Scaling Apprenticeship to Increase Human Capital

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The Challenge: Improving the Skills, Productivity, and Wages of Americans

The 2016 election heightened an ongoing debate in the United States about how best to respond to two of the foremost economic challenges of the current era: stagnant wages and limited career prospects for American workers without a bachelor's degree. This paper argues that building a large-scale apprenticeship system in the United States would address both of those challenges, while also yielding substantial additional gains for employers and the US economy and without additional government spending.

Apprenticeship programs combine academic and structured, work-based learning under a mentor or supervisor. They allow students to earn wages and contribute to production, while working towards a valuable occupational-based credential. Apprenticeship programs improve the learning process as students apply what they learn, encourage student engagement and their incentives to perform well in academic courses, increase the match between workers' skills and labor market demands and widen access to rewarding careers for workers who prefer learning-by-doing over traditional classroom education and the four-year college model.

Wage stagnation, while no doubt worsened by the country's slow, unequal recovery from the Great Recession, is not a new trend. Men's long-term earnings have stagnated with each passing cohort from those entering the workforce in 1967, to those entering in 1983. (Women's earnings increased 59% over the period, but from a low base.) Research (Guvenen 2018) suggests that this wage stagnation is driven largely by low starting wages, a pattern which suggests weak transitions from school to the labor market. Commentators and various political factions blame these labor market problems on everything from bad trade deals, to declines in manufacturing jobs, to the outsourcing of jobs to an uncompetitive tax and regulatory environment, to lax immigration policy.[2] There's another contributing factor that often receives less attention: the weaknesses of US secondary, post-secondary, and training system in preparing many students for well-paying jobs and rewarding careers.

US researchers too often identify skills as years of schooling, completion of degrees, and scores on tests of math and verbal capabilities. To Goldin and Katz (2008), increases in educational attainment have been too slow to yield healthy economic growth and reduce wage inequality. This view on skills is one reason for the dramatic expansion of higher education spending over the last decades. In 2013, the United States spent $27,900 per full-time equivalent student, 89 percent more than the OECD average of $14,800.

Yet, despite increases in schooling, added government spending, and the buildup of mountains of student debt, US employers report that they face a serious skills mismatch in various occupations, especially those in technical fields. One survey of a nationally representative sample of manufacturing companies found that, "eighty-four percent of manufacturing executives agree there is a talent shortage in US manufacturing, and they estimate that 6 out of 10 open skilled production positions are unfilled due to the

[2] In a review of factors affecting the 1999-2016 decline in labor force participation, Abraham and Kearney (2018) find that trade and the penetration of robots into the labor market, are the most important factors.

shortage" (Giffi et al. 2015). The shortfalls in skills are less the result of too few college graduates and more to do with jobs that require occupational and employability skills. In fact, productivity depends at least as much on occupational competencies and employability skills, such as communication, teamwork, allocating resources, problem-solving, reliability and responsibility. Strikingly, in hard-to-fill jobs, firms generally favor prefer relevant work experience over a BA degree (Fuller and Raman 2017).

The myriad nature of skills raises questions about the near exclusive focus on schooling and academic test scores. So, too, does the recognition that many young people become disengaged from formal schooling, leading to weak high school outcomes (as reflected in high rates of enrollment in remedial coursework in two-year colleges) and low completion rates for community college students. Of students starting a two-year community college program in 2012, only 22 percent of all students and only 12 percent of black students had graduated within 3 years (NCES 2018). Meanwhile, fewer youth have been gaining valuable work experience. Employment rates for 16-19-year-olds dropped from 42 percent in 1990 to 29 percent in 2017.

A wide body of evidence suggests that apprenticeship programs are far more cost-effective than academic-only approaches at raising skill levels, especially employability and occupational skill levels. Yet the United States has lagged far behind other developed countries – countries like Germany and Switzerland, but also Australia, Canada, and England -- in creating apprenticeships. In these countries, apprentices constitute about 2.5-3.0% of the labor force, or about 10 times the U.S. rate.

Increasing the availability of apprenticeships would increase youth employment and wages, improve workers' transitions from school to careers, upgrade those skills that employers most value, broaden access to rewarding careers, increase economic productivity, and contribute to positive returns for employers and workers. This memo reviews the evidence on apprenticeship programs and presents policy proposals to upgrade human capital by stimulating a large-scale expansion of apprenticeships.

2 Advantages and Disadvantages of Expanding Access to Apprenticeship

2.1 The Advantages

Apprenticeships are distinctive in that they enhance both the worker (supply) side and the employer (demand) side of the labor market. On the supply side, the financial gains to apprenticeship are strikingly high. Studies on U.S. programs indicate that apprentices do not sacrifice earnings during their education and training, and that their long-term earnings benefits exceed the gains to completing a degree at a community college (Hollenbeck 2008). Recent reports from an apprenticeship program in the state of Washington indicate that the gains to earnings from various education and training programs far surpassed the gains to all other alternatives (Washington State Workforce Training and Education Coordinating Board 2014). A broad study of apprenticeship in 10 U.S. states also documents large and statistically significant earnings gains from participation in apprenticeship programs (Reed et al. 2012).

These results are consistent with many studies of apprenticeship training in Europe showing high rates of return for workers. One study (Fersterer, Pischke, and Winter-Ebmer 2008) exploited variation in apprentices' abilities to complete their programs (caused by firms going out of business) to estimate the effects of additional years of apprenticeship. The researchers found that apprenticeship training raised wages by about 4% per year of training. For workers completing a three- to four-year apprenticeship, post-apprenticeship wages were 12-16% higher relative to what they would have been without the apprenticeship. Because the workers' costs of participation were often minimal, the Austrian study found high overall benefits and modest costs.

Non-economic outcomes are more difficult to quantify, but evidence from Europe suggests that vocational education and training in general is linked to higher confidence and self-esteem, improved health, higher citizen participation, and higher job satisfaction (Cedefop 2011). These relationships hold even after controlling for income. An Australian study found that quality apprenticeships improve mental health (Buchanan 2016).

On the demand side, employers can feel comfortable raising the skill requirements and the complexity of tasks that new hires are expected to accomplish, knowing that their apprenticeship programs will ensure an adequate supply of well-trained workers. Firms reap several additional advantages from their apprenticeship investments (Lerman 2014). They save significant sums of money in the form of reduced recruitment and training costs, reduced errors in placing employees, and reduced costs when the demand for skilled workers cannot be quickly filled. Other benefits of apprenticeship for firms include reliable documentation of appropriate skills, increased worker productivity, higher morale, and a reduction in safety issues.

Another benefit to firms, rarely captured in studies, is the positive impact of apprenticeships on innovation. Well-trained workers are more likely to understand the complexities of a firm's production processes, and to identify and implement technological improvements, especially incremental innovations that improve existing products and processes. A study of German establishments documented this connection and found a clear relationship between the extent of in-company training and subsequent innovation (Bauernschuster, Falck, and Heblich 2009).

The evidence suggests that employers achieve positive returns to their investments in apprenticeship. After reviewing several empirical studies, Muehlmann and Wolter (2014) conclude that "...in a well-functioning apprenticeship training system, a large share of training firms can recoup their training investments by the end of the training period. As training firms often succeed in retaining the most suitable apprentices, offering apprenticeships is an attractive strategy to recruit their future skilled work force..."

In the US, evidence from surveys of more than 900 employers indicates that the overwhelming majority believe their apprenticeship programs are valuable and produce net gains (Lerman, Eyster, and Chambers 2009). Nearly all sponsors reported that their

apprenticeship program helps them meet their skill demands. Eighty-seven percent reported they would strongly recommend registered apprenticeships; an additional 11% recommended apprenticeship with some reservations. A recent US study found 40-50% returns to two expensive apprenticeship programs (Helper et al. 2016).

Apprenticeships are also a useful tool for enhancing youth development. They integrate what young people learn in the classroom with their on-the-job experiences, which benefits hands-on, non-traditional learners. Early apprenticeships can also help engage youth and build their identity (Halpern 2009). Youth who participate in apprenticeships early in their careers also benefit from a longer period of economic returns to training and a lower probability of developing bad work habits.

Young apprentices work with adult mentors (Halpern 2009). These mentors and other supervisors not only teach young people occupational and employability skills but also offer encouragement and guidance, provide immediate feedback on performance, and impose discipline. Unlike community colleges or high schools, where one counselor must guide hundreds of students, each mentor deals with only a few apprentices.

Youth apprenticeships can be less costly for employers than programs focused on older workers. Wages can be low because youth have fewer medium- and high-wage alternatives, and because youth have fewer family responsibilities and are more able to sacrifice current for future income. For example, while Swiss firms invest heavily in their apprenticeship programs, they pay their young apprentices very low wages during the apprenticeship period.

Unlike most government human capital programs that offer government funding each year per full-time equivalent trainee and result in a social cost in the foregone earnings of trainees, there is an initial fixed cost for helping employers establish apprenticeships but subsequent years require far less government funding, as employers bear most of long-term costs of training. Moreover, the foregone earnings of apprentices will be modest since they will receive wages during their training and contributions to production. Firms will recover a significant share of their costs during the apprenticeship itself.

2.2 The Disadvantages

Adopting the policies recommended below for expanding apprenticeship may carry some disadvantages. One such disadvantage is that employers may not respond by offering high-quality apprenticeships at scale. These initiatives will no doubt focus the energy of policymakers, energy that might otherwise have been devoted to improving existing educational programs. Thus, even if the performance-based funding for apprenticeships is not spent because few new apprenticeships are generated, other more effective initiatives may be foregone.

A second potential disadvantage is that some of the proposed funding might support employer apprenticeships that would have been created even in the absence of government funding. A third is that weak counseling might lead many young people into

apprenticeships that are a bad fit. (Still, apprenticeships are likely to yield better matches between worker interests, worker skills, and the demands of firms than many existing training programs.)

Finally, some scholars are concerned that apprenticeship training, due to its specificity to one industry or occupation, may yield weaker capabilities to adapt to technological change. While this concern is not without merit, I would argue that apprenticeships are more likely than traditional educational models to provide many participants with confidence in their ability to learn (and thus, if necessary, later adapt), as well as with powerful incentives to perform well in their academic coursework.

Recently released data from the 2016 National Household Education Survey found that former apprentices were very likely to apply the skills they learned during their apprenticeship to their current job. Among workers ages 40 and over, 67% of those completing apprenticeships of one year or more reported using the skills they learned in the program all or most of the time; another 24% reported doing so some of the time.[3] European studies yield similar results (Clark and Fahr 2001; Geel et al. 2001).

3 Current Barriers and New Proposals

3.1 Current Barriers to Apprenticeship in the United States

The experiences of Australia, Canada, and England demonstrate that scaling apprenticeship is quite possible, even outside countries with a strong tradition of apprenticeship. While none of these countries have the strong apprenticeship tradition seen in countries like Austria, Germany, or Switzerland, they have nonetheless grown significant programs. In fact, if apprenticeships as a share of the U.S. labor force reached the levels already achieved in Australia, Canada, and England (on average), the United States would attain over 4 million apprenticeships, about nine times the current number of registered apprenticeships in the civilian sector.[4]

A government role in apprenticeship makes sense economically and socially. Like other public investments in career-focused education and training, apprenticeships lessen credit constraints for students, generate productivity gains not fully captured by students or firms, and lower the excess burdens and administrative costs of transfers. As a cost-effective method for subsidizing preparation for careers, apprenticeships lower pressures for increasing government funding of higher education and other measures that impose economic distortions, such as high minimum wages. From a social perspective, apprenticeships are likely to increase mobility and reduce inequality by improving career prospects for those who learn best by doing, many of whom are from low-income families.

[3] Tabulations by the author from the 2016 National Household Education Survey.

[4] Currently, the US has 444,000 registered apprenticeships. There are an unknown number of independent apprenticeships not registered with state or local governments. See data sources by country in Appendix A.

Why, then, has the United States failed to generate the kind of large-scale apprenticeship program seen in other developed countries? In this section, I describe the historic barriers to expansion in the United States.

A Failure to Try

One barrier is a failure to try. Overall, the federal government has devoted less than $30 million (per year) to the Office of Apprenticeship (OA) to supervise, market, regulate, and publicize the system.[5] Many states have only one employee working under their OA. Were the United States to spend what Britain spends annually on apprenticeship, adjusting for differences in the size and composition of the labor force, it would provide at least $9 billion per year for apprenticeship. In fact, the British government spends as much on advertising its apprenticeship programs as the entire U.S. budget for apprenticeship.

Total government funding for apprenticeship in the United States has been minimal, often less than $100 per apprentice annually (Reed et al., 2012). Meanwhile, the annual cost of instruction and support services per full-time equivalent student in two-year public colleges was approximately $16,000 in 2008-2009 (Cellini 2012). Today's annual costs are no doubt substantially higher. The Federal Pell Grant program for low- and lower-middle income college students costs about $27 billion per year, with a good chuck of the spending going toward career-focused programs in community and career colleges (Rethinking Pell Grant Study Group, 2013).

The Structure of the Registered Apprenticeship System

The second barrier is the complex administrative structure of the registered apprenticeship system. This includes separate state administrations in half the states and federal governance in the other half; the requirement that each firm or set of firms have an approved set of occupational skill frameworks; the lack of national occupational frameworks; delays in the approval process; and the lack of an auditing system to assure quality.

Limited Information

A third barrier is the limited capabilities of OA staff and intermediary organizations to sell and organize apprenticeships. Because few employers outside commercial and industrial construction offer apprenticeships, most employers are unlikely to hear about the model from other employers or from workers in other firms. Compounding this problem are two factors: the difficulty of finding information about the content of existing programs, and the fact that developing apprenticeships is complicated for most employers, often requiring technical assistance that is unavailable in most of the country.

[5] Recently, dollars for apprenticeship demonstrations and state expansion grants have increased federal spending by about $50-90 million per year. Annual funding for the Office of Apprenticeship remains at about $30 million.

Asymmetric Funding Treatment

A fourth issue is the asymmetric treatment of government funding for post-secondary education and training. Pell grants, subsidized loans, and state college subsidies provide financial support to students taking for-credit courses. Yet, in general, similar subsidies for academic related instruction linked to apprenticeships receive little government aid.

3.2 The Proposals

So how can the US overcome these problems and scale apprenticeships? Building and sustaining a high-quality apprenticeship system will require several elements, including:

- effective branding and broad marketing;
- incentives for selling and organizing apprenticeships to private and public employers;
- credible, recognized occupational standards with continuing research on changing requirement;
- public funding for off-job quality instruction;
- a system of credible end-point assessments of apprentices & programs;
- one or two certification bodies to audit programs and issue credentials;
- simple systems enabling employers to create and to track the progress of apprentices;
- counseling and screening for prospective apprentices to insure they have the aptitude for, and interest in, the field;
- training for the trainer/mentors of apprentices; and
- research, evaluation and dissemination.

Recognizing the US cannot accomplish this vision overnight, I focus on four feasible initiatives. The goals are to achieve a major increase in the scale of the publicly-supported apprenticeship system within a few years, and to provide an infrastructure for long-term expansion.

Policy Proposal 1: Developing an Apprenticeship Brand

The federal and/or state governments should create a distinctive and quality brand. South Carolina chose to link apprenticeship with local pride by using "Apprenticeship Carolina" as its brand name. Britain has now established a copyright for the term "Apprenticeship" so that employers cannot claim to offer an apprenticeship without meeting the terms of the established program.

Once a brand name has been selected – "American Apprenticeships," let's say -- the program should advertise to the public, focusing first on firms and later on potential apprentices. Political officials, business leaders, and the media should highlight apprenticeships as a high-quality career option in all types of occupational areas. Videos of successful employers and apprentices should be widely featured. This proposal is

likely to require minimal funding; the UK spends about $30 million/year on advertising apprenticeships; advertisements for proprietary career schools, many of which are largely funded indirectly with government funds, are extensive as well.

Federal, state, and local governments could show leadership and credibility by creating apprenticeship positions in the public sector. A large share of state and local employees works in occupations that could be filled through apprenticeships, in positions in information technology, accounting, health care, administration of parks and courts, and security (including police and fire). Such a step would be feasible and cost-effective. Britain now requires government agencies to fill 2.3% of their jobs with apprentices.

Policy Proposal 2: Establish and Fund a Public/Private Entity to Develop and Maintain Apprenticeship Occupational Frameworks.

These occupational frameworks should reflect both employer needs and long-term skill requirements. Consensus frameworks are especially important if the public sector provides funding for the general skills component of apprenticeships (i.e. for skills that have value outside the training firm). Employers rarely have the time to develop such frameworks, nor do all employers in the same industry always share a common vision. To ensure that American Apprenticeships remains a quality brand, and to simplify the process of implementing apprenticeships, the Congress should establish the American Apprenticeship Standards Institute, which would be tasked with researching, creating, and updating apprenticeship competency frameworks for a broad range of occupations. Other countries rely on a non-political institute to insure the focus is on apprenticeship, more flexibility in collaborating with employers, and with moving quickly to establish and revise occupational frameworks.

Working with industry associations and individual public and private employers, the AASI would produce frameworks with potential job titles, occupational pathways, certification and licensure requirements, salary ranges, and employment opportunities. The frameworks should be limited to about 500-600 occupations in order not to be so narrow as to limit the range of skills apprentices can apply, or so broad as to lack direct relevance to employer demands.

Each framework should describe the following:

- cross-cutting competencies, including personal effectiveness (such as reliability, initiative, interpersonal skills, and adaptability);
- academic competencies; and
- workplace competencies (such as planning, teamwork, scheduling, problem-solving, and working with tools).

The key occupational skill frameworks should begin with job functions (i.e. what functions should the skill worker in the occupation be able to complete at a high level?), then specify the competencies needed to undertake the job functions and the criteria for judging performance in the functions. The frameworks should also describe the knowledge, skills, and tools and technologies required to achieve the competencies and

thus perform the job functions at a high level. Currently, examples of competency-based occupational frameworks already developed for the US Department of Labor range from transmission line worker to community health worker.[6]

Employer programs could use these frameworks to gain official recognition for their apprenticeship programs. The United States could look to the United Kingdom's Institute for Apprenticeship as a resource for developing skill frameworks for many occupations. Funding of about $40 million per year should be sufficient to support the AASI's work in establishing competency-based frameworks and in ensuring they are up-to-date.

Policy Proposal 3: Programs to Support the Selling and Organizing of Apprenticeships

Branding and broad marketing will not suffice without a well-developed system for selling and organizing apprenticeships. Selling an apprenticeship program as a partial solution to an employer's talent management efforts is not easy and typically requires several face-to-face encounters. Employers whose interest is piqued by an advertisement must have a resource they can turn to for more information about developing and implementing an apprenticeship program. Working with a company to organize apprenticeships requires determining the most suitable occupations, developing a plan to combine work-based and academic instruction, and filling out the forms and other materials required for registering apprenticeships.

The US should establish incentives for intermediaries (private or public) to sell to, and organize apprenticeships for, employers. Current employees with state and federal labor departments have been unable to sell and organize effectively. In addition, the incentives should be structured so that intermediaries ensure apprentices receive the appropriate training and work-based learning experiences and achieve high completion rates. Funding should go only to those intermediaries that stimulate apprenticeships that follow the official occupational frameworks. Intermediaries should also help employers find and fund quality training options for the off-job components of apprenticeship.

Britain managed to achieve an apprenticeship scale of over 850,000 in about eight years, largely through the efforts of 850 employment and learning providers[7]. Australia achieves high levels of apprenticeship partly through private, often nonprofit, Group Training Organizations (GTOS). The GTOs, which serve as the formal employers and place apprentices with host employers, are tasked with: selecting and recruiting apprentices; paying wages and providing for workers' compensation, sick/holiday pay and other employment benefits; managing the quality and continuity of training, both on and off the job; and providing the ongoing support necessary for the apprentice to complete the apprenticeship successfully.

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[6] See https://www.urban.org/policy-centers/center-labor-human-services-and-population/projects/competency-based-occupational-frameworks-registered-apprenticeships for examples.

[7] See https://www.aelp.org.uk/

The incentives should be sufficient to stimulate intermediaries to create 1.5-2 million additional apprenticeships over the next four years. Evidence from organizations suggests that effective selling and organizing apprenticeships could be achieved at a cost of about $2,000 for each apprentice that completes the first 60 days of a program, along with an additional $2,000 for each apprentice that completes the program in full. The payments could vary with the long-term returns to occupations. One reason for expecting modest per-apprentice costs is that once employers establish an apprenticeship program, most are likely to continue the program over time (with less effort by intermediaries). The experience of UK intermediaries suggests that about 60-70% of apprentices hired are the result of repeat business from employers.

Along with intermediary incentives, the federal government should establish an independent auditing system to assure program quality and to avoid fraud. The audits, which would increase the credibility of the apprenticeship system, should identify the strengths and weaknesses of existing programs. Current funding levels are far too low for the Office of Apprenticeship to conduct appropriate audits. Since only the programs would be audited, not each apprentice, a sum of about $100 million should be sufficient to allow the OA to complete audits every two to three years. Following the experience of Ofsted in the UK, the audits could rank programs for quality and identify intermediaries with programs that are deemed inadequate to receive continued funding.

Unlike most government-supported human capital programs, a significant share of the long-term costs of apprenticeship programs will be borne by the employer in the form of apprentice wages and the costs of work-based training. The foregone earnings of apprentices will also be modest since they will receive wages during their training. Firms, meanwhile, will recover a significant share of their costs during the apprenticeship itself. The costs to the government will come largely in the form of setup costs and contributions to off-job training.

The gross costs of the incentive scheme will depend on the number of new apprentices that complete 60 days of their programs and the number that complete their programs in full. The annual costs will also depend on the rate of phase-in for the program. It will take time to reach 1 million new apprenticeships and 750,000 completers per year. Assuming intermediaries stimulate half a million new apprenticeships per year, the initial costs of the incentives would total about $1 billion. In equilibrium, if the intermediaries successfully generated 900,000 new participants and 675,000 completers per year, the costs of the incentives would reach about $3.15 billion per year.

At scale, the stock of apprentices in any given year would reach well over 2 million. Since about three-fourths or more of the occupational and employability training for these apprentices would take place at worksites (at no public cost), full public support for the off-job training could be about $8 billion, raising the overall costs to $11.15 billion. For comparison, were these apprentices to attend community college full-time, the costs for instruction and services would amount to at least $32 billion per year (assuming the 2008 figure of $16,000/student reported by Cellini). Over time, the costs of incentives to intermediaries could fall as employers adopted apprenticeships without intermediaries and intermediaries lowered their costs by gaining repeat business.

Policy Proposal 4: Using Existing Funding for Off-Job Training and Incentives.

One can make a strong theoretical and practical case for a system in which employers are not required to fund the off-job learning components of apprenticeship. Theoretically, the skills learned in the off-job courses are general in the Becker sense that the added productivity of the worker can be applied not only to his or her current employer, but to many other employers. For this reason, the employer may not be able to recoup the provision of this general training. The worker gains the benefit, and the government shares in the gains in the form of higher taxes and reduced transfers.

Federal, state, and local governments already spend tens of billions of dollars on an array of education and training programs. The effectiveness of federal dollars would be far higher if at least some of these funds were made available for off-job apprenticeship training. Encouraging this shift in priorities, however, will require detailed analysis of each funding source.

In some cases, government funds could be substituted directly for employer funding, while in other cases existing government training funds could be made accessible for apprenticeship. Currently, for example, the Trade Adjustment Assistance (TAA) program provides funding to those who lose their jobs due to trade impacts. Participants receive both support for training, often in a community college program, and income support in the form of extended unemployment insurance while undergoing training. The regulations governing TAA could be changed to specifically allow funding to be used for the instructional component of a registered apprenticeship program, as well as the apprentice incentive program.

The United States Department of Labor's Workforce Innovation and Opportunity Act (WIOA) programs are already required to work with apprenticeship programs, but WIOA staff are ill-equipped to help scale apprenticeship. Some of WIOA's over $3 billion dollars could be directed toward the intermediary incentive program. Training WIOA business services staff to sell and organize apprenticeships could also defray some of the costs of the incentive program.

Some of the $1.8 billion now allocated to Job Corps and YouthBuild could be redirected to apprenticeship initiatives, or made available to local program operators to sell and organize apprenticeships. These two programs are expensive, cover only about 56,000 participants per year, and yield modest or no gains in earnings.[8] Although apprenticeships have demonstrated far higher earnings gains than existing programs, including Job Corps and YouthBuild, any diversion of funds should be accompanied by a renewed effort to target disadvantaged youth for participation in apprenticeships.

[8] Federal spending on Job Corps ($1.7 billion) is about 20 times the amount spend on YouthBuild (about $80 million). Also, YouthBuild attracts some private funding. Though these programs yield some benefits, the high costs generally do not justify the benefits. See Schochet et al. (2006) and Miller et al. (2016). As of 2017, the cost per participant in Job Corps was about $34,000 per participant (Employment and Training Administration FY2016).

Funding for the Carl D. Perkins Career and Technical Education Act of 2006 has supported career and technical education in high schools and colleges. Some of the $1.7 billion annual outlays on the program could subsidize the cost of off-job training for apprentices.

Currently, the Pell Grant program spends about $27 billion per year. Over half of Pell recipients are in public two-year or for-profit colleges, often in career-focused education programs. Loan programs that are very costly to the federal government also support students in these programs. Allowing students to use Pell grants for apprenticeship would save significant sums and generate higher earnings gains. Although Pell grants are currently not well-suited for apprenticeship, Pell eligibility criteria could be modified to eliminate prorating Pell grants for full-time apprentices but in part-time schooling. Also, one could raise the income protection allowance for students with apprenticeship earnings or treat any individual participating in a full-time apprenticeship as an independent student.[9]

State governments could encourage more apprenticeships with the use of their existing subsidies to community colleges. States commonly reimburse community colleges for some percentage of the cost of a full-time equivalent (FTE) student. Suppose the reimbursement rate were 60% of the costs of an FTE but that much of the actual and accredited learning (say, 70%) for an occupation program took place at the work site in an apprenticeship. If the costs of the community college instruction fell to only 40% of the normal costs of an FTE but the state continued the 60% subsidy, then colleges could provide the classroom component of apprenticeship free to employers. They could use the remaining 20% to sell employers on and help them organize apprenticeships.

The GI Bill already provides housing benefits and wage subsidies for veterans in apprenticeships, however funding levels for college and university expenses are far higher than for apprenticeship. Offering half of the GI Bill's per-recipient college benefit to employers who hire a veteran into an apprenticeship program could be accomplished by amending the law. However, unless the liberalized uses of Pell grants and GI Bill benefits are linked with the intermediary incentive campaign to sell and organize apprenticeships, the take-up by employers is likely to be limited.

Another way of financing the off-job education of apprentices is to link the intermediary incentive program with youth apprenticeships in high schools. Since high school CTE courses, and some college courses within high schools, are already an entitlement, the funds to complement work-based learning in apprenticeships would be readily available.

Policymakers should consider starting such a policy at career academies—schools within high schools that have an industry or occupational focus—and regional career and technical education (CTE) centers. Over 7,000 career academies operate in the U.S. in fields ranging from health and finance, to travel and construction. Career academies and CTE schools already include classroom-related instruction and sometimes work with

[9] I am grateful to Diane Jones for making these suggestions.

employers to develop internships. Because a serious apprenticeship involves learning skills at the workplace, at the employer's expense, these school-based apprenticeship programs could reduce the costs of teachers, relative to a full-time student. If, for example, a student spent 2.5 days per week (or 50%) in a paid apprenticeship, the school should be able to save 15-30% of the costs of educating a traditional, full-time student. Applying these funds to selling and organizing apprenticeships should allow the career academy or CTE program to stimulate employers to provide apprenticeship slots.

4 Conclusion

Today, funding for the "academic only" approach to skill development in the US dwarfs the very limited amounts available to market and support apprenticeship. Yet, apprenticeship programs yield far higher and more immediate gains in earnings than do community or career college programs and cost students and the government far less. Postsecondary education costs students not only in tuition but also in foregone earnings, often without ever obtaining a useful degree or credential. In contrast, apprentices rarely lose earnings or need to go into debt while they learn occupational skills. Apprentices are already connected with an employer and thus work on up-to-date equipment and learn modern business practices.

Expanding access to apprenticeship programs could improve the lives of millions of Americans and help prevent further erosion of the middle class. Apprenticeships widen the pathways to rewarding careers by upgrading occupational skills, employability skills, and traditional academic skills. For hands-on and non-traditional learners, academic coursework completed in the context of an apprenticeship program can increase worker motivation and improve the efficacy of the delivery process. Furthermore, given the effects of these programs on worker productivity and innovation, firms will have an increased incentive to adopt "high road" strategies with respect to their apprenticeship programs. Especially in today's tight labor market, apprenticeships represent one of the best ways firms can attract and retain skilled workers.

While structural barriers to apprenticeship exist in the United States, federal investments in marketing and standards development, along with ongoing financial support for the off-job costs of apprenticeship, could overcome these barriers. And as more employers adopt apprenticeship strategies successfully, network effects could well take over, with employers learning from each other about the value of apprenticeship.

The United States undoubtedly has a long way to go before it reaches the apprenticeship levels in Australia, Canada, and the United Kingdom, let alone the level in Switzerland, where 95% of 25-year-olds have an occupational credential (70% through apprenticeship) and 25% hold BA degrees. The example of the United Kingdom, however, proves that rapidly expanding apprenticeship as a quality brand for success in a wide range of occupations is feasible.

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Appendix A: Data on Apprenticeship and Labor Force Levels: Australia, Canada, England, and US

Table A1: Apprenticeships as Shares of Labor Forces: Australia, Canada, England and US

	Apprenticeships	Labor Force	Apprenticeship Share of LF
Australia	270000	13,180,000	0.020
Canada	453000	19,200,000	0.024
England, 2016-2017	917000	30,000,000	0.031
Average: Australia, Canada, and England	546,667	20,793,333	0.025
US, civilian	444,306	161,000,000	0.003
US Projected Civilian Apprentices	4,006,002		

Sources: See below for links to data on apprenticeship and labor force statistics

Australia
https://www.ncver.edu.au/data/data/all-data/apprentices-and-trainees-2017-september-quarter-data-slicer
http://www.abs.gov.au/ausstats/abs%40.nsf/mf/6202.0
Canada
http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/educ66a-eng.htm
http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor07a-eng.htm
http://www5.statcan.gc.ca/cansim/a47
England
http://researchbriefings.files.parliament.uk/documents/SN06113/SN06113.pdf
https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/headlinelabourforcesurveyindicatorsforallregionshi00
US
https://www.bls.gov/news.release/empsit.t01.htm
https://www.doleta.gov/oa/data_statistics.cfm