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ALL TOGETHER NOW:
LEVERAGING FIRMS TO INCREASE WORKER PRODUCTIVITY GROWTH

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ABSTRACT

I describe a new policy that endows firms with limited-duration, virtual shares in their own workers' future realized earnings growth. The policy seeks to leverage employers to address a key challenge of the modern world: increasing worker skills well into adulthood. I label the policy "generalized experience rating" (GER) because it builds on the more narrow experience rating long embodied in the US unemployment insurance system. GER can be interpreted as a Pigouvian tax, and as a mandate alleviating an adverse selection problem. I discuss many design issues and potential unintended consequences. I conclude the policy may warrant further research.

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1 Introduction

The past 40 years have not been kind to the US economy. Major problems include slower growth in educational attainment (Goldin and Katz, 2010), slower productivity growth (Byrne et al., 2016), relative earnings stagnation for lower-skilled workers (Goldin and Katz, 2010; Piketty et al., 2016), declining labor force participation (Juhn and Potter, 2006), and declining upward mobility (Hauser et al., 2000; Chetty et al., 2016; Hilger, 2016a). In this paper, I describe a new policy tool that may help to address these problems by democratizing worker skill-accumulation and career advancement. The policy arises out of "experience rating," a unique feature of the U.S. Unemployment Insurance (UI) system since 1935. Experience rating levies a higher tax on firms that lay off more workers for longer periods of time. I explore the idea of replacing traditional experience rating with a "generalized" experience rating (GER) scheme that taxes employers for worker earnings declines, and rewards employers for worker earnings gains. These worker earnings changes could stem from layoff as in traditional experience rating, but could also stem from skill growth, promotions, job search improvements, and many other factors both inside and outside the current employer.

One rationale for GER is similar to that for traditional experience rating. Just as unemployment has fiscal externalities on the UI system, worker earnings changes have fiscal externalities on the progressive tax-expenditure system more broadly (Prante and Hodge, 2013; Center for Labor Market Studies, 2014).[1] And just as unemployment responds to experience rating (Topel, 1984; Card and Levine, 1994; Anderson and Meyer, 1994),

[1]The tax-expenditure system, as opposed to the tax-benefit system, incorporates social expenditures that are not valued by individual recipients such as costs of incarceration and law enforcement.

employer-facilitated worker skill growth and career advancement may respond to GER (Abramitzky and Lavy, 2014; Davis and Henrekson, 2005). GER also addresses two other potential sources of under-investment in worker skill and career advancement: high costs of investment undertaken by individual workers in isolation, and individual behavioral biases against trading short-term sacrifice for uncertain long-term gains.[2]

The key feature of GER is a government cash transfer to or from employers that equals a share S of their workers' future realized earnings gains over some period of time T, weighting earnings gains across these T subsequent periods by $\rho_1, \rho_2, ..., \rho_T$ where typically $\sum_{j=0}^{T} \rho_j = 1$. This transfer is equivalent to endowing firms with virtual equity shares in their workers' future earnings growth. These equity shares are "virtual" because they need not be financed directly out of workers' earnings, as they would under a true equity contract. To illustrate, suppose $S = 0.2$, $T = 5$, and all weight is placed on the initial earnings gain in the year following the base year. Figure I presents GER transfers to a hypothetical firm for base years 2007 through 2011 under this "subsequent-year" weighting scheme. For the base year of 2007, the subsequent year earnings change is $4,000, and the firm therefore receives 20% of $4,000 or $800 over each of the next five years. For the base year of 2008, the subsequent year earnings change is -$2,000, so the firm therefore pays $400 over each of the next five years. These transfers encourage the hypothetical firm to invest in worker training and career advancement services in each year that raise the future output of its workers, even if workers at this firm tend exhibit high turnover rates.

By rewarding results rather than inputs, GER may create a new market in which firms provide high-quality, low-cost job training, job search, and job placement programs to their

[2] Another approach more exactly analogous to traditional experience rating would be to tax firms according to changes in workers' net future contributions to the overall tax-expenditure system. While many of the implications of this approach are similar, I focus on earnings because changes in workers' net future contributions to the tax-benefit system are currently more difficult for policymakers to measure (e.g., see discussions in Prante and Hodge 2013; Center for Labor Market Studies 2014).

workers, or else shop and negotiate for better external programs on behalf of their workers. Firms would be motivated to facilitate completion of these programs with tools such as improved coordination, automatic enrollment, matching investments, and social pressure. New business ventures could gather and generate information about the effectiveness of different training and career advancement tools for different types of workers, and then sell this information to employers in the form of consulting and implementation services. The beneficial effects of employers' "workplace wellness" programs on employer health costs and worker health, and the ecosystem of research and consulting devoted to improving these programs, provides one example of this dynamic (Baicker et al., 2010).

GER transfers act as a Pigouvian subsidy for firm production technologies that are relatively more intensive in worker training and career advancement. Firms providing more "dead end" jobs pay a tax, and firms providing more "career ladder" jobs receive a subsidy. By tying this subsidy to workers' future earnings, GER also solves a moral hazard problem that prevents firms from reaching their full potential as facilitators of worker productivity growth. The problem is that firms have incentives to provide workers with postponed, prolonged, and lower-quality job training in order to save on costs and prevent turnover (e.g., Hart et al., 1997), and to obstruct worker attempts at external job search and placement. Consistent with these incentives, the most common form of employer training assistance takes the form of tuition credits for voluntary, independent enrollment without any attempt at coordination or guidance, which only become available after a substantial probation period (Cappelli, 2004). The most obvious way workers could solve this problem privately is by selling a share of their own future earnings to their current employers. However, this market solution is unlikely to work due to the same problems with adverse selection that preclude a private market for unemployment insurance (Hendren, 2015). GER addresses this adverse selection problem by mandating that all firms purchase

virtual shares of workers' future earnings, thereby attenuating firms' moral hazard problem in training provision and allowing firms to realize their large potential as facilitators of worker skill growth and career advancement.

As with any new policy, GER raises many important concerns about unintended consequences. Depending on how it is implemented, GER may amplify employment volatility, and may generate perverse employer incentives to backload worker earnings and hours, to waste resources on identifying workers with higher *ex ante* predicted earnings growth, to dilute worker earnings into a larger number of hours, and to reduce opportunities and earnings for historically disadvantaged groups—among other issues. In each case, I find that market forces, worker preferences, and simple extensions to basic GER policies may contain these social costs, suggesting these concerns need not outweigh GER's large potential benefits on purely theoretical grounds. Further research on GER, and possibly even experimentation, may therefore prove worthwhile.

The paper proceeds as follows. Section 2 lays out the basic mechanics of GER policies. Section 3 argues that GER policies are not radical or utopian, and in fact build on long-standing precedents to fill an important void in US workforce development in a distinctly American way. Section 4 describes the large potential advantages employers could leverage to help workers increase skills growth and career advancement, both directly and as a spur to innovation in these areas. In Section 4, I describe the market failures that GER serves to address, which include externalities, moral hazard, and adverse selection. Section 5 discusses many important policy design issues and potential unintended consequences of GER. Section 6 concludes.

2 Mechanics of GER

Consider a worker who invests in a training program that costs C_{worker} in year t_0, raising her productivity from P_L to $P_L + \Delta P$ and raising her earnings from E_L to $E_L + \Delta E$.[3] This investment yields a permanent, annual dividend of ΔE.[4] If a worker remains employed for, say, $T_{\text{life, } t_0}$ additional years after period t_0, and we ignore discounting, she receives a total present value earnings gain of

$$R_{\text{worker}} = T_{\text{life, } t_0} \times \Delta E - C_{\text{worker}}. \tag{1}$$

Now consider a firm that invests in the same job training program for a worker at cost C_{firm} at time t_0, again raising the worker's productivity from P_L to $P_L + \Delta P$. This investment yields an annual dividend of $\Delta P - \Delta \tilde{E}$ for the duration of the worker's tenure at that firm as of time t_0, or $T_{\text{duration, } t_0} \leq T_{\text{life, } t_0}$. Note that $\Delta \tilde{E}$ need not equal ΔE, because earnings may adjust to compensate the employer for more or less of the training cost C_{firm}. The return to the firm is

$$R_{\text{firm}} = T_{\text{duration, } t_0} \times \left[\Delta P - \Delta \tilde{E}\right] - C_{\text{firm}}. \tag{2}$$

This return is larger if post-training worker tenure is longer, and if workers capture a smaller share of productivity gains in the form of earnings gains due to various labor market frictions (e.g., Acemoglu and Pischke, 1998, 1999). As I discuss below, it is likely that $C_{\text{firm}} < C_{\text{worker}}$ for many reasons and that, despite this efficiency advantage, firms

[3] All earnings are assumed to be deflated with a Price Index that is most relevant to worker expenditures, not the price index most relevant to firm owners, i.e., the firm's output price. An implication of using a CPI is that GER will pro-cyclically punish firms that reduce workers' earnings in response to an adverse product demand shock, just as traditional experience rating punishes firms that reduce some workers' earnings to zero with layoffs in response to an adverse demand shock.

[4] I ignore time discounting throughout this section for simplicity.

are likely to provide less than socially efficient levels of job training and search assistance to workers as a benefit paid for out of earnings. Putting aside cost differences, the benefits to firms of investing in workers tend to be smaller than the benefits to workers of investing in themselves, i.e., $R_{\text{worker}} >> R_{\text{firm}}$. This old observation led Becker to conclude that workers would probably have to finance the vast majority of investment in "general" skills out of foregone earnings (Pigou, 1912; Becker, 1962).

In the current US policy environment, workers acting on their own without employer assistance are likely to under-invest in general skills and career advancement due to tax-benefit progressivity, high costs of investment undertaken in isolation by individual workers, and behavioral biases against making short-term sacrifice in exchange for uncertain, long-term rewards.[5] GER policies provide a way to compensate firms for investing in workers—even when post-training worker tenure is short and workers capture a large share of productivity gains. GER provides this compensation in a way that rewards better worker outcomes and therefore encourages effective, efficient training.

GER policies involve an income sharing parameter $S \in (0, 1)$, a time horizon $T > 1$, and a set of weights ρ_j for $j \in [1, T]$ with $\sum_{j=1}^{T} \rho_j = 1$ that dictate the relative importance of more proximate earnings changes. As before, the firm chooses whether to make an investment increasing the worker's productivity from P_L to $P_L + \Delta P$ and earnings from $\hat{E}$ to $\hat{E} + \Delta\hat{E}$, and the worker stays at the firm through year T_{duration, t_0} before leaving for a job with a different employer. Note that $\Delta\hat{E}$ can differ from both ΔE and $\Delta\tilde{E}$ as earnings may adjust to the GER policy.[6] Each year of the worker's tenure, the firm and the worker can take actions, either together or separately, that may increase the worker's productivity. These actions may include job training, allocation of tasks, and job search assistance to increase job match quality. GER mandates that the firm receive a transfer

[5] I discuss these market failures addressed by GER below in Section 5.
[6] I discuss this endogenous earnings response below in Section 6.

from the government equal to share S of any earnings gains *or losses* accruing to the worker over T years following each year of this tenure, both internally at the hiring firm and externally after a worker departs.[7]

In our simple framework of a discrete, fixed, annual investment in workers, a firm would receive a GER transfer for investments made during year t_0 amounting to $T \times S \times \Delta\hat{E}$. The firm would receive this return on each year's investment up through the final year of a worker's tenure, t_{tenure}. Returns accruing to a firm for investment in any particular year t become

$$R_{\text{firm}}^{GER} = T_{\text{duration,t}} \times \left(\Delta P - \Delta\hat{E}\right) - C_{\text{firm}} + T \times S \times \Delta\hat{E}. \tag{3}$$

This return under GER, R_{firm}^{GER}, can be much larger than the return accruing to employers without GER, R_{firm}. GER therefore can induce some share of firms to undertake investment in workers that would not have done so otherwise, and may also induce a shift in market and employment shares toward firms adopting more worker-enhancing production technologies. Prior researchers have established a similar point more formally in documenting how traditional experience rating reduces firm incentives to undertake layoffs (e.g., Feldstein, 1978), in keeping with the original goals of experience rating (Becker, 1972).

In this simplified example, earnings growth over the next year reflects a fixed, permanent effect of any training that occurred in the prior year. In reality, training may have time-varying effects on earnings. In this case, GER payments could be gradually transferred to a firm employing a worker in a base period t_0 over T years as future earnings are realized, resulting in a total transfer of $T \times \sum_{j=0}^{T} \rho_j S \times \left(\hat{E}_{t_{j+1}} - \hat{E}_{t_j}\right)$. If the weights ρ_j decline over time but remain above zero, for example, they imply greater accountability of employers

[7]GER payments should apply both to within-firm and between-firm earnings gains. See explanation below in Section 6.

for worker earnings changes realized more proximately in the future. Figure II illustrates GER transfers to a firm under a "uniform" weighting scheme in which $\rho_j = 1/T$.

Why does GER align incentives for more efficient investment in workers? Below I argue informally that workers struggle to observe the quality of a firm's training decisions, and this information problem makes it hard for workers to compensate employers for training out of foregone earnings. To illustrate, consider a firm choosing not only whether to invest in training, but also how much to invest. Suppose workers cannot observe this choice. Also assume a competitive labor market such that earnings always equal productivity, hence $\Delta P = \Delta \hat{E}$. Without GER, employers cannot commit to provide any training and hence are unable to compensate workers in the form of training rather than cash, even if the employer has access to highly productive training technologies.[8] With GER in place, equation 3 implies the employer will invest in training up to the point at which $S \times T \times \frac{\partial \Delta \hat{E}}{\partial C} = 1$ even if workers decline to receive any compensation in the form of training. Under a benchmark "moderate" GER policy with $S = 0.2$ and $T = 5$, this condition becomes $\frac{\partial \Delta \hat{E}}{\partial C} = 1$. In other words, the firm will voluntarily provide training up to the point at which \$1 of investment in training increases future annual earnings by \$1. Because firms still only receive a small share of the social returns to training, they may still under-invest relative to a social optimum. However, below I discuss many ways that firms can essentially pay workers' fixed costs of investment, and may therefore crowd in substantial additional investment by workers. These fixed costs may include, for example, re-arranging work schedules to accommodate training, gathering information

[8] Employers could provide training if they faced a strong reputational penalty from short-changing workers on training that had been paid for up front out of earnings. The strength of reputational effects is an empirical question. Note this mechanism presumes a high degree of worker sophistication and access to information which is not readily available to workers apart from anecdotes of friends or, more recently, employer review websites like GlassDoor. Unfortunately, employer reviews are only weakly informative for large firms with heterogeneous managers and work environments, and large firms employ most workers.

about training programs, searching for new jobs in broad employer networks, and many other tactics.

Importantly, note that GER need not be financed out of earnings and hence need not augment the earnings insurance already implicit in the progressive tax-benefit system. Debates over GER can proceed independently of debates over the optimal degree of earnings insurance or tax-benefit progressivity. GER could be financed, for example, out of general tax revenue. I discuss financing options for GER in more detail in Section 6.

A concrete example can illustrate the magnitudes at stake for GER. Traditional experience rating tax contributions as a percent of total wages have been about 0.5-1.5% over the 1960-2008 period (Vroman and Woodbury, 2014). GER transfers are likely to be in the same ballpark. Assume a GER policy with $S = 0.2$ and $T = 5$, and consider a firm that invests in workforce development over the course of one year to an extent that increases its workers' future earnings by 1%. An increase of 1% in future earnings would be equivalent to something like one tenth of a year in college, or less, given prevailing Mincerian returns to college over 10% (e.g., Oreopoulos and Petronijevic, 2013). This firm would receive an annual transfer of 1% of its total wage bill ($= 0.2 \times 1\% \times 5$), which is similar in magnitude to tax rates under traditional experience rating. Further suppose workers earn \$30,000/year upon hiring. Then 1% of earnings yields the firm \$300.

Prior work suggests that \$300 is large compared to costs of effective interventions. Bettinger and Baker (2014) and Carrell and Sacerdote (2016) both find that coaching students through the financial aid and college application process dramatically increases college enrollment of young adults at costs below \$300 per student. A transfer of \$300 is is also substantial compared to costs of community college, and Jepsen et al. (2014) find large earnings gains to associates degrees and diplomas, especially in certain fields that employ-

ers could easily steer workers towards to maximize earnings growth. [9] These findings suggest that investing in programs that help workers find and complete high-return external degrees could increase employer profit under GER, even if firms only recover a small share of potential earnings gains ($S = 0.2$) for a limited number of years ($T = 5$). Employer assistance may also crowd-in private investment from workers, much like matching contributions crowd in greater saving (Duflo et al., 2006).

Impacts of GER on aggregate worker productivity growth would be governed by at least three key empirical questions. One question concerns the elasticity of employer investment in workers with respect to GER parameters such as S, T, and weights ρ_j. Another question concerns potential costs of GER due to strategic behavior and various sources of DWL. Below I discuss some of the limited existing evidence that bears on these questions.

3 Precedents for GER

GER builds on traditional experience rating, a unique US policy that enjoys longstanding, bipartisan support. Prior work documents that firms respond strongly to experience rating by stabilizing employment (Feldstein, 1978; Topel, 1984; Card and Levine, 1994; Anderson and Meyer, 1994). Just as experience rating reduces deadweight loss from UI by discouraging taxpayer-subsidized "unemployment holidays," GER reduces DWL from overall tax-benefit progressivity by discouraging taxpayer-subsidized "underemployment" in the sense of under-developed skills and career ambitions. And just as experience rating seeks to encourage adoption of business practices that stabilize employment and to re-allocate from higher-layoff firms to lower-layoff firms (Becker, 1972), GER seeks to en-

[9] Under an assumption of constant returns to scale and 10% earnings gains per year of college attainment and ignoring the value of students' time, the skill-production technology embodied in community colleges generates a 1% earnings gain at a cost of something like $900, or total private cost to students of $340, based on annual total and private costs for a year of community college of $9,000 and $3,400, respectively (Johnson, 2014).

courage adoption of business practices that develop workers' potential and to re-allocate resources toward firms adopting more worker-enhancing production technologies.

GER also builds on traditional policies that encourage firms to invest in physical capital. Prior work has shown that firms alter their investments in physical capital in response to incentives such as "bonus depreciation" (e.g., Zwick and Mahon, 2017). Whereas physical capital does not leave firms, human capital rapidly and unilaterally does leave firms, and this inefficiently reduces incentives for firms to facilitate investment in human capital relative to physical capital. GER would address this imbalance and leverage firms' sophisticated investment apparatus to increase human as well as physical capital.

Many other countries in Europe and Asia subsidize worker training to a greater extent than the US (e.g., Commission on the Skills of the American Workforce, 1990). The typical policy levies a tax on firms in the range of 1-2% of payroll that subsidizes approved or publicly-provided worker training programs. These policies often require a substantial bureaucracy to evaluate, approve, and monitor specific training programs, much like the US Department of Education's role in determining eligibility of colleges for Title IV federal student aid programs. In some cases, governments directly administer public training programs much like state governments in the US administer public colleges. GER would provide the US with a more efficient approach to workforce development due to its emphasis on actual earnings gains rather than training inputs, just like traditional experience rating—a unique American institution—has provided the US with a more efficient approach to UI. GER requires a smaller and less intrusive public bureaucracy, and therefore may offer a better "fit" with American political institutions. GER implies a smaller bureaucracy because it aligns incentives in a way that avoids any need for public evaluation, approval, and monitoring of specific training programs. GER also prevents firms from collaborating on earnings to exploit GER by generating conflicting incentives for "sending"

and "receiving" firms in any worker job switch. These self-enforcement features of GER are reminiscent of value-added taxation.

GER can also be understood as the reciprocal of equity compensation for workers. Firms often pay some workers with equity in order to address moral hazard problems that may threaten to limit workers' productive effort. Reciprocally, GER sells virtual equity in workers to firms in order to address similar moral hazard problems that threaten to limit employers' effort toward increasing workers' human capital. I describe these moral hazard problems in more detail below.

GER is also similar to tax subsidies that encourage firms to facilitate worker financial investment for retirement through saving instruments such as 401ks. This policy rewards firms for setting up investment options for workers, without any additional reward for actually increasing worker savings. This is analogous to the OECD approach to subsidizing worker training, which also does not link subsidies to actual earnings gains realized by workers. Congress acknowledged this problem when it passed the Employee Retirement Income Security Act of 1974 (ERISA) to impose standards on the retirement plan investment options that firms provide to their workers. These regulations, however, have left ample room for firms to offer substandard investment options. Examples include the focus on high-fee mutual funds rather than low-fee index funds (e.g., Elton et al., 2006) and a focus on high-risk "company stock" rather than low-risk diversified portfolios (Benartzi et al., 2007). Firms have also traditionally failed to address workers' plausible behavioral biases against saving and away from optimal portfolio allocations, by for example offering automatic rather than voluntary enrollment (Carroll et al., 2009; Chetty et al., 2013), default investment in best-practice portfolios with a large share of equity that shifts gradually into bonds over the lifecycle (Brown et al., 2007), or by using tactics intended to overcome workers' problems with self control and commitment (Thaler and Benartzi, 2004). Over-

all, regulations have not caused firms to act in a proactive fashion to ensure workers' real retirement security.[10] GER overcomes these problems for saving in the form of human capital, rather than financial capital, by directly subsidizing earnings growth rather than training inputs.

GER also acts as a classic Pigouvian tax, much like Pigouvian taxes on pollution. The reason is that workers are likely to under-invest in human capital for reasons discussed below. This under-investment implies that firms adopting more worker-enhancing production technologies generate positive externalities by moving workers' human capital closer to its socially optimal level. GER therefore brings private net benefits of worker training closer to social net benefits, increasing economic efficiency.

Finally, GER is related to "value-added" policies that reward teachers and schools for gains in student test scores (e.g., Kane and Staiger, 2005). Prior work has found that VA-based incentive systems can potentially increase mean teacher quality even when VA measures contain substantial noise (Kane and Staiger, 2005; Chetty et al., 2014). GER may be a promising application of value-added methods because earnings are a better proxy for welfare than test scores, and earnings can typically be observed both before and after a particular employer hires a worker. Test scores, in contrast, have no intrinsic value, and it is not possible to observe more meaningful, longer-term outcomes before children reach early adulthood. On the other hand, earnings raise additional problems for reasons that I discuss in Section 6. Statistical techniques that have proven useful in the VA literature on teachers could also potentially be modified to improve GER (e.g., Chetty et al., 2014).

[10] Surprisingly, the evidence that existing institutions have resulted in severe, widespread under-saving is rather weak (e.g., Scholz et al., 2006).

4 The Untapped Potential of Employers

In this section I discuss evidence that bears on two of the empirical parameters governing effectiveness of GER: the capacity of employers to facilitate worker productivity growth, and the responsiveness of employer investments in workers to GER parameters such as S and T. While direct evidence is not available, there are several reasons to think these parameters may be substantial.

Firms can and do undertake many kinds of activities that benefit worker skill and career growth. Firms can choose levels of formal training, on-the-job training, job task assignments, job search assistance, job security, and many other services and activities.[11] Returns to these activities may vary dramatically across firms and workers. GER embraces this variation by letting firms and workers decide how best to increase worker earnings, and rewarding actions based on demonstrated success.

In providing all of these services that benefit workers, employers have four comparative advantages over workers, and over most other social organizations such as schools, churches, or worker training agencies: *coordination, expertise*, *scale*, and *complementarities*. These advantages tend to increase in firm size.

1. *Coordination.* Individuals struggle to balance college with family and job responsibilities, and this tension likely prevents workers from initiating and completing other training programs throughout their career (Johnson and Rochkind, 2009). Firms are well-suited to address this problem because they already employ the majority of most workers' time on a day-to-day basis. For example, firms could integrate external course schedules and academic calendars into job scheduling and task management software. Firms could also

[11] For example, Becker (1972) documents that firms adopting limited private unemployment insurance before the New Deal increased rotation of workers across many types of jobs, thereby assuring that all workers would remain productive in the event of demand reductions affecting any particular job task and reducing the need for layoffs.

negotiate with colleges and other training programs for greater availability of night and weekend courses.

2. *Expertise.* Firm human resource departments could act as depositories of learning and expertise in training programs and career advancement. Identifying high-quality, low-cost training programs has proven to be a difficult problem for professional labor economists, not to mention individual workers. Likewise, job search poses difficult problems of information acquisition, duration, and negotiation that most individual workers may struggle to address. In contrast, firms can assess quality of external training programs, evaluate returns to different college majors or vocational programs, commission experiments to obtain greater insight into which programs work best for which workers, and procure services of external consulting agencies that specialize in worker training program evaluation. Firms also may recognize the kinds of skills they value in workers, and which are most in need of improvement among new and potential hires. Obama White House (2014), for example, concludes that training programs have been shown to increase workers' earnings most robustly when designed in close collaboration with employers. The Registered Apprenticeship program, discussed below, illustrates this point.

3. *Scale.* In leveraging their expertise, firms can exploit returns to scale that are not available to individual workers. Firms can set up large-scale internal training programs, and firms can use their bargaining power to negotiate with external training programs for lower prices and higher quality. Firms can also cultivate and maintain larger and more dispersed employment networks around the country, and actively "pitch" their workers to other firms on the basis of internal information about worker performance and potential.

4. *Complementarities.* Firms already provide many types of worker training internally, and GER would encourage firms to formalize these programs for broader recognition in the labor market. For example, companies that teach workers how to use certain machines or

software programs could provide verifiable skill assessments and credentials to workers, and could subject internal training programs to independent auditing for quality assurance.

Some firms may simply help workers identify and complete valuable external training programs, but other employers could also build internal training programs. Prior work suggests much potential for valuable on-the-job training programs remains unrealized for reasons that GER can partly address. One piece of evidence supporting this view comes from work on the Registered Apprenticeship program, which has existed in the U.S. since 1937. Mathematica (2012) estimates large positive effects of these apprenticeships on earnings, yielding high private and social rates of return despite the program's substantial costs. Apprenticeships tightly integrate training with work, ease the coordination burden and leverage employer knowledge of how best to train workers in productive skills. But surveys show that over half of employers sponsoring apprenticeships worry trained workers may be "poached" by other firms before training costs can be recouped (Lerman et al., 2009). This is remarkable because only a tiny share of firms sponsor apprentices, and presumably these firms face unusually weak poaching threats.[12] Positive causal effects on worker earnings have also been documented for many other job training programs, especially those involving close collaboration with employers (Heckman et al., 1999; LaLonde, 2003; Obama White House, 2014; Card et al., 2010).[13] Other work documents substantial positive impacts on productivity of "innovative" HR practices that increase worker training alongside other complementary policies, but that nonetheless diffuse slowly across firms due to high transition costs (Ichniowski et al., 1997). This literature justifies optimism that motivated employers could successfully advance workers' careers through well-chosen investments.

A significant, permanent GER program could also give rise to important general equi-

[12]See Hoffman and Burks (2017a) for a recent example of empirical research documenting this problem.
[13]Unfortunately, many of the studies discussed in these review articles do not contain enough information about program costs to estimate rates of return.

librium effects. GER could give birth to a new ecosystem of evaluation and innovation in training and career advancement programs. New firms could emerge that conducted experiments in training program effectiveness, consulted with employers on providing the highest-return investments in workers, tailored training programs to individual workers based on worker preferences and abilities, and cultivated credible, far-flung job networks connecting labor markets over space. Walmart could encourage workers to undertake training in computer programming or accounting, graphic or user interface design, or basic literacy and numeracy, depending on the aptitudes and preferences of each worker. Job search and placement, like skill development, would also benefit from employer cooperation. For example, under GER employers may require—not only encourage, but require—that all workers maintain resumes and LinkedIn profiles, and help workers to practice job interview skills. All of these activities would be viewed with hostility by employers in the absence of GER. Finally, a valuable market may also develop for internal training program accreditation, so that firms can "sell" their workers to other employers at higher earnings.

5 GER as Efficient Response to Market Failure

Four factors suppress investments in skill and career advancement below their socially optimal level: tax-benefit progressivity, complexity, individual behavioral biases, and borrowing constraints.

Tax-benefit progressivity, other things equal, reduces incentives to invest in skill and pursue an ambitious, full-time career. Existing evidence suggests that educational and occupational choices, for example, may be quite sensitive to tax-benefit progressivity (Abramitzky and Lavy, 2014; Davis and Henrekson, 2005). The tax-expenditure system in the US, as in other OECD countries, is quite progressive. Annual net fiscal contributions amount to something like 30-50% of earnings gains associated with higher educational attainment, and

something 10% of all income gains with much larger externalities at top incomes (Prante and Hodge, 2013; Center for Labor Market Studies, 2014).[14]

Second, individuals seeking to invest in education and training on their own face high costs relative to firms due to their limited expertise, small scale, inability to coordinate training with job assignments, and inability to credibly formalize their private learning from independent study. These high costs are consistent with a literature documenting that many individuals struggle to make optimal decisions in markets for complex products.[15] To give just one example, Jepsen et al. (2014) find that labor market returns vary enormously among men and women, between associate's degrees, diplomas, and certificates, and between different fields within each of these credentials, in the Kentucky labor market of the 2000s. There is little hope that individual workers in Kentucky will sign up for JSTOR and read this paper. However, there is some hope that Kentucky employers—especially large employers—will process this kind of evidence, or else consult other websites or research companies to do it for them. Labor economists could play a productive role in brokering this new market for information.

Third, individuals may face not only high costs of navigating these markets in isolation, but also behavioral biases that push against making short-term sacrifices in exchange for longer-term gains.[16] If workers are not entirely sophisticated about acknowledging these biases, they may fail to demand the kinds of defaults, commitment devices, and coaching

[14]Some of these fiscal externalities observed in cross-sectional data are mechanically related to tax formulas and therefore causal, while others such as incarceration and benefit take-up need not be causal. Hendren (2016) discusses causal impacts of various policies on individuals' total net fiscal contributions.

[15]Prior work documents naive or *ad hoc* consumer choice in markets for financial assets (Hastings et al., 2013), schools for children (Hastings and Weinstein, 2008), college applications (Hoxby and Avery, 2013; Hoxby and Turner, 2012; Bulman, 2015), and health insurance plans (Ketcham et al., 2012). In all these cases, many consumers select lower-quality products at higher prices due in part to a lack of clear, accurate, and credible information. Competition need not eliminate these problems (e.g., Gabaix and Laibson, 2006; Duarte and Hastings, 2012).

[16]These biases include limited self-control and time-inconsistency (e.g., Bryan et al., 2010), over-confidence (Hoffman and Burks, 2017b), framing effects (Busse et al., 2015), and many others (Kahneman, 2013). The economic importance of these biases across different markets is not yet well-understood.

that can alleviate them.

Finally, workers—especially lower-income workers—may struggle to finance training out of foregone earnings or borrowing due to non-collateralizability of human capital (Becker, 1967).

The idea that firms may be well-situated to address these problems and assist workers with human capital accumulation raises a question. Why don't workers just pay firms to facilitate greater general training and career advancement out of earnings, much like workers already pay firms to provide other benefits such as health insurance? If workers tend to leave the firm too quickly after training for the firm to recoup costs, or if assistance takes the form of placement in better jobs with other employers, this should simply increase the amount of earnings workers need to forego. Borrowing constraints are not a satisfying explanation, especially above the lowest income levels.

One plausible answer is that workers cannot trust firms to provide these more directed kinds of assistance due to asymmetric information. Training programs are complex services with long-term, hard-to-verify impacts on workers' labor market outcomes. Individuals typically interact with specific types of training programs only one time or very infrequently during their lives. Therefore, individuals may be unable to assess training program quality in a sophisticated way. In cases where individuals have trouble evaluating service quality and reputation effects are weak, service providers may wind up selling inefficient quantities and qualities of the service to consumers. For example, firms facilitating training for workers may delay and prolong this training in order to increase retention, or narrowly tailor such training to the short-term interests of the employer. Competition among employers need not eliminate this problem (Hart et al., 1997; Hilger, 2016b).

One indication that this moral hazard problem may be large is that most firms specializing in human capital production, i.e., schools and colleges, have adopted non-profit and

public organizational forms throughout US history. In these organizations, leaders are not accountable to shareholders seeking to maximize profit even at the expense of students. Instead, leaders are accountable to boards of directors seeking to represent the mission statement of the school (non-profit), or accountable to elected public representatives (public). Another striking feature of many schools is their historical dependence on alumni donations and tax payments for support. This funding model simulates a partial equity stake of schools in their students much like GER, and helps to align incentives toward efficient, productive training. Consistent with this interpretation, the recent onset of for-profit colleges has raised concerns about excessive costs, deceptive marketing, and low quality in pursuit of profits at the expense of students (e.g., Cellini and Turner, 2016).

Unlike schools and colleges, most employers do not specialize in training. Instead, employers specialize in production of other goods and services for which moral hazard is not an overriding concern. These employers therefore typically choose for-profit organizational forms. This for-profit structure may perversely encourage firms—much more than schools and colleges—to provide worker training that is delayed, slow, cheap, and ineffective. These concerns constrain the market for firm-provided and firm-guided training as a worker benefit financed out of earnings. Indeed, most firms that provide general training do so in the form of tuition reimbursement designed for take-up by a small set of sophisticated workers, rather than leveraging firms' multiple advantages to help all workers advance their careers beyond their tenure at the firm (Cappelli, 2004). Some employers also provide subsidies to attend a particular college with which they have negotiated a private contract, potentially incorporating price discounts and changes in product quality. All of these caveats threaten to reduce the value of employer-provided training to workers, and hence reduce the quantity of worker training provided in equilibrium to inefficiently low levels.

In theory, workers could partly alleviate this moral hazard problem by selling a share

of their future earnings to firms, just like firms partly alleviate moral hazard among top employees by providing compensation in the form of stock or bonuses linked to the firm's stock price. This is equivalent to a private market for earnings insurance. Unfortunately, it is almost certain that private information and adverse selection preclude such a market. Hendren (2015) has shown that, under reasonable assumptions, workers have sufficient private information about future layoffs to undermine private markets in unemployment insurance, consistent with the failure of these markets to develop before the New Deal mandated participation (Nelson, 1969). If workers possess substantial private information about future layoff probabilities, workers surely also possess substantial private information about future earnings changes more generally, especially given that workers exert relatively less control over future layoff than they do over many other determinants of earnings. This private information precludes a private market for earnings insurance, and hence also precludes a market-based solution to the moral hazard problem in employer-provided training. The classic solution to adverse selection in private markets is a government mandate. That is exactly what GER achieves by endowing all firms with virtual shares of their workers' future earnings changes.

6 Policy Design Issues

In this section I discuss several critical policy design and implementation issues that bear on the third key parameter governing effectiveness of GER: the extent of strategic behavior and DWL. The many adjustments to basic GER policies discussed here raise concerns about policy complexity, but do not seem obviously insurmountable. It is therefore an empirical question whether these challenges generate large social costs compared to GER's potential social benefits. I discuss the following problems in order:

1. Will GER exacerbate downturns?
2. Firm size and high-earning workers
3. Within-firm vs. between-firm earnings changes
4. Strategic backloading of compensation
5. Annual earnings vs. hourly wages
6. Selection and capitalization
7. Is GER regressive?
8. Parenthood, schooling, and apprenticeships
9. Financing GER
10. Alternatives to unweighted mean earnings
11. Multiple employers

6.1 Will GER exacerbate downturns?

Both traditional and generalized experience rating may exacerbate economic downturns. This is because experience rating increases tax rates on firms that experience adverse demand shocks and pass these shocks on to workers in the form of layoffs and earnings reductions. Important recent work by Johnston (2017) finds that traditional experience rating taxes do reduce hiring in a subset of firms experiencing very large downturns in Florida, i.e. firms at the 89th percentile of firm layoff rates. The pattern of results suggests a key role for binding credit constraints on hiring faced by some firms at some times. These estimates provide upper bounds on costs of demand shock amplification in the

economy more generally, especially at larger firms where credit constraints are presumably less binding. But these costs do warrant great caution in experimenting with GER. One approach to alleviate these costs suggested by Johnston would be to implement "experience rating savings accounts" that require firms to save positive GER transfers up to some threshold sufficient to finance GER payments during a downturn, with only "surplus" GER receipts being paid in cash (e.g., Feldstein and Altman, 2007). This would assure that firms have ample funds to pay higher GER taxes in case of layoff without having to make sharp cuts in subsequent hiring.

6.2 Firm size and high-earning workers

Two simple, practical restrictions on GER would likely be that it only be applied to larger firms with many employees, and that it only be applied to workers earning below a certain amount. This prevents small firms from bearing too much risk or spending their limited resources on amateur attempts to optimize worker training, and it prevents firms from manipulating the policy in collusion with small numbers of very highly-paid workers. Very highly paid workers also tend to have more complex compensation packages that are more difficult for policymakers to observe in a reliable fashion. Many existing social policies in the US and other OECD countries similarly exclude small firms and very highly-paid workers in practice.

6.3 Within-firm vs between-firm earnings gains

Above, I assume GER transfers accrue for earnings changes both within and between firms. There are two reasons why GER transfers should be tied to all earnings changes. To see this, suppose GER transfers only depended on between-firm earnings changes. Two problems arise.

First, consider a firm that would otherwise pay workers $20,000 in their first year and $30,000 in their second year. This firm would have an incentive to split into two firms, with one firm employing workers in their first year, and another firm employer workers in their second year. This strategy represents pure DWL and seems difficult to prevent. It would require regulators to define "employer change" rigorously and monitor attempts at evasion and avoidance.

The second problem is that firms now have an incentive to reduce earnings of workers who appear likely to leave for a different employer in the near future, thereby generating spurious earnings growth when the new employer hires the worker at earnings more in line with skills. To this end, firms would waste resources assessing which workers were likely to leave the firm, and then potentially lower these workers' earnings and undermine their job search to prolong the pre-departure window of suppressed earnings. This form of GER would thereby amplify pre-existing worker incentives to conceal their job search process, rather than collaborating with employers on career advancement.

In contrast, GER that depends on both internal and external earnings changes does not create these perverse incentives. Internal GER does create perverse incentives to backload earnings, hours, and responsibilities, but I argue below that strong market forces tend to constrain these behaviors and minimize associated DWL.

6.4 Strategic backloading of compensation

GER generates incentives for firms to backload worker compensation to generate spurious earnings gains without increasing actual skill growth. For example, instead of paying a worker $40,000/year indefinitely, a firm could pay a worker $35,000 in year 1, $45,000 in year 2, and $40,000 thereafter. If $S = 0.2$ and $T = 5$, the firm would receive a GER transfer of $10,000 as a reward for the initial earnings gain, and would have to pay a GER bill of

$5,000 for subsequent earnings decline, leaving the firm with an additional $5,000. The firm could share part of this transfer with the worker to compensate for backloading $5,000 of compensation by one year. This kind of behavior does not increase worker productivity and represents pure DWL.

Three forces constrain earnings backloading. First, workers may be laid off from, or wish to leave, any given employer at any point in time, and this reduces the expected value of a firm's promise of future compensation. Annual job separation rates are 40% in recent years, implying that on average workers value a dollar backloaded by one year at 60 cents.[17] Second, workers further reduce the value of this backloaded dollar because it entails additional risk. Existing estimates of risk-aversion suggest this would reduce the value of backloaded earnings by an additional 10% to, say, 54 cents.[18] Third, workers value future earnings less than current earnings even without uncertainty. Evidence on individual discount rates suggest this will tend to reduce the value of future earnings by an additional 10-30% per year of delay, reducing a value of a dollar backloaded by one year from 54 cents to something like 36-49 cents (e.g., Hausman, 1979; Warner and Pleeter, 2001; Andreoni and Sprenger, 2012).

Putting these three forces together, employers would have to pay workers something like $2 for each $1 of pay backloaded for one additional year. This means the firm in the above example with $S = 0.2$ and $T = 5$ would have to spend all of its additional GER transfers—and possibly more—on increasing the worker's compensation just to leave both the worker and the firm indifferent. This new compensation sequence would be, approximately, $35,000 in year 1, $50,000 in year 2, and $40,000 thereafter, with the larger earnings gain in year 1 being mostly offset by the larger earnings losses in year 2.

[17] Firms could eliminate this uncertainty by promising to restore any unreceived backloaded earnings as severance pay at time of separation. This approach would require severance pay to decrease in job tenure. The complexity of this pay package may alienate workers, as I discuss further below.

[18] This calculation is an approximation based on assuming constant relative risk aversion of 2.

In practice, other factors further reduce the value of this option to workers and firms and make it unlikely to emerge in equilibrium. Long-term delays in pay will not be feasible due to high worker discount rates. However, as the above example makes clear, short-term backloading entails substantial pay cuts to offset early artificial earnings gains (e.g., earnings decline from year 2 to year 3). Workers may find this pay cut alienating, and this further reduces the value of backloaded compensation profiles. Second, as discussed in Section 2 GER may be designed to depend on earnings changes in each of the subsequent T years of earnings following a base year, rather than just the next-year earnings change after the base year scaled up by T. This form of GER would further reduce the value of earnings backloading.[19] For example, if GER weighted earnings changes equally across T years following a base year, GER payments from the above backloading strategy would be almost completely eliminated.[20] It therefore appears unlikely that moderate, well-designed GER policies would induce widespread backloading of compensation.

6.5 Annual earnings vs. hourly wages

Over 40% of American workers are salaried and therefore do not generate meaningful data on hours worked.[21] For these workers, GER must be linked to changes in total earnings. This creates an incentive for firms to generate earnings gains by backloading worker hours and responsibilities. To see this, consider a salaried worker who, in the absence of GER, would work approximately 40 hours/week at a salary of $40,000, without any skill gains. This implies the firm values this worker's contribution at around $20/hour. Under GER,

[19] A comparison of Figures I and I illustrates this point.

[20] Consider the backloaded pay sequence $35,000 in year 1, $45,000 in year 2, and $40,000 thereafter. With equal weights on annual earnings changes for T years following a base year, the first year earnings gain yields GER payments with NPV approaching $1,000, and the second year earnings decline yields GER liabilities with NPV approaching $1,000, resulting in zero net GER gains from the strategy.

[21] Figure taken from https://www.bls.gov/opub/reports/minimum-wage/2015/home.htm, accessed on 5/9/17.

the firm may therefore hire this worker on a full-time basis to do only 35 hours/week in practice at a salary of $35,000 in the first year, and then "promote" this worker to a full-time job requiring 45 hours/week hours/week in practice at a salary of $45,000. This amounts to backloading hours rather than wages. As in the case of backloading pay, workers prefer not to postpone hours worked, and it is similarly unlikely that GER transfers will be large enough to allow firms to compensate workers for this less-preferred career profile.

For hourly workers, GER could in theory depend on growth in workers' hourly wages, rather than total earnings. While this has substantial appeal due to the tighter link between hourly wages and worker productivity, it turns out to be infeasible. To see this, consider a worker who would be paid $10/hour for 40 hours/week for two years in the absence of GER. Under GER, the firm would have an incentive to alter this worker's reported hours of work to generate spurious wage growth over this two year period. For example, the firm could pay the worker the same annual earnings of $20,000 for the same 40 hours/week of work, but report 50 hours/week in the first year and 40 hours/week in the second year, generating the appearance of a large hourly wage increase from $8/hour to $10/hour, once again generating a GER payment that the firm could share with the worker.[22] This is much more feasible than annual earnings or hours backloading, because real compensation or hours worked do not change in any way, obviating any need to compensate workers. One obstacle to this strategy is that public policies already enforce accurate reporting of work hours and hourly wages, including programs such as minimum wages, overtime pay regulations, IRS rules related to employer benefit eligibility, and unemployment insurance eligibility. However, these policies all create incentives to *under-report* of hours and *over*-report hourly wages. Enforcement agents are able to detect under-reported hours at over-reported hourly wages, because such behavior generates implicit unreported earnings for

[22]For simplicity, I ignore overtime and other laws that affect costs of altering worker hours.

workers. For example, if a firm claims that workers only provide 30 hours/week at a reported hourly wage of \$10 but workers actually provide 40 hours/week, workers can file complaints claiming additional backpay at a rate of \$10/hour. In contrast, GER creates incentives for employers to *over-report* hours and *under*-report hourly wages, i.e. "dilute" earnings into more hours at lower wages. In this case, workers who "out" the firm have no claim to backpay, and it seems difficult for enforcement agents to prove that workers are in fact not providing labor that employers claim they are providing. For example, firms could simply claim that workers are being compensated for remaining "on call" in case a sudden need for work arises. Such claims seem almost impossible to falsify.

Due to this problem of earnings "dilution," GER must depend on earnings even in the case of hourly workers. This creates the same incentive to backload hours as discussed above for salaried workeres, and once again this behavior would be constrained by worker preferences against backloaded hours in a competitive labor market. Another implication is that employers stand to gain in GER transfers when their part-time employees leave to obtain full-time jobs, even if skills and hence hourly wages do not increase for these workers. Likewise employers stand to lose if full-time employees leave to obtain part-time jobs. This suggests employers may seek out part-time employees interested in switching to full-time work, and avoid hiring full-time workers interested in switching to part-time work. I discuss this implication more below in Sub-Section 6.6 on selection.

An important case of pervasive, part-time employment is college students, and earnings-based GER would have interesting implications for this labor market.[23] Consider a GER program with $S = 0.2$ and $T = 5$. Consider an 18-year old full-time college student. Suppose this student is guaranteed to graduate from college and begin work at age 22. Employer 1 could offer to "hire" this student for "40 hours" of labor at a wage of \$0 during

[23]Similar issues arise for unemployed workers, newly-released prisoners, and other workers with zero or very low earnings.

ages 18-22. The student need not do any actual work for the employer over this time. At age 22, the student then accepts a job with Employer 2 and earns an average salary of \$50,000/year over the next five years. Employer 1 receives GER transfers from this strategy worth approximately \$50,000 ($= \$50,000/\text{year} \times 5 \text{ years} \times 0.2$). However, if labor markets are competitive, Employer 1 will obviously not be able to keep all of this transfer. In fact, if Employer 1 does not provide any value to the student, then the student will shop around for other employers until she finds one willing to "hire" her for an up-front, one-time payment of \$50,000. For college students in particular, GER based on earnings may therefore create a new market for student "sponsorship" services that facilitate efficient completion of full-time schooling. These services could include, for example, coaching, tutoring, counseling, and flexible work opportunities for students who want additional financial resources.[24] It must be acknowledged that implications of GER in this type of labor market are difficult to fully envision.

These considerations raise a concern that firms will expend resources identifying students who appear likely to achieve very high earnings in the future. Risk-adjustment of GER payments as discussed below becomes particularly important in this environment. For young adults, it would be natural for this risk-adjustment to incorporate parental income or parental education, much like financial aid applications. This would prevent firms from increasing GER transfers by sponsoring more students from high-SES backgrounds who are likely to achieve high income in the future whether or not they receive any support services.

[24] Growing evidence suggests these kinds of services can increase college enrollment and persistence dramatically, and that program design and targeting both matter (e.g., Carrell and Sacerdote, 2016; Bettinger and Baker, 2014).

6.6 Selection and capitalization

GER may cause firms to invest in identifying and hiring workers with high *ex ante* predicted earnings growth, rather than invest in workers to increase their earnings growth. These additional resources devoted to selecting different workers represent DWL. However, the market will act to constrain this behavior by *capitalizing* workers' predicted earnings growth into current earnings, to the extent that information about a worker became publicly available to competing employers.

To see this, consider a worker who earns $40,000 in period 1 but is predicted by all employers to earn $50,000 in all future periods, even if no additional training takes place. With GER parameters $S = 0.2$ and $T = 5$, firms should be willing to pay up to an additional $10,000 ($= 0.2 \times \$10,000 \times 5$) to hire this worker in period 1—the full value of the anticipated GER transfer. However, if this happened it would raise earnings in period 1 to $50,000, eliminating the GER transfer this premium was supposed to capitalize and yielding a loss for the firm. Therefore, it must be the case that earnings in period 1 go up, but not by the full amount of GER transfers predicted based on pre-GER earnings growth. It turns out that earnings in the first period increase by an amount equal to $\frac{S \cdot T}{1+S \cdot T}$ of pre-GER earnings growth.[25] In this example, capitalization reduces the change in earnings by 50% ($= \frac{0.2 \cdot 5}{1+0.2 \cdot 5}$), meaning earnings in period 1 increase to $45,000, decreasing realized earnings growth from $10,000 to $5,000. This formula amounts to an upper bound on capitalization because firms only realize a worker's predicted future earnings changes with uncertainty due to worker turnover, and because the worker need not bear the full incidence of the transfer.

Once the labor market adjusts to GER and begins capitalizing information about workers

[25] Denote period 1 earnings after introduction of GER as $\tilde{y}_1$, and period 1 earnings before introduction of GER as y_1. Then maximum capitalization is defined as $\tilde{y}_1 - y_1 = S \cdot T \cdot (y_2 - \tilde{y}_1)$. Rearranging yields the stated result that $\tilde{y}_1 - y_1 = \frac{S \cdot T}{1-S \cdot T}(y_2 - y_1)$. Capitalization of earnings changes that occur further in the future will be less complete, because it is less certain to occur under a worker's current employer.

into their current earnings, it will become more difficult for employers to "pick winners" when hiring workers, much as it is already difficult for employers to "pick winners" in the stock or real estate market. There is therefore room for optimism that most firms will respond to GER by increasing skill growth and career advancement of workers they already hire, rather than trying to outsmart the labor market and hire workers pre-destined for high idiosyncratic earnings growth.

Of course, some firms may specialize in labor market arbitrage, much like some firms specialize in stock market and real estate arbitrage. And capitalization will be incomplete because earnings growth is harder to arbitrage than stock and real estate price growth.[26] Therefore employers may justifiably seek out underpriced high-growth workers. Given that firms already search for "bargains" in the labor market, it is not clear that searching for underpriced high-growth workers will require substantial additional resources, especially given that many advantageous hard-to-observe worker characteristics (e.g., tenacity, ambition) also likely predict high earnings growth. One troubling possibility is that workers with lower unpriced predicted earnings growth may have trouble finding work. Fortunately, GER provides a built-in response to this problem, because severely under-utilized workers represent the most obvious arbitrage opportunities for potential employers. In particular, GER seems more advantageous for these workers than traditional experience rating, which creates downside risk without any offsetting upside risk.

The extent of capitalization, the amount of effort firms devote to selecting high-growth workers, and the resulting impacts on worker earnings and employment are important empirical questions for assessing both equity and efficiency of GER.

[26] For example, it is difficult to "sit on" undervalued workers for speculative purposes in the way that investors often "sit on" stocks and real estate. Likewise, it is difficult to implement the kinds of high-frequency and high-volume trading strategies that underlie much capital market arbitrage.

6.7 Is GER regressive?

Even if capitalization works well, GER may reduce equity if disadvantaged groups have lower *ex ante* predicted earnings growth, and if GER does not compensate for this effect by inducing greater skill and earnings growth for these groups. It is in fact the case that disadvantaged groups currently experience smaller earnings gains. Table I shows mean earnings changes in the NLSY79, pooling years 1982-2012, cohorts born 1957-65, and ages 26-65. Mean annual earnings changes have been larger for whites than blacks, men than women, and more educated than less educated workers.

One tool to address this problem would be to "risk-adjust" GER based on observable worker characteristics such as age, gender, and educational attainment. GER transfers would then depend on worker earnings growth conditional on these observed characteristics. Table II explores the potential for this risk-adjustment to improve distributional effects of GER across socioeconomic and demographic groups. All columns represent coefficients from regressions of earnings changes on background characteristics, conditional on a full set of year by age dummies. Columns (1)-(3) show regressions of earnings changes on parental education groups, race, and cognitive skill, respectively. All of these variables predict earnings changes in ways consistent with GER exacerbating inequality across groups defined by class, race, and cognitive ability, by capitalizing these predicted earnings changes into current earnings. However, columns (4)-(7) explores the impact of risk-adjusting GER by sex and educational attainment, in addition to year and age. The results show that this very simple risk-adjustment policy eliminates 60-80% of predicted earnings differences across parental education, race, and cognitive skill groups, and these remaining differences imply relatively small regressive transfers between groups.[27] Risk-adjustment on the bases

[27] At most something like half of these differences could be transferred to workers by capitalization under the kinds of moderate GER schemes discussed here (e.g., $S = 0.2$ and $T = 5$). Table II implies that, under risk-adjustment by age, sex, and educational attainment, children of college-educated parents receive at most under $200 in additional GER transfers per year compared to workers with high-school

of year, age, sex, and educational attainment does not appear obviously politically infeasible. Below, I discuss extensions to basic GER that provide additional incentives for firms to hire and assist lower-skilled workers, and show these policies are highly affordable.

In short, simple and uncontroversial risk-adjustment of GER transfers could address a large share of equity concerns.

6.8 Parenthood, schooling, and apprenticeships

GER transfers would have to be adjusted to avoid punishing firms that hire workers with children, or planning to have children, or who are pregnant with children. One option would be to exempt workers who have new children (both mothers and fathers) from all GER transfer calculations for a certain period of time, after which their GER base earnings can be re-set to continue encouraging skill development. Another option would be to impute GER transfers following childbirth as the average GER transfer for other workers at the firm.

Likewise, GER policies would need to be adjusted to avoid punishing firms that hire workers who subsequently return to full-time or even part-time schooling. Jepsen et al. (2014) find that students receiving associate's degrees and diplomas in community college starting around age 30 exhibit very large earnings and employment declines for two years before earnings surpass their pre-college levels. Likewise, many college graduates work for several years before returning to graduate school when earnings decline dramatically.

GER should not simply exempt these workers or reset their base earnings once they leave school. This would eliminate incentives for employers to help workers transition into high-quality external training programs. A better approach would be to make use of full-

leaver parents, while white workers would receive at most $100 of additional GER transfers per year compared to black workers. Even these conservative upper bounds are tiny fractions of the prevailing earnings gap between these groups.

time and part-time enrollment status indicators. Governments already track these data to determine eligibility for policies including financial aid, health insurance, and survivor's insurance. GER could impute earnings at pre-college levels while students are enrolled and progressing toward a degree at Title IV postsecondary institutions, or could impute earnings using some weighted combination of actual earnings and pre-college earnings. Then post-college earnings would count as normal in GER against the pre-college base. This approach encourages employers to help workers interested in college attend high-value college programs that facilitate degree completion. It even encourages employers to place laid-off workers directly into worthwhile college programs if no comparably high-paying jobs are available.

What about workers who transition into intensive on-the-job training programs such as apprenticeships? For example, firms may hire workers for six months to assess their suitability for an apprenticeship program, and then invite them to participate at the cost of temporarily lower earnings, followed by higher productivity and earnings after program completion. GER would punish the firm for this decrease in earnings. However, two considerations make this less pathological than the college enrollment problem. First, GER encourages firms to start workers on training programs as quickly as possible in order to avoid many periods of high earnings followed by the short period of lower earnings. Second, firms in this case stand to gain from the worker's higher future earnings, even if the worker is "poached." These gains in can easily outweigh losses, even for workers with many pre-training periods of high earnings at the training employer.

Finally, GER may penalize employers whose workers switch from more lucrative private sector work into less lucrative (but necessarily less productive) non-profit or public sector work. For example, Goldman Sachs and McKinsey hire many young college graduates at high earnings who later move on to lower-paid careers in research, teaching, and policy-

making. GER would punish firms for adopting this kind of employment strategy. However, in practice this concern is unlikely to be important because GER payments would phase out for the kinds of highly-paid workers employed by these firms. GER base earnings could also be re-set for workers who switch sectors.

Once again, modest extensions to GER could address concerns about punishing employers whose workers transition into parenthood, schooling, or lower-paid sectors of the labor market.

6.9 Financing GER

GER could be fully financed out of workers' earnings, in which case it would create a new earnings insurance program. This approach has the benefit of being budget-neutral from the government's perspective. However, it may be desirable to separate GER from the separate issue of optimal social insurance against earnings losses, and finance GER out of general tax revenue instead. In this case the overall cost to the government would likely be small for several reasons.

First, total average annual earnings gains each year are small. Table I shows that aggregate earnings changes for the NLSY79 cohorts born 1957-65 have averaged 3% of earnings. A GER program with $S = 0.2$ and $T = 5$ without any risk-adjustment or bencharking would therefore increase the fiscal burden by something like 3% of aggregate earnings, or 1.8% of GDP if earnings represent 60% of national income. Capitalization of anticipated GER payments into current earnings would reduce measured earnings growth and fiscal impacts. Behavioral responses that increase earnings growth (as intended) would increase the fiscal burden of GER, but reduce the fiscal burden of other social programs tied to earnings and employment (again, as intended). However, if GER indexed payments to average worker earnings growth above or below average earnings growth of similar workers,

the policy would be almost mechanically budget neutral, and would consist entirely of transfers from lower-training firms to higher-training firms. This indexing should take place based on aggregate earnings growth, rather than earnings growth indexed by industry or occupation, in order to reallocate resources toward more worker-enhancing sectors of the economy.

6.10 Alternatives to unweighted mean earnings growth

So far I have specified GER in terms of the unweighted mean earnings growth of workers at each firm. However, GER could also depend on other statistics characterizing worker earnings growth. GER transfers could be weighted more toward "max" future earnings gains, which may lead firms to encourage workers to pursue high-risk, high-return careers in entrepreneurship. GER transfers could also be weighted more toward "min" future earnings gains, which would lead firms to carefully prevent workers from experiencing the worst future labor market outcomes such as unemployment or incarceration.

GER could also depend on weighted mean earnings growth. For example, weights could be larger for earnings gains achieved by lower-SES workers, and smaller for earnings losses suffered by lower-SES workers. This type of GER scheme would encourage firms to hire and cultivate lower-income workers, and to take risks on hiring workers with spotty employment histories.

The fiscal burden of these more complex schemes is harder to predict, but likely to remain small. For example, consider a GER program that encourages firms to "take risks" on lower-skilled workers by setting $S = 0.3$ for earnings gains and $S = 0.1$ for earnings losses for the 17% of workers without high school degrees in the NLSY79 over the 1982-2012 period. Table III displays the mean conditional earnings gains and losses of this lower-skilled subgroup. These figures suggest that the GER policy described here would

generate transfers with NPV of $2,380 to employers for each lower-educated worker year. The realized GER transfer is likely to be smaller as labor markets capitalize some of these transfers into current worker earnings. Even without capitalization, this policy could be financed with a tax equivalent to 1.7% of all earnings or 1% of GDP. Again, GER may increase productivity and hence impose a larger direct fiscal burden, but in this case GER also partly pays for itself through positive fiscal externalities on other government taxes and expenditures.

6.11 Multiple employers

Many workers will accumulate more than one previous employer in any significant period of time, and other workers will work for multiple employers simultaneously. Identical issues arise in traditional experience rating, and have been addressed in different ways by different states (Vroman and Woodbury, 2014, footnote 3). The simplest rule would be a pro rata-type allocation. Essentially, workers can have up to one full-time employer at any time. If two firms each account for half of a worker's earnings over a particular base period, then those employers each get half of the GER transfers generated by that worker over the relevant time window. In some cases this may yield perverse outcomes, for example if one employer clearly invested much more heavily in the worker than the other contemporaneous employer. As these issues do not appear critical and can lean on build on existing UI law, I leave more detailed discussion of this issue to future work.

7 Conclusion

In this paper I have outlined a new policy proposal seeking to alleviate constraints on worker skill to the US economy. The policy endows firms with virtual equity in the future earnings

changes of their workers, thereby amplifying employer incentives to increase worker skills and job match quality. I refer to the policy as "generalized experience rating" because it generalizes traditional experience rating in the UI system to all changes in worker earnings, as opposed to only those changes in worker earnings due to involuntary layoff. GER provides a subsidy to employer-facilitated training and career advancement that acts as a corrective to skill-suppressing effects of tax-benefit progressivity, high costs of investments undertaken by individuals in isolation, and individual behavioral biases. GER can also be interpreted as a mandate addressing an adverse selection problem that precludes a well-functioning private market for equity in worker earnings.

By alleviating the firms' moral hazard problem, GER allows firms to leverage economies of scale, expertise, coordination, and complementarities to realize their large potential as catalysts of worker skill growth and career advancement. GER offers important advantages over alternative forms of training subsidies, including a reduced administrative burden for governments, self-enforcement features reminiscent of value-added taxation, and greater incentives for innovation in training and job search technologies. By sparking innovation and technology adoption, GER may help to restore faster growth, lower inequality, and greater mobility to the modern US economy.

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Restriction	Statistic	Level All	Change All	Change White	Change Black	Change Male	Change Female	Change Coll Grad	Change Some Coll	Change HS Grad	Change HS Drop
None	Mean	$41,890	$1,242	$1,279	$636	$1,844	$640	$2,888	$914	$613	$275
None	SD	$47,934	$17,440	$17,649	$13,124	$20,369	$13,874	$22,445	$16,868	$14,831	$13,095
None	P10	$0	-$9,596	-$9,627	-$9,016	-$11,310	-$8,014	-$9,906	-$10,323	-$8,951	-$9,799
None	P25	$11,550	-$2,040	-$2,040	-$1,959	-$2,549	-$1,545	-$1,573	-$2,229	-$2,159	-$2,400
None	P50	$33,138	$150	$205	$0	$650	$0	$1,271	$193	$0	$0
None	P75	$55,423	$4,788	$4,858	$3,659	$6,301	$3,481	$6,997	$4,720	$3,832	$3,552
None	P90	$84,485	$12,688	$12,810	$10,564	$15,680	$9,618	$17,461	$12,315	$10,423	$10,693
None	N	87,679	84,540	68,693	10,202	40,389	44,151	20,612	18,289	31,509	13,953
Stable Hours	Mean	$47,477	$1,955	$2,004	$1,023	$2,340	$1,433	$3,509	$1,710	$1,229	$774
Stable Hours	SD	$27,067	$13,604	$13,693	$10,543	$15,615	$10,254	$17,405	$12,398	$11,399	$10,778
Stable Hours	P10	$21,146	-$5,544	-$5,489	-$6,162	-$6,639	-$4,034	-$5,242	-$5,280	-$5,466	-$6,673
Stable Hours	P25	$29,495	-$1,522	-$1,501	-$1,856	-$1,875	-$1,169	-$1,094	-$1,525	-$1,659	-$2,289
Stable Hours	P50	$42,292	$960	$990	$502	$1,124	$825	$1,914	$1,002	$617	$299
Stable Hours	P75	$58,301	$4,670	$4,712	$3,887	$5,659	$3,640	$6,565	$4,577	$3,747	$3,684
Stable Hours	P90	$77,422	$10,532	$10,618	$9,211	$12,619	$7,999	$13,468	$9,990	$8,639	$9,549
Stable Hours	N	12,683	29,726	24,883	2,990	16,339	13,387	8,106	6,684	11,608	3,280

Table I: Earnings Changes by Subgroup, All and Stable Hours

Notes: Table presents moments characterizing the distribution of earnings changes for each subgroup over the 1982-2012 period, based on the NLSY79. Sample weights used in all calculations.

Variables	(1) ΔEarnings	(2) ΔEarnings	(3) ΔEarnings	(4) ΔEarnings	(5) ΔEarnings	(6) ΔEarnings	(7) ΔEarnings
Parent HS Grad	376.9***				-23.87		
	(73.46)				(68.74)		
Parent Some College	849.5***				-29.80		
	(96.39)				(92.64)		
Parent College Grad	1,875***				374.8**		
	(188.4)				(177.0)		
Black		-588.9***				-210.9***	
		(78.14)				(73.19)	
AFQT			25.32***				6.747***
			(1.437)				(1.482)
Female				-1,135***	-1,161***	-1,147***	-1,039***
				(67.98)	(68.86)	(69.05)	(68.67)
HS Grad				413.6***	431.4***	404.9***	294.3***
				(70.27)	(73.85)	(72.40)	(77.62)
Some College				818.7***	810.5***	815.5***	593.2***
				(91.67)	(95.66)	(93.76)	(109.0)
College Grad				2,591***	2,512***	2,573***	2,168***
				(111.1)	(120.2)	(112.7)	(128.4)
Constant	-1,810	-989.2	-6,008***	5,925	2,002	-4,138**	-3,825
	(1,935)	(4,700)	(2,032)	(4,149)	(4,604)	(1,904)	(2,606)
Observations	82,227	78,895	79,468	84,363	82,050	78,742	79,307
R-squared	0.009	0.007	0.010	0.014	0.015	0.014	0.014
Age*Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table II: Effects of SES Variables on Earnings Changes

Notes: Table presents regressions of individual worker earnings changes on various SES variables. Regressions pool 1982-2012 in the NLSY79 and cluster at the individual level. Sample weights used in all calculations. Earnings deflated with CPI-U into 2016 dollars.

Restriction	Statistic	Level All	Change All	Change White	Change Black	Change Male	Change Female	Change Coll Grad	Change Some Coll	Change HS Grad	Change HS Drop
Δ Earnings > 0	Mean	$54,814	$9,373	$9,441	$7,900	$11,189	$7,309	$11,862	$8,876	$7,926	$8,136
Δ Earnings > 0	SD	$54,687	$15,673	$15,827	$11,688	$17,819	$12,486	$19,371	$14,747	$13,387	$11,600
Δ Earnings > 0	P10	$11,336	$696	$698	$632	$832	$584	$815	$690	$630	$686
Δ Earnings > 0	P25	$25,087	$1,836	$1,845	$1,670	$2,285	$1,508	$2,302	$1,803	$1,588	$1,733
Δ Earnings > 0	P50	$42,360	$4,621	$4,631	$4,370	$5,620	$3,736	$5,570	$4,527	$4,004	$4,654
Δ Earnings > 0	P75	$65,476	$10,281	$10,308	$9,629	$12,162	$8,275	$12,318	$9,878	$8,835	$10,140
Δ Earnings > 0	P90	$100,212	$20,907	$21,084	$18,314	$25,331	$16,230	$27,333	$19,727	$17,620	$18,330
Δ Earnings > 0	N	45,705	42,566	35,307	4,603	21,676	20,890	12,156	9,406	15,123	5,794
Δ Earnings < 0	Mean	$34,718	-$9,161	-$9,240	-$7,685	-$10,579	-$7,642	-$11,787	-$9,194	-$7,896	-$8,184
Δ Earnings < 0	SD	$34,261	$16,313	$16,498	$12,653	$18,251	$13,779	$21,511	$15,807	$13,802	$12,340
Δ Earnings < 0	P10	$0	-$22,469	-$22,779	-$18,303	-$26,432	-$18,846	-$31,068	-$22,673	-$19,355	-$20,210
Δ Earnings < 0	P25	$10,564	-$9,959	-$9,978	-$9,399	-$11,319	-$8,635	-$12,222	-$10,368	-$8,759	-$10,006
Δ Earnings < 0	P50	$29,033	-$3,590	-$3,579	-$3,741	-$4,117	-$3,086	-$3,718	-$3,703	-$3,288	-$4,112
Δ Earnings < 0	P75	$48,950	-$1,286	-$1,285	-$1,269	-$1,525	-$1,066	-$1,384	-$1,299	-$1,186	-$1,389
Δ Earnings < 0	P90	$72,149	-$498	-$498	-$513	-$622	-$405	-$520	-$521	-$452	-$589
Δ Earnings < 0	N	32,530	32,530	26,487	3,868	16,150	16,380	7,177	7,261	12,715	5,320

Table III: Earnings Changes by Subgroup, Positive and Negative

Notes: Table presents moments characterizing the distribution of earnings changes for each subgroup over the 1982-2012 period, based on the NLSY79. Sample weights used in all calculations.

Year	2007	2008	2009	2010	2011	2012
Earnings	$20,000	$24,000	$22,000	$28,000	$28,000	$28,000
Change		$4,000	-$2,000	$6,000	$0	$0

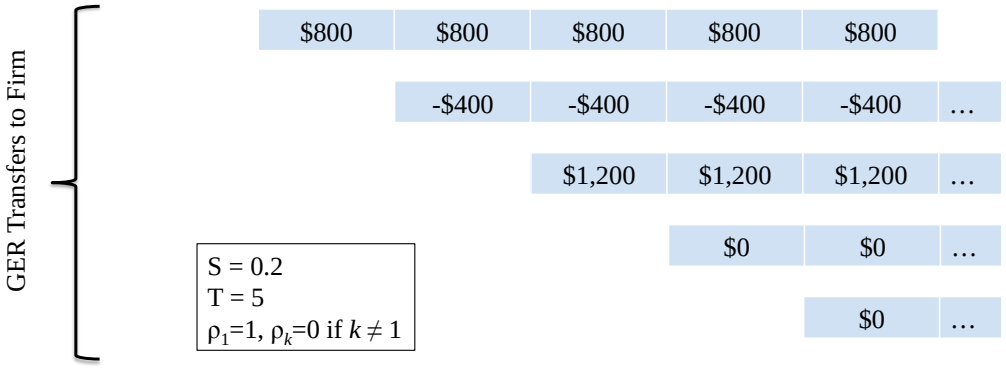

Figure I: Illustration of GER Transfers to a Firm Under Subsequent-Year Weighting

Notes: Figure illustrates hypothetical GER transfers to a particular firm under subsequent-year weighting over a period of time.

Year	2007	2008	2009	2010	2011	2012
Earnings	$20,000	$24,000	$22,000	$28,000	$28,000	$28,000
Change		$4,000	-$2,000	$6,000	$0	$0

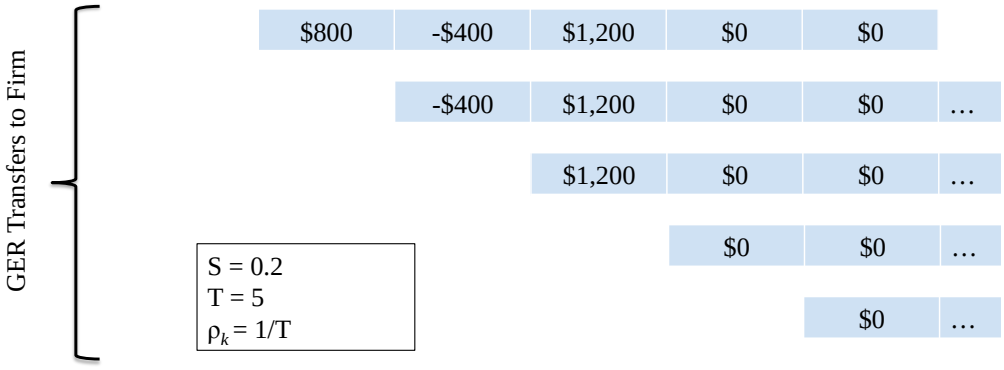

Figure II: Illustration of GER Transfers to a Firm Under Uniform Weighting

Notes: Figure illustrates hypothetical GER transfers to a particular firm under uniform weighting over a period of time.