firms are also more likely to attract follow-on financing. The researchers studied 13 angel investment groups in 12 nations — Argentina, Australia, Belgium,



ings may reflect an upper bound of angel-investor impact.

Across nations, firms that attracted a high level of interest among angel investors were more likely to grow, issue patents, win new rounds of funding, and have a successful exit from the startup phase. In nations with below-average venture activity, the startup firms had greater struggles, but the impact of angel interest was again positive. In countries with less conducive entrepreneurial environments, companies seeking angel funding appeared to be older and

larger on average and usually were already generating revenue compared to applicants in more entrepreneurship-friendly countries. Yet despite their apparent greater maturity, the firms in these markets sought smaller amounts of funding. The researchers suggest that firms seem to “self-censor” when they apply to angel groups in the less venture-friendly markets, reflecting the fact that the angel investors themselves are more risk-averse or less experienced in assessing very-early-stage investments.

Having a robust angel community

appears to be an important predictor of startup success. It is important to note that in many countries the level of angel investment is very small, so it might not be a panacea for larger problems of unemployment and slow economic growth. Nonetheless, the researchers conclude, “the positive impact of angel financing on the development of portfolio firms remains consistent across the nations... regardless of the level of venture activity and the entrepreneur-friendliness of the environment.”

—Laurent Belsie

## When Temporary Tax Incentives Work, and for Which Firms

Temporary tax incentives boost capital equipment purchases when companies see an immediate benefit, according to research by Eric Zwick and James Mahon in *Tax Policy and Heterogeneous Investment Behavior* (NBER Working Paper No. 21876). This is especially the case for small firms, which respond much more strongly than large firms to those tax breaks.

“Bonus depreciation has a substantial effect on investment,” the researchers find. Accelerated depreciation on capital equipment raised investment an average of 10.4 percent a year between 2001 and 2004 and 16.9 percent a year between 2008 and 2010, according to their estimates.

These estimates are substantially higher than estimates from most previous studies. One reason for the disparity is the authors’ focus on much smaller enterprises than have been examined in previous research. Examining more than 120,000 firms from 1993 to 2010 using Internal Revenue Service data

from unaudited corporate tax returns, the researchers compare investment by

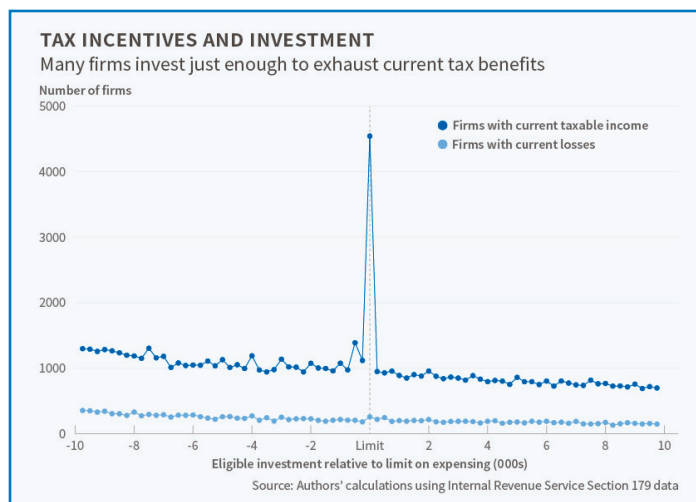
investment spending—the top 5 percent of firms are responsible for more

Allowing accelerated depreciation of capital equipment raised investment an average of 10.4 percent a year between 2001 and 2004 and 16.9 percent between 2008 and 2010.

companies in industries that buy mostly short-duration capital against those that

than 60 percent of total investment—the researchers find that the responses of small and medium-size firms matter for aggregate estimates of the policy response. The authors estimate that, when adjusting for the response of small firms, the elasticity of investment spending with respect to the after-tax price of investment goods is 27 percent greater than the elasticity for the largest firms.

If a firm is currently reporting a loss, and it is in a “tax-loss” position, it will not receive the benefits from accelerated depreciation until a future date when it returns to profitability and begins to pay taxes. The researchers use this feature to study the importance of immediate tax benefits versus future ones.



buy mostly long-duration capital. Only the latter group receives substantial benefits from bonus depreciation and thus responds strongly to this tax incentive.

While large firms account for most

“Firms *only* respond to investment incentives when the policy immediately generates cash flows,” they conclude. “This finding holds even though firms can carry forward unused deductions to offset future taxes.”

The study also finds that when there are limits on the amount of investment that is eligible for bonus depreciation, many firms undertake investments that fall within a few hundred dollars of this limit. When Congress raises the limit,

firms raise their investment spending.

The authors investigate the characteristics of firms that take advantage of bonus depreciation, and find that they are disproportionately cash-constrained firms. Those that do not pay dividends, and that have low cash flow holdings, are between 1.5 and 2.6 times more likely to act on bonus depreciation incentives than their unconstrained counterparts. The findings support models of corporate behavior that emphasize liquidity considerations

and financial constraints.

“The results imply that stimulus policies which target investment directly and yield immediate payoffs are most likely to influence investment activity,” the researchers conclude. “Policies that target financial constraints might have a similar effect if conditional on the investment decision. In an approximate sense, bonus depreciation operates like a loan from the government.”

—Laurent Belsie

## Does Science Advance One Funeral at a Time?

Knowledge accumulation—the process by which new research builds upon prior research—is central to scientific progress, but the way this process works is not well understood.

In **Does Science Advance One Funeral at a Time?** (NBER Working Paper No. 21788), [Pierre Azoulay](#), [Christian Fons-Rosen](#), and [Joshua S. Graff Zivin](#) explore the famous quip by physicist Max Planck. They show that the premature deaths of elite scientists affect the dynamics of scientific discovery. Following such deaths, scientists who were not collaborators with the deceased stars become more visible, and they advance novel ideas through increased publications within the field of the deceased star. These “emerging stars” are often scientists who were not previously active within that field.

The results suggest that outsiders to a specific scientific field are reluctant to challenge a research star who is viewed as a leader within that field.

The authors tracked the publication records of scientists—both collaborators

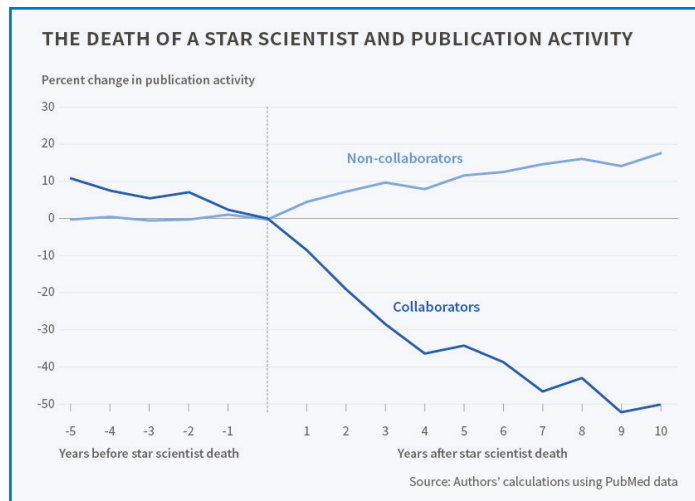
and non-collaborators—before and after a “research superstar” died. To narrow the scope of their study, they focused on aca-

demics in the life sciences, a sector which is heavily supported by National Institutes of

retiring or becoming administrators—between 1975 and 2003. Publication data was gathered from the National Library of Medicine’s PubMed service, which indexes and tracks articles by research topics, names of authors and coauthors, citations, related articles, and other information from 40,000 publications.

When a star scientist dies, outsiders often tackle mainstream questions in the field by leveraging new ideas that arise in other domains.

The findings confirm previous work showing that the number of articles by collaborators decreased substantially—by about 40 percent—after the death of a star scientist. Publication activity by



Health funding and produces a high volume of research. They established a list of 12,935 elite scientists using criteria such as the amount of research funding received, publication citations, number of patents, membership in prestigious organizations,

non-collaborators increased by an average of 8 percent after the death of an elite scientist. By five years after the death, this activity of non-collaborators fully offset the productivity decline of collaborators. “These additional contributions are disproportion-

ately likely to be highly cited,” the researchers found. “They are also more likely to be authored by scientists who were not previously active in the deceased superstar’s field.”

Few of the deceased scientists served as editors of academic journals or on committees overseeing the issuance of research grants, so the researchers rule out the possibility that the deceased scientists used their influence to limit who could or could not publish their work or receive grants within

their field. Instead, they say, the evidence suggests that outsiders were reluctant to challenge the leadership within research areas in which an elite scientist was active. While entry occurs after a star’s passing, it is not monolithic. Key collaborators left behind can regulate entry into the field through the control of intellectual, social, and resource barriers.

“While coauthors suffer after the passing of a superstar, it is not simply the

case that star scientists in a competing lab assume the leadership mantle,” the authors conclude. “Rather, the boost comes largely from outsiders who appear to tackle the mainstream questions within the field but by leveraging newer ideas that arise in other domains. This intellectual arbitrage is quite successful—the new articles represent substantial contributions, at least as measured by long-run citation impact.”

—Jay Fitzgerald

## Training and Retention of Older Workers in Germany

The combination of declining birth rates and increasing longevity in developed countries means labor forces are aging and in some nations shrinking. These patterns are particularly evident in Germany, where the population is expected to decline by 18.8 percent over the next 15 years. The labor force will age and may contract by as much as 35 percent. German firms have responded to these demographic changes by instituting targeted training programs intended to induce workers to stay on the job beyond traditional retirement age.

In **The Relationship between Establishment Training and the Retention of Older Workers: Evidence from Germany** (NBER Working Paper No. 21746), Peter B. Berg, Mary K. Hamman, Matthew M. Piszczek, and Christopher J. Ruhm discover that when employers offer training programs targeted at older workers, women—especially low-wage women—are more likely than men to continue working beyond traditional retirement age.

The researchers, who analyze data from the Linked Employer-Employee Dataset of Germany’s Institute for Employment

of relevant pay scales, so the promise of slightly higher wages for additional years of employment may be less attractive to them

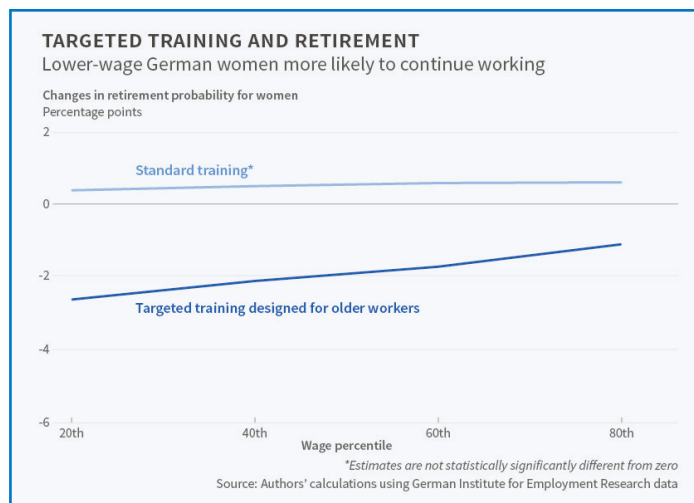
German women over 50, who on average are less financially secure than men, are more likely to improve their pay and delay retirement when employers offer training targeted at older workers.

Research, cannot definitely explain this gender disparity. They suspect, however, that lifetime earning patterns play a key role. Men nearing traditional retirement

than the promise of substantially higher wages for such years to women.

Because many women interrupted their working careers to raise families, their potential wage gains associated with targeted retraining are often much larger than the gains for men. Because of their often-interrupted work histories, women tend to qualify for smaller pensions than men, and, more generally, women are far more likely to be financially insecure. For many women, training programs focus on getting them up to speed regarding developments on the job that occurred while they were out of the labor force. The study strongly suggests that offering targeted training may both improve women’s earnings and encourage longer working lives.

—Matt Nesvisky



age tend to have longer histories of uninterrupted employment than women and higher lifetime earnings, as well as higher average wages. They may be near the top

## Declining Wealth and Work Among Male Veterans

In **Declining Wealth and Work Among Male Veterans in the Health and Retirement Study** (NBER Working Paper No. 21736), Alan L. Gustman, Thomas L. Steinmeier, and Nahid Tabatabai present new evidence on how the relative financial status of veterans and nonveterans approaching traditional retirement age has varied over the last two decades. Using data on four cohorts of respondents in the Health and Retirement Study, they compare the wealth and employment status of veterans and nonveterans. Specifically, they study male veterans between the ages of 51 and 56 in 1992, 1998, 2004, and 2010. Depending on the year, one-third to one-fifth of those who served saw combat, either in Vietnam or in the First Gulf War.

The researchers find that veterans in the 1992 survey were better educated, healthier, wealthier, and more likely to be working than nonveterans of the same age. However, by 2010 the differentials were reversed in all categories. The veterans in 2010 were less well-educated, less healthy, less wealthy, and less likely to be working than nonveterans.

Did changes in military practices cause the reversal of these differentials? While the data cannot rule out this explanation, they are consistent with a simpler explanation: the incidence of military service, and the socio-economic mix of those in the armed forces, changed over time. Nearly half of the men who were in

their early 50s in 1992 had served in the military. For those in this age range in 2010, only 16 percent had served.

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Veterans who were in their early 50s in 1992 were better educated, healthier, and wealthier than nonveterans of the same age. By 2010, this pattern had reversed.

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The selection mechanism was changed from a draft to an all-volunteer military in 1973, when members of the

14 percent more wealth when they were in their early 50s than their non-veteran counterparts. In the young-

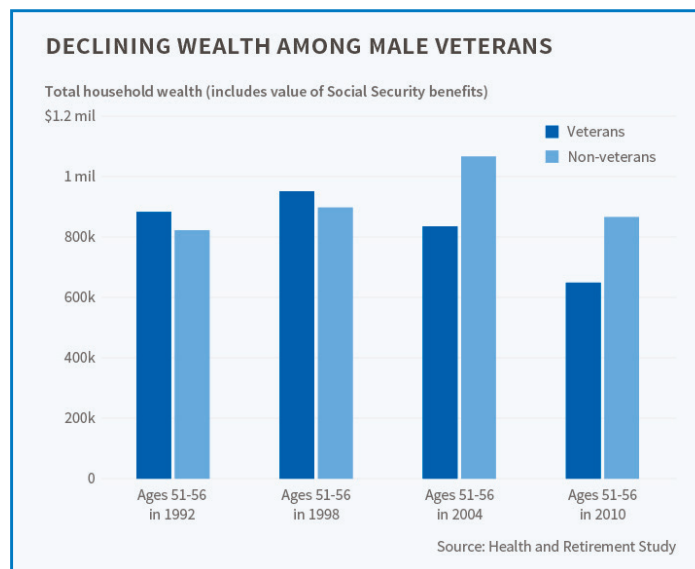
est cohort, veterans on average had 31 percent less wealth. The authors point out that these differences are

in large part due to compositional changes in the veteran cohorts over time. After controlling for military experience, rank, education, race, marital status, disability status, and various measures of health, the differences in wealth between veterans and nonveterans are much smaller. For the oldest cohort they disappear, and for the youngest cohort, the disparity narrows to 13 percent.

The researchers also provide evidence on the com-

ponents of wealth for veterans' households. The average total wealth of veterans' households, measured in 2010 dollars, was \$883,000 for those in the oldest cohort and \$648,000 for those in the youngest cohort. Almost half of this wealth came from expected Social Security payments, while pensions and real estate accounted for about 23 percent and 14 percent of total wealth, respectively. The youngest cohort had less wealth than the oldest cohort in all measured categories, with the greatest difference — \$73,000 — in total pension wealth earned from all sources.

— Andrew Whitten



2010 survey cohort were between 14 and 19 years old. Moreover, eight percent of the veterans in the 1992 survey cohort served for ten or more years, and 13 percent were nonwhite. The comparable statistics for the 2010 survey cohort were 13 percent and 29 percent, respectively. These findings are consistent with the hypothesis that men who actively chose to join the military after the end of the draft had weaker labor-market prospects than the general population, and that this was reflected in their circumstances when they were in their early 50s.

Veterans in the oldest cohort had

# Technology and the Geography of Foreign Exchange

The best-selling, contrasting narratives of Thomas Friedman in *The World is Flat* and Michael Lewis in *Flash Boys* are among the prominent efforts to identify impacts of electronic technology on economic activity. In *Cables, Sharks and Servers: Technology and the Geography of the Foreign Exchange Market* (NBER Working Paper No. 21884), Barry Eichengreen, Romain Lafarguette, and Arnaud Mehl test those authors' core ideas by analyzing the effect that undersea fiber-optic cables have had on foreign exchange trading.

Under what the researchers call the "Flat World" hypothesis (after Friedman), location, distance, and other geographical factors no longer hinder far-flung currency traders. This could result in increased decentralization of trading locations. Under the alternative "Flash Boys" hypothesis (after Lewis), trading might increasingly concentrate in a few major centers because of the potential for high-frequency stock traders to profit from split-second differences in access to market data.

Drawing on data from the Bank for International Settlements (BIS), the researchers estimate how technological advances influenced the geographic location of transactions in 55 currencies between 1995 and 2013. They conclude that growth of electronic trading combined with a proliferation of underwater fiber-optic cables led to a concentration of foreign exchange transactions in major financial centers located near the sea, such as London, New York, and Tokyo. That is, the new technology has made the global foreign exchange market "flashier" rather than "flatter."

The new cables increased bandwidth, the data output for a given unit of time; they also reduced latency, the speed in milliseconds required for an order to reach a trading

increased by 21 percentage points. Only nine of the 55 currencies they study were traded more actively onshore than offshore in 2013.

The introduction of cable connections

The declining cost of long-distance communication has led to a further concentration of foreign exchange trading in financial centers.

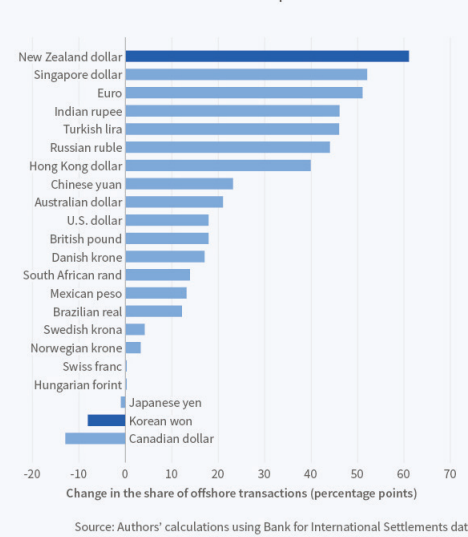
venue. "The reduction in latency is especially attractive to high-frequency traders seeking to exploit tiny, short-lived price discrepancies," the researchers note. These traders also benefit from lower transaction costs associated with economies of scale, such as those achieved by aggregating orders.

increased local trading for countries within the same time zone as one of the three big financial centers—London, New York, and Tokyo. Thus, the share of offshore trading in the currency of New Zealand, a country in a time zone three hours ahead of Tokyo, and where pre-existing financial frictions to offshore trading were therefore substantial, rose sharply with the completion of a cable connection. In contrast, the share of offshore trading in the currency of Korea, a country in the same time zone as Tokyo, and where pre-existing frictions to offshore trading were thus minimal, actually fell with the completion of its cable connection. Cable connections increased the share traded offshore for the vast majority of currencies in the BIS sample.

The researchers note that while undersea fiber-optic cables have recently given a competitive advantage to financial centers located near oceans, landlocked cities are increasingly being connected by terrestrial cables. For example, a cable was recently laid between Frankfurt and Zurich. This suggests that some cities' history and commitment to being financial centers may influence the financial geography of the future.

—Steve Maas

**CABLE CONNECTIONS AND OFFSHORE TRADING**  
The impact on foreign exchange trading if a country is connected to a submarine fiber-optic cable



Over the study period, the researchers estimate that transactions taking place outside the countries where the currencies originated

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