Happiness and Innovation around the World*

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ABSTRACT

Using data from World Happiness Report, we document that happiness positively affects innovation. The effect is more pronounced for firms with high R&D intensity, high R&D growth, and high innovation propensity. We also find that happiness has a stronger impact in countries with national culture of high trust, long-term orientation, and muscularity. Our results are robust to including a range of controls and to using an instrumental variable approach and quasi-natural experiment. Further, we find that happiness promotes innovation through which channels of collaboration, productivity, and risk-tolerance. Overall, our results suggest that happiness fosters innovation around the world.

Keywords: Happiness, Innovation, World Happiness Report, Life ladder, PATSTAT, Patents, Sustainable development, Risk-tolerance
JEL: G02, G31, I31, D60

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ABSTRACT

Using data from World Happiness Report, we document that happiness positively affects innovation. The effect is more pronounced for firms with high R&D intensity, high R&D growth, and high innovation propensity. We also find that happiness has a stronger impact in countries with national culture of high trust, long-term orientation, and muscularity. Our results are robust to including a range of controls and to using an instrumental variable approach and quasi-natural experiment. Further, we find that happiness promotes innovation through which channels of collaboration, productivity, and risk-tolerance. Overall, our results suggest that happiness fosters innovation around the world.

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"How Googles' strategy for happy employees boosts its bottom line? … companies like Google have invested more in employee support and employee satisfaction … for Google, it rose by 37%; … Under scientifically controlled conditions, making workers happier really pays off … higher employee happiness levels associated with a 12% rise in productivity."

~ Forbes (September 17th, 2018) [1]

1. Introduction

Innovation is crucial for sustainable growth and economic development (e.g., Kogan, Papanikoaou, Seru, and Stoffman, 2017; Chang, McLean, Zhang, and Zhang, 2018). Previous literature finds that several country-specific factors such as creditor rights, legal laws, financial development, stock market liberalization, and social capital can influence innovation (e.g., Acharya and Subramanian, 2009; Acharya, Baghai, and Subramanian, 2014, Hsu, Tian, and Xu, 2014; Moshirian, Tian, Zhang, and Zhang, 2021; Xie, Zhang, and Zhang, 2021).[2] However, relatively little is known how country-level *affective states* (i.e. happiness) shape innovation.[3] In this paper, we fill the gap by investigating the impact of happiness on innovation.

Happiness is defined as how people experience and evaluate their lives as a whole (De Neve and Ward, 2017). Previous research documents that when people are happier, they are more resilient to failure, more productive at work, and nicer to be around (e.g., Ifcher and Zarghamee,

[1] The link for original article is here: https://www.forbes.com/sites/pavelkrapivin/2018/09/17/how-googles-strategy-for-happy-employees-boosts-its-bottom-line/?sh=7aaa753222fc

[2] Other studies that explore the determinant of innovation include Lerner, Sorensen, and Stromberg (2011), Aghion, van Reenen, and Zingales (2013), Brown, Martinsson, and Peterson (2013), Chemmanur, Loutskina, and Tian (2014), Fang, Tian, and Tice (2014), Chang, Fu, Low, and Zhang (2015), Cornaggia, Mao, Tian, and Wolfe (2015), Balsmeier, Fleming, Manso (2017), Bradley, Kim, and Tian (2017), Levine, Lin, and Wei (2017), Bhattacharya, Hsu, Tian, and Xu (2017), and Brav, Jiang, Ma, and Tian (2018).

[3] Recent studies shows that *affective states* are an important driver of human behaviors, which eventually impacts economic outcomes (e.g., Loewenstein, 2000; Capra, 2004; Kirchsteiger, Rigotti, and Rustichini, 2006; Dahl and DellaVigna, 2009; Card and Dahl, 2011; Ifcher and Zarghamee, 2011).

2011; Osward, Proto, and Sgroi, 2015; Bellet, De Neve, and Ward, 2020). For example, Oswald, Proto, and Sgroi (2015) show that happiness has positive effects on labor productivity. Bellet, De Neve, and Ward (2020) document that happiness increases performances of firms. In finance literature, Kaplanski, Levy, Veld, and Veld-Merkoulova (2015) show that happy people are more optimistic and expect higher returns. Similarly, Edmans (2011) shows that firms included in the "100 Best Companies to Work for" tend to have higher future abnormal stock returns.

Motivated by these studies, we examine the relationship between happiness and innovation. We conjecture that happiness promotes innovation by enhancing collaboration, productivity, and risk-tolerance. Intuitively, people in *positive affective states* (i.e., happier states) can become more optimistic and creative. Previous studies provide evidence for this notion. For instance, Isen, Daubman, and Nowicki (1987) show that a positive expectation enhances creativity. Rowe, Hirsh, and Anderson (2007) show that positive affective states increase the scope of attention. Ifcher and Zarghamee (2011) show that positive mood makes people more willing to think about the future. A recent survey by Harvard Business Review (HBR) Analytical Services (2020) support this view.[4] According to the HBR survey, 87% of executives believe that happiness can give a competitive advantage to their company. On the other hand, 79% of executives believes unhappiness in their workplace hurt productivity. Happiness can also play out at the country levels interacting with better public goods and higher trust. For example, Xie, Zhang, and Zhang (2021) show that county-level trust facilitates innovation by acting as an informal contracting mechanism.

[4] The original report can be found here: "Cultivating workforce well-being to drive business value." by HBR Analytical Services (2020). (https://hbr.org/sponsored/2020/07/cultivating-workforce-well-being-to-drive-business-value)

Chuluun and Graham (2016) shows local happiness induces firm-level investment and research and development (R&D).

We measure happiness as the Cantril life ladder index (also known as life ladder or Cantril ladder). The data is from the World Happiness Report by the United Nations Sustainable Development Solutions Network.[5] In this report, happiness is a country-level aggregate view of *affective states* on life. The World Happiness Report includes survey results from respondents more than 150 countries.[6] The country level of happiness (life ladder) varies greatly across countries. The life-ladder changes every year and ranges from 3.559 to 8.019 in average by country.[7]

We start our analysis by examining the relationship between happiness and innovation. Our baseline results show a positive relation between happiness and innovation over the period 2005-2016. In terms of economic significance, a one standard deviation increase in the happiness leads to about 13.57% increase of innovation. We find that our results remain unchanged after excluding U.S. sample. We also examine a different set of fixed effects to account for time-varying characteristics across firms, industries, and countries. We find that the results are consistent with the baseline findings.

[5] Many previous studies use survey results for their research such as World Value Survey (WVS) and World Happiness Report. (e.g., Guiso, Sapienza, and Zingales, 2008; Ahern, Daminelli, and Fracassi, 2015; Benabou, Ticchi, and Vindigni, 2015; De Neve and Ward, 2017; Bellet, De Neve, and Ward, 2020; Xie, Zhang, and Zhang, 2021)

[6] The question to respondents is "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?"

[7] According to the World Happiness Report 2021, the level of happiness significantly decreases in 2020 during Covid 19 pandemic.

Next, we examine the heterogeneous effect of happiness on innovation in response to R&D characteristics. Following previous literature (e.g., Acharya and Subramanian, 2009), we conjecture that the effect of happiness is greater for firms in R&D intensive industries. We find that the positive effect of happiness on innovation is more pronounced for firms with high R&D intensity, high R&D growth, and high innovation propensity. We further investigate the heterogeneous effect of happiness in national culture (Chui, Lloyd, Kwok, 2002; Xie, Zhang, and Zhang 2021). We examine three dimensions of national culture developed by Hofstede. We find that happiness has a stronger effect in countries with national culture of muscularity, long-term orientation, and trust.

Next, we identify the causal effect of happiness on innovation. The issue of identification is important in our study since the relationship between happiness and innovation can be bidirectional. We employ three approaches to address this issue. First, we implement instrumental variable analyses. In the instrumental variable approach, we use Olympic medals, natural disasters, and democratic quality as instruments. We find that the coefficients of instrumented happiness are consistent with our baseline results. Second, we implement a quasi-natural experiment. We consider the global financial crisis as a negative and exogenous adverse shock to the level of happiness. We find that the impact of the global financial crisis is negative to innovation while the positive effect of happiness on innovation holds. Third, to alleviate the issue of omitted variables, we augment our regression models by controlling for a wide array of country-level variables. We consider three categories of country characteristics: financial development, polarization, market

openness.[8] We find that the positive relationship between happiness and innovation remain unchanged after controlling for unobservable confounding country characteristics. Overall, our findings remain intact through all identification tests.

Further, we investigate the potential channels through which happiness facilitates innovation. We examine three channels including collaboration, productivity, and risk-tolerance. Previous studies suggest that innovations can rely on collaboration among innovators, and informal social capital can encourage collaboration by allowing innovators to share resources and expertise with each other (Dovey, 2009; Lerner, 2009; Xie, Zhang, and Zhang, 2021). We find that the effect of happiness is more pronounced in countries with higher collaboration proxied by social support, more freedom to make choices, and less corruption. Prior research also indicates that productivity can be a channel of the positive effect on innovation (e.g., Oswald, Proto, and Sgroi, 2015; Bellet, De Neve, and Ward, 2020). We find that happiness increases the number of patents per employee. The results imply that happiness fosters the incentives to engage in innovation activities. Previous literature suggest that happiness promotes innovation through which the channel of risk-tolerance (e.g., Acharya and Subramannian, 2009; Manso, 2011, Acharya, Baghai, and Subramanian, 2014). We find that the effect of happiness is greater with risk-tolerance, proxied by investor protection and legal enforcement.

The contribution of this paper is threefold. First, this paper adds to the literature in happiness, broadly literature in subjective well-being. Previous research documents that happier

[8] We use eight additional variables including credit to GDP, market capitalization to GDP, interest rate, income inequality, business ownership, government responsibility, capital account openness and trade openness.

people show high labor productivity and high scope of attention and creativity. (e.g., Rowe, Hirsh, and Anderson, 2007; Ifcher and Zarghamee, 2011; Osward, Proto, and Sgroi, 2015; Bellet, De Neve, and Ward, 2020). Empirical literature shows that happier people are more optimistic, and firms tend to have higher abnormal returns and increase firm investment (Edmans, 2011; Chuluun and Graham, 2016; Kaplanski, Levy, Veld, and Veld-Merkoulova, 2015). We add to this literature by providing evidence that happine ss indeed promotes innovation.

Second, this paper contributes to the literature on finance and innovation in a cross-country setting. Previous studies explore how country-specific characteristics such as bankruptcy regimes, legal laws, policy uncertainty, financial development, religiosity, and social capital affect innovation output (e.g., Acharya and Subramanian, 2009; Brown, Martinsson, and Petersen, 2013; Hsu, Tian, and Xu, 2014; Bénabou, Ticchi, and Vindigni, 2015; Luong, Moshirian, Nguyen, Tian, and Zhang, 2017; Bhattacharya, Hsu, Tian, and Xu, 2017; Xie, Zhang, and Zhang, 2021). Closely related to our study, Xie, Zhang, and Zhang (2021) show that trust promote innovation by encouraging collaboration and enhancing failure tolerance. We add this line of research by showing that happiness exhibits a positive effect on innovation through which channel of collaboration, productivity, and risk-tolerance.

Third, in a broader perspective, this study contributes to the literature on economic growth. Early studies discuss that innovation plays a key role in economic growth (Schumpeter 1934; Solow, 1957; Romer, 1990). Recent studies shows that technological innovation is essential for economic development and productivity growth (e.g., Kogan, Papanikoaou, Seru, and Stoffman, 2017; Chang, McLean, Zhang, and Zhang, 2018; Moshirian, Tian, Zhang, and Zhang, 2021). This

paper adds to this literature by providing suggestive evidence that country-level happiness could fosters economic growth.

The remainder of this paper is organized as follows. We discuss the relevant literatures in Section 2. Section 3 presents the data and the sample. We present our empirical analyses and findings in Section 4. We analyze the issues of identification in Section 5. We investigate the potential economic channels in Section 6. We summarize our findings and conclude the paper in Section 7.

2. Previous Literature and Empirical Implications

Happiness is a state of emotional well-being of a person to the good life.[9] In psychological literature, many studies show that happiness affects human behavioral decisions (e.g., Iaffaldano and Muchinsky, 1985; Kenny, 1999; Frey and Stutzer, 2002; Kahneman and Krueger, 2006; Clark, Frijters, and Shields, 2008; Krause, 2013). These studies indicates that the behavior of happy people differs in general from that of less happy people. Similar to this notion, recent studies in economics documents that *affective states* are an important driver of human behaviors, which eventually impacts economic outcomes (e.g., Loewenstein, 2000; Capra, 2004; Kirchsteiger,

[9] While happiness is the commonly used colloquial term, scholars of subjective well-being are careful to distinguish its distinct components. "Happiness" as measured by survey questions about life satisfaction and the best life possible is an evaluative dimension of subjective well-being which assesses peoples' views of their lives as a whole. This dimension correlates with people's agency, capacity, choice, and meaning and purpose in life. It is also typically more closely correlated with income than other well-being dimensions, as people with more income have more choice over the kinds of lives that they choose to lead, and thus the ability to plan for and invest in those futures.

Rigotti, and Rustichini, 2006; Dahl and DellaVigna, 2009; Card and Dahl, 2011; Ifcher and Zarghamee, 2011; Chuluun and Graham, 2016).

More closely related to happiness or well-being, previous research documents that when people feel happier, they are more resilient to failure, more productive at work, and nicer to be around (e.g., Isen, Daubman, and Nowicki, 1987; Ifcher and Zarghamee, 2011; Osward, Proto, and Sgroi, 2015; Bellet, De Neve, and Ward, 2020). For example, a pioneering paper, Oswald, Proto, and Sgroi (2015), show a robust causal effect of happiness on labor productivity in laboratory settings. In a similar vein, Bellet, De Neve, and Ward (2020) provide evidence from a natural experiment that happiness increases performances of firms. In empirical studies in finance, Kaplanski, Levy, Veld, and Veld-Merkoulova (2015) show that happy people are more optimistic and expect higher stock returns. Edmans (2011) shows that firms included in the "100 Best Companies to Work for" list tend to have higher future abnormal stock returns.

Intuitively, people in *positive affective states* (i.e., happier states) become more optimistic and creative. Previous literature supports this notion. Isen, Daubman, and Nowicki (1987) show that a positive expectation enhances creativity. Fredrickson (2001) show that positive emotions can be an important factor of human flourishing. Rowe, Hirsh, and Anderson (2007) provide evidence that positive affective states increase the scope of attention. Ifcher and Zarghamee (2011) show that positive mood reduces time preference over money and makes people more willing to think about the future. Happiness can also play out at the country-level interacting with better public goods, religion, trust, and good democracies. For example, Bénabou, Ticchi, Vindigni (2015) show that greater religiosity is associated to less favorable views of innovation cross countries.

Xie, Zhang, and Zhang (2021) show that trust facilitates innovation by acting as an informal contracting mechanism.

Prompted by previous studies and discussions, we conjecture that happiness can increase the likelihood and efficiency of innovation through several channels. First, we consider that collaboration can be a channel through which happiness impacts innovation. Previous studies suggest that informal social capital can encourage collaboration by allowing innovators to share resources and expertise with each other (Lerner, 2009). According to Dovey (2009), Khanna and Mathews (2016), and Xie, Zhang, and Zhang (2021), innovations can rely on collaboration among innovators and successful collaboration hinges on trust among people.

Second, we expect that happiness can positively affect innovation by improving productivity. Previous research shows that happiness not only relates to individual productivity (Oswald, Proto, and Sgroi 2015), but also increases the scope attention (Rowe, Hirsh, and Anderson 2007). Ifcher and Zarghamee (2011) show that positive mood makes people more willing to think about the future. Bellet, De Neve, and Ward (2020) provide evidence from a natural experiment that happiness increases performances of firms. In a similar vein, the theoretical paper of Bénabou and Tirole (2003) also suggests that the driving channel between optimism and productivity is intrinsic motivation. Based on the discussion, we conjecture that productivity can be a channel that happiness affects innovation.

Third, we expect that risk-tolerance can be a channel through which happiness can affect innovation. Innovation involves a high probability of failure depending on various unpredictable conditions. Manso (2011) shows that the optimal incentive for facilitating innovation should

exhibit substantial tolerance for failure and long-term rewards. Acharya and Subramannian (2009) also mention that "when bankruptcy code is creditor friendly, excessive liquidations cause levered firms to shun innovation, whereas by promoting continuation upon failure, a debtor-friendly code induces greater innovation." Acharya, Baghai, and Subramanian (2014) emphasize the similar point. They show debtor-friendly bankruptcy regimes and strong legal protection for employees alleviate concerns about the adverse impact of innovation failure and encourage their risk-taking and innovation efforts. In all, we expect that happiness fosters innovation through which the channel of risk-tolerance.

3. Data and Sample

3.1 Measuring happiness

We measure happiness as the Cantril life ladder index (also known as life ladder or Cantril ladder). The data is from the World Happiness Report by the United Nations Sustainable Development Solutions Network. In the report, happiness is a country-level aggregate view of affective states on peoples' life. The World Happiness Report includes survey results from respondents more than 150 countries. The number of respondents each country is roughly 3000. In the World Happiness Report, the respondents evaluate their current lives on a ladder where score of zero represents the worst possible life and ten the best possible. The question to respondents is "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?" The World Happiness Report also include other variables such as social support, freedom to make life choices, generosity, and perception of corruption. All variables from the World Happiness Report are reported annually.

*** Figure 1 Here ***

Figure 1 provides a visualization of happiness (life ladder) using the data in 2010. In Figure 1, darker shades imply higher level of happiness and brighter shades imply that the country is less happy. Figure 1 shows that the life-ladder ranges from 3.55 to 7.77 across countries in 2010. The life-ladder is relatively higher in Canada, Australia, and Northern Europe while life-ladder is lower in China, South Asia, Eastern Europe, and Africa, indicating that there is a large variation in happiness index across countries.

*** Figure 2 Here ***

Figure 2 presents the time trend of life-ladder and GDP growth for selected countries. Figure 2 implies that life-ladder and GDP growth are not perfectly correlated. In some countries, GDP growth varies in the opposite direction to the change in life ladder. Figure 2 suggests that our measure of happiness, life-ladder, captures something other than GDP growth, alleviating the possible concern that life-ladder could be another proxy for the development level of a country or financial development.

3.2 Innovation measures

We measure innovation output using two proxies: quantity of patents ($PAT_{i,t}$) and quality of patents ($CIT_{i,T}$). Previous international studies use patents as the innovation output measures

(e.g., Acharya and Subramanian, 2009; Hsu, Tian, and Xu, 2014; Acharya, Bahai, and Subramanian, 2014; Xie, Zhang, and Zhang, 2021). We retrieve the patents data from World Patent Statistical Database (henceforth PATSTAT) maintained by European Patent Office (EPO). This database contains rich information on global patents, which allows us to track firm-level innovation activities.

We measure $PAT_{i,t}$ as the total number of patents filed by firm i in year t. We use the number of patent applications as the measurement of firms' innovation quantity. PATSTAT classifies all applications in patent families, where each one of the applications is attributed to a family identifier. Thus, each unique family identifier can correspond to several patent applications. In our estimation, applications are identified with unique family identification so that the same patent filed in multiple countries or in subsequent years will not be recurrently counted. In our sample, each patent count represents a unique innovation

We measure $CIT_{i,T}$ as the total number of forward citations received by patent applications i published in year P_i within T years from its publication date. We consider the quality of patents since more important patents are expected to be cited more frequently by other patents. The citation of patents can better capture the firm innovation activities (Aghion, Van Reenen, and Zingales, 2013; Kogan, Papanikoaou, Seru, and Stoffman, 2017; Xie, Zhang, and Zhang, 2021).

3.3 Descriptive statistics

Our firm level data comes from Thomson Reuters Worldscope database for the period that matches with the World Happiness Report and PATSTAT. Worldscope provides wide coverage

of international firm-level data. Our final sample relies on the joint availability of innovation measures, financial variables, and the happiness index. Our final sample consists of 80 countries from 2005 to 2016.[10]

Table 1 presents the descriptive statistics. Panel A reports the sample composition by country and Panel B reports the sample composition by year. In Panel A, we report the total number of firm-year observations, number of firms, happiness (life ladder), and standard deviation of happiness. In our sample, we have 80 countries including various firm-year observations. The number of firm-years differs since not all firms by country are observed throughout our sample period. The total number of firms is 15,899 and the total number of firm-year observation is 122,198. The average of happiness (life ladder) is 6.278 and the standard deviation of happiness is 1.9. The life-ladder ranges from 3.559 to 8.019 across countries. Denmark has the highest average level of happiness Denmark (7.722) and Bulgaria has the lowest average level of happiness (4.182).

*** Table 1 Here ***

Table 2 reports the descriptive statistics and correlations of main variables. We winsorize all continuous variables at the 1% and 99% percentile to reduce the impact of outliers. The variable descriptions are in Appendix A1. Panel A presents the basic summary statistics. In our sample, the average number of patents is 18.171 and the standard deviation is 67.482. The average number of citations is 39.196 and the standard deviation is 175.305. We find that patent measures are skewed,

[10] The sample period is chosen to match the availability of happiness index from the World Happiness Report.

which causes a bias when we use the data as is. Thus, we use the natural logarithm of patent measures plus one to minimize the problems with extreme values. We use variables including firm size, Tobin's Q, operating cash flow (OCF), sales growth, leverage, R&D, capex, HHI, and GDP growth. These variables are used as our regression specification. Panel B shows the correlation of the variables based on the same sample.

4. Empirical Results

4.1 The effect of happiness on innovation

In this section, we present empirical results on how happiness could affect firm-level innovation. We first show the baseline regression results and check the robustness. To test our hypothesis, we analyze the effect of happiness on firms' innovation by estimating the following regression model:

$$Innov_{ict+1} = \alpha_i + \beta Life\ ladder_{ct} + \gamma X_{ct} + \delta Yi_{ict} + \varepsilon_{ict} \quad (1)$$

For $Innov$, we use the logged number of patents, *PATENT,* in year *t+1* of firm *i*, and the logged number of patent citations, *CITEPAT*. PATENT capture the quantity of innovation activity and CITEPAT account for the quality of patents. For all patent measures, we use the measures in *t+1*. $Life\ ladder_{ct}$ is the level of happiness in year *t* for country *c*. Following the previous literature (e.g., Acharya and Subramanian, 2009), we use firm-level control variables (Y_{ict}) including Ln(TA), Tobins' Q, OCF, sales growth, leverage, R&D, and Capex. We also use country-level control variables (X_{ct}) including GDP growth, and SD of life ladder. We expect the coefficient β to be significantly positive, which indicating that happiness promotes innovation.

*** Table 3 Here ***

Our baseline regression results are presented in Table 3. In column (1) and (3), we conduct univariate regressions without adding any control variables. In column (2) and (4), we add control variables. In all regressions, we control for time, industry, and firm fixed effects. Standard errors are clustered by country and year (Peterson, 2009). The results in Table 3 provide strong support for our empirical implications. All the coefficients of happiness are significantly positive at the 1% level in column (1) and (2), and at the 5% level in column (3) and (4). The coefficient of happiness is 0.218 (*t*-stat = 2.54) in column (3), indicating that higher level of happiness indeed induces firms' innovation. In terms of the economic magnitude, the impact of happiness is sizable. The results suggests that one standard deviation increase in the happiness leads to about 13.57% (= $e^{0.218*0.871/1.492} - 1$) increase of corporate innovation.

*** Table 4 Here ***

In addition, we check potential robustness issues in Table 4. First, we test whether our results remain unchanged after excluding U.S. sample. In our sample, the number of non U.S. sample is 100,713. Panel A reports the results. We find all the coefficients of happiness are significantly positive, indicating firms in happier countries tend to be more innovative. Further, we added a different set of fixed effects to control for unobserved and time-varying heterogeneity across firms and countries. Panel B reports the results. We find the coefficients in column (1) – (5) are significantly positive. Overall, the results in Table 3 and Table 4 suggest that firms in happiness enhances innovation.

4.2 Cross-sectional heterogeneity: R&D characteristics

Next, following Acharya and Subramanian (2009) and Chuluun and Graham (2016), We examine the heterogeneous effect of happiness on innovation in response to R&D characteristic measures. We use three proxies: R&D intensity, R&D Growth, Innovation Propensity. *RD intensity* is the measure of SIC 2-digit industry level R&D intensity, calculated as the industry median ratio of R&D spending scaled total assets following Li (2011). *R&D Growth* is high-tech intensiveness as the annual percentage of growth in R&D expenses for publicly listed firms in each year. *Innovation Propensity* is innovation propensity as the averaged total number of patents filed for publicly listed firm in each year. The last two measures are consistent with Levine, Lin, and Wei (2017).

*** Table 5 Here ***

Table 5 shows the results. In column (1) and (2), we test *R&D intensity*. In column (3) and (4), we test *R&D Growth*. In column (5) and (6), we test *Innovation Propensity*. In Table 5, we find that the coefficients in column (1) – (5) are significantly positive. The results indicate that happiness induces more innovation for firms in industries that are more R&D intensive. The results are also consistent with Chuluun and Graham (2016), which shows local happiness level induces more firm-level investment and R&D. Overall, Table 5 provide evidence that the positive impact of happiness is much stronger for firms both in industries that are high R&D intensive, high R&D growth, and high innovate propensity.

4.3 Cross-sectional heterogeneity: national culture

In this section, we test the heterogeneous effect of happiness on innovation in response to culture. Culture can matter for innovation both at the firm-level and the country-level (e.g., Chui, Lloyd, Kwok, 2002; Xie, Zhang, and Zhang, 2021). Previous literature suggests that corporate cultures that are more patient and tolerant of failure encourage more innovation (e.g., Manso, 2011; Tian and Wang, 2014). We examine the heterogeneous response of different firms to the level of life-ladder conditional on different national culture. We use three dimensions of national culture developed by Hofstede: *Muscularity, Long-term Orientation, Trust. Muscularity* is a cultural index which measures the degree that people in society prefer for achievement, heroism, assertiveness, and material rewards for success with higher values. *Long-term Orientation* is a cultural index which measures society's attitudes toward future, indicating more preference to thrift and efforts in modern education as a way to prepare for the future. *Trust* is an index which measures that people have more trust in others in the society.

*** Table 6 Here ***

Table 6 shows our results. In column (1) and (2), we test *Muscularity*. In column (3) and (4), we test *Long-term Orientation*. In column (5) and (6), we test *Trust*. In Table 6, we find that the coefficients in column (1), (2), (3), and (5) are significantly positive. In column (1), the estimated coefficient is 0.007, indicating that the impact of happiness is stronger in a society preferring for achievement and heroism. In column (3), the estimate coefficient is 0,003, indicating the impact of happiness is more pronounced in a society preparing for the future. In column (5), the estimated coefficient 0.241, suggesting that the positive impact of happiness on innovation is stronger in a society with higher values of trust among people. The results are consistent with Xie,

Zhang, and Zhang (2021), which shows that county-level trust facilitates innovation by acting as an informal contracting mechanism. Overall, these results suggest that certain culture such as muscularity, long-term orientation, and trust, has more pronounced effects on the relationship between happiness and corporate innovation.

4.4 Alternative measure: R&D

In this section, we explore further robustness issues. First, we use alternative measure of innovation. Despite the wide acceptance and usage of patent activities as innovation measures, the innovation measures could be subject to certain limitations (e.g., Acharya and Subramanian, 2009; Hsu, Tian, and Xu, 2014; Moshirian, Tian, Zhang, and Zhang, 2020). For example, Chang, McLean, Zhang, and Zhang (2018) note that firms in many countries, especially those in emerging markets, do not file patent applications to the USPTO and that this proportion varies across countries over time. In addition, firms may keep some inventions secret for strategic purposes or not all firm-level innovation can meet the patenting criteria. For this reason, we use firms' R&D expenditure as an alternative of innovation activities.

*** Table 7 Here ***

Table 7 shows the test results. In Table 7, the dependent variable is firm-level R&D expenditure. Same as baseline specifications, we use firm-level control variables including Ln(TA), Tobins'Q, OCF, sales growth, leverage, R&D, and Capex. We include country-level control variables including GDP growth, and SD of life ladder. We also control for time, industry, and firm fixed effects. The coefficient of happiness is 0.003 (*t*-stat = 2.67), indicating that happiness

increases firm-level R&D expenditure. Overall, the results in Table 7 are consistent with baseline results.

5. Tests on identification

5.1 Instrumental variable approach

The causal relation between happiness and innovation can be bidirectional. The two directions of causality are not mutually exclusive, and they may be at work simultaneously. For example, firms' active innovation can increase the rosy expectation for futures, as a result, lead more happiness in countries. To mitigate this concern, we consider an instrumental variable (IV) approach. Sports events are more likely to be a short-term mood change which fit at a higher frequency data. For example, Edmans, Garcia, and Norli (2007) use sports outcomes to proxy for mood changes within a country. Thus, for our analysis at the annual level, we find three measures that are related to happiness as instrumental variables: *Olympic Medals, Natural Disasters, and democratic quality*. *Olympic Medals* is total number of Olympic medals (bronze) earned by the country. *Natural Disaster* is the annual total number of incidents of natural disaster (including wildfire, landslide, mass movement, volcanic activity, storm, flood, extreme temperature, earthquake, and drought) within the country from Global Natural Disaster report. *Democratic quality* is the average value of World Bank measures on voice and accountability, and political stability and absence of violence, and is obtained from World Happiness Report. We expect that these instruments carry a significant relation with the level of happiness and affects corporate innovation only through this channel.

*** Table 8 Here ***

We present our IV estimations in Table 8. We report the IV estimations using Olympic Medals and natural disasters in column (1) and (2), natural disasters and democratic quality in column (3) and (4). The column (1) and (3) present the first stage estimation results. We predict that instrument variable (Olympic Medals) should be positively correlated with the level of happiness. The first-state regression results are consistent with our prediction. The coefficient for Olympic Medals is 0.003 (*t*-stat = 2.87), indicating that the instrumental variable is positively associated with the level of happiness. The identification F-test pass the critical vale of appropriate instrument. The column (2) and (4) present the second-stage regression results. The coefficient in column (2) is 0.546 (*t*-stat = 2.11) and the coefficient in column (4) is 0.385 (*t*-stat = 1.72). The coefficients of instrumented happiness are consistent with our baseline results, which is significantly positive. Overall, the results show that the relationship between happiness and invoation remains significantly positive under the instrumental variable specification.

5.2 Quasi-natural experiment

We use a quasi-natural experiment to mitigate any remaining endogeneity concerns. We exploit the global financial crisis of 2007-2008 as an adverse shock to the level of happiness. The financial crisis is considered as the most serious worldwide crisis since the Great Depression of the 1930s. The timing and sweeping nature of the crisis were unexpected, and its impact was beyond the control of both governments and firm managers. Accordingly, the financial crisis serves as a negative and exogenous adverse shock to the level of happiness.

***Table 9 Here ***

We first examine how the average level of happiness has changed in response to the global financial crisis. We test the crisis as a treatment event as a negative and exogenous shock. In column (1) and (2) in Table 9, the interaction term, *Life_latter*Financial Crisis,* is statistically significant 1% level for *CITEPAT*. These results suggest that firms decrease innovation activities when firms are suffered by the financial crisis. Overall, the results in Table 9 provide the suggestive evidence that the impact of the global financial crisis is negative to innovation while the positive effect of happiness on innovation holds.

5.3 Unobservable confounding conditions

Innovation could be affected by unobserved factors that affect the level of happiness and the countries where firms located. To address this issue, we consider three categories of country characteristics: Financial Development, Polarization, Market Openness. To measure Financial Development, we use *Credit/GDP*, *Mcap/GDP*, and *Interest Rate* (Solow, 1956; Romer, 1986). To measure Polarization, we use *Income Inequality*, *Business Ownership*, *Government Responsibility* (Julio and Yook, 2012; Gulen and Ion, 2016). To measure Market Openness, we use *Capital Account Openness* and *Trade Openness* (Moshirian, Tian, Zhang, and Zhang, 2021). The detailed variable definition is listed in the Appendix A1.

*** Table 10 Here ***

Table 10 reports the results by adding variables. In column (1) and (2), we add variables for Financial Development. In column (3) and (4), we add variables for Polarization. In column

(5) and (6), we add variables for Market Openness. In column (7) and (8), we add all variables. In Table 10, we find that all coefficients in column (1) – (8) are significantly positive. The results indicates that the positive relationship between happiness and innovation remain unchanged after controlling for unobservable confounding country characteristics.

6. Potential Channels

In this section, we discuss the potential economic channels through which the level of happiness facilitates corporate innovation. We perform three sets of analyses to shed light on the channels including collaboration, productivity, and risk-tolerance.[11]

6.1 Collaboration channel

Happiness can increase the likelihood and efficiency of innovation by increasing collaboration. We presume collaboration is more likely by happier people. According to Dovey (2009) and Xie, Zhang, and Zhang (2021), innovations can rely on collaboration among innovators and successful collaboration hinges on trust among people. Previous studies suggest that effective legal system and informal social capital can encourage collaboration by allowing innovators to share resources and expertise with each other (Lerner, 2009). Thus, based on discussion, we expect that collaboration is a channel through which the level of happiness facilitates innovation.

[11] In addition to these three channels, there can be a funding channel through which happiness facilitates innovation. Previous studies suggest that higher level of social capital (e.g., trust) can increase the supply of capital (Guiso, Sapienza, and Zingales, 2008; Bottazzi, Da Rin, and Hellmann, 2016; Giannetti and Wang, 2016; Levine, Lin, and Xie, 2017; Dudley et al., 2017; Xie, Zhang, and Zhang, 2021). We examine the funding channel, however, the results are not significant. The tests results are in Appendix Table A1.

*** Table 11 Here ***

Table 11 presents the results of regression. We expect to see a positive and significant coefficient of the interaction term between happiness and collaboration. We use three measures to proxy collaboration: *social support*, *freedom to make life choices, and corruption*. In column (1) and (2), we test *social support*. In column (3) and (4), we test *freedom to make life choices*. In column (5) and (6), we test the level of *corruptio*n. In Table 11, we find that the coefficients of interaction terms are significantly positive. The results indicate that the positive relationship between happiness and innovation is more pronounced in countries with more social support, more freedom to make choices, and less corruption, thereby encourage more collaboration and spurring more innovation.

6.2 Productivity channel

Next, we investigate whether happiness impacts innovation by increasing productivity. Happiness can positively affect innovative activities through improving inventors' productivity. Studies show that happiness not only relates to individual productivity (Oswald, Proto, and Sgroi 2015), but also increases the scope attention (Rowe, Hirsh, and Anderson 2007). Similarly, Ifcher and Zarghamee (2011) argue that positive mood reduces time preference over money and makes people more willing to think about the future. The theoretical work of Bénabou and Tirole (2003) also suggests that the driving channel between optimism and productivity is intrinsic motivation. Together with the previous literature and discussion in section 6.1, we expect that happiness can play a more important role in facilitating collaboration and enhancing innovation output.

*** Table 12 Here ***

To examine this conjecture, we use two separate proxies: *patent per employee*, *citation per employee*. Bhattacharya, Hsu, Tian, and Xu (2017) use the number of patent inventors that have filed at least one patent in a sample country-industry-year as a proxy for incentives to innovate. Similarly, we conjecture that more inventors filing patent applications reflect a greater productivity. Table 12 presents the results of regression. In column (1), we test patent per employee. In column (2), we test citation per employee. In Table 12, we find that the coefficients of happiness are significantly positive. The results imply that happiness indeed increase the number of patents per employee. This finding supports our interpretation that happiness fosters the incentives to engage in innovation activities, contributing to the productivity.

6.3 Risk-tolerance channel

Next, we investigate whether happiness impacts innovation by increasing risk-tolerance. Innovation involves a high probability of failure depending on various unpredictable conditions. Manso (2011) shows that the optimal incentive that facilitates innovation should exhibit substantial tolerance for failure and long-term rewards. Acharya and Subramannian (2009) also mention that "when bankruptcy code is creditor friendly, excessive liquidations cause levered firms to shun innovation, whereas by promoting continuation upon failure, a debtor-friendly code induces greater innovation." Debtor-friendly bankruptcy regimes and strong legal protection for employees alleviate firms' and employees' concerns about the adverse impact of innovation failure and hence encourage their risk-taking and innovation efforts (Acharya, Baghai, and Subramanian, 2014).

Based on this discussion, we conjecture that risk-tolerance is an important channel through which the level of happiness fosters corporate innovation.

*** Table 13 Here ***

Table 13 presents the results for risk-tolerance channel. We use two groups of risk-tolerance proxies: legal enforcement, investor protection. To measure legal enforcement, we employ *Rule of Law*, *Repudiation of Contracts*, and *Judicial Efficiency*. To measure investor protection, we employ *Anti-self-dealing*, and *information sharing*. Panel A of Table 13 reports the results with legal enforcement. In column (1) and (2), we test *Rule of Law*. In column (3) and (4), we test *Repudiation of Contracts*. In column (5) and (6), we test *Judicial Efficiency*. In Panel A, we find that the coefficients of interaction terms are significantly positive in column (1), (2), (3), (4), and (6). Panel B reports the results with investor protection. In Panel B, we find that the coefficients of interaction terms are significantly positive. Overall, the results suggest that happiness, together with a risk-tolerance scheme, promotes firm innovation.

7. Conclusion

This paper investigates the effect of happiness on innovation. We examine the relationship between happiness and innovation. We conjecture that happiness can increase innovation by increasing collaboration and risk-tolerance and enhancing productivity. Previous research documents that when people feel happier, they are more resilient to failure, more productive at work, and nicer to be around. Intuitively, people in *positive affective states* become more optimistic

and creative. Many previous studies support this notion. Happiness can also play out at the country levels interacting with better public goods, lower crime rates, higher trust, and good democracies.

To proxy happiness, we use the Cantril life ladder index from World Happiness Report published by the United Nations. The World Happiness Report includes survey results from respondents more than 150 countries. The happiness index varies greatly across countries. Using the happiness index, we find that happiness positively affect innovation. The positive effect is more pronounced for firms with high R&D intensity, high R&D growth, and high innovation propensity. The effect of happiness is stronger for countries with national culture of muscularity, long-term orientation, and trust.

Our results are robust to including a range of controls and to using instrumental variable analyses. In the instrumental variable approach, we use Olympic medals, natural disasters, and democratic quality as instruments. We find that the coefficients of instrumented happiness are consistent with our baseline results. We also augment our regression models by controlling for a wide array of country-level characteristics. We find that the positive relationship between happiness and innovation remain unchanged after controlling for unobservable confounding country characteristics. Overall, our findings remain intact through all identification tests.

Further, we find that happiness promotes innovation through which channels of collaboration, productivity, and risk-tolerance. We find that the positive relationship between happiness and innovation is more pronounced in countries with more social support, more freedom to make choices, and less corruption. In productivity channel, we find that happiness increases the number of patents per employee. The results indicate that happiness promotes the incentives to

engage in innovation activities. In risk-tolerance channel, we find that the effect of happiness is more pronounced for firms with investor protection and legal enforcement. Overall, our results suggest that happiness, together with collaboration, productivity, and risk-tolerance channels, fosters firm innovation.

Our findings produce several implications. First, our study provides supporting evidence why governments and firm managers needs to pay attention to happiness as a causal force to promote sustainable growth. Especially, happiness could be an important factor for countries whose cultural backgrounds are more diverse. In terms of policy implications, our results suggest that countries can improve the innovation output for their economy by fostering happiness. Our study also provides suggestive implications that happier workers can be more productive in their jobs. In fact, many firms increasingly claim to care about how their employees feel at work and have begun to invest in management practices and services to create and maintain a happier workforce. There could be various reasons for this, but by doing so, firms can attract and retain high quality workers and have a competitive edge.

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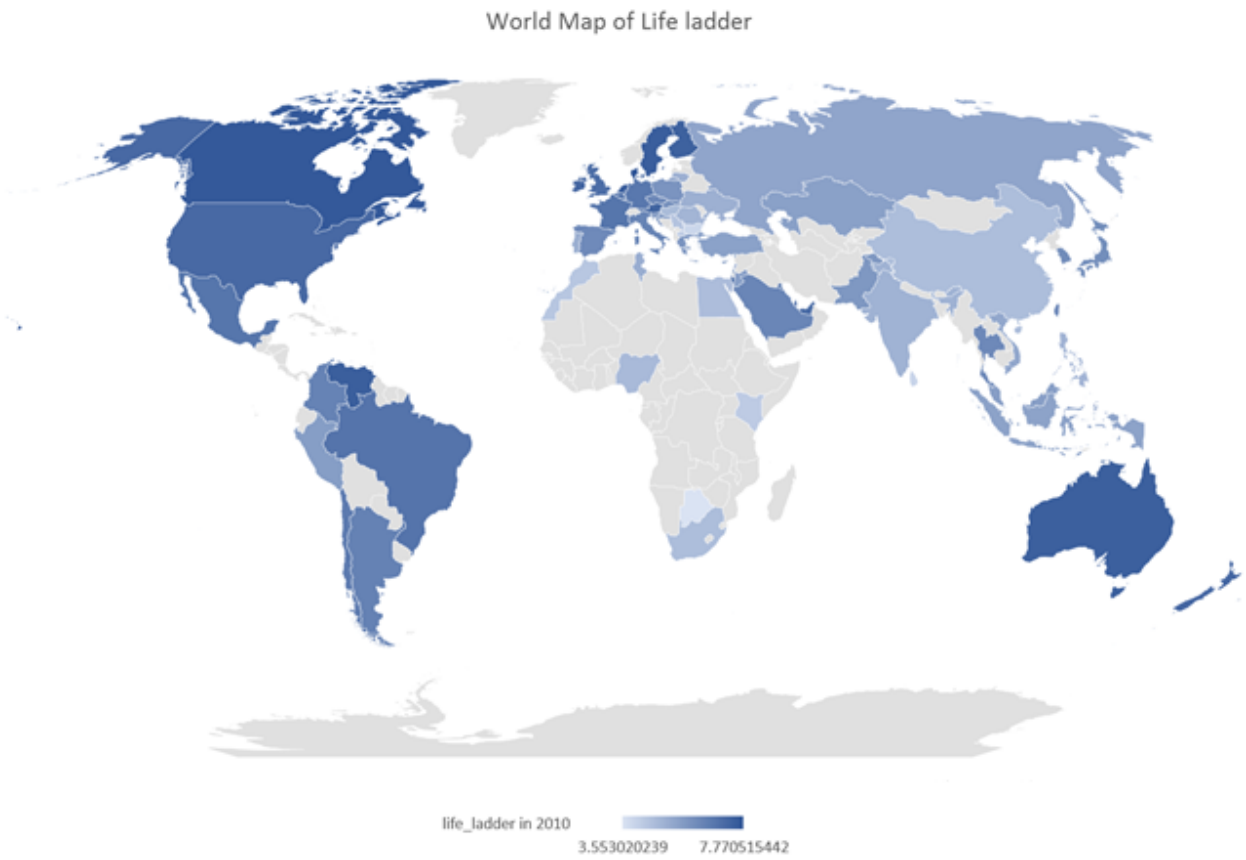

Figure 1 World Map of Life Ladder (2010)

Figure 1 provides a visualization of life-ladder using the data in 2010. In Figure 1, darker shades imply higher level of happiness and brighter shades imply that the country is less happy.

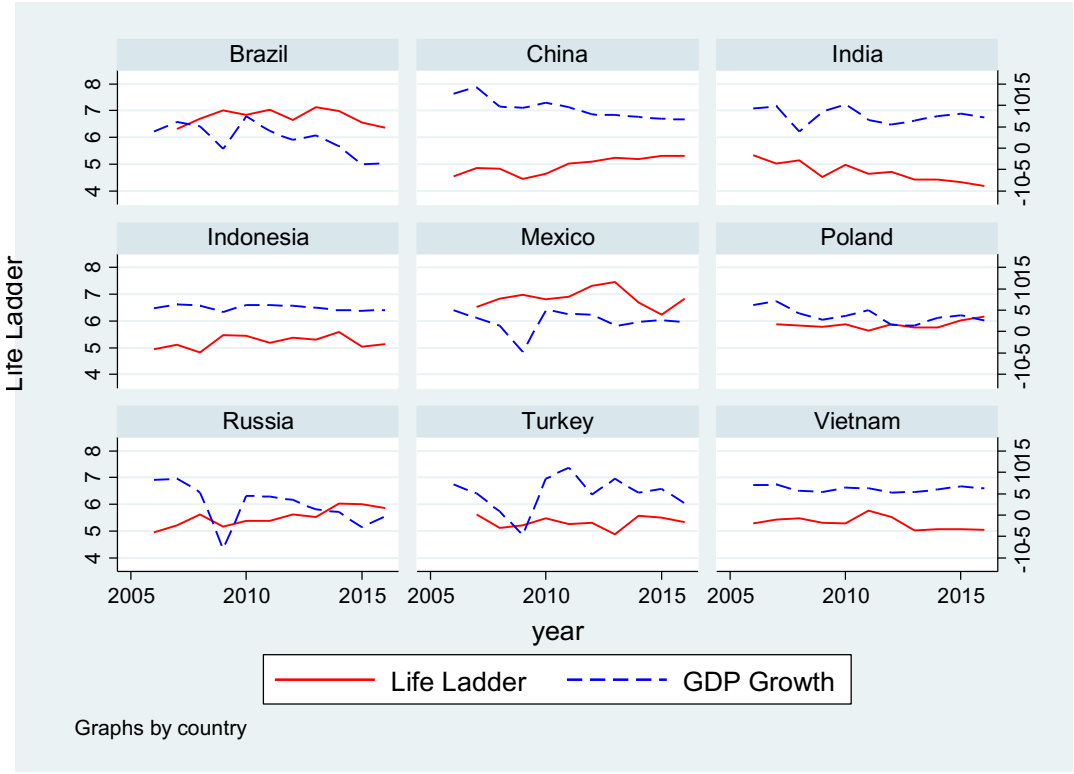

Figure 2. Time Variation of Life Ladder and GDP Growth for Selected Countries

Figure 2 presents the trend of life-ladder and GDP growth for selected countries. The solid led line indicates life ladder. The blue dot line indicates GDP growth.

Table1. Sample Composition

Panel A. Sample Composition by Economy

Economy	No. of Firm-Years	No. Firms	Life Ladder	ΔLife Ladder	SD of Life Ladder
Argentina	185	21	6.427	0.040	2.052
Australia	4,322	630	7.322	-0.031	1.725
Austria	346	51	7.251	-0.045	1.778
Belgium	417	57	7.037	-0.008	1.585
Brazil	972	130	6.792	0.036	2.240
Bulgaria	60	10	4.182	0.186	2.062
Canada	4,005	536	7.470	-0.010	1.709
Chile	228	25	6.413	0.052	2.142
China	12,374	1,720	4.999	0.086	1.908
Colombia	71	11	6.370	0.032	2.407
Croatia	96	14	5.589	-0.001	1.980
Cyprus	30	6	6.133	-0.247	2.254
Czech Rep.	36	6	6.450	0.072	1.969
Denmark	518	64	7.722	-0.039	1.554
Egypt	101	13	4.603	-0.079	2.238
Estonia	20	3	5.409	-0.006	1.812
Finland	516	72	7.474	0.011	1.555
France	2,095	280	6.682	-0.145	1.786
Germany	2,934	380	6.708	0.078	1.803
Greece	298	39	5.560	-0.105	2.253
Hong Kong	1,527	234	5.444	0.084	1.881
Hungary	41	5	4.961	0.059	2.051
India	6,199	750	4.720	-0.110	1.945
Indonesia	228	26	5.230	0.017	1.647
Ireland	173	26	7.079	-0.101	1.800
Israel	1,422	178	7.236	-0.004	1.769
Italy	1,092	140	6.255	-0.092	1.908
Japan	23,560	2,659	6.056	-0.046	1.904
Jordan	84	11	5.409	-0.031	2.300
Kenya	80	9	4.328	0.003	1.757
Kuwait	93	12	6.367	-0.073	1.809
Latvia	31	4	5.151	0.141	1.806
Lithuania	49	6	5.612	-0.044	1.928
Luxembourg	90	16	6.975	-0.049	1.571
Malaysia	1,457	178	5.873	0.032	1.751
Malta	25	4	6.216	0.043	2.069
Mexico	244	27	6.828	-0.052	2.158
Morocco	41	10	4.951	0.267	1.767

Netherlands	487	72	7.466	0.008	1.315
New Zealand	404	60	7.328	0.038	1.661
Nigeria	30	11	4.940	-0.523	2.058
Norway	323	82	7.562	0.159	1.664
Pakistan	299	36	5.212	-0.100	2.282
Peru	119	15	5.518	0.081	2.195
Philippines	371	45	5.004	0.097	2.388
Poland	915	138	5.807	0.041	1.946
Portugal	84	13	5.220	-0.003	2.227
Romania	148	23	5.291	0.049	2.245
Russia	190	27	5.530	0.105	2.022
Saudi Arabia	136	20	6.481	-0.090	2.179
Singapore	2,083	284	6.600	0.028	1.481
Slovenia	85	13	5.922	-0.014	2.118
South Africa	1,051	128	4.884	-0.027	1.984
South Korea	9,430	1,149	5.893	0.041	2.104
Spain	696	85	6.551	-0.073	1.905
Sri Lanka	286	32	4.305	0.034	1.874
Sweden	1,563	214	7.382	0.007	1.612
Switzerland	490	108	7.570	0.079	1.615
Taiwan	8,591	1,278	6.211	0.044	1.911
Thailand	807	99	6.156	0.028	1.749
Tunisia	26	4	4.964	0.036	1.921
Turkey	619	68	5.281	-0.012	2.247
United Arab Emirates	50	8	6.849	-0.040	1.941
UK	5,262	717	6.871	-0.028	1.843
USA	21,481	2,789	7.171	-0.035	1.966
Vietnam	112	18	5.304	-0.050	1.562
Total/Mean	122,198	15,899	6.278	-0.008	1.900

Panel B. Sample Composition by Year

Year	Freq.	Percent
2005	4,604	3.77
2006	6,170	5.05
2007	10,371	8.49
2008	12,248	10.02
2009	10,822	8.86
2010	12,646	10.35
2011	12,960	10.61
2012	13,178	10.78
2013	12,993	10.63
2014	13,394	10.96
2015	12,812	10.48
Total	122,198	100

This table reports the sample composition used in the estimation. Panel A presents the sample composition by country. Panel B shows the sample composition by year. All variables are defined in Appendix.

Table 2. Summary Statistics

Panel A. Descriptive Statistics

Variable	N	Mean	Median	S.D.	Min	Max
No. of Patents	122,198	18.171	1.000	67.482	0.000	521
No. of Citations	122,198	39.196	0.000	175.305	0.000	1411
$PATENT_{t+1}$	122,198	1.105	0.693	1.492	0.000	6.186
$CITEPAT_{t+1}$	122,198	0.893	0.000	1.629	0.000	6.955
Patents per Employee	80,632	1.043	0.015	3.181	0.000	23.627
Citations per Employee	80,632	1.395	0.000	5.992	0.000	47.887
Ln(TA)	122,198	12.557	12.455	2.031	7.600	17.667
Tobin's Q	122,198	1.742	1.214	1.603	0.450	11.057
OCF	122,198	0.058	0.076	0.172	-0.945	0.415
Sales Growth	122,198	0.122	0.048	0.470	-0.759	3.141
Leverage	122,198	0.217	0.184	0.198	0.000	0.960
R&D	122,198	0.016	0.000	0.040	0.000	0.266
Capex	122,198	0.056	0.033	0.069	0.000	0.409
HHI	122,198	0.426	0.341	0.303	0.037	1.000
HHI^2	122,198	0.273	0.117	0.331	0.001	1.000
Life Ladder	122,198	6.278	6.263	0.871	3.559	8.019
GDP Growth	122,198	2.953	2.422	3.522	-14.814	26.276
SD of Life Ladder	122,198	1.900	1.902	0.185	1.022	2.753
Social Support	119,620	0.868	0.902	0.090	0.373	0.987

Panel B. Pearson's Correlation

		$PATENT_{t+1}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	$PATENT_{t+1}$	1													
(1)	$CITEPAT_{t+1}$	**0.805**	1												
(2)	Life Ladder	**-0.044**	**0.056**	1											
(3)	Social Support	-0.003	**0.074**	**0.765**	1										
(4)	Ln(TA)	**0.317**	**0.240**	**-0.054**	0.016	1									
(5)	Tobin's Q	**0.031**	**0.039**	**0.074**	0.018	**-0.239**	1								
(6)	OCF	**0.081**	**0.048**	**-0.186**	**-0.137**	**0.388**	**-0.298**	1							
(7)	Sales Growth	0.000	**0.028**	**0.051**	0.016	**-0.067**	**0.159**	**-0.039**	1						
(8)	Leverage	**-0.051**	**-0.043**	**-0.029**	**-0.077**	**0.152**	-0.008	**-0.138**	**-0.036**	1					
(9)	R&D	**0.100**	**0.082**	**0.099**	**0.092**	**-0.187**	**0.181**	**-0.181**	**0.046**	**-0.147**	1				
(10)	Capex	0.005	0.008	**-0.068**	**-0.113**	**0.081**	**0.043**	**0.123**	**0.206**	**0.099**	**-0.069**	1			
(11)	HHI	**-0.083**	**-0.053**	**0.068**	**0.040**	0.019	**-0.090**	**0.061**	**-0.048**	**0.042**	**-0.063**	-0.014	1		
(12)	HHI^2	**-0.079**	**-0.056**	**0.063**	**0.038**	0.016	**-0.072**	**0.055**	**-0.043**	**0.041**	**-0.063**	-0.007	**0.970**	1	
(13)	GDP Growth	0.009	**-0.052**	**-0.483**	**-0.524**	-0.008	**0.116**	**0.106**	**0.088**	0.004	**-0.046**	**0.152**	**-0.054**	**-0.039**	1
(14)	SD of Life Ladder	**0.051**	**-0.024**	**-0.331**	**-0.303**	**0.094**	0.004	**0.048**	**-0.045**	**0.054**	**-0.116**	**-0.021**	**-0.088**	**-0.086**	**0.023**

This table reports the descriptive statistics and correlations of the main variables that are used in the estimation. Panel A presents the basic summary statistics of variables based on a sample with no missing firm- and country- level characteristics. Panel B shows the correlation of the variables (correlation coefficients significant at 1 percent levels are marked as bold). All variables are defined in Appendix.

Table 3. Baseline Regression

	(1) $PATENT_{t+1}$	(2) $PATENT_{t+1}$	(3) $CITEPAT_{t+1}$	(4) $CITEPAT_{t+1}$
Life Ladder	0.201***	0.175***	0.218**	0.202**
	(3.35)	(4.13)	(2.54)	(2.32)
Ln(TA)		0.148***		0.019
		(6.67)		(0.67)
Tobin's Q		0.013***		0.003
		(2.67)		(0.40)
OCF		0.040*		0.096***
		(1.65)		(2.67)
Sales Growth		-0.017***		-0.013
		(-2.67)		(-1.30)
Leverage		-0.138***		-0.241***
		(-4.95)		(-4.46)
R&D		0.868***		0.677*
		(3.94)		(1.65)
Capex		-0.057		-0.104
		(-1.20)		(-1.31)
HHI		-0.201**		-0.147
		(-2.13)		(-1.00)
HHI^2		0.099		0.075
		(1.31)		(0.61)
GDP Growth		-0.024***		-0.030***
		(-3.86)		(-2.87)
SD of Life Ladder		0.169*		0.130
		(1.68)		(0.77)
Firm FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
N	122,198	122,198	122,198	122,198
Adj. R^2	0.802	0.804	0.671	0.672

This table reports the baseline test that examines sample-wide effect of happiness on corporate innovation. Firm level and country level controls are progressively introduced into the baseline model to control for firm- and country- specific characteristics. Firm and industry-year fixed effects are included in the regressions. All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Robustness Tests

Panel A. Main Effect: USA excluded

	(1) $PATENT_{t+1}$	(2) $PATENT_{t+1}$	(3) $CITEPAT_{t+1}$	(4) $CITEPAT_{t+1}$
Life Ladder	0.196***	0.175***	0.137*	0.146*
	(3.254)	(3.982)	(1.953)	(1.915)
Ln(TA)		0.158***		0.031
		(6.562)		(1.102)
Tobin's Q		0.014**		0.007
		(2.418)		(0.776)
OCF		0.060**		0.085**
		(2.189)		(1.999)
Sales Growth		-0.017**		-0.008
		(-2.364)		(-0.640)
Leverage		-0.133***		-0.149***
		(-4.472)		(-3.095)
R&D		0.871***		0.729*
		(4.007)		(1.688)
Capex		-0.050		-0.015
		(-0.958)		(-0.174)
HHI		-0.191*		-0.087
		(-1.890)		(-0.584)
HHI^2		0.070		0.005
		(0.884)		(0.042)
GDP Growth		-0.022***		-0.017*
		(-3.933)		(-1.874)
SD of Life Ladder		0.221**		0.286*
		(1.981)		(1.739)
N	100,713	100,713	100,713	100,713
Adj. R^2	0.791	0.795	0.648	0.650
Firm FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes

Panel B. Alternative Fixed Effects

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder	0.161***	0.151*	0.136***	0.143*	0.126***	0.089
	(3.99)	(1.87)	(3.90)	(1.69)	(3.66)	(1.08)
Ln(TA)	0.144***	0.026	0.325***	0.289***	0.325***	0.289***
	(6.38)	(0.85)	(22.08)	(12.74)	(21.93)	(12.48)
Tobin's Q	0.010**	-0.003	0.080***	0.076***	0.078***	0.072***
	(2.02)	(-0.34)	(12.62)	(8.69)	(11.76)	(7.67)
OCF	0.027	0.089**	-0.329***	-0.302***	-0.334***	-0.307***
	(1.00)	(2.20)	(-6.48)	(-5.53)	(-6.59)	(-5.27)
Sales Growth	-0.020***	-0.021**	0.003	0.004	-0.001	-0.004
	(-3.10)	(-2.19)	(0.39)	(0.32)	(-0.13)	(-0.33)
Leverage	-0.126***	-0.231***	-0.451***	-0.465***	-0.445***	-0.453***
	(-4.46)	(-4.22)	(-19.42)	(-10.39)	(-18.68)	(-9.66)
R&D	0.875***	0.634	3.799***	3.698***	3.820***	3.714***
	(3.68)	(1.30)	(9.34)	(8.16)	(9.22)	(7.37)
Capex	-0.069	-0.116	0.185**	0.021	0.168*	0.002
	(-1.43)	(-1.31)	(2.09)	(0.18)	(1.83)	(0.01)
HHI	-0.120	0.046	-0.189	-0.354*	-0.164	-0.274
	(-1.05)	(0.28)	(-1.19)	(-1.79)	(-1.00)	(-1.25)
HHI^2	0.024	-0.132	0.229*	0.324**	0.208	0.255
	(0.26)	(-0.99)	(1.83)	(2.11)	(1.62)	(1.51)
GDP Growth	-0.023***	-0.029***	-0.024***	-0.027**	-0.023***	-0.026***
	(-3.80)	(-2.98)	(-3.85)	(-2.54)	(-3.90)	(-2.67)
SD of Life Ladder	0.148	0.099	0.137*	0.069	0.114	0.039
	(1.54)	(0.60)	(1.65)	(0.40)	(1.40)	(0.23)
Firm and Year FE	Yes	Yes				
Country Ind-Year FE			Yes	Yes		
Country, Industry and Year FE					Yes	Yes
N	122,198	122,198	122,198	122,198	122,198	122,198
Adj. R^2	0.802	0.655	0.310	0.315	0.309	0.299

This table reports the robustness tests that examines sample-wide effect of happiness on corporate innovation. Panel A exclude USA. Panel B shows estimation with alternative fixed effects. Panel C presents the estimation results with standard errors clustered at different levels. Firm and industry-year fixed effects are included in the regressions. All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Cross-sectional Variation: Industry-level Innovation Intensity

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder × R&D Intensity	0.072**	0.130**				
	(1.99)	(2.05)				
Life Ladder × R&D Growth			0.244**	0.551**		
			(2.18)	(2.04)		
Life Ladder × Innovation Propensity					0.001	0.001*
					(1.45)	(1.74)
Life Ladder	0.117***	0.100*	0.137***	0.107	0.157***	0.146**
	(4.19)	(1.88)	(4.00)	(1.54)	(4.90)	(2.07)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	107,242	107,242	107,242	107,242	107,239	107,239
Adj. R^2	0.808	0.681	0.808	0.681	0.808	0.681
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of industry-level innovation intensity. *R&D Intensity* is R&D intensiveness as the annual percentage of R&D expenses to total assets for each publicly listed firm in each year. *R&D Growth* is high-tech intensiveness as the annual percentage of growth in R&D expenses for each publicly listed firm in each year. *Innovation Propensity* is innovation propensity as the averaged total number of patents filed for each publicly listed US firm in each year. The last two measures are directly obtained from Levine, Lin, and Wei (2017). Firm level controls are included in the baseline model to control for firm-specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Cross-sectional Variation: National Culture

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder × Muscularity	0.007**	0.009**				
	(2.54)	(1.99)				
Life Ladder × Long-term Orientation			0.003*	-0.001		
			(1.71)	(-0.16)		
Life Ladder × Trust					0.241***	0.140
					(3.59)	(1.34)
Life Ladder	-0.170	-0.240	-0.008	0.241	0.038	0.041
	(-1.44)	(-1.10)	(-0.09)	(0.99)	(1.11)	(0.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	120,231	120,231	121,633	121,633	111,467	111,467
Adj. R^2	0.805	0.674	0.804	0.673	0.809	0.677
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of natural culture. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Alternative measure: R&D

	(1) *R&D*
Life Ladder	0.003***
	(2.67)
Ln(TA)	0.001**
	(2.51)
Tobin's Q	0.001***
	(5.59)
OCF	-0.017***
	(-6.04)
Sales Growth	0.002***
	(7.13)
Leverage	-0.002**
	(-2.03)
Capex	0.008***
	(4.89)
HHI	-0.004
	(-1.48)
HHI^2	0.003
	(1.44)
GDP Growth	-0.000***
	(-2.64)
SD of Life Ladder	0.004**
	(2.42)
N	122,213
Adj. R^2	0.828
Firm FE	Yes
Industry-Year FE	Yes

This table reports test that examines the effect of happiness on corporate investment and R&D spending. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Instrumental Variable Analysis

VARIABLES	(1) 1st Stage	(2) IV +Medals +Disaster	(3) 1st Stage	(4) IV +Medals +Democracy
Life Ladder		0.546**		0.385*
		(2.11)		(1.72)
Olympic Medals	0.003***		0.002***	
	(2.87)		(2.67)	
Natural Disaster	0.008			
	(1.61)			
Democratic Quality			0.353	
			(1.04)	
Ln(TA)	0.002**	0.354***	0.002**	0.349***
	(2.10)	(19.43)	(2.22)	(19.98)
Tobin's Q	0.000	0.088***	-0.000	0.089***
	(0.17)	(13.10)	(-0.04)	(13.84)
OCF	0.000	-0.411***	-0.004	-0.395***
	(0.03)	(-7.71)	(-0.63)	(-7.60)
Sales Growth	-0.003	0.009	-0.002	0.007
	(-0.37)	(0.79)	(-0.30)	(0.72)
Leverage	0.003	-0.460***	0.001	-0.460***
	(0.52)	(-19.79)	(0.15)	(-20.14)
R&D	0.124***	3.920***	0.127***	3.777***
	(2.79)	(6.67)	(3.02)	(7.18)
Capex	0.001	0.147	-0.004	0.126
	(0.02)	(1.41)	(-0.15)	(1.26)
HHI	0.002	-0.220	-0.002	-0.195
	(0.12)	(-1.08)	(-0.10)	(-1.00)
HHI	-0.008	0.279*	-0.004	0.257
	(-0.51)	(1.68)	(-0.29)	(1.65)
GDP Growth	-0.043***	-0.009	-0.047***	-0.013
	(-3.63)	(-0.73)	(-4.32)	(-1.51)
SD of Life Ladder	-0.405***	0.197	-0.481***	0.084
	(-2.71)	(1.17)	(-3.03)	(0.52)
N	82,042	82,042	87,846	87,846
Adj. R^2	0.201	0.184	0.176	0.183
Country Industry and Year FE		Yes		Yes
Industry-Year FE		Yes		Yes
1st stage F-stat	7.874		5.082	
Partial R^2	0.0635		0.0409	

This table reports the baseline test that examines sample-wide effect of happiness on corporate innovation with instrument variables approach. We use three measures that are related to happiness as IV: *Natural Disaster* is the annual total number of incidents of natural disaster (including wildfire, landslide, mass movement, volcanic activity, storm, flood, extreme temperature, earthquake, and drought) within the country from Global Natural Disaster report, *Olympic Medals* is total number of Olympic medals (bronze) earned by the country, and *Democratic quality* is the average value of World Bank measures on voice and accountability, and political stability and absence of violence, and is obtained from World Happiness Report. Firm level and country level controls are introduced into the baseline model to control for firm- and country- specific characteristics. Country, industry and year dummies are included in the regressions. All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9. Quasi-natural Experiment

	(1)	(2)
	$PATENT_{t+1}$	$CITEPAT_{t+1}$
Life Ladder × Financial Crisis	0.032	0.109***
	(1.13)	(3.16)
Controls	Yes	Yes
N	122,198	122,198
Adj. R^2	0.804	0.673
Firm FE	Yes	Yes
Industry-Year FE	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of financial crisis (2007-2008). Firm level controls are included in the baseline model to control for firm-specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Controlling for unobservable confounding conditions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Financial Development		Polarization		Market Openness		All Confounding Factors	
	PATE NT_{t+1}	*CITEP* AT_{t+1}	*PATE* NT_{t+1}	*CITEP* AT_{t+1}	*PATE* NT_{t+1}	*CITEP* AT_{t+1}	*PATE* NT_{t+1}	*CITEP* AT_{t+1}
Life Ladder	0.103**	0.086*	0.190**	0.201*	0.120**	0.124*	0.141**	0.160**
	(3.42)	(1.72)	(4.10)	(2.38)	(4.05)	(2.09)	(4.01)	(2.68)
Credit/GDP	0.003**	0.011**					0.004**	0.014**
	(2.58)	(4.52)					(3.11)	(5.35)
Mcap/GDP	-0.000	-0.000					0.001	0.001
	(-0.64)	(-0.59)					(0.87)	(0.84)
Interest Rate	0.009	-0.012					0.009*	-0.013
	(1.46)	(-0.96)					(1.70)	(-1.22)
Polarization: Income Inequality			-0.415**	-0.692**			-0.611**	-0.747**
			(-3.63)	(-3.21)			(-3.61)	(-2.96)
Polarization: Business Ownership			0.493**	0.105			0.931**	0.619
			(2.64)	(0.30)			(3.46)	(1.48)
Polarization: Government Responsibility			-0.148	0.414*			-0.351*	0.018
			(-1.03)	(1.84)			(-1.92)	(0.06)
Capital Account Openness					-0.026	0.027	-0.073*	-0.029
					(-0.78)	(0.41)	(-1.89)	(-0.49)
Trade Openness					-0.274*	-0.543**	-0.324**	-0.788**
					(-1.92)	(-2.36)	(-2.16)	(-3.78)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm & Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	90,076	90,076	104,931	104,931	101,021	101,021	82,795	82,795
Adj. R^2	0.831	0.726	0.811	0.684	0.828	0.713	0.833	0.730

This table reports test that examines the effect of happiness on corporate innovation by controlling for extra country level characteristics. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from

Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 11. Collaboration Channel: Social Support

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder × Social Support	0.032	0.224***				
	(0.64)	(2.68)				
Social Support	-0.236	-1.427***				
	(-0.70)	(-2.60)				
Life Ladder × High Freedom to Make Life Choices			0.017	0.141**		
			(0.58)	(2.57)		
High Freedom to Make Life Choices			-0.179	-0.910**		
			(-0.92)	(-2.56)		
Life Ladder × Low Corruption					0.099*	0.549***
					(1.76)	(5.77)
Low Corruption					-0.709*	-3.612***
					(-1.91)	(-6.15)
Life Ladder	0.160***	0.097	0.083***	0.119*	0.048*	0.066
	(3.80)	(1.32)	(3.24)	(1.78)	(1.72)	(0.94)
Ln(TA)	0.144***	0.023	0.096***	0.001	0.083***	-0.014
	(6.17)	(0.71)	(8.65)	(0.06)	(7.93)	(-0.59)
Tobin's Q	0.009*	-0.005	0.006**	-0.003	0.007***	-0.005
	(1.73)	(-0.64)	(2.46)	(-0.44)	(2.66)	(-0.79)
OCF	0.042	0.115***	0.034	0.089**	0.036	0.107***
	(1.51)	(2.68)	(1.33)	(2.29)	(1.40)	(2.77)
Sales Growth	-0.022***	-0.025***	-0.014***	-0.021**	-0.014***	-0.020**
	(-3.42)	(-2.73)	(-2.72)	(-2.35)	(-2.68)	(-2.20)
Leverage	-0.134***	-0.239***	-0.120***	-0.230***	-0.120***	-0.236***
	(-4.81)	(-4.46)	(-4.79)	(-4.12)	(-4.68)	(-4.24)
R&D	0.892***	0.671	0.589***	0.600	0.552***	0.804*
	(3.75)	(1.35)	(3.05)	(1.36)	(2.84)	(1.94)
Capex	-0.065	-0.080	-0.013	-0.100	0.004	-0.041
	(-1.32)	(-0.93)	(-0.30)	(-1.23)	(0.10)	(-0.47)
HHI	-0.118	0.028	0.029	0.108	0.049	-0.019
	(-1.01)	(0.17)	(0.30)	(0.67)	(0.46)	(-0.11)
HHI^2	0.021	-0.117	-0.077	-0.176	-0.079	-0.073
	(0.23)	(-0.86)	(-0.98)	(-1.31)	(-0.91)	(-0.52)
GDP Growth	-0.022***	-0.025***	-0.010***	-0.022***	-0.003	-0.007
	(-3.61)	(-2.70)	(-2.76)	(-2.82)	(-1.02)	(-1.00)
SD of Life Ladder	0.149	0.155	0.105**	0.197	0.084	0.245**
	(1.51)	(0.92)	(1.98)	(1.51)	(1.59)	(2.56)
N	119,537	119,537	117,140	117,140	109,072	109,072
Adj. R^2	0.801	0.649	0.814	0.663	0.815	0.664

Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of social support. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 12. Productivity Channel

	(1) *Patents per Employee*	(2) *Citations per Employee*
Life Ladder	0.327***	0.346*
	(4.99)	(1.95)
Ln(TA)	-0.141***	-0.279***
	(-3.40)	(-2.63)
Tobin's Q	0.072***	0.077
	(3.63)	(1.52)
OCF	0.052	-0.259
	(0.23)	(-0.46)
Sales Growth	-0.021	0.047
	(-0.50)	(0.52)
Leverage	-0.487***	-1.295***
	(-3.24)	(-3.93)
R&D	-0.380	-2.078
	(-0.37)	(-0.89)
Capex	-0.421**	-0.474
	(-2.26)	(-1.20)
HHI	-0.113	-1.282
	(-0.32)	(-1.44)
HHI^2	0.080	1.005
	(0.28)	(1.41)
GDP Growth	-0.029***	-0.074***
	(-3.12)	(-3.25)
SD of Life Ladder	0.300*	0.775**
	(1.80)	(2.45)
N	80,094	80,094
Adj. R^2	0.630	0.473
Firm FE	Yes	Yes
Industry-Year FE	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by using alternative dependent variables. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 13. Risk-Tolerance Channel

Panel A: Legal Enforcement

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder × Rule of Law	0.021*	0.137***				
	(1.72)	(3.91)				
Life Ladder × Repudiation of Contracts			0.043**	0.160***		
			(2.00)	(3.23)		
Life Ladder × Judicial Efficiency					0.010	0.077*
					(0.79)	(1.79)
Life Ladder	-0.056	-0.682***	-0.268	-1.097***	0.013	-0.334
	(-0.73)	(-3.44)	(-1.62)	(-2.95)	(0.17)	(-1.17)
N	107,542	107,542	107,542	107,542	107,542	107,542
Adj. R^2	0.817	0.681	0.817	0.680	0.817	0.680
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Investor Protection

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$
Life Ladder × Anti-self-dealing	0.404**	0.309		
	(1.98)	(1.02)		
Life Ladder × Credit Information Sharing			0.194**	0.660***
			(2.09)	(3.59)
Life Ladder	-0.116	-0.054	-0.003	-0.403***
	(-1.13)	(-0.32)	(-0.03)	(-2.64)
N	100,938	100,938	121,885	121,885
Adj. R^2	0.828	0.713	0.804	0.673
Firm FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of legal enforcement and investor protection. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All

variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A1. Variable Definitions

Variable	Definition	Main Source
No. of Patents	The yearly total number of patent applications of a firm $\mathrm{PAT_{i,t}} = \sum_{j \in J(t)} p_{j,t}$ where $PAT_{i,t}$ is the total number of patents filed by firm i in year t. $J(t)$ is the set of all patent applications the firm filed with distinct family ID in year t.	PATSTAT 2016 Autumn
No. of Citations	The yearly total number of patent citations of a firm received within 5 years after the first publication date of the application. $\mathrm{CIT_{i,T}} = \sum_{t=p_i}^{P_i+T} \sum_{j \in J(t)} C_{j,i} \; ; T \leq 5$ where $CIT_{i,T}$ is the total number of forward citations received by patent applications i published in year P_i within T years from its publication date. $C_{j,i}$ is a dummy variable that equals to 1 if the patent application j is citing patent application i, and 0 otherwise. $J(t)$ is the set of all patents applications published in year t.	PATSTAT 2016 Autumn
PATENT	Natural Logarithm of 1 plus the total number of patents filed each firm in each year.	PATSTAT 2016 Autumn
CITEPAT	Natural Logarithm of 1 plus the total number of citations made to each firm's patents in each year.	PATSTAT 2016 Autumn
Life Ladder	Life-ladder is measured by answers to the Cantril ladder question: "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?"	World Happiness Report
Ln(TA)	The natural logarithm of total assets	WorldScope
Tobin's Q	Sum of market value and book value of debt (long-term debt and debt in current liabilities) divided by total assets	WorldScope

OCF	Cash flows from operations in year t scaled by lagged total assets.	WorldScope
Sales Growth	Sales growth, defined as sales growth from t − 1 to t.	WorldScope
Leverage	Book leverage, calculated as total debt divided by beginning year total assets.	WorldScope
R&D	R&D Spending scaled by lagged total assets.	WorldScope
Capex	Capital expenditure scaled by lagged total assets.	WorldScope
HHI	Herfindahl-Hirschman Index, calculated as the summed value of squared market value within three-digit SIC industry, which measure the industry level product market competition.	WorldScope
HHI^2	The squared value of Herfindahl-Hirschman Index.	WorldScope
GDP Growth	Annual change in annual GDP (%).	World Development Indicators
SD of Life Ladder	The standard deviation of Life Ladder.	WorldScope
R&D Intensity	*R&D Intensity* is R&D intensiveness as the annual percentage of R&D expenses to total assets for each publicly listed firm in each year.	Compustat North America
R&D Growth	*R&D Growth* is high-tech intensiveness as the annual percentage of growth in R&D expenses for each publicly listed firm in each year.	Compustat North America
Innovation Propensity	*Innovation Propensity* is innovation propensity as the averaged total number of patents filed for each publicly listed firm in each year.	Compustat North America
Social Support	Social support is the national average of the binary responses (either 0 or 1) to the Gallup World Poll (GWP) question "If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?"	World Happiness Report
Democratic Quality	The average value of World Bank measures on voice and accountability, and political stability and absence of violence.	World Happiness Report
Olympic Medals	The total number of medals (bronze) earned by the country in both Winter and Summer Olympic Games.	Olympic Games

Natural Disaster	The total number of incidents of natural disasters happened in the country, including wildfire, landslide, mass movement, volcanic activity, storm, flood, extreme temperature, earthquake, and drought.	Global Natural Disaster
Muscularity	An cultural index which measures the degree that people in society prefer for achievement, heroism, assertiveness, and material rewards for success with higher values indicating a more "tough" society.	Hofstede
Long-term Orientation	An cultural index which measures society's attitudes toward future, with higher value indicating more preference to thrift and efforts in modern education as a way to prepare for the future.	Hofstede
Trust	An index which measures the trust in the society (NTRUST), with higher values indicating people have more trust in others in the society.	Hofstede
Financial Crisis	It takes the value of 1 if the year is 2007 or 2008, zero otherwise.	WorldScope
Credit/GDP	Private credit from banks and financial institutions to GDP (%), which captures the degree of credit market development.	World Development Indicators
Mcap/GDP	Stock market capitalization to GDP (%), which captures the degree of stock market development.	World Development Indicators
Interest Rate	Lending interest rate.	World Development Indicators
Polarization : Income Inequality	An averaged index of people's response to "Incomes should be made more equal" or "We need larger income differences as incentives". Higher score means people agree that we need higher income inequality.	World Values Survey
Polarization : Business Ownership	An averaged index of people's response to "Private ownership of business should be increased" or "Government ownership of business should be increased'". Higher score means people agree that we need higher government ownership of business.	World Values Survey

Polarization : Government Responsibility	An averaged index of people's response to "People or the government should take more responsibility to provide for themselves". Higher score means people agree that government should take more responsibility.	World Values Survey
Financial Openness	A capital account liberalization index which captures the degree of free movement of capital in and out of the country.	Chinn and Ito (2008)
Trade Openness	The sum of imports and exports scaled by GDP, which captures the degree of openness of a country to foreign trade.	World Development Indicators
Freedom to Make Life Choices	This index is the national average of binary responses to the GWP question "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?"	World Happiness Report
Corruption	This index are the average of binary answers to two GWP questions: "Is corruption widespread throughout the government or not?" and "Is corruption widespread within businesses or not?"	World Happiness Report
Rule of Law	An index which measures the assessment of the law and order tradition in the country. The value ranges from 0 to 6, with lower scores for less tradition for law and order.	La Porta et al. (1998)
Repudiation of Contracts	An index which captures "risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down due to budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities". The index ranges from 0 to 10, with higher scores for lower risks.	La Porta et al. (1998)
Judicial Efficiency	An index which captures the "efficiency and integrity of the legal environment as its affects business, particularly foreign firms". The value ranges from 0 to 10, with lower scores indicating lower efficiency levels.	La Porta et al. (1998)
Anti-self-dealing	An averaged index of ex ante and ex post private control of self-dealing, ranges from 0 to 1, with higher scores indicating higher shareholder protection.	La Porta et al. (1998)
Creditor Rights	An aggregated creditor rights index which is formed by adding 1 when (1) the country imposes restrictions, such as creditors' consent or minimum dividends to file for reorganization; (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay); (3) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm; and (4) the debtor does not retain the administration of its property pending the resolution of the reorganization. The index ranges from 0 to 4, with higher values indicating higher creditor rights protection.	La Porta et al. (1998)

Credit Information Sharing	A dummy variable which captures whether borrowers' credit information is shared among lenders through either a public credit registry or a private credit bureau in the country as the time of 1998.	La Porta et al. (1998)

Table A1. Funding Channel: External Finance Dependence

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$	(5) $PATENT_{t+1}$	(6) $CITEPAT_{t+1}$
Life Ladder × Firm-level Extfin	0.002	-0.017				
	(0.12)	(-0.75)				
Firm-level Extfin	-0.045	0.074				
	(-0.42)	(0.50)				
Life Ladder × Industry-level Extfin			-0.003	-0.001		
			(-0.40)	(-0.13)		
Life Ladder × Industry-level equity dependence					0.001	0.011
					(0.04)	(0.56)
Life Ladder	0.176***	0.143*	0.176***	0.203**	0.175***	0.199**
	(3.97)	(1.86)	(4.07)	(2.34)	(3.99)	(2.34)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	99,076	99,076	122,184	122,184	122,184	122,184
Adj. R^2	0.793	0.646	0.804	0.672	0.804	0.672
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports test that examines the effect of happiness on corporate innovation by examining the role of external finance dependence. Firm level controls are included in the baseline model to control for firm- specific characteristics. Firm and industry-year fixed effects are included in the regressions from Column (1) to (4). All variables are defined in Appendix. Standard errors are robust to heterogeneity and clustered by country and year. Industry-level external finance dependence and equity finance dependence are constructed following Rajan and Zingales (1998). Robust t-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A2. Social Support

	(1) $PATENT_{t+1}$	(2) $CITEPAT_{t+1}$	(3) $PATENT_{t+1}$	(4) $CITEPAT_{t+1}$
Social Support	0.900*	1.396*	0.458	1.083
	(1.86)	(1.78)	(0.93)	(1.40)
Life Ladder			0.144***	0.102
			(3.51)	(1.31)
Ln(TA)	0.152***	0.030	0.145***	0.025
	(6.14)	(0.96)	(6.28)	(0.80)
Tobin's Q	0.010*	-0.004	0.009*	-0.005
	(1.92)	(-0.51)	(1.80)	(-0.58)
OCF	0.035	0.107**	0.039	0.109**
	(1.24)	(2.46)	(1.38)	(2.53)
Sales Growth	-0.022***	-0.024**	-0.022***	-0.024**
	(-3.33)	(-2.50)	(-3.35)	(-2.53)
Leverage	-0.127***	-0.229***	-0.131***	-0.233***
	(-4.41)	(-4.26)	(-4.73)	(-4.37)
R&D	0.977***	0.748	0.908***	0.700
	(3.77)	(1.46)	(3.75)	(1.39)
Capex	-0.069	-0.095	-0.063	-0.093
	(-1.38)	(-1.08)	(-1.28)	(-1.04)
HHI	-0.122	0.045	-0.109	0.055
	(-1.04)	(0.27)	(-0.95)	(0.33)
HHI^2	0.020	-0.129	0.015	-0.133
	(0.22)	(-0.96)	(0.17)	(-0.99)
GDP Growth	-0.026***	-0.030***	-0.024***	-0.028***
	(-3.95)	(-2.98)	(-3.84)	(-2.84)
SD of Life Ladder	0.112	0.153	0.163*	0.189
	(1.18)	(1.06)	(1.70)	(1.20)
N	119,550	119,550	119,537	119,537
Adj. R^2	0.800	0.648	0.801	0.648
Firm FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes