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## Creative Destruction and Subjective Well-Being<sup>†</sup>

By PHILIPPE AGHION, UFUK AKCIGIT, ANGUS DEATON, AND ALEXANDRA ROULET\*

*In this paper we analyze the relationship between turnover-driven growth and subjective well-being. Our model of innovation-led growth and unemployment predicts that: (i) the effect of creative destruction on expected individual welfare should be unambiguously positive if we control for unemployment, less so if we do not; (ii) job creation has a positive and job destruction has a negative impact on well-being; (iii) job destruction has a less negative impact in areas with more generous unemployment insurance policies; and (iv) job creation has a more positive effect on individuals that are more forward-looking. The empirical analysis using cross-sectional MSA (metropolitan statistical area)-level and individual-level data provide empirical support to these predictions. (JEL I31, J63, J65, O33, O38)*

Does higher (per capita) GDP or GDP growth increase happiness? The existing empirical literature on happiness and income looks at how various measures of subjective well-being (SWB) relate to income or income growth, but without looking in further detail at what drives the growth process and at how the determinants of growth affect well-being. In this paper, we provide a first attempt at filling this gap.

More specifically, we look at how an important engine of growth, namely Schumpeterian creative destruction with its resulting flow of entry and exit of firms and jobs, affects SWB differently for different types of individuals and in different types of labor markets.

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Thus, in the first part of the paper we develop a simple Schumpeterian model of growth and unemployment to organize our thoughts and generate predictions on the potential effects of turnover on life satisfaction. In this model, growth results from quality-improving innovations. Each time a new innovator enters a sector, the worker currently employed in that sector loses her job and the firm posts a new vacancy. Production in the sector resumes with the new technology only when the firm has found a new suitable worker. Life satisfaction is captured by the expected discounted valuation of an individual's future earnings. In the model, a higher rate of turnover has both direct and indirect effects on life satisfaction. The direct effects are that, everything else equal, more turnover translates into both a higher probability of becoming unemployed for the employed, which reduces life satisfaction, and a higher probability for the unemployed to find a new job, which increases life satisfaction. The indirect effect is that a higher rate of turnover implies a higher growth externality and therefore a higher net present value of future earnings: this enhances life satisfaction. Overall, a first prediction of the model is that a higher turnover rate increases well-being more when controlling for aggregate unemployment than when not controlling for aggregate unemployment. A second prediction is that job creation increases and job destruction decreases well-being. A third prediction is that job destruction has a less negative effect on well-being, the more generous are unemployment benefits. A fourth prediction is that job creation increases future well-being more for more forward-looking individuals.<sup>1</sup>

In the second part of the paper we test the predictions of the model using cross-sectional metropolitan statistical area (MSA)-level US data. To measure creative destruction we follow Davis, Haltiwanger, and Schuh (1996) and use their measure of job turnover, defined as the job creation rate plus the job destruction rate.<sup>2</sup> The data come from the Census Bureau's Business Dynamics Statistics (BDS) and are at the MSA level. In addition, we also use the Longitudinal Employer-Household Dynamics (LEHD) data from the Census Bureau, which provide information on hires, separations, employment, and thus turnover, also at the MSA level. To measure SWB, we use the Cantril ladder of life from the Gallup Healthways Well-Being Index (Gallup), which asks individuals about both current and future well-being. The Cantril ladder is based on the following questions: "Imagine a ladder with steps numbered from 0 at the bottom to 10 at the top; the top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time? And which level of the ladder do you anticipate to achieve in five years?"<sup>3</sup>

We investigate whether Schumpeterian creative destruction affects these measures of well-being positively or negatively, by regressing our measures of SWB on our creative destruction variables. The empirical analysis using cross-sectional MSA-level data on SWB and job turnover vindicates the theoretical predictions:

<sup>1</sup>In the online Appendix, we characterize the transitional dynamics of the model and also extend the analysis to the case where job destruction can be partly exogenous, or to the case where the turnover rate is endogenously determined by a free entry condition.

<sup>2</sup>We have also looked at firm turnover, namely the sum of the establishment entry rate and the establishment exit rate, with similar results.

<sup>3</sup>In online Appendix A2, we also check the robustness of our results to a SWB measure from another dataset: the Life Satisfaction question from the Behavioral Risk Factor and Surveillance System, which asks respondents "In general how satisfied are you with your life?"

namely, we find that: (i) the effect of creative destruction on well-being is positive when we control for MSA-level unemployment and less so if we do not; (ii) the effects of job creation and job destruction on well-being are positive and negative, respectively; and (iii) job destruction has less negative effect when unemployment benefits are higher. Moreover, we find some evidence that job creation has a more positive impact on future well-being for more forward-looking individuals when we use income, age, and education to proxy for patience. These results are not only consistent with the theory, but they are also remarkably robust. In particular they hold whether looking at well-being at MSA level or at individual level, or whether using the BDS or the LEHD data to construct our proxy for creative destruction.

The paper relates to two main strands of literature. First, to the literature on innovation-led growth, job turnover, and unemployment (e.g., see Davis, Haltiwanger, and Schuh 1996; Mortensen and Pissarides 1998; Aghion and Howitt 1994, 1998; and Aghion, Akcigit, and Howitt 2014). In particular Aghion and Howitt (1994, 1998) and Mortensen and Pissarides (1998) develop Schumpeterian models of growth through creative destruction, where growth is driven by quality-improving innovations by new entrants that make existing firms and jobs become obsolete. In any sector where new entry occurs, the incumbent firm closes down, therefore the worker employed by the incumbent firm loses her job whereas the entering firm in the sector posts a new vacancy. Equilibrium unemployment results from assuming labor market frictions in the form of a Poisson matching rate between new vacancies and workers looking for a new job. These papers point to two opposite effects of growth on unemployment. One is a “capitalization” effect whereby more growth reduces the rate at which firms discount the future returns from creating a new vacancy: this effect pushes toward creating more vacancies and thus toward reducing the equilibrium unemployment. The counteracting effect is a “creative destruction” effect whereby more growth implies a higher rate of job destruction which in turn tends to increase the equilibrium level of unemployment. We contribute to this literature by looking at the counteracting effects of innovation-led growth on SWB.

Second, the paper contributes to the literature on SWB. In spite of a now large literature on self-reported well-being,<sup>4</sup> there is no general consensus on how seriously these SWB measures should be taken, or on exactly what they mean. Indeed some of the most exciting recent work (e.g., see Benjamin et al. 2012, 2014) is investigating these fundamental questions.<sup>5</sup> In this paper, we find that life satisfaction responds to

<sup>4</sup>In particular, in his seminal work, Easterlin (1974) provides evidence to the effect that, within a given country, happiness is positively correlated with income across individuals but this correlation no longer holds within a given country over time. This Easterlin paradox is often explained by the idea that, at least past a certain income threshold, additional income enters life satisfaction only in a relative way; Clark, Frijters, and Shields (2008) provides a review of this large literature of which Luttmer (2005), Clark and Senik (2010), and Card et al. (2012) are prominent examples. Recent work has found little evidence of thresholds and a good deal of evidence linking higher incomes to higher life satisfaction, both across countries and over time. Thus in his cross-country analysis of the Gallup World Poll, Deaton (2008) finds a relationship between log of per capita GDP and life satisfaction which is positive and close to linear, i.e., with a similar slope for poor and rich countries, and, if anything, steeper for rich countries. Stevenson and Wolfers (2013) provide both cross-country and within-country evidence of a log-linear relationship between per capita GDP and well-being and they also fail to find a critical “satiation” income threshold. Yet these issues remain far from settled, see for example the reviews by Frey and Stutzer (2002), Layard (2011), or Graham (2009).

<sup>5</sup>Benjamin et al. (2012) run three surveys to look at the extent to which, when facing two alternatives, individuals choose the alternative from which they anticipate the highest SWB (as measured by the Cantril ladder). They find that SWB and choice coincide 83 percent of the time. Benjamin et al. (2014) survey students from US medical

the future growth prospects that are inherent in creative destruction, even in spite of the related short-run unemployment effects, and at the same time we provide some evidence of the validity and usefulness of self-reported well-being as a measure of expected future material well-being. Such findings have not been documented in the well-being literature so far and they provide further evidence of the usefulness of these well-being measures.

The paper is organized as follows. Section I develops the model and generates predictions on the effects of turnover on SWB, and how these effects depend upon individual or local labor market characteristics. Section II describes the data, the approach underlying the empirical analysis, and presents the empirical results. Section III considers several robustness checks. Section IV concludes the paper. The Appendix contains the proofs and the online Appendix presents extensions to the baseline framework, additional proofs, and extra tables.

## I. Theoretical Analysis

### A. A Toy Model

In this section, we offer a simple model to motivate our empirical analysis. The source of economic growth is Schumpeterian creative destruction which at the same time generates endogenous obsolescence of firms and jobs. The workers in the obsolete firms join the unemployment pool until they are matched to a new firm. Higher firm turnover has both a positive effect (by increasing economic growth and by increasing employment prospects of unemployed workers) and a negative effect (by increasing the probability of currently employed workers losing their job) on well-being. Which effect dominates will in turn depend upon both individual characteristics (e.g., discount rate and risk-aversion) and characteristics of the labor market (e.g., unemployment benefits). To keep the analysis tractable, in what follows we will consider a steady-state economy with exogenous entry, risk-neutral agents, and only endogenous job destruction. These assumptions will be relaxed in the online Appendix: Section A1.1 focuses on transitional dynamics, Section A1.2 considers a model with exogenous job destruction, Section A1.3 considers the implications of risk aversion, and Section A1.4 endogenizes entry in the theoretical model.

*Production Technology and Innovation.*—We consider a multi-sector Schumpeterian growth model in continuous time. The economy is populated by a set of infinitely-lived and risk-neutral individuals of measure one, and discount the future at rate  $\rho$ . Therefore the household Euler equation is simply

$$(1) \quad r = \rho,$$

where  $r$  is the interest rate of the economy.

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schools who enroll in the National Residence Matching Program; they find that individuals' actual choice of residence somewhat departs from individuals' anticipated SWB rankings, and then they investigate possible sources of divergence between these SWB measures and revealed preferences. In the present paper, however, the predictions as to how creative destruction should affect individuals' utility turn out to be fully mirrored by the empirical analysis using SWB measures and data.

The final good is produced using a continuum of intermediate inputs, according to the logarithmic production function

$$\ln Y_t = \int_{j \in \mathcal{J}} \ln y_{jt} \, dj,$$

where  $\mathcal{J} \subset [0, 1]$  is the set of active product lines. We will denote its measure by  $J \in [0, 1]$ . The measure  $J$  is invariant in steady state.

Each intermediate firm produces using one unit of labor according to the following linear production function,

$$y_{jt} = A_{jt} l_{jt},$$

where  $l_{jt} = 1$  is the labor employed by the firm, and is the same in all sectors. Thus the measure of inactive product lines is equal to the unemployment rate

$$u_t = 1 - J_t,$$

where  $u$  denotes the equilibrium unemployment rate. Our focus will be on balanced growth path equilibrium, therefore, when possible, we will drop time subscripts to save notation.

*Innovation and Growth.*—An innovator in sector  $j$  at date  $t$  will move productivity in sector  $j$  from  $A_{jt-1}$  to

$$A_{jt} = \lambda A_{jt-1},$$

where  $\lambda > 1$ . The innovator is a new entrant, and entry occurs in each sector with Poisson arrival rate  $x$  which we assume to be exogenous. Upon entry in any sector, the previous incumbent firm becomes obsolete and its worker loses her job and the entering firm posts a new vacancy with an instantaneous cost  $cY$ .<sup>6</sup> Production in that sector resumes with the new technology when the firm has found a new suitable worker.

*Labor Market and Job Matching.*—Following Pissarides (1990), we let

$$(2) \quad m(u_t, v_t) = u_t^\alpha v_t^{1-\alpha}$$

denote the arrival rate of new matches between firms and workers, where  $u_t$  denotes the number of unemployed at time  $t$  and  $v_t$  denotes the number of vacancies. Thus the flow probability for each unemployed worker to find a suitable firm is

$$m(u_t, v_t)/u_t,$$

<sup>6</sup>In online Appendix A1.7, we provide sufficient conditions under which the incumbent firm in any sector will choose to leave the market as soon as a new entrant shows up in that sector. The basic story is that, conditional upon a new entrant showing up, it becomes profitable for the incumbent firm to seek an alternative use of her assets.

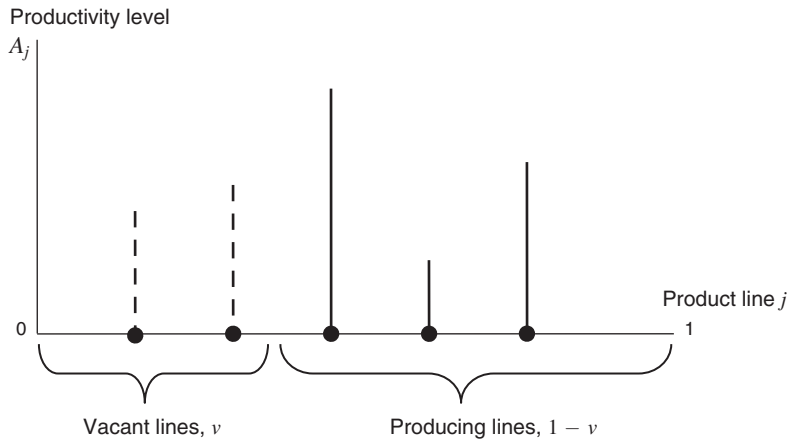


FIGURE 1. MODEL ECONOMY

whereas the probability for any new entrant firm to find a suitable new worker is

$$m(u_t, v_t)/v_t.$$

In steady state, there will be a constant fraction of product lines that are *vacant* (of measure  $v$ ), and the remaining fraction will be *producing*. We illustrate this economy in Figure 1.

Finally, we assume that in each intermediate sector where a worker is currently employed, the worker appropriates fraction  $\beta$  of profits whereas the complementary fraction  $(1 - \beta)$  accrues to the employer.

*Valuations and Life Satisfaction.*—Life satisfaction is captured by the average present value of an individual employee, namely

$$W_t = u_t U_t + (1 - u_t) E_t,$$

where  $U_t$  is the net present value of an individual who is currently unemployed, and  $E_t$  is the net present value of an individual who is currently employed.

The value of being currently employed satisfies the asset equation

$$\rho E_t - \dot{E}_t = w_t + x(U_t - E_t).$$

In words: the annuity value of being currently employed is equal to the capital gain  $\dot{E}_t$  plus the wage rate  $w_t$  at time  $t$  and with arrival rate  $x$  the worker becomes unemployed as the incumbent firm is being displaced by a new entrant. Here we already see the negative effect of turnover on currently employed workers.

Similarly, the value of being unemployed satisfies the asset equation

$$\rho U_t - \dot{U}_t = b_t + (m(u_t, v_t)/u_t)(E_t - U_t).$$



As before, the annuity value of being currently unemployed is equal to the capital gain  $\dot{U}_t$  plus the benefit  $b_t$  accruing to an unemployed worker,<sup>7</sup> and with arrival rate  $m(u_t, v_t)/u_t$  the unemployed worker escapes unemployment. For any given unemployment rate, turnover has a positive effect on the value of being unemployed because it creates job opportunities.

### B. Solving the Model

We now proceed to solve the model for equilibrium production and profits, the equilibrium steady-state unemployment rate, the steady-state growth rate, and the equilibrium value of life satisfaction.

*Static Production Decision and Equilibrium Profits.*—Let  $w_t$  denote the wage rate at date  $t$ . The logarithmic technology for final good production implies that the final good producer spends the same amount  $Y_t$  on each variety  $j$ . As a result, the final good production function generates a unit elastic demand with respect to each variety:  $y_{jt} = Y_t/p_{jt}$ .

Note that the cost of production is simply  $w_{jt}$  which is the firm-specific wage rate. Then the profit is simply

$$(3) \quad \pi_{jt} = p_{jt}y_{jt} - w_{jt} = Y_t - w_{jt}.$$

Next, the above sharing rule between wage and profits implies that  $w_{jt} = \beta(Y_t - w_{jt})$ , hence

$$w_{jt} = w_t = \frac{\beta}{1 + \beta}Y_t, \text{ and } \pi_{jt} = \frac{1}{1 + \beta}Y_t = \pi Y.$$

Clearly,  $\beta$  determines the allocation of income in the economy, with a higher  $\beta$  shifting the income distribution toward workers.

*Steady-State Equilibrium Unemployment.*—Our focus is on a steady-state equilibrium in which all aggregate variables ( $Y_t, w_t, U_t, E_t$ ) grow at the same constant rate  $g$ , and where the measure of unemployed  $u$  and the number of vacancies and the interest rate remains constant over time.<sup>8</sup> Henceforth, we will drop the time index  $t$ , when it causes no confusion.

In steady state, the flow out of unemployment must equal the flow into unemployment. Namely:

$$(4) \quad m(u, v) = (1 - u)x.$$

<sup>7</sup>Think of this benefit term as being the sum of a (monetary) unemployment benefit and of a private utility (or disutility) of being currently unemployed. In online Appendix A1.6 we analyze the case where  $b$  corresponds to unemployment benefits financed through taxing labor. There we show that the conclusion that “the negative impact of creative destruction on well-being is mitigated by the unemployment benefit,” continues to hold as long as the unemployment benefit is not financed completely by workers.

<sup>8</sup>In online Appendix A1.1, we discuss the transitional dynamics of this model. We show that following that increase in the entry rate convergence to the steady-state is fast.



The left-hand side is the flow out of unemployment, the right-hand side is the flow into unemployment, equal to the number of active sectors  $(1 - u)$  times the turnover rate  $x$ .

In addition, the number of sectors without an employed worker is equal to the number of sectors with an open vacancy,  $u = v$ . Combining this fact with the matching technology (2), we get

$$(5) \quad m = u = v.$$

Putting equations (4) and (5) together, we obtain the equilibrium unemployment rate  $u = (1 - u)x$ , or equivalently

$$(6) \quad u = \frac{x}{1 + x}.$$

That the numerator of  $u$  is increasing in  $x$  reflects the job destruction effect of turnover on currently employed workers; that the denominator is also increasing in  $x$  reflects the positive effect a higher turnover rate has on the job finding rate of currently unemployed workers.

The first effect dominates here, with the equilibrium unemployment rate increasing in the turnover rate  $x$ . However this very much hinges on the fact that innovative turnover is the only source of job destruction in this baseline model. In online Appendix A1.2, we introduce the possibility of exogenous job destruction on top of innovation-driven job destruction. Then we show that the higher the exogenous rate of job destruction, the more the innovation rate  $x$  contributes to reducing unemployment, and therefore the more positive the overall effect of  $x$  on equilibrium well-being.

Now we can express the growth rate of the economy.

LEMMA 1: *The balanced growth path growth rate of the economy is equal to*

$$g = m \ln \lambda,$$

where  $m$  denotes the flow of sectors in which a new innovation is being implemented (i.e., the rate at which new firm-worker matches occur).

PROOF:

See Appendix A.

Then, using the fact that in steady-state equilibrium we have  $m = u = \frac{x}{1 + x}$ , we get the equilibrium growth rate as

$$(7) \quad g = \frac{x}{1 + x} \ln \lambda.$$

As expected, the growth rate is increasing in the turnover rate  $x$  and with the innovation step size  $\lambda$ .

*Equilibrium Valuations and Life Satisfaction.*—Recall that life satisfaction is the average welfare of an individual employee, namely<sup>9</sup>

$$W = uU + (1 - u)E,$$

where

$$(8) \quad rE - \dot{E} = \beta\pi Y + x(U - E),$$

and

$$(9) \quad rU - \dot{U} = bY + (m(u, v)/u)(E - U).$$

Now, after substituting for  $E$  and  $U$  in the expression for the steady-state value of  $W$ , and using the fact that in steady state  $\dot{E} = gE$  and  $\dot{U} = gU$ , and that in equilibrium (see equation (5))  $m = u = x/(1 + x)$ , we get the following expression for life satisfaction:<sup>10</sup>

$$(10) \quad W = \frac{Y}{r - g} \left[ \beta\pi - \frac{xB}{1 + x} \right],$$

where

$$(11) \quad g = \frac{x}{1 + x} \ln \lambda \quad \text{and} \quad B \equiv \beta\pi - b.$$

From the above expression for  $W$ , we see three effects of turnover on life satisfaction. First, for given growth rate  $g$ , more turnover increases the probability of an employed worker losing her current job (numerator in  $\frac{xB}{1 + x}$ ) which reduces life satisfaction; second, for given growth rate  $g$ , more turnover increases the probability of an unemployed worker finding a new job (denominator in  $\frac{xB}{1 + x}$ ) which increases life satisfaction; third, higher turnover increases the growth rate  $g$  which in turn acts favorably on life satisfaction: this is the *capitalization* effect mentioned in the introduction. The overall effect of turnover on life satisfaction is ambiguous.<sup>11</sup>

*Comparative Statics and Additional Discussions.*—In this section, we discuss the implications of our model.

**Unemployment versus Capitalization Effect:** If we look at the effect of turnover on life satisfaction controlling for unemployment, this effect is unambiguously

<sup>9</sup>Note that in our analysis, life satisfaction is not necessarily equal to the present discounted value of income for at least two reasons. First, even though we labeled  $b$  as the unemployment benefit, the interpretation of it is much more general and it can embody in reality the private disutility associated with being unemployed or opportunity cost of not working. Second, our results also hold for the case of risk aversion as we illustrate in online Appendix A1.3, in which case income and life satisfaction are distinct objects.

<sup>10</sup>See Appendix B for the detailed derivation of (10).

<sup>11</sup>Using the fact that  $\frac{\partial W}{\partial x} = \frac{Y[\beta\pi \ln \lambda - B\rho]}{[(1 + x)(\rho - \ln \lambda) + \ln \lambda]^2}$ , we see that  $\frac{\partial W}{\partial x} > 0$  if and only if  $\rho < \frac{\beta\pi \ln \lambda}{B}$ .

positive. To see this, after some straightforward algebra we reexpress equilibrium well-being  $W$  as

$$(12) \quad W = \frac{Y}{r-g} [ub + (1-u)\beta\pi],$$

which for given  $u$  is increasing in  $x$  since it is increasing in  $g$  and  $g$  is increasing in  $x$  (capitalization effect).<sup>12</sup>

Taking the derivative of (10) with respect to  $x$  and substituting (11) we get

$$\frac{\partial W}{\partial x} = \frac{Y[\beta\pi \ln \lambda - B\rho]}{[(1+x)(\rho - \ln \lambda) + \ln \lambda]^2},$$

which is clearly positive when  $\rho < \frac{\beta\pi \ln \lambda}{B}$ , i.e., when the capitalization effect dominates the negative unemployment effect. Note also that life satisfaction increases more with turnover  $x$  the more generous unemployment benefits are<sup>13</sup>

$$\frac{\partial^2 W}{\partial x \partial b} > 0.$$

We summarize the above discussion in the following proposition.

**PROPOSITION 1:** (i) A higher turnover rate  $x$  increases life satisfaction  $W$  unambiguously once we control for the unemployment rate, not otherwise; (ii) life satisfaction increases more with turnover  $x$  the more generous unemployment benefits are.

**Job Creation versus Job Destruction:** So far, we have proxied job turnover using a single parameter  $x$ . However, we can also write (12) in terms of *job creation* and *job destruction rates*. Note that in our model, job creation happens through new matches, which happen at the rate  $m$  ( $=$  *job\_creation*) and job destruction happens as incumbent firms are replaced by new entrants at the rate  $x$  ( $=$  *job\_destruction*). Hence we can express (12) as

$$(13) \quad W = \frac{Y}{\rho - \ln \lambda \times \text{job\_creation}} \left[ \beta\pi - B \frac{\text{job\_destruction}}{1 + \text{job\_destruction}} \right].$$

Clearly, we obtain the following immediate comparative statics:

$$\frac{\partial W}{\partial \text{job\_creation}} > 0, \quad \frac{\partial W}{\partial \text{job\_destruction}} < 0, \quad \text{and} \quad \frac{\partial^2 W}{\partial \text{job\_destruction} \partial b} > 0.$$

<sup>12</sup> See Appendix C for the detailed derivation of equation (12).

<sup>13</sup> Indeed:

$$\frac{\partial^2 W}{\partial x \partial b} = \frac{Y\rho}{[(1+x)(\rho - \ln \lambda) + \ln \lambda]^2} > 0.$$

**PROPOSITION 2:** (i) A higher job creation rate increases, whereas a higher job destruction rate decreases life satisfaction  $W$ ; (ii) life satisfaction decreases less with job destruction the more generous the unemployment benefits.

**Current versus Future Well-Being and Transitional Dynamics:** In this section, we discuss briefly the transitional dynamics and its impact on well-being. Consider a sudden unexpected increase in the rate of creative destruction from  $x^{old}$  to  $x^{new}$  such that  $x^{new} > x^{old}$ . This generates a transition from the old steady state to a new steady state. During this transition, the path of the growth rate is summarized in the following lemma.

**LEMMA 2:** Consider an initial steady state with a creative destruction rate of  $x^{old}$ . Assume that at time  $t = 0$ , the creative destruction rate becomes  $x^{new}$ . Then the growth rate during the transition can be expressed as

$$(14) \quad g_t = g_{ss}^{new} - e^{-tx^{new}} [g_{ss}^{new} - g_{ss}^{old}],$$

where  $g^{new}$  and  $g^{old}$  are the new and old steady-state growth rates, respectively, and  $g^{new} > g^{old}$ .

**PROOF:**

See online Appendix A1.1.

Let us denote the well-being at time  $t$  under  $x^{old}$  and  $x^{new}$  by  $W_t^{old}$  and  $W_t^{new}$ , respectively. Moreover, let us denote their respective steady-state trajectories by  $W_{t,ss}^{old}$  and  $W_{t,ss}^{new}$ . Expression (14) makes it clear that when there is an increase in creative destruction from  $x^{old}$  to  $x^{new} > x^{old}$ , the growth rate will monotonically converge toward its new level. The impact of this change is illustrated in Figure 2. Before time 0, i.e., at  $t < 0$ , well-being is increasing on its trajectory  $W_{t,ss}^{old}$ . When the turnover rate increases from  $x^{old}$  to  $x^{new}$  when  $t = 0$ , well-being accelerates and starts to evolve toward its new trajectory:  $W_t^{new} \rightarrow W_{t,ss}^{new}$ .

The important point to note here is that the gap between the new trajectory and the old trajectory widens over time. For instance, the gap between  $W_t^{new}$  and  $W_{t,ss}^{old}$  at time  $t = T_1$  is smaller than the gap at time  $t = T_2$ . This implies that any change in the turnover rate has a bigger impact on the future well-being than the current well-being. Hence  $\Delta W_t \equiv W_t^{new} - W_{t,ss}^{old}$  is increasing over time. In this economy, a given individual's expected period- $T$  future well-being from a time-zero perspective can be expressed as

$$future\_wellbeing(T) = e^{-\rho T} W_T.$$

Clearly, an increase in turnover that increases future well-being will be perceived more highly by more patient individuals (with lower discount rate  $\rho$ ). In online Appendix A1.1, we show that the transition in our model happens very fast.

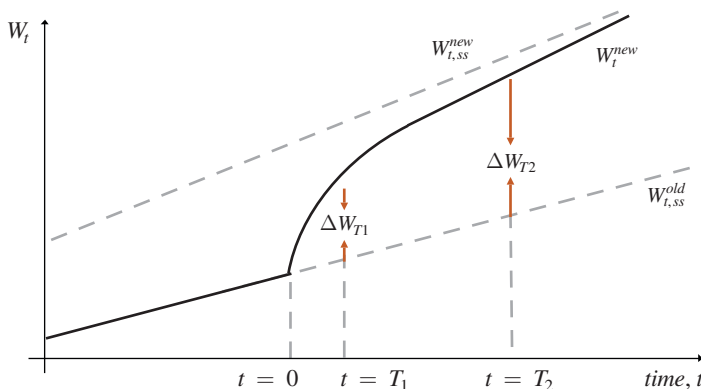


FIGURE 2. WELL-BEING DURING TRANSITION

Motivated by this fact, for any given well-being path  $W_t$ , if we approximate it with its steady-state value  $W_T \approx W_{ss}$ , we can also show this formally:

$$\frac{\partial \text{future\_wellbeing}(T)}{\partial x} \approx e^{-\rho T} \frac{\partial W_{ss}}{\partial x} > 0, \text{ and}$$

$$\frac{\partial^2 \text{future\_wellbeing}(T)}{\partial x \partial \rho} \approx -T e^{-\rho T} \frac{\partial W_{ss}}{\partial x} + e^{-\rho T} \frac{\partial^2 W_{ss}}{\partial x \partial \rho} < 0.$$

In words, future well-being increases in creative destruction, and more so for more patient individuals. A nice feature of our well-being data is that individuals are asked about their expectation about their future well-being as well. This will allow us to directly test this prediction of our model using the “future well-being” measure.

*Summary and Main Predictions.*—In the empirical analysis below, we will use cross-MSA data on well-being and job turnover to test the following predictions from the model:

**Prediction 1:** A higher turnover rate increases well-being more when controlling for aggregate unemployment than when not controlling for aggregate unemployment.

**Prediction 2:** A higher job creation rate increases well-being, whereas a higher job destruction rate decreases well-being.

**Prediction 3:** A higher turnover rate increases well-being more, whereas a higher job destruction rate decreases well-being less the more generous the unemployment benefits.

**Prediction 4:** A higher turnover rate increases future well-being more for more forward-looking individuals.

## II. Empirical Analysis

### A. Data

The data on creative destruction come from the BDS, which provide, at the metropolitan level (MSA), information on job creation and destruction rates. The job creation (destruction) rate is the sum of all employment gains (losses) from expanding (contracting) establishments from year  $t - 1$  to year  $t$  including establishment creations (destructions), divided by the average employment between years  $t$  and  $t - 1$ . These rates are computed from the whole universe of firms as described in the Census Bureau's Longitudinal Business Database. Our main measure of creative destruction is the “job turnover rate,” defined as the sum of the job creation and job destruction rates. We also analyze the role of creation rates and destruction rates separately. For our panel analysis, we use an alternative data source, the LEHD constructed by the Census Bureau. This dataset varies at the quarterly level, whereas the BDS data vary only at the annual level. The LEHD dataset also allows for a sectoral breakdown, which we take advantage of to construct a predicted Bartik-like measure of turnover that we use as a robustness check. The job creation rate in the LEHD is defined as the estimated number of workers who start a new job in a given quarter divided by the average employment in that quarter. The job destruction rate is defined as the estimated number of workers whose job ended in a given quarter divided by the average employment in that quarter.

The main data source on SWB is the Gallup Healthways Well-Being Index, which collects data on 1,000 randomly selected Americans each day through phone interviews. The period covered is 2008–2011. Subjective well-being in Gallup is assessed through various questions aimed at capturing different dimensions of well-being. We focus on the “Cantril ladder of life” questions which are intended to measure the individual’s *evaluation* of her life. Each individual is asked: “Please imagine a ladder with steps numbered from 0 at the bottom to 10 at the top; The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you; On which step of the ladder would you say you personally feel you stand at this time?”; and then “Which level of the ladder do you anticipate to achieve in five years?” We refer to answers to the first question as the “current ladder” and to the second one as the “future ladder.” The distinction between current and future ladder measures is particularly interesting, as we recall that some of the predictions, especially Prediction 4, rely mainly on future well-being.

To test the robustness of our main results to an alternative measure of well-being, we use the life satisfaction measure from the Behavioral Risk Factor and Surveillance System (BRFSS).<sup>14</sup> The sample size is roughly similar to that of Gallup but the BRFSS does not distinguish between current and future well-being. Further details on these data are provided in the robustness section.

<sup>14</sup>We prefer to use the life satisfaction measure from BRFSS rather than additional well-being measures from Gallup because the latter are destined to capture *emotional* well-being (as opposed to *evaluative* well-being), whereas the life satisfaction measure, as the Cantril ladder of life, seems better suited to capture our theoretical notion of welfare.

TABLE 1—SUMMARY STATISTICS

	Observations	Mean	Standard deviation	Min.	Max.
<i>MSA-level 2008–2011 averages (used in panel A of Tables 2, 3, and 4)</i>					
Current ladder	363	6.724	0.192	6.059	7.431
Future ladder	363	7.950	0.195	7.363	8.571
Job turnover rate	363	0.261	0.036	0.165	0.409
Job creation rate	363	0.125	0.018	0.082	0.215
Job destruction rate	363	0.136	0.021	0.082	0.225
Unemployment rate	363	0.083	0.025	0.035	0.275
log of income	363	8.127	0.164	7.517	8.605
Share African Americans	363	0.102	0.102	0	0.454
Population (in thousands)	355	726.5	1,621	55.24	19,533
Crime rate(/100,000 inhab.)	352	401.4	176.9	65.33	1,085
Unemployment insurance generosity	363	1.759	0.520	0.624	2.931
<i>Individual-level data, 2008–2011 (used in panel B of Tables 2, 3, and 4, and online Appendix Table A11)</i>					
Current ladder	556,719	6.722	1.950	0	10
Future ladder	544,620	8.032	1.983	0	10
Female	556,719	0.491	0.500	0	1
Age	556,719	39.83	11.91	18	60
Black	556,719	0.126	0.332	0	1
Asian	556,719	0.026	0.158	0	1
White	556,719	0.725	0.447	0	1
Married or living with partner	556,719	0.592	0.492	0	1
Average years of schooling	556,719	14.18	2.346	10	18
Monthly household income	556,719	5,709	5,033	347.1	16,483
log income	556,719	8.234	0.984	5.850	9.710
<i>Quarterly panel data (used in panel C of Tables 2 and 3)</i>					
Job turnover rate	5,704	0.326	0.093	0.141	1.815
Job creation rate	5,704	0.146	0.045	0.053	0.894
Job destruction rate	5,704	0.180	0.053	0.080	0.929

Additional data sources used are: the Local Area Unemployment Statistics from the Bureau of Labor Statistics for the MSA-level unemployment rate; the FBI Crime Statistics for the MSA crime rates; the Bureau of Economic Analysis for population levels; and the Department of Labor for states' unemployment insurance policies.

The descriptive statistics of our main data can be found in Table 1.

## B. Estimation Framework

Our measure of creative destruction varies at the MSA level, thus we estimate MSA-level regressions. However, in order to take advantage of our micro-level data on SWB, we also perform individual-level regressions that allow us to have a richer and more meaningful set of controls. Individual characteristics such as marital status do not vary much if we aggregate them at the MSA level, yet they are important determinants of well-being at the individual level. In all cases, regressions are OLS. We restrict the analysis to working age individuals (18–60 years old) to be closer to the model in which individuals are either employed or unemployed.<sup>15, 16</sup>

<sup>15</sup> However, we performed all the regressions for the whole population as well, which yields very similar results, though with slightly smaller coefficients.

<sup>16</sup> We cannot run separate regressions for the employed and the unemployed as we do not have access to consistent measures of employment and unemployment either in Gallup or in the BRFS.



At the MSA level, we look at purely cross-sectional regressions, where we average our SWB data at the MSA level and across our sample years.<sup>17</sup> In all specifications we control for MSA-level averages of the Gallup respondents' income. Income is measured in terms of household income brackets. We calculate the midpoints of these brackets assuming that income is log-normally distributed and we then average at the MSA level these log midpoints.<sup>18</sup> In our regressions, we also explore what happens when we add MSA-level potential confounders such as crime rate, the share of African Americans, and population.

At the individual level, we perform regressions where we control for individual characteristics such as education, income, and ethnicity, as well as gender, marital status, and age. Our specification is as follows:

$$(15) \quad SWB_{i,m,t} = \alpha \times X_{m,t} + \beta \times Y_{m,t} + \delta \times Z_{i,t} + T_t + \epsilon_{i,t}$$

where  $SWB_{m,t}$  is SWB for individual  $i$  who lives in MSA  $m$  in year  $t$ . This measure is derived through the current ladder question or the future ladder question in the Gallup survey. The variable  $X_{m,t}$  is either the job turnover rate and the unemployment rate in MSA  $m$  in year  $t$  (Prediction 1), or the job creation and the job destruction rates introduced separately (Prediction 2). Values of  $Y_{m,t}$  are MSA-level controls, such as the population level in year  $t$ , the crime rate, and the share of African Americans. Values of  $Z_{i,t}$  are individual-level controls: gender, age, age squared, four race dummies, six education dummies, six family status dummies, and nine dummies for income brackets. Values of  $T_t$  are year and month fixed effects. Finally,  $\epsilon_{m,t}$  is the error term. A constant is also included and standard errors are clustered at the MSA level. When testing Prediction 3, we interact our creative destruction proxies with a measure of the generosity of the state's unemployment insurance. When testing Prediction 4 in the online Appendix, we interact the job creation and the job destruction rates with proxies for the individual discount rate (age, education, and income). Robustness checks are discussed below in Section IIIB.

### C. Testing Prediction 1

In this section, we test Prediction 1: *A higher turnover rate increases well-being more when controlling for aggregate unemployment than when not controlling for aggregate unemployment.*

Recall that the model highlights two opposite forces whereby creative destruction impacts SWB: the negative effect that comes from the higher risk of unemployment through job destruction and the positive growth effect through new job creation. Controlling for the unemployment rate should capture part of the negative force of creative destruction and thus lead to a more positive coefficient of creative destruction on well-being than without the control for unemployment.

<sup>17</sup> Sample years are 2008–2011 for the main analysis using Gallup data, and 2005–2010 when using the BRFSS data in the online Appendix, which we then also decompose into 2005–2007 and 2008–2010.

<sup>18</sup> We also checked that our results are unchanged when using the log of MSA-level income per capita as measured by the Bureau of Economic Analysis and averaged over the relevant period.

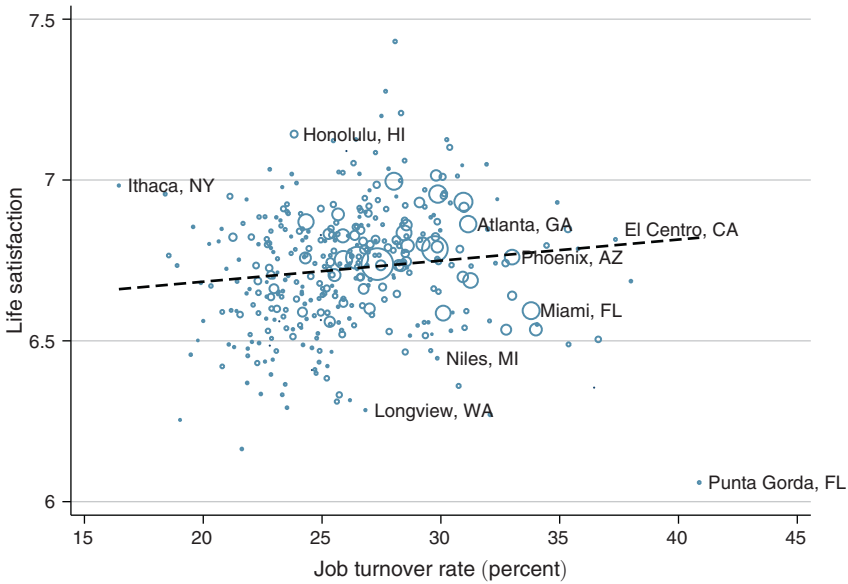


FIGURE 3. SIMPLE SCATTER PLOT



FIGURE 4. RESIDUAL SCATTER PLOT

*MSA-Level Results.*—Before displaying the regression results, we show two scatter plots where one observation corresponds to an MSA. Figure 3 plots the MSA’s average life satisfaction on MSA-level job turnover, where circle sizes are proportional to MSA population levels. We then regress these MSA-level life satisfaction and job turnover variables on the MSA’s unemployment rate and plot the residuals in Figure 4. We see that well-being is more strongly positively associated with job turnover, once we control for the unemployment rate.

Now moving to the regression results, Table 2, panel A, shows the results from baseline OLS regressions at the MSA level. We see that job turnover has a positive but statistically insignificant effect on current well-being. Column 2 shows that once we control for unemployment, job turnover has an effect on well-being that is more than twice as large and strongly statistically significant. This is in line with our model which predicts that, controlling for unemployment, turnover should have a more positive effect on well-being as it implies higher growth and a higher probability for currently unemployed workers of finding a new job.<sup>19</sup> In column 3, we add additional MSA controls: population, crime rate, and share of African Americans.<sup>20</sup> We see that these potential confounders do not significantly affect the coefficients of the creative destruction variable.

The difference between the estimates on creative destruction in column 1 versus 2 and 3 is statistically significant at the 1 percent level. The last row in each panel of Table 2 reports the  $p$ -value associated with a Wald test of the hypothesis that  $\alpha_{CD;column1} = \alpha_{CD;column2}$ .

Column 4 repeats the same specification as column 3 but with future well-being as the dependent variable. We first see that job turnover has a stronger effect on the future ladder than on the current Cantril ladder. This in turn points to the notion that individuals disentangle the short-run losses from becoming unemployed as a result of job turnover from the long-term gains associated with higher growth and more new job opportunities in the future.

The magnitude of the effect of creative destruction on current life satisfaction is in the same ballpark as that of the effect of the unemployment rate. In particular, moving from an MSA which is at the twenty-fifth percentile in terms of its level of creative destruction (i.e., with a job creation rate + destruction rate at 23.5 percent) to an MSA at the seventy-fifth percentile (i.e., with a job creation rate plus job destruction rate at 28.3 percent) is associated with an increase in the current ladder of life of 0.06 points (column 2 in Table 2, panel A). As a benchmark, looking at the same regression, moving from the seventy-fifth to the twenty-fifth percentile in terms of the unemployment rate (that is, from a 9.4 percent to a 6.7 percent unemployment rate) is associated with an increase in life satisfaction of 0.07 points. Another way to put it is that a one standard deviation increase in job turnover increases the current ladder by 0.25 standard deviation: that effect is equivalent to a 0.7 ( $= (0.036 \times 1.288/2.727)/0.025$ ) standard deviation decrease in the MSA-level unemployment rate.

*Individual-Level Results.*—In Table 2, panel B, we perform individual-level regressions and find qualitatively similar results as in panel A. The difference is that we now also control for individual-level characteristics and for year and month fixed effects. We thus control for household income brackets and we keep the control for the MSA-level log of income. Note that the MSA-level income has a negative impact on well-being once we control for individual-level income, which suggests

<sup>19</sup>The correlation between the MSA-level average job turnover rates over the period 2008–2011 and the MSA-level average unemployment rates over the same period, is equal to 0.344.

<sup>20</sup>The share of African Americans is a weighted average of the number of respondents in the surveys that report being black in the race question. Weights used to compute the weighted average are those attached to the respondent by Gallup.

TABLE 2—TEST OF PREDICTION 1

	Current ladder			Future ladder
	(1)	(2)	(3)	(4)
<i>Panel A. MSA-level analysis</i>				
Job turnover rate	0.599 (0.361)	1.288 (0.410)	1.322 (0.424)	1.726 (0.306)
Unemployment rate		-2.727 (0.786)	-2.581 (0.823)	-0.930 (0.507)
log of income	0.342 (0.0839)	0.195 (0.088)	0.225 (0.106)	0.297 (0.079)
Additional MSA controls			x	x
Observations	363	363	344	344
R <sup>2</sup>	0.100	0.198	0.217	0.459
p-value job turnover [1] = job turnover [2]		0.000		
<i>Panel B. Individual-level analysis</i>				
Job turnover rate	0.0676 (0.236)	0.521 (0.237)	0.611 (0.285)	0.984 (0.148)
Unemployment rate		-2.299 (0.443)	-2.168 (0.502)	-0.0857 (0.298)
MSA-level log of income	-0.187 (0.048)	-0.285 (0.046)	-0.263 (0.051)	-0.0424 (0.038)
Additional MSA controls			x	x
Individual controls (incl. income)	x	x	x	x
Year and month fixed effects	x	x	x	x
Observations	556,300	556,300	461,054	450,908
R <sup>2</sup>	0.103	0.104	0.103	0.095
p-value job turnover [1] = job turnover [2]		0.000		
<i>Panel C. Panel analysis</i>				
Job turnover rate	0.678 (0.0970)	0.787 (0.105)	0.249 (0.142)	0.234 (0.140)
Unemployment rate		-2.238 (0.301)	-1.743 (1.054)	-1.074 (1.057)
log of income	0.410 (0.0301)	0.360 (0.0307)	0.412 (0.0373)	0.192 (0.0390)
MSA fixed effects			x	x
Additional MSA controls	x	x	x	x
Year and quarter fixed effects	x	x	x	x
Observations	4,884	4,884	4,884	4,884
R <sup>2</sup>	0.189	0.203	0.325	0.256
p-value job turnover [1] = job turnover [2]		0.041		

*Notes:* The dependent variables are SWB measures from Gallup: columns 1 through 3 use the *current* Cantril ladder of life whereas column 4 uses the *future* ladder of life. Sample years are 2008–2011 and the sample is restricted to working-age respondents. Column 1 regresses SWB on the job turnover rate, which comes in panels A and B, from the BDS, and in panel C, from the LEHD which provide data at the quarterly level. Column 2 adds a control for the MSA-level unemployment rate. Columns 3 and 4 further add some MSA-level controls: population (in levels), crime rates, and share of African Americans. All specifications control for income at the MSA-level. All data sources and variable definitions are in the main text. Panel A carries a cross-sectional analysis at the MSA-level, where the variables are averaged across years within each MSA. The SWB measures are averaged using the weights attached by Gallup to each respondent. Panel B carries a repeated cross-section analysis at the individual-level. Month and Year fixed effects are added to the specification as well as individual controls: age, age squared, a dummy for being female, six dummies for family status, six dummies for education, and four race dummies (black, Asian, white, other, or missing), as well as nine dummies for household income brackets. Regressions are weighted by individual weights attached by Gallup to each respondent. Panel C shows the results of a quarterly panel analysis at the MSA-level. The SWB measures are averaged at the MSA-quarter level using the weights attached by Gallup to each respondent. All regressions include year and quarter fixed effects, quarterly controls for the MSA's average log of income, and the share of African Americans in the MSA, as well as annual controls for population levels and crime rates. Columns 3 and 4 add MSA fixed effects.

that well-being depends on relative income of an individual. The creative destruction variable now varies at the MSA-year level.

We can still reject at the 1 percent level that the coefficient of job turnover on well-being is the same whether or not we control for the unemployment rate. We also see that the effect of turnover is stronger on the future ladder than on the current ladder.

The magnitude of the creative destruction effect is smaller than that displayed at the MSA level. A one standard deviation increase in job turnover has an effect on the current ladder of life which is equivalent to a 0.3 standard deviation increase in the MSA-level unemployment rate ( $= (0.036 \times 0.521/2.299)/0.025$ ).

*Panel Results.*—In panel C, we show results from quarterly panel regressions with year and quarter fixed effects, with and without MSA fixed effects. However, we want to stress why we have a preference for the cross-sectional analysis. The theoretical concept of creative destruction is being proxied in our empirical analysis by a job turnover variable. So we are proxying  $x(t)$  by  $x^*(t)$  which is equal to  $x(t)$  plus some measurement (or proxy) error  $\epsilon(t)$ . Adding MSA fixed effects into the regression changes in an unfavorable way the relative variances of the signal, the variance of  $x(t)$ , and the noise, the variance of  $\epsilon(t)$ . If the job destruction variable changes only slowly over time within each MSA, which is the case here, looking at the deviation of job destruction from its MSA time-mean is going to be problematic, as more of that deviation is going to come from the proxy error, not from the variable itself. Hence our predictions are better captured by cross-sectional regressions than by panel regressions that cover such short time periods.

Because our sample period is very short, we use a quarterly frequency to look at panel specifications. Thus we use the LEHD dataset constructed by the Census Bureau, based on the Quarterly Census of Employment and Wages and other administrative and survey data. Indeed, these data contain information on employment, earnings, and job flows at the MSA and quarterly level. In terms of creative destruction: rather than job creations and destructions, the data give us the number of hires and separations. To compute the turnover rates, we divide these hires or separations by the average stock of employment in that quarter. The results are reported in Table 2, panel C.

If we compare column 1 to column 2, we see again that the coefficient for job turnover is higher when we control for the MSA-level unemployment rate than when we do not. The difference is significant at the 5 percent level. These two columns are without MSA fixed effects. When we add MSA fixed effects (column 3), the coefficient of job turnover is still significantly positive at the ten percent level, although of a smaller magnitude. Note that all the specifications in panel C control for time-varying potential MSA-level controls: population levels, crime rates, share of African Americans.

#### D. Testing Prediction 2

In this section, we test Prediction 2: *A higher job creation rate increases well-being, whereas a higher job destruction rate decreases well-being.*

*MSA-Level Results.*—Table 3, panel A, shows the results from the baseline OLS regressions at the MSA level. The first two columns use current ladder whereas

TABLE 3—TEST OF PREDICTION 2

	Current ladder		Future ladder	
	(1)	(2)	(3)	(4)
<i>Panel A. MSA-level analysis</i>				
Job creation rate	5.486 (0.978)	5.567 (1.015)	3.588 (0.825)	3.103 (0.682)
Job destruction rate	-3.586 (0.838)	-3.433 (0.870)	-0.158 (0.702)	0.144 (0.668)
log of income	0.277 (0.077)	0.293 (0.094)	0.221 (0.061)	0.324 (0.073)
Additional MSA controls		x		x
Observations	363	344	363	344
R <sup>2</sup>	0.218	0.246	0.149	0.460
<i>Panel B. Individual-level analysis</i>				
Job creation rate	1.098 (0.395)	1.274 (0.445)	1.068 (0.206)	0.944 (0.220)
Job destruction rate	-0.791 (0.274)	-0.702 (0.306)	0.926 (0.197)	0.987 (0.225)
MSA log of income	-0.197 (0.046)	-0.173 (0.048)	-0.0408 (0.031)	-0.0382 (0.038)
Additional MSA controls		x		x
Individual controls (incl. income)	x	x	x	x
Year and month fixed effects	x	x	x	x
Observations	556,300	461,054	544,228	450,908
R <sup>2</sup>	0.103	0.103	0.094	0.095
<i>Panel C. Panel analysis</i>				
Job creation rate	2.276 (0.316)	1.213 (0.357)	1.690 (0.293)	1.155 (0.349)
Job destruction rate	-0.617 (0.274)	-0.466 (0.314)	-0.647 (0.249)	-0.460 (0.285)
log of income	0.416 (0.0299)	0.416 (0.0371)	0.266 (0.0304)	0.195 (0.0389)
MSA fixed effects		x		x
Additional MSA controls	x	x	x	x
Year and quarter fixed effects	x	x	x	x
Observations	4,884	4,884	4,884	4,884
R <sup>2</sup>	0.195	0.325	0.145	0.257

*Notes:* The dependent variables are SWB measures from Gallup: columns 1 and 2 use the *current* Cantril ladder of life whereas columns 3 and 4 use the *future* ladder of life. Sample years are 2008–2011 and the sample is restricted to working-age respondents. Columns 1 and 3 regress these life satisfaction measures on the job creation and the job destruction rates, which come, in panel A and B, from the BDS, and in panel C, from the LEHD which provide data at the quarterly level. All specifications control for income at the MSA-level. Columns 2 and 4 add some MSA-level controls: the unemployment rate, population (in levels), crime rates, and share of African Americans. All data sources and variables definitions are in the main text. Panel A carries a cross-sectional analysis at the MSA-level, where the variables are averaged across years within each MSA. The SWB measures are averaged using the weights attached by Gallup to each respondent. Panel B carries a repeated cross-section analysis at the individual-level. Month and Year fixed effects are added to the specification as well as individual controls: age, age squared, a dummy for being female, six dummies for family status, six dummies for education, and four race dummies (black, Asian, white, other, or missing), as well as nine dummies for household income brackets. Regressions are weighted by individual weights attached by Gallup to each respondent. Panel C shows the results of a quarterly panel analysis at the MSA level. The SWB measures are averaged at the MSA-quarter level using the weights attached by Gallup to each respondent. All regressions include year and quarter fixed effects, quarterly controls for the MSA's average log of income, and the share of African Americans in the MSA, as well as annual controls for population levels and crime rates. Columns 2 and 4 add MSA fixed effects.

the last two columns use the future ladder as dependent variables. In the first and third columns, we see the positive effect of job creation and the negative effect of job destruction on current and future well-being which are very much in line with Prediction 2. Columns 2 and 4 introduce additional MSA-level confounders: the MSA's average population level over the period, its average crime rate and its average share of African Americans. These controls do not change the pattern: overall, job creation and destruction have opposite effects on well-being, as the theory predicted.

Now, consider the magnitudes of the various effects. A one standard deviation increase in the job creation rate is associated with an increase in the current ladder of life of slightly more than half a standard deviation ( $= 0.018 \times 5.567/0.192$ ). A one standard deviation increase in the job destruction rate is associated with a decrease in the current ladder of life of 0.4 ( $= 0.021 \times 3.433/0.192$ ) standard deviations.

*Individual-Level Results.*—In Table 3, panel B, we perform individual-level regressions and find qualitatively similar results as in panel A. Again, we control for many demographic characteristics as well as income brackets. All specifications include year and month fixed effects as well as a control for the MSA's log of income. The job creation and destruction rates vary at the MSA-year level. Standard errors are clustered at the MSA level. Again, columns 2 and 4 are similar to columns 1 and 3 except that additional MSA-level potential confounders are added. We see that these additional controls barely change the coefficient on the job creation and destruction rates. Similar to Prediction 1, the magnitudes are smaller than for the MSA-level results.

*Panel Results.*—In panel C, we show results of panel specifications using quarterly data on job creation and destruction rates coming from the LEHD, as in panel C of Table 2. Columns 1 and 3 are without MSA fixed effects, whereas columns 2 and 4 are with MSA fixed effects. All specifications include year and quarter fixed effects as well as MSA-level potential confounders such as share of African Americans, population level, and crime rate. Prediction 2 remains verified in panel analysis, with a positive effect of the job creation rate on SWB and a negative effect of the job destruction rate.

### E. Testing Prediction 3

In this section, we test Prediction 3: *A higher turnover rate increases well-being more, whereas a higher job destruction rate decreases well-being less, the more generous the unemployment benefits.*

The generosity of unemployment insurance (UI) varies at the state level. To avoid the endogeneity of the total number of benefits claimed, we use, as is standard in the literature, the maximum weekly benefit amount as a measure of the state's UI generosity. We normalize it by the average taxable wage. Our results are robust to whether or not we do this normalization. Panel A of Table 4 carries the analysis at the MSA-level whereas panel B shows the results when using individual level regressions, controlling for the same individual characteristics used in panel B of Tables 2 and 3. The coefficients of interest are that of the interaction term between job turnover and UI generosity, as well as that of the interaction term between job



TABLE 4—TEST OF PREDICTION 3

	Current ladder			
	(1)	(2)	(3)	(4)
<i>Panel A. MSA-level analysis</i>				
Job turnover rate	0.524 (0.362)	0.662 (0.378)		
Job turnover × UI generosity	0.989 (0.422)	0.897 (0.416)		
Job destruction rate			−3.661 (0.789)	−3.536 (0.816)
Job destruction × UI generosity			2.357 (1.105)	2.369 (1.113)
UI generosity	−0.288 (0.114)	−0.253 (0.113)	−0.167 (0.128)	−0.137 (0.128)
Additional MSA controls		x		x
Observations	363	344	363	344
R <sup>2</sup>	0.116	0.136	0.237	0.262
<i>Panel B. Individual-level analysis</i>				
Job turnover rate	0.0845 (0.230)	0.209 (0.262)		
Job turnover × UI generosity	0.675 (0.310)	0.670 (0.357)		
Job destruction rate			−0.794 (0.272)	−0.720 (0.300)
Job destruction × UI generosity			0.620 (0.329)	0.673 (0.372)
UI generosity	−0.198 (0.085)	−0.183 (0.096)	−0.212 (0.083)	−0.200 (0.094)
Individual controls (incl. income)	x	x	x	x
Year and month fixed effects	x	x	x	x
Additional MSA controls		x		x
Observations	556,300	461,054	556,300	461,054
R <sup>2</sup>	0.103	0.103	0.104	0.103

*Notes:* Panel A carries a cross-sectional analysis at the MSA-level, where the variables are averaged across years within each MSA, whereas panel B carries a repeated cross-section analysis at the individual-level. The first two columns are similar to the columns 1 and 3 of Table 2, and the last two columns are similar to the first two columns of Table 3, except that the creative destruction variables (job turnover, job creation, and destruction rates) are interacted with state-level UI generosity. UI generosity is measured by the average maximum weekly benefit amount over the period 2008–2011 normalized by the average taxable wage in covered employment. The variable is demeaned. We don't report the interaction coefficient for job creation as the interaction of interest is the job destruction one (see main text).

destruction and UI generosity. Indeed we expect the effect of UI generosity to alleviate the negative effect of the job destruction rate by making the risk of unemployment less costly. On the contrary, there is no clear prediction on how UI generosity should interact with the job creation rate. Thus we do not report the interaction terms and main effect of the job creation rate although these variables are included in all the specifications that feature the job destruction rate (i.e., columns 3 and 4). Note that we demean our measure of the state's UI generosity such that the coefficients for the main effect of the job turnover or the job destruction rate show the effect for MSAs located in a state where the UI generosity is at its mean value.

*MSA-Level Results.*—We see that the effect of the job turnover rate on SWB at the mean value of UI generosity is positive and that the coefficient of the interaction

term between job turnover and the generosity of UI is significantly positive and economically significant (column 1, Table 4, panel A). A one standard deviation increase in UI generosity increases the positive effect of job turnover by almost 100 percent ( $= 0.520 \times 0.989/0.524$ ). This remains true in column 2 when we control for the same potential MSA-level confounders as in Table 2 and 3.

This more positive effect of turnover on SWB in MSA located in states with more generous UI is driven by a much less negative effect of the job destruction rate. Indeed we see in column 3 that the direct effect of job destruction on well-being is negative but the interaction term between the job destruction rate and the generosity of UI is significantly positive. A one standard deviation increase in our measure of UI generosity reduces the negative effect of the job destruction rate by 33 percent ( $= 0.52 \times 2.357/3.661$ ). Thus the effect of UI generosity is not only statistically significant but also economically so.

*Individual-Level Results.*—The individual-level results of panel B shows the exact same pattern as the MSA-level results of panel A. We still have a significantly positive coefficient for the interaction terms of both job turnover and UI generosity (columns 1 and 2) as well as job destruction and UI generosity (columns 3 and 4). Results are barely affected by the addition of potential MSA-level confounders. And the magnitude of the interaction effect is roughly similar to that displayed at the MSA-level: For instance in column 3, a one standard deviation increase in our measure of UI generosity reduces the negative effect of the job destruction rate by 40 percent ( $= 0.52 \times 0.62/0.794$ ).

#### F. Testing Prediction 4

In the online Appendix A2.1, we test Prediction 4: *A higher turnover rate increases future well-being more for more forward-looking individuals.*

It is hard to find a direct measure of the discount rate. The literature on this subject found that old individuals, educated individuals, and rich individuals tend to be more patient (Gilman 1976, Black 1983, Lawrance 1991, Warner and Pleeter 2001). In the online Appendix (Table A11) we use age, education, and income to proxy for individuals with different patience levels. This exercise should be seen as a first step, as our data does not provide a measure of patience which is fully convincing on its own. Further tests of this prediction are left to future work to be conducted with better measures of patience.

### III. Robustness Checks and Extensions

In this section, we discuss various theoretical and empirical robustness checks and extensions.

#### A. Theory

*Transitional Dynamics.*—In online Appendix A1.1, we consider the transitional dynamics. More specifically, we look at the dynamic impact of a sudden increase in the entry rate. In particular we show that: (i) following such an increase in the entry

rate convergence to the steady-state is fast; (ii) the big change in welfare occurs at the time of the increase in entry rate; and (iii) the comparative statics on this change are quite similar to the comparative statics on steady-state welfare stated in Proposition 1. Thus there is no loss of insight in restricting attention to the steady state in our analysis in general.

*Exogenous Job Destruction.*—In the current model, the creative destruction rate  $x$  generates both job destruction for the workers in incumbent firms and job creation for currently unemployed workers. When job destruction is fully endogenous, as it currently is, the former effect dominates and the equilibrium unemployment rate  $u(x)$  increases in  $x$  as in (6). In online Appendix A1.2, we extend the model so as to also allow for exogenous job destruction. There we show that the higher the exogenous rate of job destruction, the more the innovation rate  $x$  will contribute to reducing unemployment (the latter effect dominates), and therefore the more positive the overall effect of  $x$  on equilibrium well-being.

*Risk Aversion.*—Our theoretical analysis can be straightforwardly extended to the case where individuals are risk averse. In online Appendix A1.3 we show that when agents are risk averse, job loss is perceived more detrimentally than when they are risk neutral. Consequently, there is a range of unemployment benefits for which higher turnover reduces life satisfaction for risk-averse individuals with log preferences whereas it would increase life satisfaction for risk-neutral individuals.

*Endogenous Entry.*—In online Appendix A1.4, we extend the model to endogenize entry. This in turn enriches our analysis of the relationship between well-being and the determinants of creative destruction. In particular, a lower entry cost will have the same effects on well-being as the effects of an increase in  $x$ , but an increase in the size of innovations will enhance both the growth effect for given  $x$  and the creative destruction effect (it will foster  $x$ ).

*Matching Efficiency.*—In online Appendix A1.5, we generalize the model by introducing a multiplicative parameter which reflects the efficiency of the matching process. This allows us to look at what happens when the costs of unemployment are incurred over longer expected time periods. We find that as the cost of unemployment has a longer impact (the productivity of matching declines), the negative impact of innovation on well-being through unemployment is amplified.

*Taxing Labor to Finance UI Benefits.*—In online Appendix A1.6, we consider a generalized version of our setting where the unemployment benefit is financed by raising taxes on labor income and corporate profits. We show that our results on unemployment benefit are robust to this generalization.

## B. Empirics

We perform several robustness checks to confirm the validity of our empirical results on the main predictions. More details are provided in the online Appendix.

*BRFSS Data.*—First we look at what happens when we use an alternative measure of SWB. Online Appendix Tables A2 and A3 use the life satisfaction measure from the BRFSS. In BRFSS, life satisfaction is measured using the question: “In general how satisfied are you with your life?” The possible answers are: “Very satisfied,” “Satisfied,” “Dissatisfied,” and “Very dissatisfied.” We recode these answers so that “Very dissatisfied” corresponds to grade 1 and “Very satisfied” to grade 4.

Online Appendix Table A2 tests for Prediction 1 and shows that, even when using the BRFSS measure of SWB, the effect of MSA job turnover on well-being is more positive when we control for the unemployment rate than when we do not. The difference is statistically significant at the 1 percent level. Online Appendix Table A3 tests for Prediction 2 and confirms a significant positive effect of job creation on life satisfaction and a negative effect of job destruction, also with this alternative measure of our left-hand-side variable.

*Effect of the 2008 Crisis.*—In the BRFSS, the life satisfaction measure starts in 2005 instead of 2008 for the Gallup variables. Thus BRFSS allows us to check that our results are robust to restricting attention to different subperiods. In particular, to deal with the concern that the period post 2008 is a period following a major recession, where all kinds of other things were going on in developed economies, in online Appendix Tables A4 and A5 we decompose the overall BRFSS sample period into the subperiods 2005–2007 and 2008–2010. Online Appendix Table A4 tests for Prediction 1 and online Appendix Table A5 tests for Prediction 2.

In online Appendix Table A4 we find that the effect of turnover on life satisfaction is less positive during the crisis years than in the period before, but this difference disappears when controlling for unemployment. In online Appendix Table A5 we find that job creation (resp. job destruction) has a more positive (resp. negative) effect on well-being before the crises years.

*Alternative Definition of Creative Destruction.*—We then look at what happens when we use an alternative measure of creative destruction. In online Appendix Tables A6 and A7 we use the measure that comes from the LEHD, which we also use in our main panel analysis because of its quarterly nature. Online Appendix Table A6 reproduces the baseline MSA cross-sectional specification of Table 2, panel A (testing for Prediction 1) but using this LEHD measure of job turnover, whereas online Appendix Table A7 reproduces the baseline MSA cross-sectional specification of Table 3, panel A (testing for Prediction 2) but using the LEHD measures of job creation and job destruction. We see that both Predictions 1 and 2 are still verified in cross-section when we use these other measures of creative destruction. Indeed the effect of job turnover as measured by the LEHD on the current ladder of life is more positive when we control for the unemployment rate than when we do not and the difference is statistically significant at the 5 percent level. The effect on well-being of the job creation rate as measured by LEHD is significantly positive and that of the destruction rate is significantly negative.

*Nonlinearity of Unemployment.*—In online Appendix Table A8, we show that Prediction 1 is robust to controlling nonlinearly for the unemployment rate. Indeed we introduce a cubic polynomial of the unemployment rate instead of just the

unemployment rate to the baseline specification of panel A of Table 2. We still have that the effect of job turnover in column 2, i.e., when controlling for the unemployment rate, here nonlinearly, is statistically different at the 1 percent level from the effect of job turnover in column 1, when we do not control for unemployment. Since the unemployment rate does not play any role in Prediction 2, we only test the robustness to nonlinear control for the unemployment rate for Prediction 1.

*Bartik Analysis.*—The last and important robustness check we perform, in Tables A9 and A10, aims at alleviating a potential endogeneity concern. Indeed, to abstract from the effects of local changes in industry composition, or from the effects of purely local shocks that could get mixed up with variations in local turnover, we construct a “predicted measure” (or Bartik-type measure) of creative destruction as follows:

$$\widehat{CD}_{m,t} = \sum_j \omega_{j,m,2004} \times CD_{j,m,USA,t}$$

For each MSA  $m$  in quarter-year  $t$ : (i) the predicted level of creative destruction,  $\widehat{CD}_{m,t}$ , is computed by taking a weighted average of countrywide sectoral turnover measures in quarter-year  $t$ ; (ii)  $CD_{j,m,USA,t}$  is the country-wide average creative destruction in sector  $j$  leaving out MSA  $m$ ; and (iii) the weights  $\omega_{j,m,2004}$  are determined by the sectoral structure in the MSA in 2004 (sectors are two-digit NAICS).

Thus, we reproduce the MSA-level quarterly panel regressions of panel C in Tables 2 and 3 but replacing the direct local turnover variable by its predicted value  $\widehat{CD}_{m,t}$ . Standard errors are still clustered at the MSA level.<sup>21</sup> The results turn out to be quite similar when using the predicted measure of turnover instead of the actual quarterly turnover rate as the right-hand side variable. In particular, for Prediction 1, the coefficient for job turnover is larger when we control for unemployment than when we do not and the difference is significant at the 1 percent level. The coefficient remains positive and significant when we add MSA fixed-effects. Interestingly the MSA fixed-effects do not make the coefficient decrease as much as when using the actual turnover rate as the main right-hand-side variable. Online Appendix Table A10 shows that the effect of job creation and job destruction, when captured by these predicted measures, are still significantly positive and negative, respectively.

#### IV. Conclusion

In this paper we have analyzed the relationship between turnover-driven growth and SWB, using cross-sectional MSA level US data. We have first built a Schumpeterian model of growth and unemployment to make predictions on how job and firm turnover affect well-being under various circumstances. Our main empirical findings are consistent with the theory: namely: (i) the effect of creative destruction

<sup>21</sup> If we assume that the sectoral composition in an MSA in 2004 has no direct effect on SWB in that same MSA in 2008–2011, we could use our predicted measure of creative destruction as an instrument to try and get at whether the effect of creative destruction on SWB is causal.

on well-being is unambiguously positive if we control for unemployment, less so if we do not; (ii) job creation has a positive and job destruction has a negative impact on well-being; (iii) job destruction has a less negative impact in MSA within states with more generous unemployment insurance policies; and (iv) job creation has a more positive effect on individuals that are more forward-looking. We see these findings not just as a test of the Schumpeterian theory of growth, creative destruction, and unemployment, but also of the usefulness of current and future well-being measures.

This is the first step of a broader research project on innovation-led growth and well-being. A first avenue forward could be to use a similar combination of the theory and of cross-section analysis to investigate other potential determinants of well-being and compare them with the determinants of (per capita) GDP growth. A second extension would be to look at how the relationship between turnover and well-being is affected by individual characteristics and by characteristics of labor markets and labor market policy (e.g., training systems and availability of vocational education). A third extension would be to look for policy shocks (e.g., labor market reforms) that may affect the relationship between creative destruction and well-being. These and other extensions of the analysis in this paper are left for future research.

## APPENDIX

### A. Proof of Lemma 1

The output in this economy is

$$\ln Y_t = \int_{j \in \mathcal{J}} \ln A_{jt} \, dj \equiv (1 - u) \ln \bar{A}_t.$$

Then after a small time interval  $\Delta t$ :

$$\begin{aligned} \ln Y_{t+\Delta t} &= \int_{\mathcal{J}} [x\Delta t \times 0 + (1 - x\Delta t) \ln A_{jt}] \, dj \\ &\quad + \int_{\mathcal{J}} \left[ \frac{m}{v} \Delta t \ln(1 + \lambda) \bar{A}_t + \left(1 - \frac{m}{v} \Delta t\right) \times 0 \right] \, dj \\ &= (1 - x\Delta t) (1 - u) \ln \bar{A}_t + u \frac{m}{v} \Delta t \ln(1 + \lambda) \bar{A}_t \\ &= [1 - u] \ln \bar{A}_t + m \Delta t \ln(1 + \lambda). \end{aligned}$$

Hence we can find the growth rate as

$$g = \lim_{\Delta t \rightarrow 0} \frac{\ln Y_{t+\Delta t} - \ln Y_t}{\Delta t} = m \ln(1 + \lambda). \quad \blacksquare$$

### B. Derivation of Equation (10)

Note that using the fact that in steady state  $\dot{E} = gE$  and  $\dot{U} = gU$ , and after subtracting the second equation from the first:

$$(r - g)(E - U) = BY + (1 + x)(U - E),$$

where  $B \equiv \beta\pi - b$ .

This yields

$$E - U = \frac{BY}{r - g + 1 + x}.$$

Then, substituting for  $(E - U)$  in the above asset equations (8) and (9), yields

$$U = \left[ bY + \frac{BY}{r - g + 1 + x} \right] \frac{1}{r - g}; \text{ and } E = \left[ \beta\pi Y - \frac{xBY}{r - g + 1 + x} \right] \frac{1}{r - g},$$

so that, after substituting for  $E$  and  $U$  in the expression for  $W$ , and using the fact that in equilibrium  $u = x/(1 + x)$ , we get

$$W = \frac{Y}{r - g} \left[ \beta\pi - \frac{xB}{1 + x} \right].$$

### C. Derivation of Equation (12)

Recall that

$$W = uU + (1 - u)E,$$

where  $E$  and  $U$  are expressed in (8) and (9). Now, using the fact that  $m(u, v)/u = (1 - u)x/u$  and that in steady state  $\dot{E} = gE$  and  $\dot{U} = gU$ , we obtain

$$E - U = \frac{BY}{r - g + x/u}.$$

Substituting for  $(E - U)$  in the asset equations (8) and (9), yields

$$U = \left[ bY + \frac{[(1 - u)x/u]BY}{r - g + x/u} \right] \frac{1}{r - g},$$

and

$$E = \left[ \beta\pi Y - \frac{xBY}{r - g + x/u} \right] \frac{1}{r - g},$$



so that

$$W = \frac{Y}{r - g} [ub + (1 - u)\beta\pi].$$

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