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What is the Impact of Financial Difficulties on Reaching Happiness?

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ABSTRACT

This paper provides a framework to reveal a measure of happiness based on British Household Panel Survey. Thereafter we focus on what is the impact of financial difficulties faced by individuals in the survey on reaching the frontier. By doing so, we also explore the underlying causality threads between happiness and financial difficulties. Our methodology follows a stochastic frontier analysis framework to estimate the happiness frontier, while we employ a flexible panel VAR for the underlying responses to shocks and estimating variance decompositions.

1. Introduction

The economics of happiness does not purport to replace income-based measures of welfare, but instead to complement them with broader measures of well-being. The field has grown substantially since the late 20th century, for example by the development of methods, surveys and indices to measure happiness and related concepts. The utilization of resources in support of improved individual happiness, including an individual’s social, human, hedonic, and financial capital, has become a popular activity, a cridecoeur for a growing international movement amongst organizational leaders, consultants who advise them, and a core governmental concern.

The examination of happiness has gathered momentum since McCrae and Costa (1991) and several studies report plethora of findings (Diener and Seligman, 2002; Hayes and Joseph, 2003; Steel et al., 2008; Weber and Huebner, 2015) 1. Alas, there is little evidence of the nexus between happiness and financial difficulties. This paper provides the missing link between happiness and financial difficulties. Moreover, building on Rayo and Becker (2007) we also estimate a happiness frontier function by introducing a parametric measured based on stochastic frontier analysis.

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1 Some studies show that greater extraversion and lower neuroticism positively affect happiness (Cheng and Furnham, 2003; Diener and Seligman, 2002; McCrae and Costa, 1991). Openness appears to embrace a mixed influence (Hayes and Joseph, 2003). There are also two additional personalities: agreeableness and conscientiousness that could nest the three main ones (McCrae and Costa, 1991).
2. Empirical Methodology and Results

Our data set comprises the British Household Panel Survey for the period 1996-2018. Following Rayo and Becker (2007) theoretical model, we build on the concept of a happiness function that takes the form:

\[ H_{it} = f (X_{it}, Z_{it}) + \nu_{it} + u_{it}, \]

where \( H_{it} \) denotes observed individual’s life satisfaction (i.e. happiness, on a scale from 1 to 7) for individual \( i \) at year \( t \); \( X_{it} \) is a vector of inputs such as annual household income, health, and education; and \( Z_{it} \) is a vector of control variables. \( Z_{it} \) counts for age, number of children, marital status, employment status, gender, region and year dummies, \( \nu_{it} \) corresponds to random fluctuations, while \( u_{it} \) accounts for individual’s happiness frontier that may raise individual’s gain in terms of happiness.

To empirically implement the above model of happiness function, we assume that individuals have an underlying happiness frontier that model (1) would reveal. To do so, we opt for the following translog specification of the happiness function:

\[
\ln H_i = \alpha_0 + \sum_i a_i \ln P_i + \sum_i \beta_i \ln Y_i + \\
\frac{1}{2} \sum_i \sum_j a_{ij} \ln P_i \ln P_j + \\
\frac{1}{2} \sum_i \sum_j \beta_{ij} \ln Y_i \ln Y_j + \\
\sum_i \sum_j \delta_{ij} \ln P_i \ln Y_j + \sum_i \phi_i \ln N_i + \\
\frac{1}{2} \sum_i \sum_j \phi_{ij} \ln N_i \ln N_j + \\
\sum_i \sum_j \xi_{ij} \ln P_i \ln Y_j + \theta_i t + \\
\frac{1}{2} \theta_j t^2 \sum_i \mu_i t \ln P_i + \sum_i \kappa_i t \ln Y_i + \\
\sum_i \nu_i t \ln N_i + kD_i + \sum_i \xi_i Z_i + u_i + \nu_i
\]

(2)

Standard symmetry restrictions in all quadratic terms are imposed in accordance with theory, while we also include dummies to capture any differences across specific groups (clusters) of individuals and time effects.

The translog happiness function is flexible and also non-linear and as such it would serve as a good fit to otherwise unobservable happiness frontier. We estimate the stochastic frontier model (2) via a maximum likelihood procedure parameterized in terms of the variance parameters \( \sigma^2_{\epsilon} = \sigma^2_u + \sigma^2_v \) and \( \lambda = \sigma_u / \sigma_\epsilon \).

The maximum likelihood procedure is an efficient estimation method and it fits the underlying data generating process of our sample. Note that as our sample refers to British Household Survey it includes a plethora of individuals who vary considerably. In the estimation of our stochastic frontier model we employ panel regressions where variability is important to obtain identification of the happiness frontier. Maximum likelihood estimation considers the above and provides accuracy in our estimations.

Figure 1 provides the histogram of the happiness frontier across the whole spectrum of individuals in the survey. At the outset it appears that the distribution of happiness frontier follows a bell shape that could resemble the normal distribution. In some detail, results show that the average happiness frontier for UK individuals over the period 1996-2018 is 0.4383 (see Figure 1 for the histogram and also Table 1 for the descriptive statistics). What does this imply? With given resources, an average individual is achieving 43.83% efficiency in transforming these resources to reach the optimal happiness frontier. These findings highlight that there could be significant margins for improving happiness frontier with the existing resources by just employing these resources more efficiently.

Figure 1. Histogram of Happiness Frontier

Notes: This Histogram illustrates average time-varying happiness frontier obtained from the Stochastic Frontier Analysis.

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2 Binder and Broekel (2011) opt for a non-parametric production function with similar inputs to estimate happiness efficiency.

3 Using the order-m nonparametric approach, Binder and Broekel (2011) find that 49.88% of UK individuals in the sample (in 2005) can be considered efficient.
Table 1. Detailed descriptive statistics of the happiness frontier

<table>
<thead>
<tr>
<th>Happiness Frontier</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>166,381</td>
<td>0.431736</td>
<td>0.2244773</td>
<td>0.0062445</td>
<td>0.943563</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Smallest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>0.0370763</td>
</tr>
<tr>
<td>5%</td>
<td>0.0888921</td>
</tr>
<tr>
<td>10%</td>
<td>0.1531326</td>
</tr>
<tr>
<td>25%</td>
<td>0.2479982</td>
</tr>
<tr>
<td>50%</td>
<td>0.4180616</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Largest</th>
</tr>
</thead>
<tbody>
<tr>
<td>75%</td>
<td>0.6085216</td>
</tr>
<tr>
<td>90%</td>
<td>0.749859</td>
</tr>
<tr>
<td>95%</td>
<td>0.8148197</td>
</tr>
<tr>
<td>99%</td>
<td>0.8835488</td>
</tr>
</tbody>
</table>

| Obs     | 166,381 |
| Sum of Wgt. | 166,381 |
| Mean     | 0.431736 |
| Std. Dev. | 0.2244773 |

Notes: This Table reports the descriptive statistics in much detail of the happiness frontier as depicted by the histogram in Figure 1.

Table 2. Parameter estimates of the happiness function

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>0.00087***</td>
<td>0.0001</td>
</tr>
<tr>
<td>Excellent health</td>
<td>0.22445***</td>
<td>0.0070</td>
</tr>
<tr>
<td>Fairly/Very poor health</td>
<td>-0.38484***</td>
<td>0.0073</td>
</tr>
<tr>
<td>High education</td>
<td>-0.15230***</td>
<td>0.0119</td>
</tr>
<tr>
<td>Medium education</td>
<td>-0.13151***</td>
<td>0.0114</td>
</tr>
<tr>
<td>Age</td>
<td>-0.02332***</td>
<td>0.0016</td>
</tr>
<tr>
<td>Age-squared</td>
<td>0.00031***</td>
<td>0.0000</td>
</tr>
<tr>
<td>Number of children</td>
<td>-0.04149***</td>
<td>0.0045</td>
</tr>
<tr>
<td>Marital status-separated</td>
<td>-0.34646***</td>
<td>0.0218</td>
</tr>
<tr>
<td>Marital status-divorced</td>
<td>-0.19301***</td>
<td>0.0147</td>
</tr>
<tr>
<td>Marital status-widowed</td>
<td>-0.23643***</td>
<td>0.0183</td>
</tr>
<tr>
<td>Marital status-never married</td>
<td>-0.12973***</td>
<td>0.0128</td>
</tr>
</tbody>
</table>

Notes: This Table reports main parameters (due to space limitation) of the happiness function (1), estimated using the Stochastic Frontier Analysis. Output: happiness; Inputs: health (excellent, good, fairly/very poor), income, education (high, medium, other). Control variables: age, age-squared, number of child, personality, financial shock, financial shock-personality interactions, and dummys of marital status, employment status, gender, region, and time. *, **, ***: significant at 10%, 5%, 1% level, respectively.

Having derived the happiness frontier, next we examine what are the underlying factors that could shape the frontier. Unequivocally, financial conditions that individuals

Table 1 reports parameters descriptive statistics for happiness frontier. It is worth noting that we cover a long sample with over 166,000 observations and we estimate the frontier of happiness to vary for the different percentiles quite considerable, from 0.03 in 1% to 0.88 in 99% (being at 0.42 in 50%). These results do not come as a surprise, since significant variability is expected given that the underlying data generating process refers to individuals that would differ considerably. The challenge is then to proceed with an inference of what explain the happiness frontier.

Table 2 reports estimated results from equation (1) for key Xit and Zit variables. Most of the coefficients are statistically significant. Among the inputs, income and excellent health condition show a positive effect on happiness, in line with Clark et al. (2009). On the other hand, medium and high educational statuses appear to lessen happiness, which could be explained by the anxiety related at times to education. In addition, individuals tend to be less happy when getting older, having more children, being unemployed, and not in a married relationship.

Personality types appear to statistically significantly affect happiness frontier, as extraversion and openness are positively related to happiness, in line with McCrae and Costa (1991). The opposite result is reported for the impact of neuroticism on frontier similarly to Diener and Seligman (2002). Neuroticism, in particular, appears to dominate other types of personality in its interaction with FS, which is reported to significantly reduce happiness frontier.
in the Survey face could play a role in their quest to reach the happiness frontier. Alas, we remain agnostic about the possible impact of a shock in financial conditions on individual’s happiness.

We explore next the nexus between happiness frontier and individual’s financial conditions as measured by the Survey data set. Moreover, the survey records individuals who state that they face either quite difficult or very difficult financial conditions. From the survey also, we employ the financial indebtedness of the individuals.

Next, we explore, as a first step, the impact of a shock in individual’s indebtedness on happiness frontier. To this end, we follow a 2x2 panel VAR model. The value of the Panel-VAR analysis lies primarily on the error terms that are used to calculate impulse responses rather than on individual parameter estimates of the system of equations (Love and Zicchino, 2006). We solve the model and obtain the moving average (MA) representations. This is done by recursive elimination of lagged independent co-variates.

The MA representation shows how the endogenous variables depend on the lagged residuals from the reduced form. The MA representation equates Happiness frontier Hit and both life and individual’s indebtedness Dit on present and past residuals ε1 and ε2 from the Panel-VAR estimation:

\[
H_{it} = a_{10} + \sum_{j=1}^{\infty} b_{11} e_{1it-j} + \sum_{j=1}^{\infty} b_{12} e_{2it-j}
\]

\[
D_{it} = a_{20} + \sum_{j=1}^{\infty} b_{21} e_{1it-j} + \sum_{j=1}^{\infty} b_{22} e_{2it-j}
\]

(3)

Under the endogeneity assumption the residuals will be correlated and therefore the coefficients of the MA representation are not interpretable. As a result, the residuals must be orthogonal. We orthogonalize the residuals by multiplying the MA representation with the Cholesky decomposition of the covariance matrix of the residuals. The orthogonalized, or structural, MA representation is:

\[
H_{it} = a_{10} + \sum_{j=1}^{\infty} 1_{1j} \varepsilon_{1it-j} + \sum_{j=1}^{\infty} 2_{1j} \varepsilon_{2it-j}
\]

\[
D_{it} = a_{20} + \sum_{j=1}^{\infty} 1_{2j} \varepsilon_{1it-j} + \sum_{j=1}^{\infty} 2_{2j} \varepsilon_{2it-j}
\]

(4)

where P is the Cholesky decomposition of the covariance matrix of the residuals:

\[
\begin{pmatrix}
\text{Cov}(\varepsilon_{1it}, \varepsilon_{1it}) & \text{Cov}(\varepsilon_{1it}, \varepsilon_{2it}) \\
\text{Cov}(\varepsilon_{1it}, \varepsilon_{2it}) & \text{Cov}(\varepsilon_{2it}, \varepsilon_{2it})
\end{pmatrix} = PP^{-1}
\]

(5)

The orthogonal residuals can be interpreted as shocks: ε1it is a shock in the happiness frontier and ε2it is a shock in the individual’s indebtedness.

The coefficients in the equations (4) give the current response of the left-hand side variable to shocks occurring j periods ago. The advantage of this reduced form Panel-VAR specification is that we can assess the dynamic interdependencies between happiness frontier and individual’s indebtedness with the minimum of restrictions imposed.

Table 3 reports the forecast error variation of the 2x2 panel VAR. It reports 5 and 10 period ahead variance decompositions, where 13.8% and 16.1% respectively of the forecast error variance of the happiness frontier is explained by individual’s indebtedness.

### Table 3. Variance Decompositions of Happiness Frontier to Financial Shock

<table>
<thead>
<tr>
<th>Period</th>
<th>Variables</th>
<th>Frontier</th>
<th>Indebtedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Frontier</td>
<td>0.8619565</td>
<td>0.1380435</td>
</tr>
<tr>
<td>5</td>
<td>Indebtedness</td>
<td>0.1621471</td>
<td>0.8378529</td>
</tr>
<tr>
<td>10</td>
<td>Frontier</td>
<td>0.838778</td>
<td>0.1612221</td>
</tr>
<tr>
<td>10</td>
<td>Indebtedness</td>
<td>0.161222</td>
<td>0.838778</td>
</tr>
</tbody>
</table>

Notes: This Table reports the variance decompositions of the panel VAR model for 5 and 10 periods ahead for a system of two variables: happiness frontier HE, financial shock FS.

Further to the forecast variance decompositions we provide, next, the Impulse Response Function (IRFs thereafter). Figure 2 reports the corresponding Impulse Response Functions. Results demonstrate the negative response of happiness frontier (HE) to a one standard deviation shock on the individual’s indebtedness (indebt) (see Figure 2, first row, second column). Something that it is also worth noting is that a shock in individual’s indebtedness would results to an increase in individual’s indebtedness (see Figure 2, first row, first column) with a very high significant level. In other words, individuals who face indebtedness could face a vicious spiral whereby further shocks would cause them to further indebtedness.
that there is a negative response of HE to a one standard deviation shock on quite difficult financial conditions (DIF1) and very difficult financial conditions (DIF2) (see last row of Figure 3). These results are of importance as they demonstrate that together with individual’s indebtedness the manner individuals perceive their financial constraints also affect negatively reaching for the happiness frontier.

These results shed new light into the individual’s adaptation to external shocks (Di Tella et al., 2010), whereby certain types of individuals who consider that they face quite difficult and very difficult financial conditions would diverge from reaching the happiness frontier.

It is also worth noting that that there is a positive response of DIF2 to a one standard deviation shock on DIF1 (see first row of Figure 3), at least in the short run. These results insinuate that individuals who perceive that they face very difficult financial conditions would also respond with a positive sign to a shock in perception that they are facing quite difficult financial conditions.

The above would imply that there might be a feedback loop between the various shocks and responses.

### 3. Conclusion

The paper provides for the first-time parametric happiness frontier, which highlights that gains could be observed without resorting to further resources. In addition, we show that financial conditions, and in particular the way individuals perceive their financial conditions, would affect their trajectory towards reaching the happiness frontier.
We show that an average individual as recorded in the British Household survey would underachieve its full happiness potential, as she/he reaches 43.83% of happiness frontier. To this end, there is some 56% of further improvement in transforming these resources to reach the optimal happiness frontier. Our study goes further to explore whether financial conditions would deter individuals from reaching their happiness frontier.

Our results are of interest as they show that individual’s response to a one standard deviation shock on the individual’s indebtedness is negative. Similar results are reported for the case that individuals perceive that they face quite difficult financial conditions and very difficult financial conditions.

These results could be of interest for policy makers and individuals alike. Policy makers should take every effort to ensure that certain monitoring of individual’s indebtedness is in place so as to consider measures to alleviate financial constraints faced by individuals. Alas, it is well known that British households face with high levels of indebtedness and thereby households should consider acting against further debts within their household budgets constraints. The present study has not considered such households budget constraints. Future research should look much more in detail in similar issues.

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References