Will FinTech Law Likely Help Countries Achieve Their Sustainable Development Goals?

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Abstract

What effect will new laws regulating financial technologies (FinTech) have on sustainable development -- and particular the sustainable development goal (SDG) scores in the developing world? In this paper, we provide the first rigorous analysis of the literature predicting how FinTech might affect the SDGs. To test these effects, we use cross-country regression on a proxy of the quality/quantity of FinTech law, FinTech credit and select SDG sub-indicators which likely reflect the whole goal. We find -- if the past helps predict the future -- that FinTech legislating will have limited impact on the SDGs dealing with economic growth. New rules could have a larger impact on social and environmental outcomes, if laws and supporting public procurements are explicitly written with such outcomes in mind. In either case, government will still likely play a determining role. FinTech policy will likely exhibit the same U-shaped effect on sustainable development as other policies and practices dealing with the accumulation of capital. If the slate of SDG-related laws in the US in 2021/2022 risk doing too little, the EU's buffet of sustainable finance law risks doing too much. We look at these laws in light of our findings.

Keywords: financial technology, FinTech, sustainable development, SDGs, financial regulation, financial inclusion.
JEL Codes: O16, O25, K23, G15
Declaration of Interests: We have no personal pecuniary or other interests in this research.
Data Statement: Readers may download our data easily on the popular World DataBank (from the World Bank) public site.

Acknowledgements: We gratefully acknowledge the support of the Research Impact Fund *Balancing the Opportunities and Risks of Financial Technology: FinTech Regulation and Policy* (Grant number R7054-18).

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Introduction

Since the 1960s, we have known that more capital is not necessarily better for economic development. Boianovsky's (2018) recent piece on this almost century-long debate highlights the role that capital-supporting institutions play in intermediating such development. Capital and financial investment (such as in foreign portfolio investment) exhibits diminishing returns. Authors at institutions like the World Bank and the European Central Bank seemed to have found that better banking and financial institutions could deploy this capital more effectively -- in effect squeezing more productivity out of each lump of capital employed (Popov, 2017). If true, financial technologies (FinTech) would seem to represent the next obvious evolution in these institutions. FinTech promises to make borrowing and lending cheaper, investment more focused and less subject to information costs, and offer new/exciting services in insurance (Jense and Cheng, 2019). FinTech even promises to internalize many of the externalities for public goods like sanitation, water, and electricity which require taxes and fiscal policy.

FinTech services -- and the laws which regulate them -- still remain in their infancy. We do not have the 20-40 years of data that the World Bank provides in areas like interest margins, stock market capitalization and so forth. Yet, we have a limited data about FinTech policy adoption and credit from mostly large economies. These data allow us to quantify the inexpressible complexity of this exciting new financial services sub-sector. We also have a universally agreed set of indicators that define 'sustainable development' for the whole world. These UN-agreed Sustainable Development Indicators (SDGs) promise to finally quantify the unquantifiable.

What relationship will likely exist between the adoption of FinTech policies/laws, the use of FinTech credit in domestic financial markets, and a jurisdiction's SDG scores? We find very limited support for such a relationship. If such a relationship exists, FinTech rulemaking (and the capital that it helps create and channel) will result in the same U-shaped relationship as other types of intermediated capital. More FinTech law is not necessarily better. Neither is simply relying on non-intervention in burgeoning FinTech markets. While the initial data suggest that FinTech will have limited effects on economic growth, the prospects for environmental and social outcomes could be far more stimulating. If written with these ends in mind, FinTech rules could have demonstrable effects on the social and environmental SDGs (11 through 17).

We organize our paper as follows. The first section makes the argument for FinTech's effects on the SDGs (something surprisingly not yet done in a rigorous way). The second section looks at the evidence we marshalled. The third section takes the relationships we found -- and discusses recent legislative activity in the US and EU. We find that the US approach of legislating on the SDGs based on market-neutral laws that apply to all contrasts with the EU's SDG-related laws that focus specifically on shaping 'sustainable

finance' in the Union. Both approaches risk missing the happy-medium that will likely characterize optimal SDG-promoting FinTech rules. The final section concludes.

Before reading on, we acknowledge our study's faults. We look at a partial snap-shot of both FinTech and SDG scores. At our time of writing, only one BIS database contained very limited data about FinTech policy and credit in a range of countries. Such data will likely explode before our study appears in print. Similarly, we only looked at SDG data for a year -- shying away from making crazy time-series related assumptions about how FinTech policy might diffuse over time, or rely on past outcomes. Any social scientist interested in dynamics will shun these limited findings.

Our research suffers from two other lacuna which might cause disquiet. We make daring predictions about policy and law based on this snap-shot. In this way, we lean heavily on our literature review - as part of our panoply of evidence. We argue that such activity will have the same effects as in the past. Hardly a daring conclusion for such a daring set of assumptions. By basing our discussion on evidence, rather than conjecture and assumptions, we hope to provide a firmer footing for financial and banking regulators with an eye on the SDGs. Finally, we could not bolster our regression running with fieldwork. Regressions should not decide any policy question. Yet, COVID-19 and delays in jurisdictions' implementation of FinTech-related policies have made such a qualitative examination impossible.

A Rigourous Argument for FinTech & Sustainable Development: A Literature Review

How would the more efficient intermediation of capital and finance for public goods affect the SDGs? Let's start in the 'modern era' -- looking at the World Bank studies of the late 2000s and 2010s. We ignore the hard-fought lessons learned about capital and development won over the 1970s-1990s. Craft (1995) presents these lessons -- boiling down to the unsurprisingly conclusion that more (capital) does not seed better development. Yet, this literature does not address the institutional factors that might reflect FinTech's impact on the sustainable development measured by the SDGs.

In this modern era, better banking institutions result in more and better economic development. Beck and Levine (2003) had already sorted out the relationship between law and finance. 'Better law' (as they defined it) led to more capital intermediated by banks and finance entities. Later in the decade, they had found that banks which take more risks and earn lower margins tended to collapse as the financial crisis of 2009-2011 hit (Beck *et al.*, 2009). For authors like Buera and co-authors (2011), only "frictions" explained the lacklustre performance of any financial system. Even as late as a few years ago, authors like Anginer *et al.* (2019) took great pains to quantify over 200 legal provisions, in the search for these elusive frictions. Once found, the resulting tsunami of capital would lead to "finance for development."

Yet, the finance for development movement, a hit in the early part of last decade, plunked into a wall by 2018-ish. Beck (2013) only a few years later would backtrack -- arguing

that unquantifiable "institutions" still affected the way that finance lead to development. Sander (2011) writing for the OECD just a few years later, sought to map all finance for development programmes and activities; trying to shepherd hard facts and proven econometric evidence about their usefulness in piping money to the economically, socially and environmentally poor. His report provides no such evidence.
Toward the end of the decade, World Bank sponsored authors like Cordella (2018) had refused to give up. He had set up a whole template designed to calculate the welfare gain attached to any finance for development scheme. The research garnered a total of 9 citations. By the start of this decade, Devine *et al.*'s (2019) effectively drove a stake through the heart of the "private finance for development" movement. Few credible, independent and rigorous studies, seemed to support the finance for development discourse.

The lack of evidence did not stop the United Nations. Seeking a new development mandate, the UN had set up its Finance for Sustainable Development Office and its Inter-Agency Taskforce on Financing for Development. We do not know how much money actually went into financing for development schemes. Databases like the OECD's or reporting tools like the World Bank's can not agree on a solid enough definition to use as a search criteria. Finance for development was just the same project finance that characterised the post World War II era.

But the private sector was hooked. The buzzwords "financial inclusion" replaced finance for development. The institutional reform of financial institutions -- whatever that means -- did not need to solve all the world's woes. Such reform only needed to add customers "at the bottom of the pyramid." Such a goal was music to bankers' ears. Within a few years, the Alliance for Financial Inclusion, the Better than Cash Alliance, the European Digital Payments Alliance and a host of other private sector funded international initiatives sprung up. Gabor and Brooks (2016) describe how they wanted nothing less than a level and open playing field for foreign and domestic financiers.

FinTech represents the latest fad in the merry-go-round of terms catching the international financial institutions and banking sectors' fancy. Huang (2020) represents one of its most ardent cheerleaders, arguing that FinTech will "not only makes financial inclusion an achievable goal but also has important implications for financial and macroeconomic stability" for China. His paper provides plenty of figures showing the growth of peer-to-peer and other transactions. Yet, the work provides zero evidence of any correlation between "financial inclusion" and "financial and macroeconomic stability" in China or elsewhere. As a result, authors like Venet (2019) could only cite the Beck and related studies and hypothesize about FinTech's effects on inclusion and growth.

Models of FinTech remain lacking on the ground. Philippon (2019) represents one of the few examples. Equation (1) shows the final result of his model. I drop all the crap about signal and conditional arguments to focus on the essential. So q represents a borower's credit worthiness, t (tao) represents the variance of this creditworthiness (expressed as the 'precision' or reciprocal of variance of this credit worthiness). In brief, the equation

shows the expected benefit from FinTech subtracted from traditional lending. Given the model's reliance on unmeasurable signals, we can not operationalize such a model.

$$E[E[q]\|B]-\|E[T|B]=\frac{\tau}{\tau+\tau_u+\tau_1}\left(\delta-d\frac{\tau_2-\tau_u}{\tau+\tau_1+\tau_2}\right) \quad (1)$$

Demir *et al.* (2020) for their part, simply ignore the modelling part of the exercise. After a cursory (but useful) literature review, they simply set out an estimation strategy defined by equation (2). Note the mistakes in the conditional operators appear in the original. All you need to know about this equation is that the *i*'s represent quintiles and the regression they run is the usual inequality equals some Fintech variable, a financial inclusion variable and a bunch of controls (in their equation (1)).

$$\min \sum_{i\in i-y_i\geq x'\alpha}\alpha|y_i-x_i'\Omega|+\sum_{i\in i-y_i\rhd x'\alpha}1-\alpha|y_i-x_i'\Omega| \quad (2)$$

What about the rest of the studies? What do they predict? Figure 1 shows the parameter estimates from regression of a range of variables. None of these models provides any easy answers to the question -- if a country's FinTechs increase credit availability, how would that affect economic growth or social and environmental factors? None goes so far as to look at FinTech rules directly.

Figure 1: Beta Estimates From a Sample of FinTech-Related Studies
(only results significant at the 5% alpha level and
average betas given in case several models are presented)

Who?	What did they find?
Demir *et al.* (2020)	FinTech's normal beta with account (0.673), savings (0.727) and 0.285 for borrowing.
Sahay *et al.* (2020)	Effect of FinTech on financial inclusion ranges from about 75% of their models being non-significant models to 1.5 and 1.8 for their 4 significant models. Roughly a 0.2% coefficient for mobile money as the independent variable.
Nizam *et al.* (2020)	Their index of 'financial inclusiveness' has beta values of 5.0 and 5.4 (two models), with GDP as the explanans.
Khera et al. (2021)	Their 6 models in a second stage regression of financial inclusion on GDP growth came up with beta coefficients of 0.61 to 1.26.
Ye *et al.* (2022)	Using quantile regression, they find that their measure of FinTech has a negative beta value with their measure of income inequality of -0.07.

A number of studies address FinTech and sustainable development so tangentially as to be unrelated. For example, Kanga *et al* (2021) exemplify the false advertising in the FinTech/GDP regression literature. They claim to regress FinTech measures on GDP per

capita. Yet, these measures consist of access to mobile phones, accounts at banks, and ATMs. ATMs probably represent the only financial technology in these kinds of studies. Yermack (2018) supposedly models FinTech's effect on growth in Sub-Saharan Africa. Yet, his version of FinTech consists of Bitcoin app and related downloads. Even a generous definition of FinTech would not encompass his dependent variables. Fenwick *et al.* (2017) look at how entrepreneurs use some FinTech technologies. But nothing in the paper consists of any solid cause and effect relationships. Shin and Choi (2019) look at FinTech's growth in South Korea. But again, no causal relationships. Papers like Narayan's (2019) are so simple or other misspecified as to be un-citeable for our purposes.

We should note that all authors would agree with our attempt to model and econometrically assess FinTech's effects on inclusion or sustainable development. Authors like Lee and Shin (2018) and Langley and Leyshon (2020) note that FinTech requires an ecosystem. Authors like them would categorically refuse to split FinTech's effects on the SDGs into self-contained pieces.

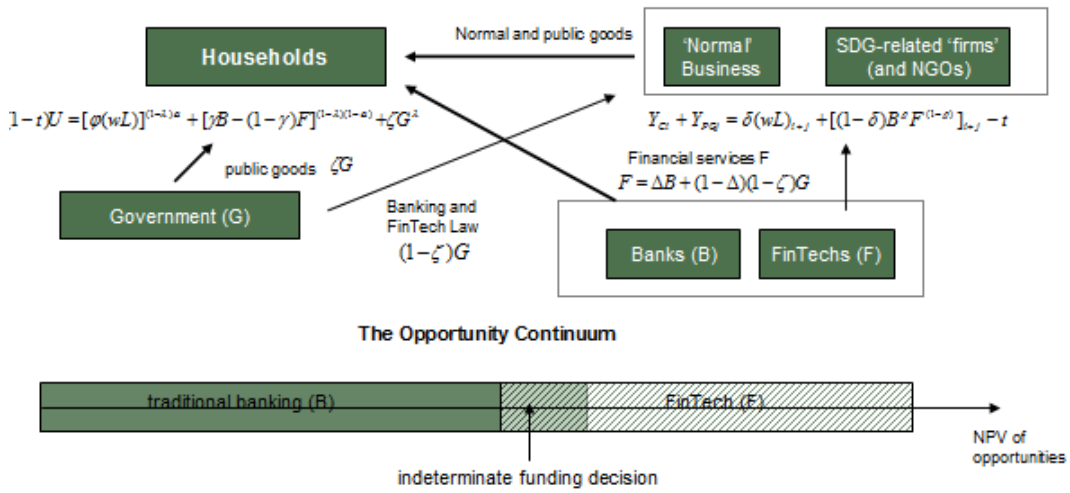
No one has modelled the decision to adopt more or less FinTech regulation. But some have described this decision and modelled similar decisions concerning previous financial regulation. For example, Scott (2020) describes the trade-off (in excruciating detail) between adopting new financial laws in the Dodd-Frank and earlier eras -- versus letting the status quo ride.

A Model of Relationship Between FinTech Rules and the SDGs

Before starting any empirical work, we need a model looking at the way FinTech affects the SDGs for three reasons. First, without a theoretical model with parameters and boxes-arrows, we can not hope to know what causes what. A simple literature review can not narrow down the very specific causal mechanisms we are looking for. Second, if we get parameters in linear regression - we will have no idea what they mean. We might get a beta in front of a proxy for FinTech law. Yet, without knowing the way this law affects things like poverty or life under the sea, we can not hope to match our model's parameters with the econometric betas we get by pressing a few buttons. Third, theories do not provide for controls the same way a tight rigorous model would. Authors like the ones we reviewed simply throw-in controls, because their intuition tells them that this factor affects FinTech or the SDGs. Yet, without a rigorous model, we can not know *how*.

Our model simplifies the economy and society into 4 sectors. We model the way households and businesses trade off their 'demand' for the FinTech law in a way which gives them access to private and public SDG-related consumption possibilities they currently do not have. Figure 8 shows our model in an easy to understand, graphical way.

Figure 2: A Model of FinTech Law and Credit Demand



We assume both business and public goods possibilities lie along an 'opportunity continuum.' If FinTech didn't provide access to extra possibilities, there would be no demand for these services. As we saw in the literature review, FinTech might make previous savings and investment opportunities profitable for households and intermediaries -- given the previous 'frictions', information costs and other distortions. Governments trade off legislating on traditional banking law or thinking about FinTech law. Consumers value FinTech services in their own right -- as they make transactions cheaper, easier and better. In theory, we need not worry about whether governments, businesses or NGOs provide FinTech-enabled public goods (the outcomes behind the SDGs). We ignore estimates of the 'demand' for SDGs, like Hatefi's (2017) or Kharas *et al.* (2019). We assume demand is nowhere near satiation anywhere in the world. As such, we only need to know that we can divide producers and production into 'normal' goods and those that specialize on offering the SDG-related goods with inherent public goods characteristics.

We further assume that households consume three goods -- regular consumption goods *C* and financial services. Households use these financial services from banking *B* and FinTech *F* providers for saving, transactions demand, and so forth. They trade-off the consumption of normal goods α with financial goods 1-α. They also trade off these two goods λ with consuming public goods like clean air, fresh water and democratic institutions. Their consumption is some fraction ϕ of their wage *w* and labour input *L*.

They also consume public goods which represent a fraction ζ of government production. They pay taxes t_C, which reduces their overall consumption. Businesses produce *i* units of output Y_{Ci} for household consumption and *j* units of Y_{PGj}; such that total production equals *i+j* units. They use a proportion δ of the value of labour services *wL* and the proportion *(1-*δ*)* of some fraction ρ of banking *B* and FinTech *F* services. They also pay taxes t_B so that the total taxes paid in this model economy equals t_C+t_B. We assume that government provides two services -- public goods for consumption ζG by households and

law for the financial sector *(1-ζ)G*. Businesses decide how to use traditional banking versus FinTech services along the opportunity continuum as described in the main text.

We use these variables to create a three-equation model of FinTech's effect on SDGs.

$$(1-t_C)U = [\varphi(wL)]^{(1-\lambda)\alpha} + [\gamma B - (1-\gamma)F]^{(1-\lambda)(1-\alpha)} + \zeta G^{\lambda} \qquad \text{s.t.} \qquad C = \varphi(wL) \tag{3}$$

$$Y_{Ci} + Y_{PGj} = \delta(wL)_{i+j} + [(1-\delta)B^{\rho}F^{(1-\rho)}]_{i+j} - t_B \tag{4}$$

$$F = \Delta B + (1-\Delta)(1-\zeta)G \tag{5}$$

In order to solve the model presented in the Figure, we first need to continue linearizing. We already made some heroic assumptions about the linearity of the trade-offs in banking and FinTech services and public provision of FinTech law versus banking law. But simply sticking everything in a computer and letting it reiterate is not helpful. So we need to make public goods' output depend on demand for goods *j*. FinTech contributes equally to the financing of normal goods and public goods (as we discussed in the literature review, many argue that FinTech can help communities internalize existing negative externalities).

Taking natural logs of our variables and using a sloppy but fast method of linearizing our variables, we see that:

$$\begin{matrix} -\ln\varphi w - \ln\zeta + \ln(1-\gamma) \\ -\ln\delta w - \ln(1-\delta) \\ -\ln[(1-\Delta)(1-\zeta)] \end{matrix} = \begin{bmatrix} \alpha(1-\lambda) & \lambda & (1-\lambda)(1-\alpha) \\ 1 & \partial Y_{PG}/\partial G & 1-\rho \\ 0 & 1 & -1 \end{bmatrix} * \begin{matrix} L \\ G \\ F \end{matrix} \tag{6}$$

We calculate old-school solutions to this matrix using Cramer's Method. First, finding the determinant, we get equation 7. Solving for the size of the financial sector *F*, we plug in the left-hand side of equation 5 into our matrix and -- after a bit of rearranging -- get equation 8. What a mess. All we can do is see how F reacts to an important parameter. Looking at the effect of FinTech law on the size of the financial sector *F*, we get equation 8'.

$$D = \alpha(1-\lambda)(-Y' - (1-\rho) + \lambda + (1-\lambda)(1-\alpha)$$

$$D = \lambda + (1-\lambda)(1-\alpha) - \alpha(1-\lambda)(1-\rho) - \alpha(1-\lambda)Y' \tag{7}$$

For F, we get:

$$Det\begin{bmatrix} \alpha(1-\lambda) & \lambda & -\ln\varphi w - \ln\zeta + \ln(1-\gamma) \\ 1 & \partial Y_{PG}/\partial G & -\ln\delta w - \ln(1-\delta) \\ 0 & 1 & -\ln[(1-\Delta)(1-\zeta)] \end{bmatrix}$$

$$F = \big(\alpha(1-\lambda)[(-\ln((1-\Delta)(1-\zeta))Y')) + \alpha(1-\lambda)(\ln\delta w + \ln(1-\delta))\big) - \lambda\ln[(1-\Delta)(1-\zeta)]$$
$$+ (\ln(1-\gamma) - \ln\varphi w - \ln\zeta) * (1-Y')) \_$$

$$F=\frac{\alpha(1-\lambda)[(-\ln((1-\Delta)(1-\zeta))Y))+\alpha(1-\lambda)(\ln\delta w+\ln(1-\delta))}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y}-\frac{\lambda\ln[(1-\Delta)(1-\zeta)]}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y}+\frac{(\ln(1-\gamma)-\ln\varphi w-\ln\zeta)*(1-Y))}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y} \quad (8)$$

$$F=\frac{\alpha(1-\lambda)[(-\ln((1-\Delta)(1-\zeta))Y))+\alpha(1-\lambda)(\ln\delta w+\ln(1-\delta))}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y}-\frac{\lambda\ln[(1-\Delta)(1-\zeta)]}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y}+\frac{(\ln(1-\gamma)-\ln\varphi w-\ln\zeta)*(1-Y))}{\lambda+(1-\lambda)(1-\alpha)-\alpha(1-\lambda)(1-\rho)-\alpha(1-\lambda)Y}$$

We can now start to play with this equation for FinTech finance to figure out how it affects the SDGs. Even common sense points to three predictions made by equation (8).

Proposition 1: FinTech affects SDG outcomes mainly through funding SDG-related business.

Just eye-balling Figure 2, we see that Fintech *F* can affect households' utility through its effect on the provision of public goods Y_{PGj} and specifically through its effect on ρ and δ and ultimately through its effects on utility at the consumer level through γ, λ or α and (at the consumer level). We can eliminate d as it does not appear in F in a significant way. We can similarly eliminate looking at γ (as it does not appear), δ as it appears only as a scaling factor and just falls out when looking at rates of change, and α for the opposite, but similar reason. Namely, α appears everywhere - something we know already.

We thus differentiate the first part by ρ, and then drop parameters like $\lambda+(1-\lambda)(1-\alpha)$ in the denominator, as well as just differentiate rho in the denominator (instead of using implicit differentiation which will make a mess) to get:

$$\frac{dF}{d\rho}=\frac{\alpha(1-\lambda)[(-\ln((1-\Delta)(1-\zeta))Y')}{\alpha(1-\lambda)-\alpha(1-\lambda)Y'}+\frac{(\ln(1-\gamma)-\ln\varphi w-\ln\zeta)*(1-Y')\cdot(dY'/d\rho)}{\alpha(1-\lambda)-\alpha(1-\lambda)Y'} \quad (9)$$

Remembering that (1-λ) represents the effect of non-government production, and α represents the effect labour has on production. So even this highly adulterated equation yields insight. Namely, the effect of FinTech on the SDGs we are interested is likely intermediated by the way it helps the rest of the economy and the way it helps workers work.

By how much will FinTech help workers work? Solving for L gives us the matrix form:

$$\begin{bmatrix} -\ln\varphi w-\ln\zeta+\ln(1-\gamma) & \lambda & (1-\lambda)(1-\alpha) \\ -\ln\delta w-\ln(1-\delta) & \partial Y_{PG}/\partial G & 1-\rho \\ -\ln[(1-\Delta)(1-\zeta)] & 1 & -1 \end{bmatrix} \quad (10)$$

or $[-\ln\varphi w-\ln\zeta+\ln(1-\gamma)]*(\rho-Y'-1)+\lambda[\ln\delta w+\ln(1-\delta)]*\ln[(1-\Delta)(1-\zeta)]*(\rho-1)]+$
$(1-\lambda)(1-\alpha)*[\ln\delta w+\ln(1-\delta)+\ln[(1-\Delta)(1-\zeta)(\rho-1)]$.

Solving for L gives us equation (11) in:

$$L=\frac{[(\rho-Y'-1)*(-\ln\varphi v-\ln\zeta+\ln(1-\gamma))]}{\lambda+(1-\lambda)[(1-\alpha)-\alpha(1-\rho)-\alpha Y']}+\frac{[\lambda\ln\delta v+\lambda\ln(1-\delta)]*\lambda(\rho-1)*\ln[(1-\Delta)(1-\zeta)]}{\lambda+(1-\lambda)[(1-\alpha)-\alpha(1-\rho)-\alpha Y']}+$$
$$\frac{[(1-\lambda)(1-\alpha)*[\ln\delta v+\ln(1-\delta)+\ln[(1-\Delta)(1-\zeta)(\rho-1)]]}{\lambda+(1-\lambda)[(1-\alpha)-\alpha(1-\rho)-\alpha Y']} \quad (11)$$

Again, we see the major effects of ρ or any of the other parameters depend mostly on Y', which represents the way public goods affect output. As such, academics' focus on GDP and labour remains as valid as ever. As such, we can state hypothesis 1 as:

Hypothesis 1: FinTech affects the SDGs through an important effect on GDP and the standard explanation for how labour produces output.

Proposition 2: Traditional banks and FinTechs will always be rivals (unless banks start up their own FinTechs) and public-good oriented SDG-producing firms will rival traditional business.

The last part of the proposition is trivial. By definition $F = \Delta B + (1-\Delta)(1-\zeta)G$ as stipulated in equation (5). Clearly, banks affect Fintech by Δ. Let's return to FinTech spending to develop a sense for its rivalry with traditional banking. Equation (4) basically pits traditional banking against FinTechs in the term $(1-\delta)B^{\rho}F^{(1-\rho)}$. By definition, traditional bank and FinTech finance serve as substitutes (except the part serving banks). What happens though when we change FinTech's effects on creating SDG-related public goods? Differentiating this term in equation (4) by ρ ives us: $\rho(1-\delta)\left[\left(\frac{B}{F}\right)^{\rho}\cdot\left(1-\frac{F}{B}\right)\right]$. In words, this simple differentiation means banks' effect on finance depends on its productivity in making output and its effect in raising capital. Again, hardly rocket science.

If dF/d(1-ρ) equals the effect of banks on the SDGs, then equation (9) already tells us what we need to know. Or the effect of FinTech's effect on output equals some function of the way public goods affect output times the effect of FinTech specially on these public goods plus the effect on non-public goods output. Hardly a surprise. In other words, we must control for all the usual ways FinTech could affect the SDGs.

Hypothesis 2: FinTech's effect on the SDGs will depend on the way public goods and the usual 'controls' affect the SDGs.

Proposition 3: As FinTech law becomes more effective (as ζ increases), the FinTech industry expands.

$$\frac{dF}{d\zeta}=\frac{\zeta\alpha(1-\lambda)[(\ln((1-\Delta)\cdot Y')]}{D}-\frac{-\zeta\lambda\ln[(1-\Delta]}{D}-\frac{\ln\zeta*(1-Y'))}{D} \text{ or}$$
$$\frac{dF}{d\zeta}=\frac{\zeta\alpha(1-\lambda)(\ln((1-\Delta)\cdot Y')+\zeta\lambda\ln[(1-\Delta]-\ln\zeta*(1-Y'))}{D} \quad (12)$$

This result, again requires FinTech rules to work 'through' Y' - or the way public goods affect output. Delta (Δ) or the government's fuinding to FinTech plays a much more important role in intermediating this relationship. But that is about it. As such, we arrive at hypothesis 3.

Hypothesis 3: As FinTech law becomes more effective (as ζ increases), the FinTech industry (and thus *F*'s effects on the SDGs) expands.

So where are we? We have three propositions suggested by our model, and three testable hypotheses. They end up corresponding to our econometric model. Namely, we roughly test whether FinTech credit and law affects standard GDP growth, whether they affect the environmental and social factors, and how variables which we control for might intermediate this relationship.

An Empirical Evaluation of FinTech's Likely Effects on the SDGs

Our model makes three testable propositions. First, FinTech affects SDG outcomes mainly through funding SDG-related business. It is non-sense to talk about SDG-related FinTech. Money does not have purposes stamped on it. Government spending (ie taxes) determine the effectiveness of that spending. Second, traditional banks and FinTechs will always be rivals (unless banks start up their own FinTechs). Similarly, public-good oriented SDG-producing firms will rival traditional business…implying a trade-off between economic growth and social/environmental outcomes. Third, if FinTechs fund the SDGs in any way, they must do so in line with distortionary government regulation which directs SDG-result producing firms to use SDG-result producing FinTech.

Our variables come from several sources. Figure 3 shows the sources we used for each variable. We used 4 different variables to measure FinTech's potential effect on the SDGs -- with 3 proxies for policy and one outcome variable looking at the results of that policy in actual FinTech credit. We boiled down the proxies for financial sector development (ie the B in our model) from the Findex database into two control-related principal components. We also boiled down out controls into two principle components which we could present more easily. The figure lists the variables we stuck into these control-related principle components in more detail.

Figure 3: Variables Used to Test Our Model

Variable	Description	Link
FinTech Index	Counts the number of rules or provisions each country possesses (as reported in Table 2, Table 3, Table 6, Table 8, and Table 10) of Ehrentaud et al.'s BIS Working Paper	*
FinTech Credit	Natural log of FinTech credit amounts reported in Cornelli et al.'s BIS study.	*
Findexable Index	Directly copied from Findexable's Global FinTech Index	*
E&Y Index	Copied from E&Y's Global FinTech Adoption Index	*
FinDex Component 1	The first tacit variable constructed from the FinDex database for 2018	*
FinDex Component 2	The second tacit variable for this diverse database.	*
Controls 1	One collection of our controls, so we can reduce our variable count	Below
Controls 2	Ditto for the second set of controls.	Below
Controls (All from World DataBank)		
Broad money	Consists of M3, seasonally adjusted index based on 2015=100, and quoted as a percent of GDP	*
GDP	Natural log transform of current GDP in US dollar terms	*
Listed Company Market Cap	Annual market capitalization of firms listed on each country's stock exchange - measured as a percent of GDP.	*
Patent Apps	Applications made by residents. From the World Intellectual Property Organization Patent Report: Statistics on Worldwide Patent Activity.	*
Legal right strength	Aggregate, composite measure, rescaled to lie on 0-1 measure. From the World Bank's Doing Business project	*
Mobile subscriptions	Subscriptions per 100 people, reprinted from the International Telecommunication Union's World Telecommunication/ICT Indicators Database	*
Air transport	Natural log of passengers carried, with source data from the International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates.	*
External Debt	Total external debt stocks repayable to non-residents in current US dollars	*
Human Capital	Index compiled by World Bank measuring expected educational attainment for a child born today by his or her 18th birthday. Adjusts for health and overall educational levels.	*
Internet Use	Percent of individuals in a national population using the Internet, from the International Telecommunication Union's World Telecommunication/ICT Indicators Database.	*
R&D Spending	Research and development expenditure as a percent of GDP, from the UNESCO Institute for Statistics	*

Figure 4 shows the variables we used to construct an aggregate measure of each country's financial development and SDGs. The principal components algorithm we used identified two principal components -- absorbing 76% of these variables' variation. The algorithm also found 2 principal components for the 17 SDGs. The first component accounts for 60% of the total variation and the second component accounts for about 20% (with membership in that second component only consisting of undernourishment and detainees/prison population).

Figure 4: Findex and SDGs Used for Component Analysis

Variable	Mean	StDev	Variable	Mean	StDev
FinDex Variables			**SDGs**		
Account	0.82	0.21	1.1.1. Percent pop. pov line	3.08	4.74
Financial instit. acct	0.82	0.21	2.1.1. Undernourishment	3.22	2.62
Withdraw in past yr.	0.85	0.10	3.b.1. Percent access to DTP3	92.17	7.72
No acct b/c too far away	0.10	0.08	4.1.1. Percent min read/maths	68.47	20.05
No acct b/c expensive	0.19	0.14	5.1.1. Legal frame gender eq.	72.94	19.65
No acct b/c no docs	0.11	0.08	6.3.1. Perc. treated waste H2O	73.60	28.20
No acct. b/c no trust	0.12	0.08	7.1.2. Pop w/ clean fuels/tech	92.37	11.32
No acct. b/c no money	0.25	0.40	8.1.1. Real GDP per cap.	1.55	1.71
Paid bills w/ internet	0.40	0.26	9.5.2. Researchers per million	8.04	0.37
Bills/buy online w/ int'	0.50	0.26	10.2.1. Per. below 50% income	17.86	4.22
Buy online only	0.41	0.23	11.1.1. Perc. in slums	14.13	13.13
Saved for biz	0.12	0.04	12.a.1. Renew elec. (watts/cap)	246.45	220.25
Saved for retire	0.31	0.17	13.1.2. Nat. DRR in Sendai	0.68	0.24
Save at fin. instit.	0.37	0.22	14.5.1. Per. protect. marine	17.83	15.72
Saved in club	0.07	0.07	15.5.1. Red List Index	0.86	0.093
Debit card	0.68	0.27	16.3.2. Detainees/prison pop	28.47	14.20
Borrowed from fin. inst.	0.15	0.06	17.15.0. Per indic. mon. by gov.	42.61	18.65
Used credit card	0.41	0.20			
Borrowed friends/fam	0.18	0.11			

Source: IMF (2020) and UN (2020) respectively.

Why do the SDGs look so simple? Out of the hundreds of SDGs sub-indicators, we choose only 1 sub-indicator that most represented the idea behind the goal. For example, Goal 2 (Zero Hunger) goes into mindboggling detail about every aspect possibly related to hunger. Such 'junk variables' include agricultural export subsidies, spending on agriculture, agriculture's percent of GDP, the food price index, the proportion of stunted or overweight children, local breeds at risk and so forth. The SDGs represent a political consensus and simple common sense led to the choice of each of the sub-variables listed in Figure 4. Figure 5 presents these indicators in more detail.

Figure 5: List of SDG Indicators Used as a Proxy for Each Goal

Goal 1	Proportion of population below international poverty line (%)
Goal 2	Prevalence of undernourishment (%)
Goal 3	Proportion of the target population with access to 3 doses of diphtheria-tetanus-pertussis (DTP3) (%)
Goal 4	Proportion of children and young people achieving a minimum proficiency level in reading and mathematics (%)
Goal 5	Legal frameworks that promote, enforce and monitor gender equality (percentage of achievement, 0 - 100) -- Area 1: overarching legal frameworks and public life
Goal 6	Proportion of safely treated domestic wastewater flows (%)
Goal 7	Proportion of population with primary reliance on clean fuels and technology (%)
Goal 8	Annual growth rate of real GDP per capita (%)
Goal 9	Researchers (in full-time equivalent) per million inhabitants (per 1,000,000 population)
Goal 10	Proportion of people living below 50 percent of median income (%)
Goal 11	Proportion of urban population living in slums (%)
Goal 12	Installed renewable electricity-generating capacity (watts per capita)
Goal 13	Score of adoption and implementation of national DRR strategies in line with the Sendai Framework

Goal 14	Coverage of protected areas in relation to marine areas (Exclusive Economic Zones) (%)
Goal 15	Red List Index
Goal 16	Unsentenced detainees as a proportion of overall prison population (%)
Goal 17	Proportion of results indicators which will be monitored using government sources and monitoring systems - data by provider (%)

Which SDGs went into which principle component? Our approach is not new. Many studies have speculated about -- or tried to find -- such groupings. Drastiochova (2020) finds this division in the EU, while Sen and Ongsakul (2020) as well as Linnerud *et al.* (2021, among tens of others) find these for global data. Figure 6 shows the SDGs and the groupings of these goals into two composites for our own data. Our own econometric analysis supports these claims. Our own principal components analysis extracted about 43% of total variance in all the SDG data we compiled for component 1 and 27% for component 2. The statistical procedure we use ensures these groups are independent (orthogonal) to each other. Thus, not only can we divide these goals conceptually -- but empirically as well.

Figure 6: Division of Economic and Public Goods

economic goods (SDG Component 1)	social goods (SDG Component 2)
adequate resources for living	reduced economic inequalities
enough food	liveable cities
medicines and well-being	non-polluting consumption and production
education	safeguard the climate
gender and other equality	protect the seas
clean water and good sanitation	protect life on land
‘clean’ energy	peace
good work and econ. growth	promote partnerships (?)

expansive industrial, innovation and infrastructural bases

The model in equilibrium makes a number of predictions.

We tested our model using four different estimation groups. Figure 7 shows the means and uncertainty (standard deviations) attached to each variable in our analysis. The first uses a proxy for FinTech regulation and credit offered by FinTech firms. Ehrentraud (2020) and his co-authors (2020) provide the basis for our regulatory variable, while Cornelli *et al.* (2020) provides the FinTech credit data.

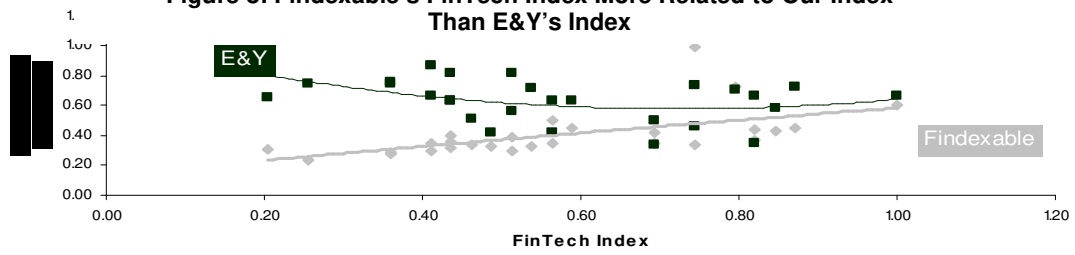
The second uses a proxy for FinTech regulation (a Findex Component) -- gauging each jurisdiction’s ability to engage in FinTech. Such a Findex component allows one to analyse all the various parts of the Findex dataset as one variable. The third approach looks only at our control variables -- like the size of the relevant economy, its linkages with the rest of the world and so forth. The right-hand side of the figure shows the control variables we used, and their summary statistics. The forth model looks at an E&Y (2019) index of each jurisdiction’s FinTech attractiveness, The Findexable (2019) measure of FinTech policy, and a measure of credit going to FinTech sectors world-wide. Figure 8 shows the relationships between these proxies for FinTech development. As shown, they are thankfully highly correlated. As such, we should expect similar results when using any of these independent variables.

Figure 7: Overview of Main Regression Variables

Variable	Mean	StDev		Variable	Mean	StDev
Main Regression				**Controls**		
FinTech Index	0.56	0.1992		Broad money (% GDP)	110.27	85.80
FinTech Credit (Ln)	5.24	2.6886		GDP (Ln of current US$)	27.58	1.20
Findexable Index	12.62	4.997		Market Cap Listed Companies (% GDP)	112.44	197.04
EY FinTech Index	0.62	0.1455		Patent Applications (Ln)	7.94	2.32
Findex Component				Strength legal rights (0-12)	5.87	2.99
Controls 1*	0	1.73		Mobile cell subscriptions %	131.50	34.28
Controls 2*	0	1.39		Air transport (Ln)	12.95	1.12
SDG Comp. 1*	0	2.29		External Debt (Ln of current $)	26.37	1.02
SDG Comp. 2*	0	1.25		Human capital Index (0-1)	0.70	0.10
				Internet use (%)	82.78	11.54
				R&D spending (% GDP)	1.78	1.03

* Our econometric methods set these variables' mean at zero. These components (composites) take the variation from a set of variables, and lump them together in a way which allows us to make conclusions about the entire dataset.

Figure 8: Findexable's FinTech Index More Related to Our Index Than E&Y's Index



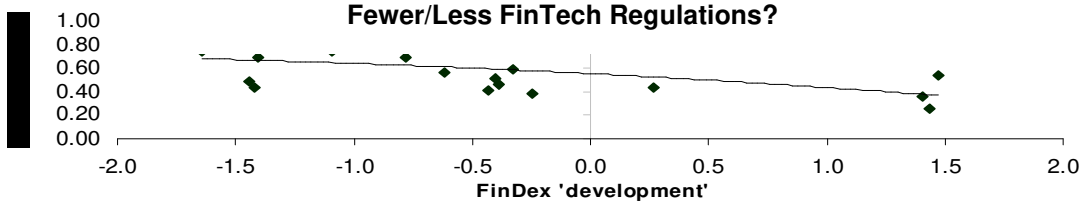
The figure shows the 3 FinTech regulation and environment indices we consulted for this study. The main variable, based on Ehrentraud et al.'s (2020) study, looks at the extent countries have adopted FinTech regulations. See the other two variables' sources for definitions.

We had to make several simplifications which affect our conclusions. First, we had to boil data from 120 countries available in the World Bank DataBank to the 30 countries reporting FinTech-related data. Even then, we only use data for 2018. Second, out of the hundreds of SDG-related indicators available, we chose only 1 sub-indicator from each goal. We tried to choose the indicator that most represented the idea behind the goal. The reader can decide for themselves how well we chose.

Three figures show the limitations of our analysis. Figure 10 shows the relationship -- without controlling for any outside factors -- between the FinTech Index we use, and a clustered proxy for financial development as derived from the IMF's Findex data. We observe a negative relationship across countries between these variables. Figure 11 shows that countries with more FinTech policies do not necessarily provide more FinTech-related credit. Thus, simply regulating does not develop markets. Figure 12 shows actual financial consumer behaviour (paying bills and buying things online) versus FinTech Finexable scores in these countries. One might draw a slightly upward slopping blob. But

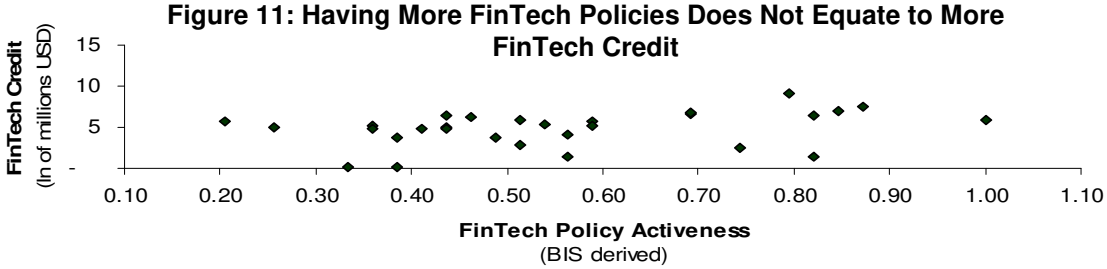
no clear relationship seems to exist. Thus readers should keep in mind that none of these data provide clear-cut conclusions -- before using advanced econometric analysis.

Figure 10: Why Do More Digitally Developed Financial Systems Have Fewer/Less FinTech Regulations?



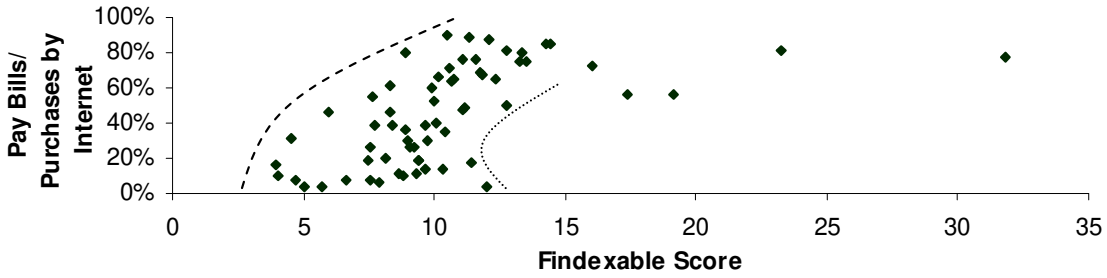
The figure shows our index of FinTech regulatory development and the single principal component we constructed for FinTech-related Findex survey items. The -0.53 Pearson's correlation coefficient underscores the negative relationship in these data.

Figure 11: Having More FinTech Policies Does Not Equate to More FinTech Credit



Source: data for Fintech Policy from Ehrentraud et al. (2020) and data for FinTech credit from Cornelli et al. (2020). The FinTech policy proxy consists of the number of FinTech polices each jurisdiction has, normalized between 0 and 1.

Figure 12: FinTech Friendly Jurisdictions Have More Online Commerce and Finance



Source: Findexable (2020) and World Bank Findex database (2020).

We should also note that countries ended up falling into groups which might be useful for future research. Figure 13 shows these clusters. Basically, we simply asked our software to group countries by similarities in the variables we used in our regressions. We seem to get a European group in cluster 1, a Latin America group in cluster 2, and an Anglo-American group in cluster 3. Cluster 4 includes everyone else. As this is a black box procedure, we can not say more about these clusters. Our only initial guess might be the way legal traditions impact on economic and even social outcomes (Roe, 2007).

Figure 13: Clusters According to the Way FinTech Regulations, FinTech Credit, General Macro Variables and Sustainable Development Goals Vary

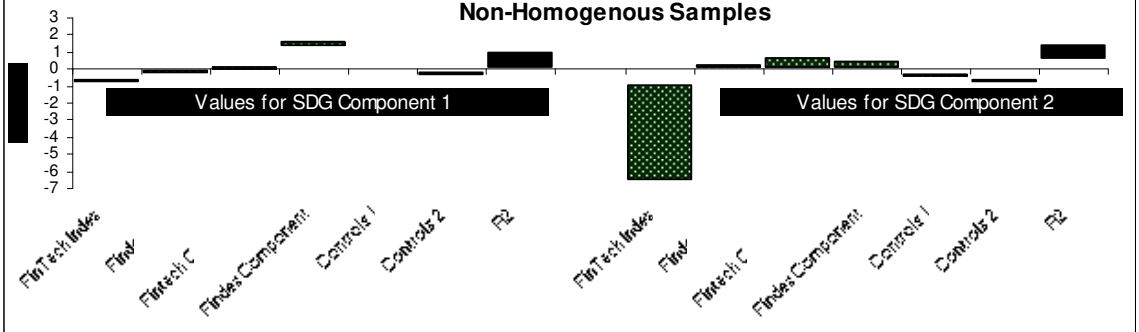
Cluster 1	Cluster 2	Cluster 3	Unclustered			
Belgium	Argentina	UK	Australia	Hong Kong	Netherlands	Saudi Arabia
Canada	Colombia	USA	Brazil	Italy	Philippines	Singapore
France	Mexico		Chile	Japan	Poland	S. Africa
Germany	Peru		China	Lux	Russia	Spain
			UAE	Sweden	Switzerland	Turkey

The figure shows the results of 3-k clustering on our FinTech Index, FinTech Credit, the Findex component, the two control components, and the 2 SDG components. We omit reporting any distances to keep the paper readable.

We look at several ways FinTech might affect the SDGs. The Appendix presents these approaches, and the resulting regression results. Looking at all these models, only financial development statistically significantly correlated with the SDGs. None of the FinTech proxies correlated at all. Using backward and forward regression, only the Findex Component was statistically significant -- at a value of 1.88. Looking at the determinants of such FinTech itself, we see only a few, fragile relationships hoping to explain FinTech in our cross-country sample. A measure of financial inclusion (account ownership as a percent of the population) correlates with FinTech. But such a relationship remains fragile.

At first glance, sustainable development has a highly unstable relationship with FinTech policy and FinTech development -- so far. Figure 14 shows the regression coefficients for each of our two SDG components on FinTech policy, FinTech credit and control variables like the extent of financial sector development. Financial development -- unsurprisingly -- positively correlates with both SDG components. Yet, **proxies for FinTech policy seem <u>negatively</u> correlated for the economic-related SDGs -- but positively correlated for socially-related SDGs.** FinTech credit availability correlates positively with both types of SDGs.

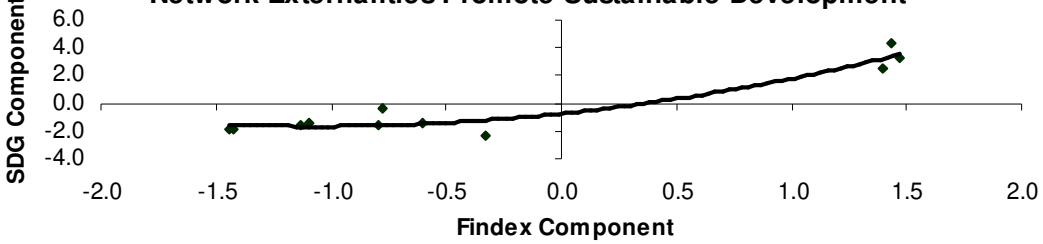
Figure 14: No Statistically Robust Relationships Due to Non-Linearities and Non-Homogenous Samples



The figure shows the b-values in linear regressions of the two principal components representing the 17 Sustainable Development Goals. For example, the variance in the parameter estimate of our FinTech Index on the principal component describing the second set of Sustainable Development Gaols varies between -0.93 and -5.53. R2 described the percent of variance the model explains.

Financial sector development positively correlates with sustainable development. Yet, a deeper study of this relationship shows the uncertainty around this statement. Figure 15 shows the relationship between our component serving as a proxy for the economic SDGs and financial development as proxied by a component which captures much of the variation in the Findex data. For low levels of financial sector development, FinTech rulemaking may draw resources away from regular economic activity -- hurting economically-related sustainable development. However, for higher levels of development, we see a positive relationship. Our model predicts such a relationship. **While such a U-shaped relationship comes as no surprise -- the negative impact of even low levels of financial development does surprise.**

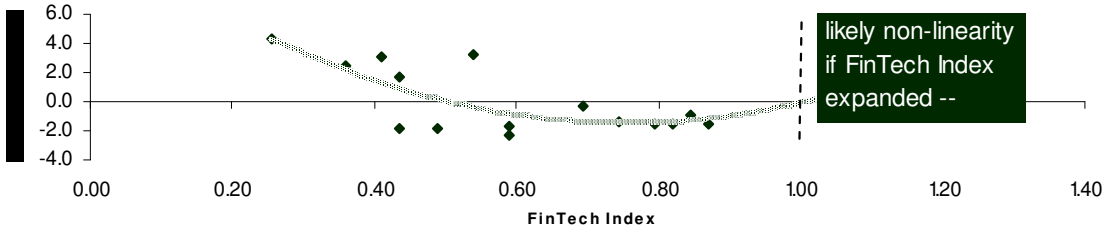
Figure 15: Likely an Ignition-Point in Financial Sector Development Before Network Externalities Promote Sustainable Development



The figure shows the relationship between the major SDG component (1) and the component on financial development (Findex). Regression tree analysis shows the break-point at 0.32.

A generalized regression model -- which specifically looks for these non-linearities -- finds it in the relationship shown above. Figure 16 shows, at least for this one year's data, we can have a higher degree of confidence in this non-linear relationship between the economic SDGs and financial sector development. Thus our model's predictions need a slight modification to allow for this non-linear nature -- something our equations do not exclude.

Figure 16: Regression Surface Analysis Shows Likely SDG Benefits for Future FinTech Policy…and Probably Only for a Sub-Set of Countries



The figure shows the non-linear relationship between FinTech policy and our main SDG component. Following authors like Deng (2019), we also find non-linearities in our data. We also find these relationships exist more strongly in some countries than others.

Thus, our three hypotheses need a slight modification. First, FinTech affects SDG outcomes mainly through funding SDG-related business. However, such a relationship will reach a point of diminishing returns. Second, public-good oriented SDG-producing firms and financiers will hit diminishing returns. We can say FinTechs will help promote

sustainable development - and better SDG scores -- without traditional banks and firms as well. Third, the distortionary government regulation which directs SDG-result producing firms to use SDG-result producing FinTech will quickly reach diminishing returns. What do these predictions portend for the US's and EU's regulatory approaches?

What Do These Results Mean For US and EU FinTech Law?

The regulatory response to FinTech has different in the US and EU. In a nutshell, the US has proceeded cautiously, drafting little regulation aimed at using FinTech for anything -- much less the SDGs (Arner, 2021). The 2012 Jumpstart Our Business Startups (JOBS) Act closest thing to a piece of law aimed at promoting development. The JOBS Act makes advertising the issue of some kinds of securities easier. For much FinTech related activity, pre-existing competition, banking and finance as well as consumer protection law applies to FinTechs as it would to banks or traditional financial intermediaries. Firms using or offering distributed ledger technologies must follow the same rules as if they maintained regular databases. Initial coin offerings must follow the same Securities Act of 1933 and the Securities Exchange Act of 1934 that other types of investments must adhere to.

If regulators follow the US approach, they would extend legislative work underway to tackle the SDGs outside of FinTech. Such an approach does nothing additional for promoting GDP growth or the SDGs 1-11 more generally. Thus, poverty reduction (SDG 1) would rely on legislative action targeting poverty, such as the Child Poverty Reduction Bill of 2021. Health care (SDG 3) would revolve around extending work on 'Obamacare' or the Affordable Care Act. Work on renewable energy (SDG 7) would extend work on the Renewable Energy Bill. Similarly, work on responsible consumption (SDG 12) would simply continue work on legislation like the RECYCLE Bill. As of our writing, the US Congress has numerous SDG-related laws in preparation -- none looking at FinTech.

The EU in contrast, has adopted a raft of laws aimed at FinTech and SDG reporting. Since 2007, the EU (2007) institutions have been procuring FinTech in the hopes of developing a FinTech which promotes the EU's various 'Agenda's -- like Agenda 2030 (Fihlo *et al*., 2018). The EU's proposal for a Corporate Sustainability Reporting Directive helps align reporting on the SDGs with the information already required under the Non-Financial Reporting Directive. The proposed directive would make all listed companies report on (and provide meta-data for) the EU's sustainability reporting standards. These non-financial standards would form part of the information audited during these companies' regular financial audits.

Such lawmaking bolsters a Europe wide strategy, action plan and other activities. The Sustainable Finance Taxonomy Regulation lays out what kinds of finance can market itself as sustainable. The EU itself sees its objectives as part of a broader sustainable finance policy under the European Green Deal. Specific planks of the Taxonomy include climate change mitigation and adaptation (SDG 13), sustainable use and protection of water and marine resources (SDG 14), transition to a 'circular economy' (SDG 12), pollution control (SDG 6) and protection of biodiversity (SDGs 14 and 15). The EU

Commission's Action Plan on Sustainable Finance includes disclosures and other activities required of FinTechs like any other financial services firms. These include compliance with the Taxonomy, standards for issuing 'green bonds', adherence to FinTech-related procurement requirements under the Sustainable Europe Investment Plan, sustainability-related aspects as part of any robo or FinTech investment or insurance advice providers. If these FinTechs conduct market research, they will need to include more/better sustainability indicators and ratings, provide investors' and asset managers' duties for promoting sustainability, and include these sustainability metrics as part of their disclosures.

Unlike in the US, the EU is already incorporating SDG-related metrics in its proactive regulation of FinTech. Several laws seek to facilitate the development of this SDG-friendly FinTech. The Second Electronic Money Directive, Markets in Financial Instruments Directive, the eID and Authentication Services Regulation, the Payment Services Providers Directive, the Packaged Retail and Insurance-Based Investment Products Regulation, the Strong Customer Authentication under the Payment Services Directive 2, the Proposed Markets for Crypto-Assets Regulation, and the Proposal for a Digital Operational Resilience Regulation all have obvious features aimed at developing FinTech-related activity. To remove any doubt, many provisions or modifications to these laws arise in the context of the FinTech Action Plan 2.0, and the Digital Finance Strategy/Package.

How do our results relate to this flurry of legislative/regulatory activity? Our model and findings both support the EU's push to incorporate SDG-related provisions into FinTech regulation right now. The US approach hopes FinTechs and financial services firms will somehow 'adjust' to the New Green Deal laws Congress has been debating in 2021 and 2022. Our results show the US will need to be proactive to get results on SDGs 11-17. Our results also show that more (or none) is not better. If the US has done too little to promote sustainable-development-inculcating FinTechs, the EU risks doing too much. Both jurisdictions will need to find a happy medium -- as FinTech rules (whether on FinTechs themselves or on all firms more generally) will experience diminishing returns to scale.

Conclusions

The late 2010s and early 2020s have seen a wave of FinTech-related activity and regulation in places like the EU. Mass media reporting on FinTech increased around the time when UN members had agreed on the SDGs and Agenda 2030. FinTech seemed like the next logical step in the private finance for development movement. Again, the EU responding by finding ways to encourage FinTech service providers to focus work on achieving the SDGs through Union-wide lawmaking. What do the available predict about the EU's hands-on approach -- and the US's hands-off approach -- to legislating SDG-friendly FinTech market development?

We find that the poor data available suggest that future FinTech regulation will have larger effects on the social and environmental SDGs (11-17) than the growth ones (SDGs

1--10). Using variants of ordinary least squares regression on 4 proxies for FinTech market development focused on rulemaking and credit offered, we find that any relationship will exhibit the same U-shaped relationship that traditional capital has on development. Namely, laws and policies (or the lack thereof) aimed at growing FinTech markets may encourage sustainable development to a limited extent. But after diminishing returns to FinTech regulating and lending/investing set in, such development would likely draw funding away from traditional old-tech productive investment.

The US and EU represent a microcosm of regulatory responses world-wide to FinTech. US lawmakers have not tried to use FinTech to bolster their SDGs scores in the same way EU lawmakers have. Instead, they have (so far) relied on traditional anti-poverty, environmental, social, and other law to propel action on sustainable development *à la* the SDGs. The EU has passed no less than 10 laws focused on some aspect of FinTech, sustainable development in FinTech reporting, and developing the protocols necessary for FinTech to operate in the Union. Such an approach -- if not too expensive -- will have positive impacts on the SDGs. But only to a point.

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Appendix I: Raw Regression Results

Figure A: Does FinTech Affect Sustainable Development?
(b-values and standard deviations)

Variable	SDG1	SDG1	SDG1	SDG2	SDG2	SDG2
Intercept	1.03	0.93	14.46	-1.53	0.84	-45.51
	(0.82)	(1.03)	(15.19)	(2.60)	(11.37)	(36.16)
FinTech Index	-0.649			-0.92		-5.53
	(1.354)			(3.87)		(6.60)
Findexable		-0.127	-0.069		0.144	
		(0.07)	(0.117)		(0.09)	
Fintech Credit LN	-0.016	0.128		0.44		0.18
	(0.107)	(0.15)		(0.54)		0.59
Findex Component	**1.40***			0.29	0.143	
	(0.31)			(0.63)	(0.094)	
Controls 1	-0.07	-0.256		-0.275		
	(0.18)	(0.237)		(0.50)		
Controls 2	-0.188	-0.148		-0.63		
	(0.187)	(0.325)		(1.95)		
SDG Component 2	0.07					
	(0.325)					
Mobile cell sub.			-0.008			
			(0.018)			
HCI			-9.71			47.6
			(19.58)			18.23
Fin. acct. account			-9.49			
			(5.95)			
Used internet 2buy			4.45			
			11.78			
Used internet 2bill						13.13
						5.29
GDP Ln					-0.094	0.80
					(0.023)	1.16
Broad money						-0.01
						0.015
R2	76%	9%	88%	63%	74%	70%

Figure A (cont): Or Do the SDGs and Other Variables Affect FinTech?
(b-values and standard deviations)

Variable	FinTech Index	FinTech Incex	FinTech Index	Findexable	Findexable	Findexable
Intercept	0.312	-0.08	-0.62	6.06	-6.19	188.60
	(0.287)	(0.27)	(1.33)	(8.35)	(26)	(78.8)
Controls 1	0.002	0.04		-0.33		
	(0.064)	(0.05)		(1.66)		
Controls 2	0.025	-0.39		7.75		
	(0.11)	(0.16)		(5.20)		
FinTech Credit LN	0.043	0.11		1.19		
	(0.05)	(0.05)		(1.40)		
SDG Comp. 1	-0.035	-0.10		-0.872		-3.63
	0.03	(0.05)		(2.27)		(0.993)
SDG Comp. 2	-0.01	-0.08		3.55		8.36
	0.041	(0.06)		(2.66)		1.11
Findex Component		0.12		-0.74		-6.84
		(0.11)		(3.82)		(2.27)
Percent DTP3			-0.01		-0.13	
			(0.01)		0.17	
Undernourishment			0.00		-0.985	
			(0.04)		(0.692)	
Fin. instit. acct.			0.52			
			(0.47)			
HCI			0.89		3.47	-68.56
			(0.74)		(15.97)	40.56
Mobile cell. sub.			0.00		0.02	-0.08
			(0.00)		(0.03)	(0.65)
GDP LN			0.05		**1.42***	-9.89
			0.04		(0.64)	(2.87)
Strength of legal inst.						-0.044
						(0.50)
Air transport						11.76
						(2.86)
Broad money			0.00			
			0.00			
Market cap.					**0.05***	
					(0.022)	
Acct ownership					**-33.77***	
					(14.76)	
Used internet bills/buy online					25.76	
					(8.76)	
R2	26%	66%	48%	85%	50%	97%

END