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Embracing responsible innovation and empowering consumers in the digital age

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ADB Working Paper Series

**EMBRACING RESPONSIBLE
INNOVATION AND EMPOWERING
CONSUMERS IN THE DIGITAL AGE**

Douglas Cumming and Sofia Johan

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Abstract

We examine the intersection between financial inclusion, financial literacy, and financial technology. Using worldwide data, we find a significant positive relation between the World Bank's "Findex" measures and various measures of financial literacy, as well as Google Trends. We show that e-commerce legislation around the world significantly positively facilitates fintech adoption. We further examine Google Scholar to identify gaps in the research in specific regions. Finally, we use more specific information from one type of fintech—crowdfunding—to show that financial literacy indeed facilitates fintech and to explain the specific mechanisms therein. We discuss the policy and research implications based on our data and provide an overview of the literature to date.

Keywords: fintech, financial inclusion, financial literacy

JEL Classification: G20, G53

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1. INTRODUCTION

This paper provides an international perspective on the relationship between responsible innovation and empowering consumers by drawing attention to financial inclusion, financial literacy, and financial technology (hereafter “fintech”). We present international statistics consistent with the view that financial literacy enables better access to finance and financial inclusion with new developments in fintech, thereby empowering consumers and facilitating responsible innovation.

To empower consumers with fintech, fintech innovation needs to take responsibility for fitting within the best practices of regulatory standards. At a broad level, new financial technology will empower consumers in countries that have rules respecting consumer protection. More specifically, countries that have e-transaction laws, cybercrime laws, and data privacy laws will enable consumers to maximize the use of fintech innovations with minimal risk. In this paper, we provide statistical evidence that these regulatory standards have important connections to fintech adoption around the world.

In countries that adopt the best regulatory practices, fintech is more likely to empower consumers in the digital age in countries with high levels of financial literacy and inclusion. In this paper, we provide statistical evidence from crowdfunding that shows that literacy is an important factor in the successful usage of one type of fintech innovation—namely crowdfunding.

Responsible innovation includes but is not limited to sustainability. In this paper, we provide further evidence that literacy facilitates the financing of responsible sustainable innovation, with further evidence from the crowdfunding literature.

This paper proceeds as follows. Section 2 begins with the best practices in terms of what “responsible innovation” means. We further explain what happens in countries around the world that do not have the best regulatory framework in regard to the adoption of fintech. Finally, we show that, even in countries with the best regulatory practices, there are still concerns among consumers with respect to the adoption of fintech.

Section 3 of this paper thereafter discusses solutions to market problems with the adoption of fintech and the achievement of responsible innovation. Section 4 then examines the specific context of crowdfunding, which is one recent and popular type of fintech innovation, and shows how financial literacy and inclusion enhance crowdfunding. Finally, section 5 provides a summary and concludes with policy recommendations and suggestions for future research.

2. BEST PRACTICES IN FINTECH INNOVATION

The research on fintech, financial innovation, and financial inclusion is in its infancy. As such, it is hard to begin by conclusively stating what it means to have “best practices” in responsible innovation in fintech. Nevertheless, we might begin with some pronouncements of responsible innovation in fintech from the US. From this perspective, an appropriate place to begin seems to be the pronouncements of the US Office of the Controller of Currency (OCC). The OCC defined responsible innovation as follows (Office of the Comptroller of the Currency 2016):

The OCC defines Responsible Innovation as the use of new or improved financial products, services and processes to meet the evolving needs of consumers, businesses,

and communities in a manner that is consistent with sound risk management and is aligned with the bank's overall business strategy.

The OCC took a step further by providing a responsible innovation framework, which consists of five pillars. The first pillar is *outreach and technical assistance*. Outreach for the OCC involves ongoing communications with banks, fintech companies, and other stakeholders. The OCC offers technical assistance to banks, fintech companies, and other stakeholders. Further, through its outreach and technical assistance, the OCC informs banks, fintech companies, and other stakeholders about OCC positions and expectations. More generally, through its web page and ongoing activities, the OCC promotes awareness of responsible innovation.

The second OCC pillar is *awareness and training*. The OCC encourages and fosters training and skills development in responsible innovation. The OCC keeps its examiners and other staff aware of emerging trends. The OCC training and awareness processes are designed with respect to leveraging existing OCC experience and expertise.

The third OCC pillar is *coordination and facilitation*. The OCC is at the focal point of a network of banks, fintech companies, and other stakeholders. As such, the OCC implements streamlined and timely responses to inquiries. The OCC innovation decisions are transparent. It further enables processes for participation in stakeholder-run pilots.

The fourth OCC pillar is *research*. Research is used to inform banks, fintech companies, and other stakeholders about OCC policy, supervision, and analysis. Additionally, research enables people to keep up to date and predict future trends in fintech.

The fifth OCC pillar is *interagency collaboration*. The OCC recognizes that fintech innovations are global in nature and not isolated to one specific country. Fintech developments and externalities spread across countries. As such, the OCC ensures and encourages the development of communication channels, information sharing, and collaboration with regulators in the US and around the world.

While fintech innovation might appear to flourish in countries like the US, with regulators that adopt best practices, it is worthwhile examining two related questions. First, what happens in countries outside the US that do not appear to have the right regulatory framework to enable responsible fintech? Second, are there nevertheless concerns about responsible innovation in fintech within the US? We examine these two questions in the remainder of this section.

Considering the first issue, outside the US, are there problems or costs associated with the absence of best practices insofar as having a suitable regulatory framework in which fintech innovation can flourish? The United Nations provided a useful summary of the adoption of e-commerce legislation worldwide,¹ which shows the following surprising facts about the international regulatory landscape:

- Only 79% of countries around the world have e-transaction laws;
- Only 52% of countries have consumer protection laws;
- Only 58% of countries have data privacy laws; and
- Only 72% of countries have cybercrime laws.

¹ UNCTAD. Summary of Adoption of E-Commerce Legislation Worldwide. https://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Global-Legislation.aspx.

To determine whether these regulatory deficiencies matter, we merged the United Nations summary of e-commerce legislation worldwide with the World Bank's Findex dataset (Ernst & Young (2019)).² The data suggest that some important and pronounced problems arise in the absence of a good regulatory framework. Table 1 summarizes the evidence. Comparing 142 countries around the world, consumer protection legislation and data privacy legislation have the most pronounced impact on consumer adoption of fintech. E-commerce legislation and cybercrime laws are important as well, but the differences across countries that do and do not have such legislation are not as pronounced as those for consumer protection legislation and data privacy legislation.

Table 1: Fintech Adoption and E-Commerce Legislation around the World

	No Consumer Protection Legislation	Consumer Protection Legislation	No E-commerce Legislation	E-commerce Legislation
Average % Used Internet to Pay Bills (N=142, Avg=22%)	11%	28%	12%	23%
T-Statistic of Difference		4.87***		1.80*
Average % Used Internet to Purchase (N=142, Avg=28%)	15%	35%	17%	29%
T-Statistic of Difference		4.96***		1.88*
Average % Make Purchases Online, Female (N=142, Avg=19%)	9%	26%	11%	20%
T-Statistic of Difference		5.12***		1.61
Average % Saved for Old Age (N=142, Avg=21%)	14%	25%	16%	20%
T-Statistic of Difference		4.86***		0.78
Average % Saved to Start, Operate, or Expand a Farm or Business (N=142, Avg=14%)	14%	14%	16%	20%
T-Statistic of Difference		-0.19		0.85
	No Cyber-crime Laws	Cyber-crime Laws	No Data Privacy Laws	Data Privacy Laws
Average % Used Internet to Pay Bills (N=142, Avg=22%)	16%	24%	11%	26%
T-Statistic of Difference		1.74*		3.88***
Average % Used Internet to Purchase (N=142, Avg=28%)	21%	30%	14%	33%
T-Statistic of Difference		1.68*		4.13***
Average % Make Purchases Online, Female (N=142, Avg=19%)	14%	21%	9%	24%
T-Statistic of Difference		1.51		3.86***
Average % Saved for Old Age (N=142, Avg=21%)	18%	22%	15%	23%
T-Statistic of Difference		1.06		2.82***
Average % Saved to Start, Operate, or Expand a Farm or Business (N=142, Avg=14%)	14%	14%	15%	14%
T-Statistic of Difference		0.08		-1.36

² The World Bank. The Global Findex Database 2017. <https://globalfindex.worldbank.org/>.

Source: Authors' calculations based on data from Ernst & Young (2019) and UNCTAD. Summary of Adoption of E-Commerce Legislation Worldwide. https://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Global-Legislation.aspx.

Table 1 shows that, on average, 28% and 35% of consumers use the internet to pay bills and make purchases, respectively, in countries with consumer protection legislation, while only 11% and 15% of consumers use the internet to pay bills and make purchases, respectively, in countries without consumer protection legislation; these differences are both statistically significant at the 1% level. Consumer protection legislation is likewise important for both males and females but does not encourage females as much as it encourages males. On average, in countries with consumer protection legislation, we observe that 26% of females make purchases online, while in countries without consumer protection legislation, only 9% of female consumers make purchases online, and this difference is significant at the 1% level. Finally, we see that consumer protection legislation is important for encouraging saving for old age but not important for encouraging saving to start a business or farm. That is, we may expect financial products for long-term retirement planning to be more attractive in countries with consumer protection legislation, but consumer protection legislation is less pertinent to shorter-term saving to start a business or farm. The data indicate that 25% of residents in countries with consumer protection legislation save for old age but only 14% of residents in countries without consumer protection legislation save for old age, and this difference is statistically significant at the 1% level. An equal percentage (14%) of residents in countries with and without consumer protection legislation save to start a business or farm.

Table 1 further shows that there are differences across countries with and without e-commerce legislation. The average percentage of consumers who use the internet to pay bills is 23% in countries with e-commerce legislation and 12% in countries without e-commerce legislation, and that difference is statistically significant at the 10% level of significance. Furthermore, 29% of consumers in countries with e-commerce legislation use the internet to make purchases, while only 17% of consumers use the internet to make purchases in countries without e-commerce legislation, and that difference is statistically significant at the 10% level. A greater proportion of women use the internet to make purchases in countries with e-commerce legislation than in countries without e-commerce legislation (20% versus 11%), but the difference is not statistically significant. In addition, a greater proportion of consumers save for old age and save to start a business in countries with e-commerce legislation than in countries without e-commerce legislation (20% versus 16% in both cases of saving for old age and saving to start a business), but again that difference is not statistically significant.

A greater percentage of consumers use the internet to pay bills and make purchases online in countries with cybercrime laws (24% and 30%, respectively) than in countries without cybercrime laws (16% and 21%, respectively), and these differences are both statistically significant at the 10% level. A greater percentage of females make purchases online and a greater percentage of residents save for old age in countries with cybercrime laws (21% and 22%, respectively) than in countries without cybercrime laws (14% and 18%, respectively), but these differences are not statistically significant. Furthermore, an equal percentage (14%) of residents in countries with and without cybercrime laws save to start a business or farm. See Table 1.

Finally, Table 1 indicates that residents in countries with data privacy laws are significantly more likely to use the internet to pay bills (26% in countries with versus 11% in countries without), make purchases online (all 33% in countries with and 14% in countries without; and females 24% in countries with and 9% in countries without), and save for old age (23% in countries with compared with 15% in countries without); these differences are all statistically significant at the 1% level of significance. However,

as with the differences in consumer protection laws, e-commerce legislation, and cybercrime laws, the difference in saving to start a business or farm is not significantly different in countries with data privacy laws (14%) than in countries without data privacy laws (15%).

Overall, the data in Table 1 indicate that there are clearly costs to countries that do not have the right regulatory framework to enable responsible fintech. However, a question arises regarding whether there are problems with responsible innovation in fintech even within countries such as the US. A 2019 survey (Auxier and Rainie 2019) recently suggested that indeed there are problems; at least, more consumers think that there are problems than do not think that there are problems. Specifically, the survey results indicated that consumers are concerned about how companies (79% concerned) and the government (64%) collect data, and most (70%) feel that personal information is less secure in 2019 than in 2014. There is a concern among 62% of consumers that it is impossible to experience daily life without companies and the government collecting data (and 72% feel that with cell phones). In addition, 75% believe that unwanted data collection occurs with the intent to develop consumer profiles. Most have concerns about what the government (78% concerned) and companies (59%) do with the data that they collect.

These concerns are not alleviated by boilerplate agreements pertaining to data privacy policies. Companies have asked almost all consumers (97%) to agree to a data privacy policy and have even asked 25% of consumers to agree to such policies on a daily basis; however, only 36% have ever read such a policy, and only 20% say that they read these policies before agreeing to them.

Consumers recognize that there are benefits to this data collection, such as mitigating terrorist threats; 49% feel that it is acceptable for the government to collect data about them for that purpose. Overall, most consumers feel that the risks of data collection outweigh the benefits (81% for companies and 66% for government data collection). In respect of these risks, 84% and 81% have a concern about the lack of control over the data that the government and companies collect about them, respectively, and fewer than 5% feel that they feel that they have significant control over data that companies or the government collect about them.

Finally, while there are data protection laws, a majority of consumers (63%) have scant understanding of these laws, and a tiny minority (3%) have a significant understanding of these laws. Most (75%) feel that there should be more government regulations on the corporate use of consumers' personal information.

3. SOLUTIONS AND SUGGESTIONS FOR IMPROVEMENT

The international comparative evidence and consumer-specific evidence are highly consistent with the view that financial regulation and financial education and literacy empower consumers and enable responsible fintech innovation. The development of novel approaches to encourage financial education in some countries has fostered financial literacy. For example, in Viet Nam, games have achieved significant success in increasing financial knowledge and literacy (Thanh Van 2020). Moreover, in respect of financial regulation, in Hong Kong, China, for example, a 2016 change in regulation significantly supported fintech adoptions related to mobile payment. Specifically, prior to 2016, a banking ordinance regulated the mobile payment regime, while, after 2016, the stored value facilities regulated the mobile payment regime separately. The stored value

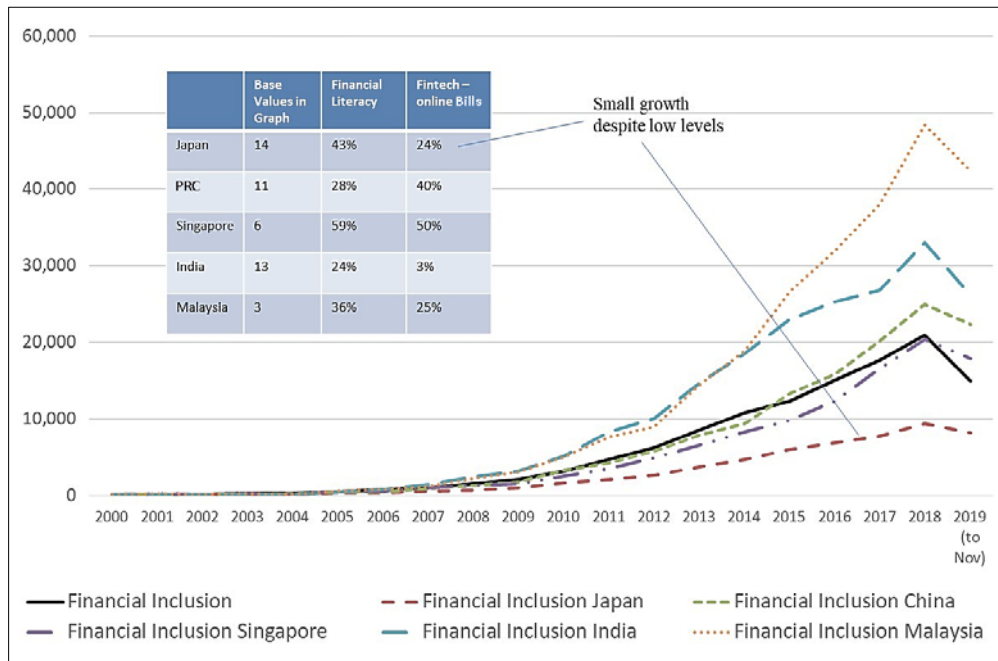
facilities in Hong Kong, China have since been increasing at a much faster rate and have enabled much faster payment systems (Pang 2019).

Financial literacy involves educating consumers. Boilerplate agreements are meaningless if no one reads them. Learning involves distinct methods with digital technologies, and the science behind effective learning is just evolving to match the digital needs (Chasse, Auricchio, and Liebert 2019). Seminars, webinars, and news briefings are necessary to develop more effective tools to meet consumer needs. Financial education should begin in grade school, and stronger rule setting and enforcement of data privacy are necessary. The OCC framework that the start of section 2 described is useful, but there are no pronouncements that deal with US residents' concerns about data privacy. In addition, a framework is necessary for regulatory agencies in different countries to coordinate differently with countries with deficient regulatory settings.

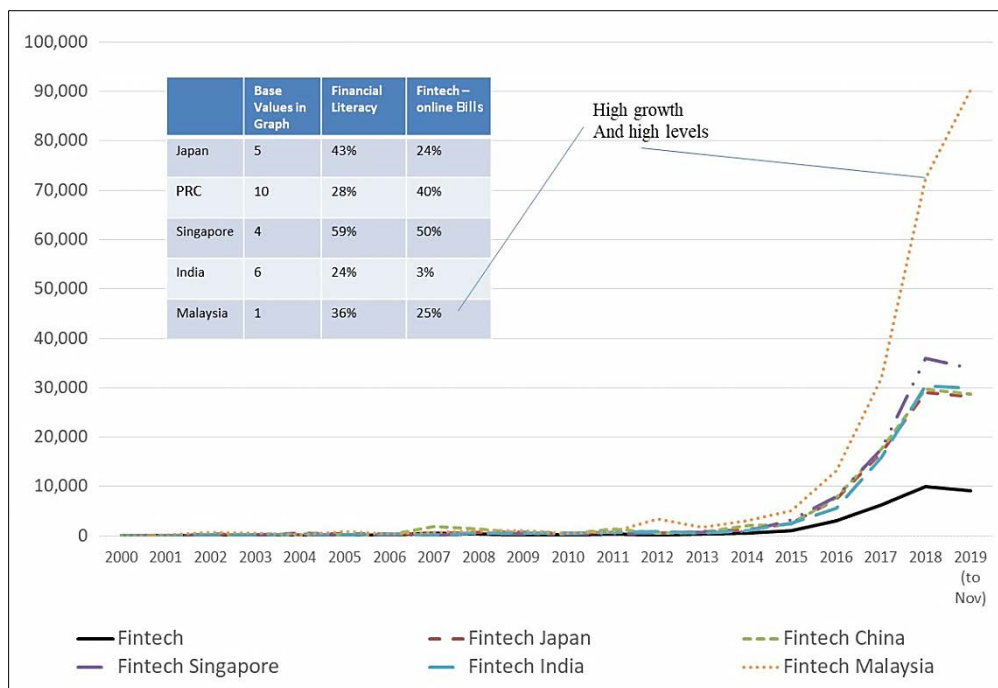
One concern regarding financial literacy rules in developed countries such as the US is the problematic and ongoing struggle with “know your client” (KYC) rules. There are numerous examples of violations of the KYC principles, which keep consumers less informed than they should be. For example, mutual funds in the US have faced concerns from the Department of Labor on fiduciary standards with regard to clients on acting in the best interest of consumers and properly informing consumers about fee arrangements (Menickella 2019). The UK, continental Europe, and Australia have banned trailer fees (known as 12b1 fees in the US), which enable kick-back payments to advisors every year for keeping their clients invested in funds, but Canada and the US have not. There are clear conflicts of interest with such fees, as they distort the incentives of intermediaries to misdirect client monies into funds that pay these fees and keep client monies in these funds even when they are underperforming (Cumming, Johan, and Zhang 2019a). An additional and more direct example involves bank tellers upselling various unsuitable products to clients (O'Hara 2016). Billions of dollars in fees and misallocated capital are at stake every year. It is important to inform consumers to protect them against the inherent biases that developed countries permit, even including Canada and the US.

An additional mechanism to help empower consumers and improve financial literacy is more research, as indicated by the best practice standards of the OCC that the start of section 2 outlined. Not only is “more” research not the answer, but also the type of research can aid consumer needs. One tool that enables a useful assessment of whether the right research focus exists in different countries is Google Scholar. See Figures 1–3.

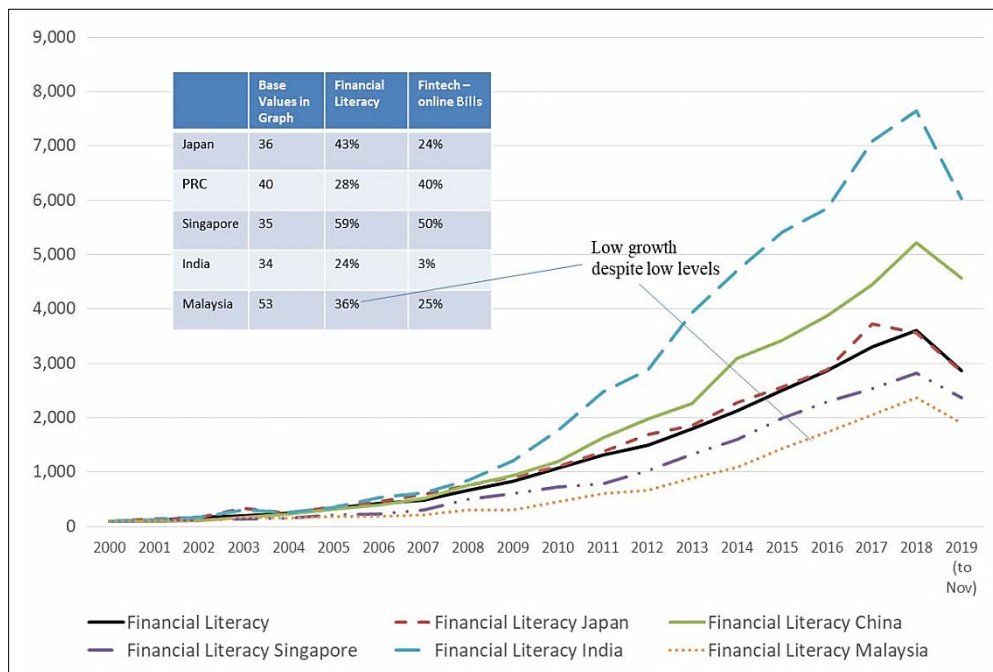
Figure 1 presents an index of the number of documents that Google Scholar found from 2000 (the inserted table for the year 2000 indicates the base values) and the growth in document hits up to November 2019, the time of preparation of this paper. Figure 1 presents the search term “financial inclusion” and includes financial inclusion for all countries around the world as well as financial inclusion in five other countries in Asia (Japan, the People's Republic of China [the PRC], Singapore, India, and Malaysia). Also in Figure 1 is a chart of the Findex levels. Figure 1 shows that, for example, growth in financial inclusion research is low in Japan and lower than in any other country in the chart, while Japan lags behind other countries on fintech and paying bills online (24% in Japan), at least relative to the PRC (40%) and Singapore (50%). Japan also lags the worldwide average for growth in financial inclusion research.

Figure 1: Financial Inclusion Trends in Google Scholar

Source: Authors' calculations from Google Scholar.

Figure 2: Fintech Trends in Google Scholar

Source: Authors' calculations from Google Scholar.

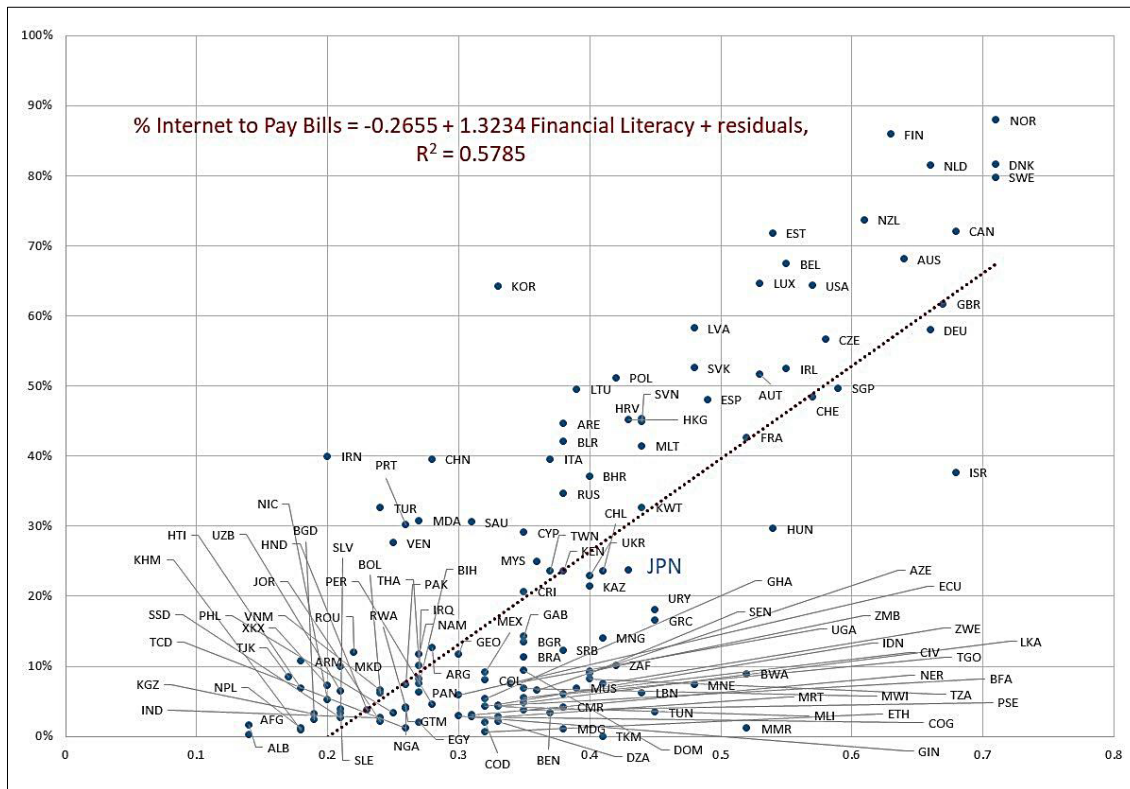
Figure 3: Financial Literacy Trends in Google Scholar

Source: Authors' calculations from Google Scholar.

Figure 2 presents similar evidence to Figure 1 but for Fintech. Figure 2 shows that Malaysia has a very high growth rate in fintech research, and Malaysia (25%), in relation to paying bills online, compares favorably with Japan (24%) but still lags behind the PRC (40%) and Singapore (50%). However, Figure 2 shows that all of the countries in Asia have high levels of growth in fintech research compared with the worldwide average.

Figure 3 again presents similar information to Figures 1 and 2 but focuses specifically on financial literacy. The growth in financial literacy research lags the worldwide average in Malaysia and Singapore, and the growth in financial literacy research in Malaysia appears to be necessary in view of its low level of financial literacy (36%) relative to Japan (43%) and Singapore (59%).

Figure 4 presents clear evidence that financial literacy is highly positively correlated (the Pearson correlation coefficient is 76%) with fintech, such as the Findex index on the percentage of consumers who use the internet to pay bills. A simple regression model with a constant and one variable for financial literacy shows that it has the power to explain over 57.8% of the variation in average consumers across countries who use the internet to pay bills.

Figure 4: Financial Literacy and Findex's Using the Internet to Pay Bills

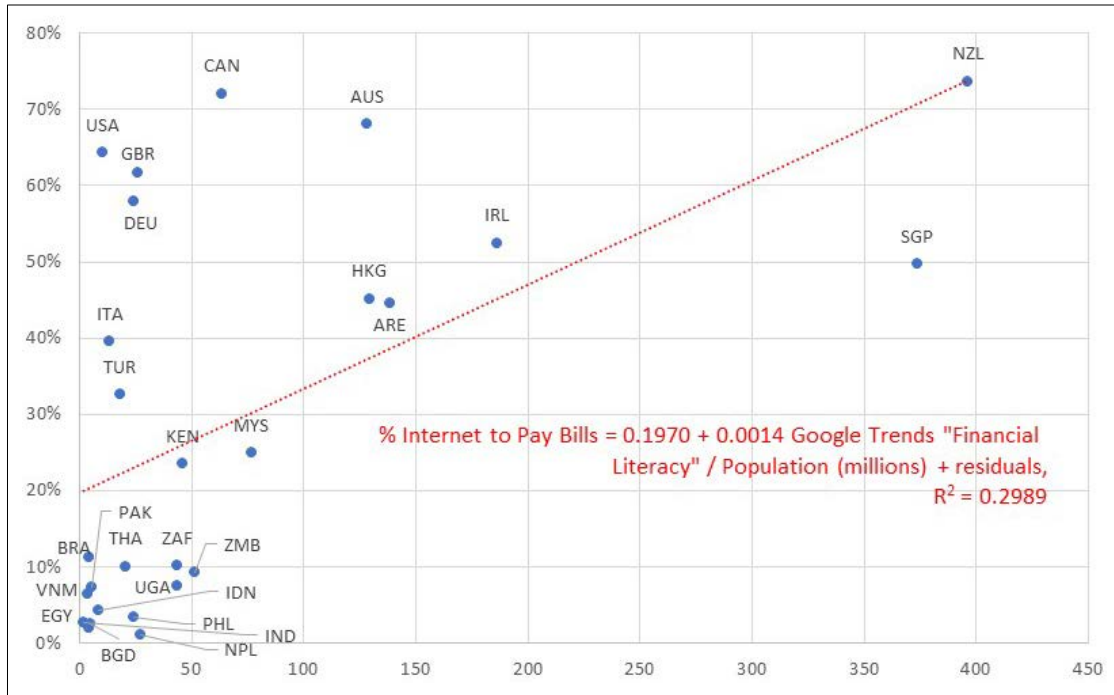
Source: Authors' calculations using data from Ernst & Young (2019) and Klapper et al. (2015).

Figure 4 is highly consistent with the view that financial literacy is the key to empowering consumers. The adult financial literacy rate is shockingly low, showing an average of only 36.65% across 143 countries, with a maximum of 71% in Denmark, Norway, and Sweden and a minimum of 13% in Yemen (Klapper, Lusardi, and van Oudheusden 2015). Therefore, even developed countries have substantial room for improvement, as financial literacy is critical to financial inclusion and responsible fintech innovation.

We provide further evidence of the link between financial literacy and fintech in Figure 5. Figure 5 uses cross-sectional Google Trends data for the search “financial literacy” in the countries where the data are available.³ The data clearly indicate a positive relation between financial literacy searches and actual financial literacy, as the Findex percentage of people using the internet to pay bills evidences. The simple regression line shows a goodness of fit of almost 30% with just one explanatory variable in Figure 5. Other Findex indices are consistent with this positive relation between Google Trends searches per population, but we do not report them here for conciseness.

³ In many countries there are no search items, due largely to language differences across countries.

Figure 5: Google Trends “Financial Literacy”/Population (Million People) and Findex’s Using the Internet to Pay Bills



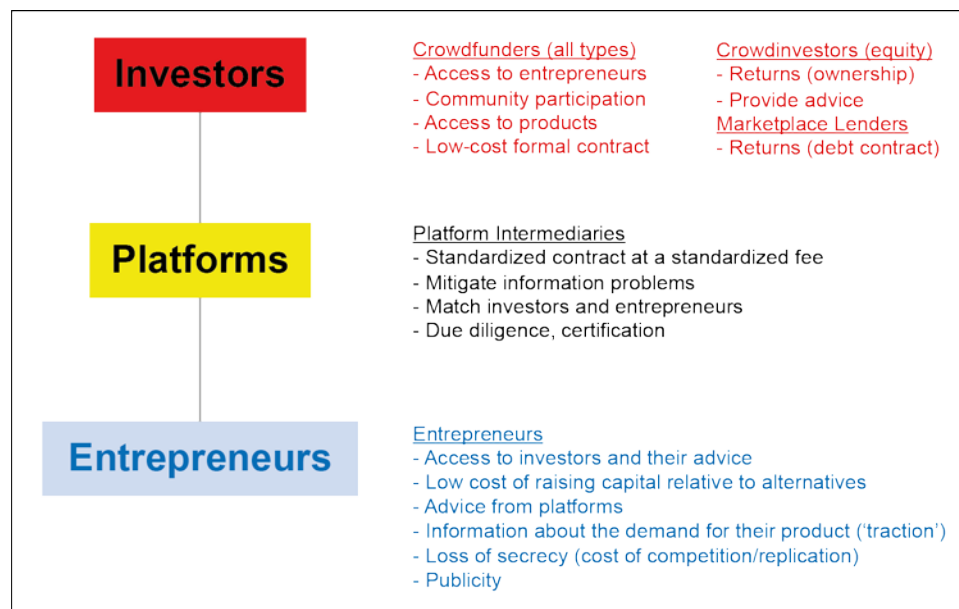
Source: Authors' calculations using data from Ernst & Young (2019) and Klapper et al. (2015).

4. EMPOWERING CONSUMERS THROUGH LITERACY: EVIDENCE FROM CROWDFUNDING

In this section, we focus on one type of fintech innovation: crowdfunding. To highlight the role of fintech in responsible innovation, we focus on the crowdfunding of cleantech projects. We begin with a brief background on crowdfunding in the first subsection. Then, in the second subsection, we discuss the evidence on the link between financial literacy and crowdfunding.

4.1 What Is Crowdfunding?

Crowdfunding platforms are intermediaries between retail investors and entrepreneurs (Cumming and Johan 2019). See Figure 6. Crowdfunding platforms carry out due diligence on entrepreneurs before the entrepreneurs seek access to capital, and more due diligence enables better crowdfunding outcomes (Rossi and Vismara 2018; Cumming, Johan, and Zhang 2019b). Entrepreneurs seek capital, and retail investors seek access to entrepreneurs in terms of early access to their products (in the case of reward crowdfunding) or an investment through equity sharing (equity crowdfunding) or a loan (marketplace lending).

Figure 6: Crowdfunding Intermediation

Source: Cumming and Johan (2019), Chapter 1, Figure 1.1.

Crowdfunding diligence checks include background checks, site visits, credit checks, cross-checks, account monitoring, and third-party proof (Cumming and Johan 2019; Cumming, Johan, and Zhang 2019b). These background checks have the purpose of mitigating the risks to the investors or crowdfunders as well to the platform itself. Moreover, in some countries, the due diligence is associated with the legal standards that apply to the platform, possibly implicitly through various regulations and surveillance from the securities commission in the country. The risk is that, without due diligence, an entrepreneur who is not of sufficiently high quality, or possibly overtly fraudulent, will proceed, thereby causing losses to investors and the platform and diminishing other investors' future interest in crowdfunding.

Crowdfunding platforms not only carry out due diligence but may also offer services that people may view as consulting services. For example, Cumming, Johan, and Zhang (2019b) reported that platforms offer pre-listing evaluation, strategic guidance, business planning, contract help, and promotion services. They also found evidence that these services appear to enable more successful outcomes.

There is a wide array of platform fee levels and types of fees. One of the most common fee arrangements (including the one that Cumming, Johan, and Zhang [2019b] observed) is a fixed percentage of the capital raised only if the campaign is successful (5% is a common amount). Platforms may also charge a fixed percentage regardless of whether the funding is successful. Other types of fees include simple one-time listing fees, periodical subscriptions (of course at different levels/tiers), and a two-part management fee with a carry percentage (similar to the typical 2% management fee and 20% carried interest fee that venture capital uses, albeit typically at lower levels).

The financial intermediation diagram in Figure 6 shows some additional important insights in terms of investor benefits. First, investors (or crowdfunders) in reward crowdfunding receive a benefit in terms of early access to a product and/or some other reward that the entrepreneur/crowdfunder offers. Second, investors in equity and debt crowdfunding receive a financial benefit. Third, there are various other benefits for reward, equity, and debt investors in crowdfunding, including obtaining access to

entrepreneurs (i.e., lowering search costs) and utility from participating in the entrepreneurial community. Fourth, these benefits all come at a low transaction cost relative to other forms or methods of financing entrepreneurs. For example, others (e.g., Cumming and Johan 2019) have noted that the legal fees for investing through angel investors can be much more expensive as a percentage of the capital raised relative to crowdfunding. Cumming and Johan (2019) provided an example that shows 45% transaction costs as a percentage of capital raised for an entrepreneur who raised \$150,000 from angel investors; we are unable to tell whether and how much of an outlier that is, but the case is certainly suggestive of large costs. By contrast, the transaction costs as a percentage raised in crowdfunding are around 5%. This 5% cost compares well to investment bank and other fees in an IPO (Chen and Ritter 2000), which are normally 7% for the largest issues and can increase to 40%–50% for very small issues on junior stock markets (Cumming and Johan 2013).

The financial intermediation diagram in Figure 6 shows both the costs and the benefits for entrepreneurs (crowdfunders). In terms of the costs, perhaps the most pronounced concern is theft. There are numerous examples and discussions online about people stealing crowdfunding ideas that people post online (Yap 2017). The copying often happens in a different country, so it is not immediately observable to the crowdfunder who had his/her idea stolen. Entrepreneurs often receive encouragement not to crowdfund unless they have a business process that they have developed sufficiently well or an idea that is not easy to replicate without significant effort and time. In that way, entrepreneurs can at a minimum build up a competitive advantage in terms of time and consumer recognition. Of course, where possible, it is helpful to obtain patent/copyright/trademark protection.

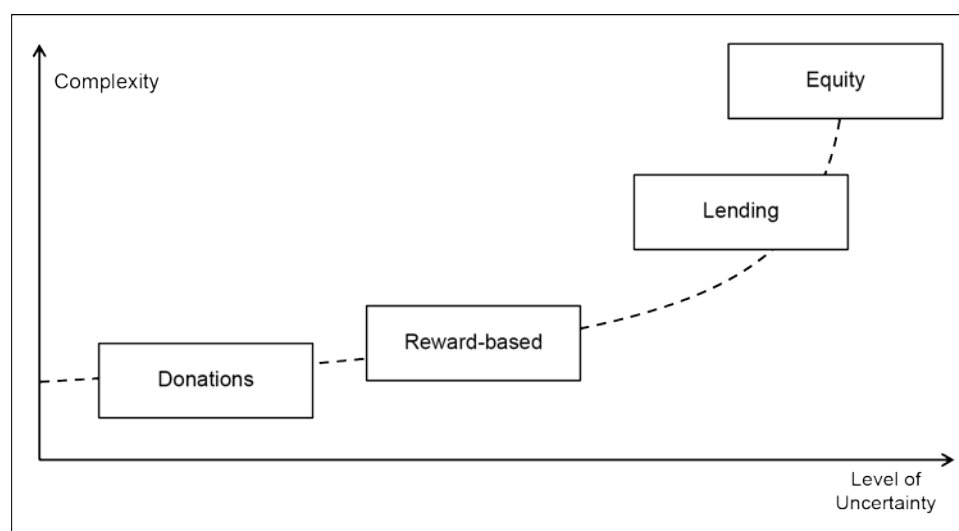
A benefit for entrepreneurs to using crowdfunding is that they can obtain more capital more cheaply (at a lower cost of capital) than with other forms of finance. Crowdfunding enables a wider geographic spread of investors and lowers search costs. The wider array of investors brings about a form of marketing for the entrepreneurs' products. The marketing benefit enables greater customer adoption and allows the entrepreneur to demonstrate traction, or product take-up/usage rates, which then provides a proof of concept to larger investors in later financing rounds (such as venture capital, private equity, IPOs, and other forms of subsequent investment). In addition, a more diverse set of investors lowers potential hold-up costs; that is, with a single source of capital, there is a pronounced risk that investors will renegotiate the financing terms in a subsequent investment round, and there is little protection for entrepreneurs if they do not have alternative sources of capital from different investors initially.

Crowdfunding is indeed a complicated process. To attract investors or crowdfunders, entrepreneurs need to be able to signal their quality. A signal needs to be costly insofar as other, lower-quality, entrepreneurs cannot easily copy them. Investors also need to be sophisticated to distinguish high-quality from low-quality entrepreneurs and fraudulent entrepreneurs. Entrepreneurial fraud has indeed occurred in various crowdfunding cases (Cumming and Johan 2019). For example, some entrepreneurs have simply used the funds raised to pay themselves directly without ever developing the product that they promised. Other entrepreneurs have falsely claimed the use of certain inputs in their product, such as the use of Kobe beef in a beef jerky campaign (Pepitone 2013). To overcome problems of information asymmetry and agency costs, entrepreneurs need to be financially literate and educated to signal their ability properly and investors need to be financially literate and sophisticated to understand the signals. Furthermore, there needs to be sufficient regulatory oversight and enforcement to deter potential fraudsters.

The importance of financial education and literacy increases with different types of crowdfunding. The lowest risks in terms of the uncertainty and complexity of a

crowdfunding campaign are associated with donation crowdfunding. For pure donation crowdfunding, the main type of risk is whether the funding cause is legitimate. For example, there are cases of people faking cancer to raise money through donation crowdfunding (Lanigan 2019). Reward crowdfunding involves a higher level of uncertainty and complexity insofar as there are uncertainties about the product and whether the entrepreneur will develop it successfully and deliver the promised rewards as well as pure fraud risk. Debt crowdfunding, or marketplace lending, involves financial knowledge about interest rates and the probability of default alongside risks associated with the entrepreneur's business plan; as such, it is more uncertain and complex than reward crowdfunding. Finally, with equity crowdfunding, the risk and uncertainty are at the highest levels, as the investors need to have knowledge of the operations of a stock corporation, voting rights, the separation of ownership and control, illiquidity, and other financial matters alongside all of the business risks associated with the entrepreneur. Figure 7 summarizes these different degrees of uncertainty and complexity for different types of crowdfunding.

Figure 7: Uncertainty and Complexity in Different Types of Crowdfunding



Source: Ahlers et al. (2015).

Clearly, the nature of crowdfunding and different types of crowdfunding show a potential role for financial literacy and education. The next subsection provides a discussion of research that has shown the intersection of financial literacy and education in different crowdfunding contexts.

4.2 How are Education and Financial Literacy Related to Crowdfunding?

Meoli, Rossi, and Vismara (2020) presented the most important evidence on a direct link between investment crowdfunding, one type of fintech innovation, and financial literacy and education by engaging in a panel dataset across countries and over time. They statistically related the emergence and success of investment-based crowdfunding platforms (including debt and equity platforms) in different countries with the national levels of financial literacy and education in a country and over time (Australia, Austria, Canada, France, Germany, Italy, New Zealand, the UK, and the US over the years 2007 to 2019). Their data are consistent with the view that digital finance and

financial innovations such as crowdfunding offer enormous potential, but that potential is only attainable if the consumers in a country have the tools to manage the risks properly. Their statistical analysis did not reveal a direct relationship between the level of financial literacy in a country and the survival profiles of crowdfunding platforms, but it did find evidence that financial literacy enhances the chance of survival of platforms that deliver voting rights to small investors. This evidence is consistent with the view that voting rights are a more complicated form of crowdfunding (in the spirit of Figure 7 discussed above) and that financial literacy enables a better understanding of the complexities of that type of crowdfunding.

There are some alternative explanations for the results that Meoli, Rossi, and Vismara (2020) obtained for the overall sample. First, truncation bias and unobservability bias can exist, as some platforms may fail after the 2019 period in their study. Second, some platforms that start eventually pivot and begin to offer different services instead of those that they initially offered (i.e., a pure crowdfunding platform ends up becoming a different type of financial entity). Further, there are many platforms that intend to start but are never successful. Cumming, Johan, and Zhang (2019b) reported information from Canada from a survey of platforms that started or attempted to start, with actual and expected levels of success, as well as from platforms that pivoted; the number of platform respondents that operated successfully was larger than the observed numbers in practice. Meoli, Rossi, and Vismara (2020) deemed a platform to have failed only if it was once successful. It is possible that the levels of financial literacy damage the entrepreneurial process of starting a platform such that it is unable to start successfully, fails, or pivots to another business line after a brief start in a way that Meoli, Rossi, and Vismara did not observe. They concluded that a better understanding of the impact of financial literacy is necessary to inform consumers properly, particularly in developing markets.

In view of these alternative explanations from Meoli, Rossi, and Vismara, we offer some additional evidence that is consistent with the view that financial literacy and crowdfunding are indeed connected in practice. Crowdfunding has the potential to empower consumers in responsible innovation insofar as they essentially vote with their dollars for which innovations receive funding. Additionally, the features of cleantech make financial literacy much more important to make use of crowdfunding in this area of cleantech innovation (Cumming, Leboeuf, and Schwenbacher 2017; Cumming and Johan 2019). Cleantech is non-excludable and non-rival. Non-excludable means that, once someone has made an investment, the benefits of such an investment are non-excludable for all stakeholders. For example, if firm A were to adopt cleantech investments, thereby improving the air/water quality, everyone benefits, including competitors. Cleantech is also non-rival, which means that a firm's consumption of the benefits associated with improved air/water quality does not affect other firms' consumption.

In view of the non-rival and non-excludable features of cleantech, Cumming, Leboeuf, and Schwenbacher (2017) made a number of predictions, two of which are directly pertinent to our context here. First, they conjectured that cleantech crowdfunding campaigns are more likely to make use of more detailed soft information to mitigate information problems, including more gallery items, video pitches, longer project descriptions, and better-worded project descriptions. Second, they conjectured that the success of cleantech crowdfunding campaigns is more sensitive to the use of soft project information. The reasons for these predictions are directly tied to the non-excludable and non-rival features of cleantech investments. Providers should articulate the benefits of cleantech more clearly for investors to want to offer their own capital and share it more broadly with others in the community. Cumming, Leboeuf, and

Schwienbacher (2017) also conjectured that the country-level Hofstede cultural conditions of low individualism and low indulgence are more often associated with cleantech, since individuals care more about community benefits in those cultural environments.

Cumming, Leboeuf, and Schwienbacher (2017) tested their propositions with data from Indiegogo around the world (over 22,000 campaigns from over 90 countries). Table 2 summarizes the data. The data indicate strong support for the idea that cleantech projects are larger (goals of \$26,095 and pledges of \$7,900 on average) than non-cleantech projects (goals of \$20,635 and pledges of \$6,478), and these differences are statistically significant. Cleantech projects have longer catchphrase project descriptions (average 120.8 words), more updates (5.68), more pictures (9.04), a greater likelihood of having a video (85%), and longer full-text descriptions (6,554 words) than non-cleantech projects, which have on average a catchphrase length of 114.8 words, 5.05 updates, 6.63 pictures, a 78% chance of a video, and a full-text description of 4,510 words. Table 2 further shows that cleantech projects are more common when oil prices are higher and when they have been rising in the 6 months prior to the start of a cleantech campaign. Finally, Table 2 shows that countries with higher levels of indulgence and individualism have fewer cleantech crowdfunding campaigns.

Table 2: Cleantech Crowdfunding versus Other Types of Crowdfunding

	Non-cleantech			Cleantech			Mean Diff. Test
Variables	Mean	S.D.	Median	Mean	S.D.	Median	
Project Characteristics							
Goal	\$20,635	\$26,160	\$10,000	\$26,095	\$30,764	\$15,000	−5,500***
Total Pledge	\$6,478	\$30,318	\$2,460	\$7,900	\$23,695	\$3,088	−1,400*
Soft Information and Success							
Catch Phrase Length (# Words)	114.8	38.75	125	120.8	36.48	131	−5.97***
Updates	5.05	8.88	2	5.68	7.85	3	−0.63***
Gallery Items	6.63	10.46	3	9.04	11.10	5	−2.41***
Video Pitch Dummy	0.78	0.41	1	0.85	0.36	1	−0.07***
Full Text Length (# words)	4,510	3,302	3,707	6,554	4,366	5,349	−2,000***
Macroeconomic Conditions							
Oil Price Evolution 6 Months before Campaign	1.77	10.70	4.14	2.52	10.17	4.87	−0.75***
Oil Price at Start	95.74	7.15	95.25	95.93	7.19	95.34	−0.19
Oil Price at End	95.97	7.04	95.25	96.28	7.23	95.61	−0.31*
Cultural Dimensions							
Individualism	86.21	13.04	91	83.12	18.58	91	3.09***
Indulgence	66.54	8.18	68.08	65.97	9.38	68.08	0.57***
Observations		21,102			1,864		

Source: Cumming, Leboeuf, and Schwienbacher (2017).

Cumming, Leboeuf, and Schwienbacher (2017) presented regression evidence on the determinants and success of cleantech crowdfunding projects. The regression evidence supports the summary statistics in Table 2. A one standard deviation increase in oil prices prior to the campaign results in a 10.0% increase in the likelihood of a cleantech campaign. A one standard deviation increase in individualism reduces the likelihood of cleantech campaigns by 16.7%, consistent with the benefits of cleantech being non-excludable and non-rival. The regressions further show that, controlling for other things

being equal, cleantech deals are on average 16.0% higher than the average goal of \$21,039, have on average 32.1% more gallery items, are 8.7% more likely to have video pitches, and have 41.8% more words than the average of 4,661 words across all deals. Finally, and very interestingly for fintech and financial literacy, cleantech deals have a readability score that is 1.2 higher on average or 7.7% higher than the average score. That is, cleantech deals have project descriptions that are much better worded than non-cleantech deals.

Cumming, Leboeuf, and Schwienbacher (2017) presented a number of regressions that explain project campaign success for successful fundraising. The data indicate that, while cleantech crowdfunding outcomes are not worse than outcomes of other types of campaigns, cleantech crowdfunding success is nevertheless much more sensitive to the use of soft information, including project descriptions, and the use of videos. The fact that the campaign design is more important for the success of cleantech than for the success of non-cleantech crowdfunding, we may infer that responsible innovation in fintech is indeed closely connected to financial literacy.

Meoli, Rossi, and Vismara (2019) provided further information on crowdfunding project success across countries. They found that countries with higher financial inclusion and financial literacy have much higher rates of crowdfunding and higher rates of crowdfunding success, and these findings hold regardless of the type of project receiving crowdfunding. These findings support the important linkages between financial inclusion, financial literacy, and fintech that this paper discusses.

Cumming, Meoli, and Vismara (2019) presented evidence that equity crowdfunding enables the financial inclusion of more geographically rural and remote communities as well as younger communities. They did not find, however, any differences by race or gender.

5. SUMMARY AND CONCLUSION

This paper presented practical evidence on the important ways in which financial innovation can empower consumers through financial inclusion and financial literacy.

We first explained the importance of a suitable regulatory framework. We showed that consumer protection rules and data privacy rules are strongly and statistically related to fintech adoption across countries. E-commerce legislation and cybercrime rules are also statistically important but perhaps not as consistently important as consumer protection rules and data privacy rules. However, we showed that, even in countries with data privacy rules and consumer protection rules, there are problems. For example, in the US, there are substantial concerns about data privacy. There are also problems concerning how intermediaries treat the existing rules, such as the KYC rule. These problems diminish the ability of consumers to benefit from responsible innovation in fintech.

Financial literacy is the key to mitigating many of these issues around the world. There is huge scope for financial literacy to improve across countries. The financial literacy rates around the world are not even at 37% on average, and the top countries have rates that are barely above 70%. Financial literacy is most directly connected to fintech adoption, and there is ample evidence from the research trends from Google Scholar advocating improvements in the direction of research in different countries around the world.

Fintech innovations, such as crowdfunding, clearly show the importance of financial literacy in the successful use of fintech. Particularly in the case of responsible innovations within fintech, such as cleantech crowdfunding, there is clearly a pronounced role for financial literacy. Fintech solutions, such as crowdfunding, are empowering to consumers, and consumers are much more powerful when armed with financial literacy. Cleantech entrepreneurs make more use of soft information to inform the crowd about their projects, such as higher-quality text, videos, and updates. In addition, cleantech entrepreneurs who use these soft mechanisms to mitigate information problems are more likely to use fintech successfully. A greater emphasis on literacy can make fintech more effective, especially in responsible and sustainable innovation.

Future research could examine in more detail other types of fintech applications than crowdfunding and the specific role of financial literacy and inclusion in responsible innovation and consumer empowerment. Google Scholar trends are a tool that can guide gaps in research. More research that is well directed can help to mitigate the gaps in financial literacy and improve the levels of financial inclusion. We hope that the discussion here inspires more work along these lines in the coming years.

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