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1 Introduction

Several studies report a distinctive upward trend in U.S. earnings (labor income) inequality during the second half of the 20th century. This inequalization process can be traced back at least to the 1980s (and according to Kopczuk et al., 2010, the 1950s). Katz and Murphy (1992), Katz and Autor (1999) and Yun (2006) employ the Current Population Survey March supplement in order to address this issue. While the 1969 Gini coefficient for individuals' wages (0.264) was similar to that of 1979 (0.270), by 1989 this coefficient had risen to 0.289, and by 1999, to 0.307.

Other inequality measures, such as the variance of log-earnings and log-wage differentials between top 10% and bottom 10%, point to a slight decrease in inequality during the 1970s (see Table 1 in Yun, 2006), but an unambiguous increase in the 1980s and 1990s. DiNardo et al. (1996) also points to the 1980s as a turning point for U.S. wage inequality.

This is also roughly in line with the analysis performed in Piketty and Saez (2003), according to which the top 1% wage share in the United States dropped from an average of 8.4% during the 1930s to 6.6% in the 1940s, and then 5.7% in the 1950s. During the 1960s and first half of the 1970s it stabilized at the 5.2-5.3% level, bouncing back up to 5.9% in the second half of the 1970s, 7.5% in the 1980s, 9.7% in the 1990s, and the all-time high of 11.2% in the first decade of the 21st century.[1]

The 1980s also saw a rise in unemployment, from the previous decade's average of 6.2% to 7.3%, and then back to 5.8% in the 1990s.[2] In the first half of the 1980s alone,

[1] Calculations based on Table IV in Piketty and Saez (2003) and the updated data available at http://www.quandl.com/PIKETTY/TS8_2.

[2] Data collected from the Bureau of Labor Statistics website.

it reached an average of 8.3%. Acemoglu (1999) reports data indicating that not only unemployment as a whole increased in the 1980s, but also the unemployment rate for each level of educational attainment.[3] This happened despite the twofold increase in the fraction of the workforce with more than twelve years of education (that is, at least one school year past high school) observed in the span of two decades: 18.5% on average in the 1960s, 25.9% in the 1970s, and then 35.1% in the 1980s.[4]

So it is not the case that the deepening of wage inequality in that period could be explained simply as the primary effect of a productivity shock, which would make it more easy for highly educated workers to find jobs *vis-à-vis* other workers (who would thus be forced to receive "zero wages"). A second and more fundamental effect of such a shock would be a qualitative change in the composition of jobs. Jobs more well suited to skilled workers were made available (in substitution to older generic jobs that pooled together all types of workers), and at the same time such workers may have become more picky and prone to endure unemployment periods, due to their higher reservation wage.

Indeed, Acemoglu (1999) shows how a job search model with random matching and (generalized) Nash bargaining can account for all the aforementioned demographic movements. In that model, both technical progress and a larger proportion of skilled workers can make the equilibrium in the labor market switch from a *pooling* one (in which all firms choose the same level of capital and decide to hire workers regardless

[3] These data can be accessed here: https://www.census.gov/prod/1/gen/95statab/labor.pdf, page 422.

[4] Considering both males and females 25 years old and over. Calculations based on the March supplements of the Current Population Survey. The educational attainment data for each year (expect for 1961 and 1963, linear interpolation was used for these) can be accessed here: https://www.census.gov/hhes/socdemo/education/data/cps/.

of his/her productivity) to a *separating* one (in which some firms choose a low level of capital and hire only unskilled workers, and others choose a high level of capital and hire only skilled workers). Albrecht and Vroman (2002), Shi (2002) and Dolado et al. (2009) achieve similar results, with some differences in the modeling.[5] This brought an increase in the wage premium and in earnings inequality (even if one considers the zero earnings earned by unemployed workers, as discussed in the next section).

If Acemoglu's reasoning is correct, it should imply not only testable predictions with respect to the observed evolution of inequality, but also that of social mobility. After all, a productivity shock should have differing short- and long-term effects on the employment status of each type of worker. Fields (2010) shows that the rising inequality in 1980s U.S. was associated with what can quite suggestively be called "Gates gains"-type mobility. That is, long-term earnings (thought of as the average between base- and final-year earnings) became more unequal during that period than the short-term (base-year) earnings. As the 1990s got underway, although inequality continued to rise, this disequalizer-of-longer-term-incomes character of mobility lost its strength, perhaps even giving place to an equalizer ("Gates loses") mobility process.[6]

The next section briefly reviews the main elements of Acemoglu's (1999) dynamic model and its equilibria possibilities, while Section 3 shows how we may compute Fields' (2010) social mobility index within Acemoglu's framework. Section 4 considers two different shock sources, both capable of generating a qualitative change in the

[5] Albrecht and Vroman (2002) allow for endogenous arrival rates and use a production function with perfect complementarity between physical and human capital. Shi (2002) considers directed search, while Dolado et al. (2009) opens for the possibility of on-the-job search.

[6] See Table 2 in Fields (2010).

job composition and wage structure equilibrium: skill-biased technical change and an increase in the supply of skills throughout the labor force. Both possibilities will be shown to be consistent with the actual mobility patterns observed for the 1970s and the 1980s in the United States. Section 5 concludes.

2 Model

Acemoglu's (1999) dynamic model belongs to the class of job search/matching models with wage bargaining. Here we shall try to present only the elements and equations necessary to describe its equilibria. For a full description of the model, we refer the reader to Acemoglu (1999).

There are two types (perfectly observable to firms) of workers: the skilled (corresponding to a fraction ϕ of the workforce), who are endowed with a human capital level of $h = \eta > 1$, and the unskilled (corresponding to a fraction of $1-\phi$), with $h = 1$. Each firm must, prior to participation in the job market, choose its "capacity", i.e., the level k of physical capital it will employ, together with its future employee's human capital h, to produce $y(h,k) = h^{\alpha}k^{1-\alpha}$, where $\alpha \in (0,1)$. The interest rate is r, arrival rates for vacancies and for unemployed workers (of either type) are $p > 0$ and $q > 0$ respectively, and the exogenous layoff rate is $s > 0$.

Among the several possibilities of steady-state equilibria that may emerge, we concentrate on two contrasting types: pooling and separating. In both, letting $\beta \in (0,1)$ represent workers' bargaining power, a worker with human capital level h will receive 0 earnings whenever unemployed and $w(h,k) = \beta y(h,k)$ whenever employed in a firm of capacity k. In a pooling equilibrium, all firms choose the same capacity

k^P, and hire whatever type of worker they meet, implying the same unemployment rate for both skilled and unskilled workers: $u^P = s/(s+p)$, by standard steady-state accounting. In a separating equilibrium, high-tech jobs are created for skilled workers, and low-tech jobs for unskilled workers. High-tech firms choose capacity $k^H > k^P$, while low-tech firms choose $k^L < k^P$. Here, the unemployment rates of skilled and unskilled workers, u^H and u^L, are generally different. One-period steady-state earnings distribution for both these types of equilibria can be represented schematically as follows:

$$\Xi^P = \begin{bmatrix} (1-\phi)\,u^P & 0 \\ (1-\phi)\left(1-u^P\right) & \beta\left(k^P\right)^{1-\alpha} \\ \phi u^P & 0 \\ \phi\left(1-u^P\right) & \beta\eta^\alpha\left(k^P\right)^{1-\alpha} \end{bmatrix} \tag{1}$$

and

$$\Xi^S = \begin{bmatrix} (1-\phi)\,u^L & 0 \\ (1-\phi)\left(1-u^L\right) & \beta\left(k^L\right)^{1-\alpha} \\ \phi u^H & 0 \\ \phi\left(1-u^H\right) & \beta\eta^\alpha\left(k^H\right)^{1-\alpha} \end{bmatrix}, \tag{2}$$

where each row in these matrices corresponds to a different category (in order, unemployed unskilled workers, employed unskilled workers, unemployed skilled workers, and employed skilled workers), the first column corresponds to that category's size within the population/workforce, and the second column corresponds to that category's earnings.

Acemoglu computes all the values appearing in (1) and (2) as:

$$\begin{aligned}
k^P &= a\left(1-\phi+\phi\eta^{\alpha}\right)^{1/\alpha}, \\
k^L &= a, \\
k^H &= a\eta, \\
u^P &= \frac{s}{s+p}, \\
u^L &= \frac{s}{s+p\mu^L}, \\
u^H &= \frac{s}{s+p\mu^H},
\end{aligned}$$

where $a := (1-\alpha)^{1/\alpha}$ and $\mu^L, \mu^H \in (0,1)$ are the fractions of vacancies for low- and high-tech jobs in the separating steady state (whence $u^L > u^P$ and $u^H > u^P$).[7]

Two key observations must be made about these expressions. The first is that $k^L < k^P < k^H$: in fact, one needs only note that $1 = (1-\phi+\phi)^{1/\alpha} < (1-\phi+\phi\eta^{\alpha})^{1/\alpha} < ((1-\phi)\,\eta^{\alpha}+\phi\eta^{\alpha})^{1/\alpha} = \eta$. The second is that pooling compresses skill premia:

$$\frac{w\left(\eta,k^H\right)}{w\left(1,k^L\right)} = \frac{\beta\eta^{\alpha}\left(k^H\right)^{1-\alpha}}{\beta\left(k^L\right)^{1-\alpha}} = \frac{\eta^{\alpha}\left(a\eta\right)^{1-\alpha}}{a^{1-\alpha}} = \eta, \tag{3}$$

but

$$\frac{w\left(\eta,k^P\right)}{w\left(1,k^P\right)} = \frac{\beta\eta^{\alpha}\left(k^P\right)^{1-\alpha}}{\beta\left(k^P\right)^{1-\alpha}} = \eta^{\alpha} < \eta. \tag{4}$$

Also the exact regions in the parameter space where each type of equilibrium

[7] In order to find μ^L and $\mu^H = 1-\mu^L$, call the fraction of skilled workers within the unemployment pool $\lambda := u^H\phi/\left(u^L(1-\phi)+u^H\phi\right)$, so that $(1-\lambda)/\lambda = [(1-\phi)/\phi]\left[s+p\left(1-\mu^L\right)\right]/\left[s+p\mu^L\right]$. Equating the expected values of opening vacancies with capacities k^L and k^H yields, as shown in Acemoglu (1999), $\lambda\eta/(r+s+q\lambda) = (1-\lambda)/(r+s+q(1-\lambda))$. Plugging the root $\lambda \in (0,1)$ in the previous equation gives μ^L and $\mu^H = 1-\mu^L$.

emerges can be calculated. In general terms, what we must bear in mind is that if the productivity differential η is not large enough, or if there are very few (ϕ) skilled workers on the market, it may not be worthwhile for firms to design special, qualitatively different, jobs for the skilled workers, because on average it may take longer to meet the right person for the job (that is, a skilled worker).

For $\alpha = 0.4$, $\beta = 0.5$, $p = 5$, $q = 5$, $s = 0.5$ and $r = 0.05$ (all rates annual), we have that the (approximate) point $(\eta, \phi) = (1.3, 1/3)$ is such that lowering either η or ϕ a bit gives a pooling equilibrium, while raising either η or ϕ a bit gives a separating equilibrium (the reader may want to check this in Figure 2 in Acemoglu's paper). Incidentally, these parameter values for η and ϕ coincide with those used in the comparative statics exercises in Albrecht and Vroman (2002), and the skill premium of 30% (see (3)) is in line with Katz and Murphy (1992).

Acemoglu's proposed reasoning for the demographic movements observed in the 1980s is that an upward shock in η (skill-biased technical change) and/or ϕ (an increased supply of skills) drove the job market away from a pooling equilibrium and into a separating equilibrium, thus increasing unemployment (both u^L and u^H are larger than u^P) and inequality. His reasoning for the rise in inequality is based simply on the wage differential calculations (3) and (4). It should be noted, however, that even if one is interested only in the inequality of strictly positive earnings (which is not the standpoint of this work), since the category sizes change following a shock in η or ϕ, observations about the variation in the skill premium alone cannot be directly translated into observations about the Gini coefficient (or any other inequality index) moving up or down.

In order to verify the rise in inequality stemming from Acemoglu's line of reasoning, we can simply compute the Gini coefficient I for the distributions (1) and (2), using the above parameter values, and assuming (η, ϕ) starts at $(\eta_1, \phi_1) = (1.3, 1/3)$ and is then nudged to $(\eta_2, \phi_1) = (1.4, 1/3)$ or $(\eta_1, \phi_2) = (1.3, 0.4)$. In this case, we get $I\left(\Xi^P(\eta_1, \phi_1)\right) = .112$, $I\left(\Xi^S(\eta_2, \phi_1)\right) = .281$ and $I\left(\Xi^S(\eta_1, \phi_2)\right) = .263$.

Finally, it should be noted that Acemoglu's argument is a steady-state one, in that it admittedly ignores any transition dynamics. Not only for simplicity purposes, but in order to duly pursue our task of testing the strength of his model along a new dimension (that of social mobility in the notion explained in the next section), we stick to his assumptions.

3 Social mobility

In order to address the issue of equalization/disequalization of earnings throughout time, we apply Fields' (2010) E measure. This measure can be thought of as the relative amount by which short-term income inequality overestimates long-term income inequality. Given a period t and an observation period length of $T > 0$ years, $E_{t,t+T}$ is computed as follows:

$$E_{t,t+T} = 1 - \frac{I\left(\overline{\Xi}_{t,t+T}\right)}{I\left(\Xi_t\right)}, \tag{5}$$

where I is an inequality index (a convex 0-homogeneous real function), Ξ_t is the base-year (t) distribution of income (in the case of our model, simply labor earnings), $\overline{\Xi}_{t,t+T}$ represents the distribution of long-term incomes. An individual's long-term income may be calculated by aggregating his/her incomes over the observation period, or by simply making an average between base-year (t) and final-year ($t+T$) incomes in that period – or, equivalently (from the homogeneity of I), adding up these two incomes.

Applying the latter specification of long-term incomes, Fields (2010) found that, while 5-year earnings mobility in the United States was of an equalizing nature in the 1970s, it had a disequalizing character in the 1980s. In fact, he computed and plotted the function $E_{t,t+5}$ (with t on the horizontal axis), and observed that while $E_{t,t+5}$ was positive for $t \in \{1969, 1970, 1974, 1975\}$, it was negative for $t \in \{1979, 1980, 1984, 1985\}$. Evidently, $E_{t,t+T} < 0$ is equivalent to $I\left(\overline{\Xi}_{t,t+T}\right) > I\left(\Xi_t\right)$, that is, it directly indicates long-term incomes more unequal than current incomes (or, as Fields put it, "Gates gains").

It should be noted that Fields' E measure of mobility is fundamentally different from measures of inequality of long-term or permanent incomes, such as $I\left(\overline{\Xi}_{t,t+T}\right)$ itself. The latter concept has been explored, for instance, in Flinn (2002), Aaberge et al. (2002), and Bowlus and Robin (2004), Flabbi and Leonardi (2010) and Kopczuk et al. (2010). If both long-term and short-term income inequalities move in the same direction, one cannot assert for sure whether long-term income inequality is being overestimated more, or less, by the announced short-term income inequality.

A measure with which E can be immediately associated is Shorrocks' (1978) mobility measure M, since both are equal when (i) long-term incomes are defined as the sum of short-term incomes from t until $t+T$ and (ii) $\Xi_t = \Xi_{t+1} = \cdots = \Xi_{t+T}$. Thus $I\left(\overline{\Xi}_{t,t+T}\right)/I\left(\Xi_t\right)$ can also be understood as a rigidity index, but a directed one, because there is a base year, whereas M is defined symmetrically with respect to all the years within the observation period. So $I\left(\overline{\Xi}_{t,t+T}\right)/I\left(\Xi_t\right) < 1$ (or $E_{t,t+T} > 0$)

corresponds to a "Gates loses" mobility process, while $I\left(\overline{\Xi}_{t,t+T}\right)/I\left(\Xi_t\right) > 1$ ($E_{t,t+T} < 0$) corresponds to the "Gates gains" situation already mentioned.

Fields (2010) compares E with many other measures of social mobility besides Shorrocks's, both from a theoretical and an empirical point of view. While the time paths of other mobility measures for the period 1970-1990 in the U.S. typically present an inverted-U pattern, and are always positive, E has a distinctive shape, peaking in the mid-1970s, then becoming negative in the late 1970s, and pointing back up in the 1980s. Our task is to check if Acemoglu's model would also generate such a behavior.

The main underlying hypothesis in Acemoglu's (1999) modeling of the mentioned demographic changes observed in the 1980s in the U.S. is that at some point in time around 1980 there was an exogenous upward shock either on skilled-worker productivity or on the measure of skilled workers within the labor force, capable of changing the then prevailing pooling equilibrium in the labor markets to a separating equilibrium. Thus, if his argument is correct, we should expect to observe the following pattern arising from the model: $E_{t,t+T} > 0$ if Ξ_t and Ξ_{t+T} are both of the pooling type, and $E_{t,t+T} < 0$ in case Ξ_t corresponds to a pooling equilibrium but Ξ_{t+T} corresponds to a separating one. As a robustness test, we may want to check that it would not be the case that $E_{t,t+T} < 0$ if Ξ_t was already of the separating type (otherwise, one could argue that possibly the labor markets in the 1970s were already in a separating equilibrium).

4 Comparative statics

Here we study the effect of skill-biased technical change (an upward η-shock) and of an increase in the supply of skills (an upward ϕ-shock) on the time path of the E measure of mobility-as-an-equalizer-of-longer-term-incomes. Since our analysis must be a steady-state one in order to be compatible with Acemoglu (1999), one possibility in order to follow through with the mobility calculations would be to impose that at all times following the shock (say, at the end of period t), the economy is at a steady-state.

However, the specification of long-term earnings used by Fields (2010) does not call for that, since data collected at years $\tau \in \{t+1, \ldots, t+T-1\}$ have no influence over $\overline{\Xi}_{t,t+T}$ or $E_{t,t+T}$ in (5). So we simply assume that T is large enough so that Ξ_{t+T} is close to the new steady-state of the economy. In the present context, this is a sensible hypothesis, since $E_{t,t+T}$ is a continuous function of the distributions Ξ_t and Ξ_{t+T}, and we are only interested in evaluating the sign of $E_{t,t+T}$.

Let the random variable $M_{i,\tau}$ inform whether worker i is unemployed ($M_{i,\tau} = 0$) or employed ($M_{i,\tau} = 1$) at period τ, and C_i inform his/her skill level (0 for unskilled, 1 for skilled). We make the following

Assumption 1. For our computational purposes, $M_{i,\tau+T}$ and $M_{i,\tau}$ can be considered conditionally independent given C_i, for any worker i and period τ. That is, $\Pr(M_{i,\tau+T} = m_{\tau+T} \mid C_i = c, M_{i,\tau} = m_\tau) \approx \Pr(M_{i,\tau+T} = m_{\tau+T} \mid C_i = c)$.

True conditional independence would require that the loose $\approx$ symbol in this assumption be an exact $=$. That would simply not be true. In fact, the probabilities

$\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=1\right)$ and $\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=0\right)$ can be computed in an exact fashion, and shown to approach each other when T is sufficiently large. Applying Kolmogorov's system of forward differential equations for the computation of transition probabilities in a Markov process yields[8]

$$\begin{aligned}\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=1\right) &= 1-\frac{s}{s+p\mu_c}\left(1-e^{-(s+p\mu_c)T}\right),\\ \Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=0\right) &= \frac{p\mu_c}{s+p\mu_c}\left(1-e^{-(s+p\mu_c)T}\right),\end{aligned}$$

where $p\mu_c$ is the effective hiring rate for a type-c worker ($\mu_0=\mu_1=1$ in a pooling equilibrium, and $\mu_0=\mu^L,\mu_1=\mu^H$ in a separating equilibrium). Note that

$$\begin{aligned}&\lim_{T\to\infty}\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=1\right)=\frac{p\mu_c}{s+p\mu_c}\\ =\ &\lim_{T\to\infty}\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=0\right),\end{aligned}$$

and $p\mu_c/\left(s+p\mu_c\right)=1-u_c=\Pr\left(M_{i,\tau+T}=m_{\tau+T}\mid C_i=c\right)$, where $u_0=u_1=u^P$ in a pooling equilibrium, and $u_0:=u^L,u_1:=u^H$ in a separating equilibrium. Hence, Assumption 1 is a sound one indeed.

How large must T be? Note that $\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=1\right)-\Pr\left(M_{i,\tau+T}=1\mid C_i=c,M_{i,\tau}=0\right)=e^{-(s+p\mu_c)T}$. For instance, using $p=5$ and $s=0.5$ as in Acemoglu (1999), and $T=5$ as done in Fields (2010) for the U.S. case, we get, for the pooling-equilibrium case, a difference in the 10^{-12} order of magnitude. In the separating-equilibrium case, even if μ_c is so small that $p\mu_c=1$, both probabilities would differ by less than a thousandth.[9] That is, $T=5$ is more than fine to justi-

[8] This technique is explained in Feller (1957, chapter XVII.9).

[9] For the whole parametric region considered in the comparative statics performed in the next

fiably incorporate Assumption 1 in our calculations. At the same time, it might be noted that, for $T = 2$, as applied in Fields (2010) for the French case, assuming we have similar p and s values, one may justifiably prefer to perform the exact calculations, using the expressions above and an additional hypothesis about the immediate effect of the shock ocurring at t on employment of each category of individuals, or considering transition dynamics for the problem.

4.1 Skill-biased technical change ($\uparrow \eta$)

First, let us consider the situation in which, at the end of period t, the productivity differential η becomes $\eta' > \eta$. In order to address the issue of equalization/disequalization of long-term incomes, we must look at the two equilibrium distributions of earnings, Ξ_t and $\overline{\Xi}^{PS}_{t,t+T}$. The two possibilities for Ξ_t are given in (1) and (2). For $\overline{\Xi}_{t,t+T}$, we may consider eight different categories. Each unskilled individual might have been unemployed or employed at t, and may be unemployed or employed at $t + T$ as well; the same happens with skilled workers.

Denoting by $\overline{\Xi}^{PS}_{t,t+T}$ the distribution of long-term earnings when moving from a

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section, $p\mu_c$ happens be confined to the $[1.1, 3.9]$ interval. This corresponds to the particular case for which $\phi = 1/3$ and $\eta = 1.5$, where one obtains $\mu_0 = \mu^L \approx 0.23$ and $\mu_1 = \mu^H \approx 0.77$, which, multiplied by $p = 5$, give rise to (approximately) the endpoints of that interval.

pooling to a separating equilibrium, and similarly for $\Xi^{PP}_{t,t+T}$ and $\Xi^{SS}_{t,t+T}$, we get:

$$\Xi^{PS}_{t,t+T} = \begin{bmatrix} (1-\phi)\, u^P u^{L\prime} & 0 \\ (1-\phi)\left(1-u^P\right) u^{L\prime} & \beta\left(k^P\right)^{1-\alpha} \\ (1-\phi)\, u^P\left(1-u^{L\prime}\right) & \beta\left(k^{L\prime}\right)^{1-\alpha} \\ (1-\phi)\left(1-u^P\right)\left(1-u^{L\prime}\right) & \beta\left(k^P\right)^{1-\alpha}+\beta\left(k^{L\prime}\right)^{1-\alpha} \\ \phi u^P u^{H\prime} & 0 \\ \phi\left(1-u^P\right) u^{H\prime} & \beta\eta^\alpha\left(k^P\right)^{1-\alpha} \\ \phi u^P\left(1-u^{H\prime}\right) & \beta\left(\eta'\right)^\alpha\left(k^{H\prime}\right)^{1-\alpha} \\ \phi\left(1-u^P\right)\left(1-u^{H\prime}\right) & \beta\eta^\alpha\left(k^P\right)^{1-\alpha}+\beta\left(\eta'\right)^\alpha\left(k^{H\prime}\right)^{1-\alpha} \end{bmatrix},$$

with primes meaning "post-shock" (and similarly for $\Xi^{PP}_{t,t+T}$ and $\Xi^{SS}_{t,t+T}$). The first four rows correspond to the four possible movements of the unskilled workers between employment statuses (in order, unemployment to unemployment, employment to unemployment, unemployment to employment, and employment to employment). Since I must be 0-homogeneous, the second column of this distribution matrix could also be normalized through division by $\beta a^{1-\alpha}$, and be accordingly written as: $\Big(0, (1-\phi+\phi\eta^\alpha)^{(1-\alpha)/\alpha}, 1, (1-\phi+\phi\eta^\alpha)^{(1-\alpha)/\alpha}+1,$ $0, \eta^\alpha(1-\phi+\phi\eta^\alpha)^{(1-\alpha)/\alpha}, \eta', \eta^\alpha(1-\phi+\phi\eta^\alpha)^{(1-\alpha)/\alpha}+\eta'\Big)$.

As for the first column, it derives from Assumption 1, by treating the approximation therein as an equality. As an example, the third entry corresponds to the measure of those unskilled workers who were unemployed at t, but employed at $t+T$:

$$\begin{aligned} & \Pr\left(C=0, M_t=0, M_{t+T}=1\right) \\ = & \Pr\left(M_{t+T}=1 \mid C=0, M_t=0\right) \Pr\left(C=0, M_t=0\right) \\ = & \Pr\left(C=0, M_t=0\right) \Pr\left(M_{t+T}=1 \mid C=0\right) = (1-\phi)\, u^P \left(1-u^{L\prime}\right). \end{aligned}$$

In order to investigate the impact of skill-biased technical change on mobility, we analyze the behavior of $E_{t,t+T}$ for different values of η. We may take, for instance, $\eta = 1.2$, $\eta = 1.3$ and $\eta = 1.4$, besides the aforementioned parameter values, and $\phi = 1/3$. In the first and second cases, the economy starts out at a pooling equilibrium, while in the third case, at a separating one. This might be checked by comparing η to the threshold $\eta^* = (1-\phi)\,(r+s+q\phi)^{\alpha} \,/ \left(\left((r+s+q)^{\alpha}\,\phi^{\alpha} - (r+s+q\phi)^{\alpha}\,\phi\right)^{1/\alpha}\right) \approx 1.318$, as explained in Acemoglu (1999). These three values for η are shown in Figure 1.

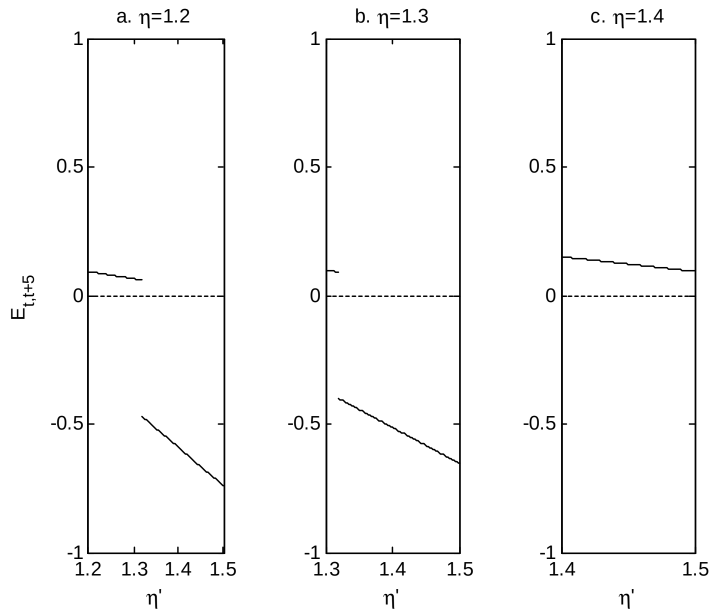

Figure 1. The impact of skill-biased technical change on the mobility-as-an-equalizer-of-longer-term-incomes index.

Other than the point $\eta' = \eta^*$, where one obtains multiple (two) steady-state equilibria, each $\eta' \geq \eta$ corresponds to either the pooling or the separating case. As Figures 1a and 1b show, if the old (at t) labor markets equilibrium was of the pooling type and the new (at $t + 5$) equilibrium is still of the pooling type, then $E_{t,t+5}$ is positive (or "Gates loses", in the sense that short-term inequality overestimates long-term inequality). This is consistent with the values of $E_{t,t+5}$ reported in Fields (2010, table 2) for $t \in \{1969, 1970, 1974, 1975\}$.

Hence, assuming only the possibility of upward (or null) shocks in productivity, the 1970s can be seen to be consistent with a period of pooling equilibrium in the labor markets. Now, since Fields (2010) also reports a negative $E_{t,t+5}$ ("Gates-wins mobility") in the late 1970s, "pooling" is really the only possibility for the 1970s. In fact, if the equilibrium were of the separating type for $t \in \{1969, 1970, 1974, 1975\}$, then we would be in the situation of Figure 1c, and $E_{t,t+5}$ would remain positive.

Having established the accordance of Acemoglu's model with "Gates loses" mobility in the 1970s, and assuming there was a skill-biased technical change, the negative values reported in Fields (2010) along with Figures 1a and 1b show that this shock must have been sufficiently large so that $\eta' > \eta^*$, thus bringing the labor markets to a qualitatively different, separating equilibrium, and making, at least temporarily, long-term earnings more unequal than short-term ones. Therefore, Acemoglu's model passes (at least in a qualitative sense) the test provided by the observed behavior for the mobility-as-an-equalizer-of-longer-term-incomes index.

4.2 Increased supply of skills ($\uparrow \phi$)

Here we assume it is the supply of skills that increases at the end of period t, from ϕ to $\phi' > \phi$. This shock happens in a way that no skilled person becomes unskilled, and learning occurs equally on- and off-the-job. Formally, we make the following assumptions, where $C_{i,\tau}$ stands for the skill level of worker i at τ (0 for unskilled, 1 for skilled).

Assumption 1'. For our computational purposes, $M_{i,\tau+T}$ and $(M_{i,\tau}, C_{i,\tau})$ can be considered conditionally independent given $C_{i,\tau+T}$, for any worker i and period τ. That is, $\Pr(M_{i,\tau+T} = m_{\tau+T} \mid C_{i,\tau} = c_\tau, M_{i,\tau} = m_\tau, C_{i,\tau+T} = c_{\tau+T}) \approx \Pr(M_{i,\tau+T} = m_{\tau+T} \mid C_{i,\tau+T} = c_{\tau+T})$.

Assumption 2. $C_{i,t+T}$ and $M_{i,t}$ are conditionally independent given $C_{i,t}$, for any worker i. That is, $\Pr\left(C_{i,t+T}=c_{t+T}\mid C_{i,t}=c_t, M_{i,t}=m_t\right) = \Pr\left(C_{i,t+T}=c_{t+T}\mid C_{i,t}=c_t\right)$.

Assumption 1' is a simple extension of Assumption 1, and says that in order to determine the likelihood of a worker being employed at $\tau+T$, the information of his skill level at $\tau+T$ supersedes any information available about his status at period τ. As shown before, for the given parameter values, $T=5$ is more than enough, by all practical means. Assumption 2 stipulates that the ϕ-shock affects equally those who were working and those who were looking for a job at t.

Again we illustrate with the situation in which a pooling equilibrium becomes a separating equilibrium:

$$\Xi^{PS}_{t,t+T}=\begin{bmatrix}
(1-\phi')\,u^P u^{L\prime} & 0\\
(1-\phi')\left(1-u^P\right)u^{L\prime} & \beta\left(k^P\right)^{1-\alpha}\\
(1-\phi')\,u^P\left(1-u^{L\prime}\right) & \beta\left(k^{L\prime}\right)^{1-\alpha}\\
(1-\phi')\left(1-u^P\right)\left(1-u^{L\prime}\right) & \beta\left(k^P\right)^{1-\alpha}+\beta\left(k^{L\prime}\right)^{1-\alpha}\\
(\phi'-\phi)\,u^P u^{H\prime} & 0\\
(\phi'-\phi)\left(1-u^P\right)u^{H\prime} & \beta\left(k^P\right)^{1-\alpha}\\
(\phi'-\phi)\,u^P\left(1-u^{H\prime}\right) & \beta\eta^\alpha\left(k^{H\prime}\right)^{1-\alpha}\\
(\phi'-\phi)\left(1-u^P\right)\left(1-u^{H\prime}\right) & \beta\left(k^P\right)^{1-\alpha}+\beta\eta^\alpha\left(k^{H\prime}\right)^{1-\alpha}\\
\phi u^P u^{H\prime} & 0\\
\phi\left(1-u^P\right)u^{H\prime} & \beta\eta^\alpha\left(k^P\right)^{1-\alpha}\\
\phi u^P\left(1-u^{H\prime}\right) & \beta\eta^\alpha\left(k^{H\prime}\right)^{1-\alpha}\\
\phi\left(1-u^P\right)\left(1-u^{H\prime}\right) & \beta\eta^\alpha\left(k^P\right)^{1-\alpha}+\beta\eta^\alpha\left(k^{H\prime}\right)^{1-\alpha}
\end{bmatrix}.$$

As before, the first four rows correspond to the unskilled who remained unskilled (in the same order as in the previous subsection), and the last four to those who were already skilled at t. The middle four correspond to those who were unskilled at t, but following the ϕ-shock, became skilled. For instance, the eighth row corresponds to the measure of previously unskilled but now skilled workers who were employed in period t and are again at $t+T$:

$$\begin{aligned}
& \Pr\left(C_t=0, M_t=1, C_{t+T}=1, M_{t+T}=1\right) \\
= \;& \Pr\left(M_{t+T}=1 \mid C_t=0, M_t=1, C_{t+T}=1\right) \Pr\left(C_t=0, M_t=1, C_{t+T}=1\right) \\
= \;& \Pr\left(M_{t+T}=1 \mid C_{t+T}=1\right) \Pr\left(C_{t+T}=1 \mid C_t=0, M_t=1\right) \Pr\left(C_t=0, M_t=1\right) \\
= \;& \Pr\left(M_{t+T}=1 \mid C_{t+T}=1\right) \Pr\left(C_{t+T}=1 \mid C_t=0\right) \Pr\left(C_t=0, M_t=1\right) \\
= \;& \left(1-u^{H\prime}\right) \frac{\phi'-\phi}{1-\phi} (1-\phi) \left(1-u^P\right) = (\phi'-\phi) \left(1-u^P\right) \left(1-u^{H\prime}\right),
\end{aligned}$$

where Assumptions 1' and 2 were used in the third and fourth lines, respectively.

The comparative statics using Acemoglu's (1999) parameter values are summarized in Figure 2, with a very similar pattern to that of Figure 1 (but now the jump is at $\phi^* = 1/3$). Hence, exactly as argued in the previous subsection for the case of a ϕ-shock, we once again see that Fields' (2010) calculations for the E mobility measure provide further confirmation of Acemoglu's conjecture of a qualitative change in job composition taking place in the 1980s. Therefore, the qualitative change in job composition experienced in the 1980s was a disequalizing force not only with respect to short-term incomes, but also with respect to long-term ones.

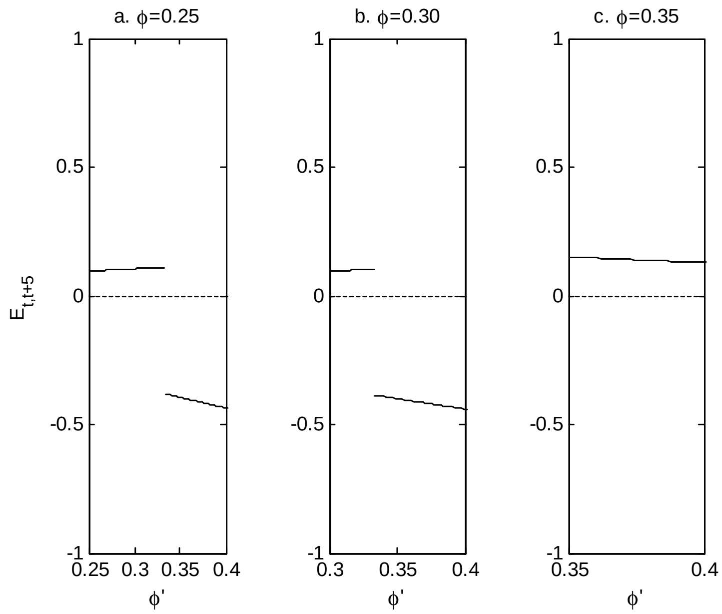

Figure 2. The impact of an increase in the fraction of skilled workers on the mobility-as-an-equalizer-of-longer-term-incomes index.

5 Conclusion

We have shown that Acemoglu's (1999) job search model can be used to explain not only the increased unemployment and inequality observed in the United States in the 1980s, but also the documented replacement of a "Gates loses" mobility process for a "Gates gains" one. In order to do so, we had to make a few assumptions on how the productivity shock long-term effects were distributed throughout the workforce, besides discussing how long should long be.

Thus, moving from a pooling to a separating equilibrium in the labor market does not bring only more short-term income inequality, but also more long-term income inequality. This happens in a sufficient magnitude so that long-term earnings are even more unequal than short-term ones.

Further research applying Fields' social mobility measure to the labor economics literature may try to consider job search models which do not characterize only steady-state equilibria. A few possibilities would be Bowlus and Robin (2004), Moscarini (2005) and Yashiv (2006). Then mobility along the transition path to the new equilibrium could be calculated as well. In this case, hypotheses regarding exactly how productivity shocks act (immediately, not in the long-term) on each category of the workforce must be made, and the same analysis tools employed here (such as Kolmogorov's equations, for the case of continuous time models) may still be used. The computational complexity of the analysis, however, will grow considerably.

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