

Fintech expansion and institutional environment

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The study examines the role of institutional factors in fintech expansion by using Fintech licencing, macroeconomic and bank industry data from 2005 to 2019 in 30 EU and related countries. We found that investors establish fintech companies in countries where environmental uncertainties and resource asymmetries are minimised. The findings indicate that an institutional framework that limits corruption and establishes transparent, accountable and ownership-friendly regulations, leads to the rapid growth of Fintech companies. Institutional factors keep their decisive role during the period of regulatory transformation and bank crises. We also found that PSD2 regulation that unifies technological and reporting standards has also been accommodating to the fintech sector's growth. The study contributes to current literature and leads to significant policy implications by providing extensive evidence that institutions facilitate the fintech industry's growth.

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1. Introduction

Technological advances have transformed financial services during the last years (Lucey et al., 2018). Digital currencies and crowdsourcing, for example, have changed the ways companies are financed, while internet banking and mobile banking services are now also provided by non-bank financial service providers. These technology applications in finance are commonly called "FinTech" (Arner et al., 2016). Companies that provide fintech solutions reshape commercial practices (Dapp et al., 2014) and erode the banks' advantages (Stulz, 2019) whilst lowering bank costs (Bradley, 2018). FinTechs focus on simplifying financial products' customer experience by quickly addressing customer needs (Kryparos, 2018). As a result, intermediation in lending shifts from traditional banks to shadow banking (Buchak et al., 2018). These fundamental changes in intermediation that Fintech bring, eventually raise regulatory challenges (FSB, 2019). It is an open question whether regulators should step up and what direction they should scrutinise unregulated sectors and operations (Harker, 2017; Anagnostopoulos, 2018). Recent evidence from US mortgage market, for example, indicates that overregulation may decelerate sector growth and increase costs (Buchak et al., 2018). From the other side, regulatory-induced changes may force banks to adopt standards that help Fintech industry development. For example, 'RegTech', an advanced regulation in fintech applications, may prompt financial institutions to facilitate technology-based solutions that help Fintechs (Arner et al., 2016).

Recent findings indicate Fin Tech reduce inequality through the channels of information and financial inclusion (Demir et al., 2020) given the relation of financial inclusion with human and economic development (Shaban et al., 2020) and

the ability of Fintech in increasing financial literacy and financial inclusion (Panos and Wilson, 2020), raising the need to facilitate the growth of the Fin tech.

So far, the role of institutional factors for the development of Fintech has not been systematically investigated. How the protection of property rights, for example, accelerates the development of Fintech is something yet not empirically examined. In this study, we fill this research gap by investigating how institutional factors affect the development of Fintech. We explore the development of Fintech licencing in Europe, in a period that significant regulatory changes are implemented through ‘PSD2’ EU directive, a regulation that establishes standards of conformity in market transactions (Cortet et al., 2016). EU-related countries provide an ideal mix to examine institutions' role because they have geographic proximity and notable institutional differences. The paper provides evidence that the development of Fintech is affected positively by the commitment of governments to provide and implement sound regulations that promote property rights. These findings are robust even after using a more extensive set of different control factors and model adjustments for endogeneity and causality.

The study sample includes Fintech in Norway, Iceland and all twenty-eight EU countries from 2006 to 2019, licenced as Payment Institutions, Electronic-money institution, Account Information Service Provider, Exempted Electronic-money institution and Exempted Payment Institutions.

The paper advances existing literature in several ways. First, it is the first study to examine the effect of institutional factors on fintech sector growth. Second, it is the first study that evaluates the effect of PSD2 regulation on fintech births to the best of our knowledge. In this study, we also dismantle the impact of PSD2 regulatory changes and bank sector crises on the Fintech from institutional development, to examine interaction effects. Thus, we add more depth to studies that examine the effect of institutional factors.

Overall, the study brings significant evidence that favours the adoption of advanced regulations on a global scale. The findings directly suggest that the application of Regulatory frameworks that ensure efficient market players can compete on a level playing field will benefit FinTech development significantly. The improvement of country governance indices is found to strengthen the fintech industry's growth, even during bank crises. This growth has accelerated since the adoption of the advanced regulation PSD2. The sector's growth is also found to be favoured by human capital, financial capital, and competitive structure of the banking sector. All in all, the study provides substantial evidence that supports our hypotheses and can be a starting point for future studies.

The paper is structured as follows. The following section reviews relevant literature and the regulatory environment and examines the hypothesis to be tested. Section 3 presents the data, variables and models used in this study. Section four discusses the empirical findings. Section 5 contains robustness tests. The final part concludes the paper with a summary.

2. Literature Review and Hypothesis Development

2.1 Fintech and EU Regulation

Literature review leads to two definitions of ‘Fintech’, a broad and a narrow one. According to the broad definition, Fintech is associated with modern technologies used by the banking sector and refers to firms whose business model focuses on these innovations¹. Fintech is, according to this definition, a “technology-enabled innovation in financial

¹ The emergence of Fintech is discussed interalia in Buchak et al., 2018; Shim and Shin, 2016.

services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services.” (FSB, 2019, p.1, BCBS, 2018, p.8) novel technologies adopted by the financial service institutions (Gai et al., 2018), and modern technologies, such as internet-related (for example, cloud computing, mobile internet) with business activities typical of the financial services industry (for example, loans, payments, transfers of monetary values and diverse banking operations)” (Gomber et al., 2017). The current study places emphasis on fintech companies that apply technology to improve payments, also called Paytechs. These Fintechs built on technologies such as the digital wallet and NFC and advance electronic payments and mobile payments, both at POS and mPOS. (Schueffel, 2017b). We select them because of their importance since payments represent a significant proportion of the fintech sector. This part of the fintech sector is developing fast, with the increased use of smart devices, new digital applications, alternative processing networks, wearable technologies and new payments processes (EPA, 2016). We measure these companies' expansion based on the related licensing rights defined by the European Banking Authority (EBA).

Electronic Money Institution (EMI) was historically the first licence these companies obtained, introduced in Electronic Money Directive (EMD) 2000/46/EC (EC, 2000) and allowed these companies to issue electronic money. EMD was completed by Directive 2007/64 (EC, 2007) and repelled by EMD2 Directive 2009/110/EC (EC, 2009), which allowed EMIs to provide also other than electronic money payment services through the Account Information Service Provider licence that enabled the functioning of the entire spectrum of payment services. Existing licenses are now (i) Electronic-money institution (EMI), (ii) Payment institution (PI), and (iii) Account Information Service Provider (AISP). National Authorities can also grant payment institutions (both EMI and PI) licenses²³, nonetheless, such licenses could also be crucial for domestic pay techs. The role of the regulatory environment for Fintech is discussed in Arner et al. (2016), Chen (2016) and Stern et al. (2017) that stress the need the regulators to facilitate the development of new financial services and Fintech, by coupling growth and innovation with financial stability. The PSD2 Directive (EC, 2015) enables Fintech players to take advantage on the new Application Programming Interfaces (API) settings and to have payment and non-payment revenues long taken for granted by existing banks (Cortet et al., 2016). However, this directive's effect for the growth of the industry and the role of an advanced institutional environment for the development of the industry has not been examined so far.

2.2 Hypothesis tested

Early studies found that well-structured regulation prevents local governments from making major decisions that would negatively affect business activities (Shleifer and Vishny, 1997). Well-functioning laws correlate with acceptable

². A second, narrower, definition that is not adopted in the current study regards Fintechs as new non-bank entrants and start-ups and non-bank entrants, that constitute an alternative finance industry. Entities whose activity is therefore based on the use of new technologies are considered Fintech. They are usually start-ups that are not banks, though some can apply for obtaining a banking licence, e.g. Revolut. The definition suggested in Schueffel (2017a) describes Fintech as a new financial industry that applies technology to improve financial activities. Also, Kim et al. (2016) Micu and Micu (2016) and Shim and Shin (2016) current definitions of Fintech by subject - Fintech is a service sector, which uses mobile-centred IT technology to enhance the efficiency of the financial system. The fintech firms have an enormous impact on the financial services industry (Shim and Shin, 2016) and have technological advantages over non-fintech firms, offering more convenient services (Buchack et al., 2018). Fintech can offer a way toward a structural change in the financial industry because political economy considerations can stifle change in the sector's traditional part (Buchack et al., 2018).

³ Exemption scope is set it Article 3, points (k) & (l) of PSD2

corporate governance practices, investments and the development of the economy (La Porta et al., 2000). Institutional factors, such as legal rules, can decrease the cost of entry in markets(see, for example, Bahoo et al.,2020), protect the interests of shareholders and the degree of their enforcement affects company value (La Porta et al., 1998), encourage competition and are likely to decrease costs for newcomers (Grosse and Trevino, 1996, Fan et al., 2011). The development of institutions and institutional structures, decreases agency monitoring costs (Selznick, 1957; Hill and Jones, 1992) and the costs of information gathering and analysis. These institutions reinforce the protection of property and intellectual rights (Khoury and Peng, 2011) and deter segmentation, monopoly power, and legal and institutional privileges that favour corruption and over-regulation (Demirguc-Kunt and Huizinga, 1999, Wei, 2000; Demirguc-Kunt and Levine, 2001; Naceur and Omran, 2011). The institutional environment also influences organisation's technology decisions (Salge et al., 2015, Liu et al., 2015, Gomber et al., 2017), and provide payoffs that benefit new companies (Baumol, 1996) facilitating so the development of entrepreneurship (Zalan and Toufaily, 2017, Lee and Shin, 2018).

We hypothesise that entrepreneurs will prefer to establish fintech companies in a country that provides the minimum political, economic, and social risks for fintech investment, while also holding an efficient financial system for its development because an environment of abundant resources coupled by low risks should strengthen the development of these companies. Our hypothesis stems on Resource Dependence Hypothesis (Pfeffer and Salancik, 1978, Hillman et al., 2009) by arguing that business owners try to reduce environmental uncertainty by establishing Fintech in countries with environmental uncertainties resource asymmetries are minimum. We argue that institutions' role can reduce those information asymmetries in enhancing transparency in terms of Voice and Accountability, Government Effectiveness, Regulatory Quality, the rule of law, and corruption. If institutions develop cognitive, normative and regulative structures that define social behaviour (Scott, 1995), institutions should define investment behaviour and activity by helping Fintech. We outline our hypothesis as follows.

Hypothesis (H1): *The growth of fintech companies is positively affected by institutional factors*

3. Data and model

Overall, the study examines fintech companies from 30 European countries during the period 2005 to 2019. The Fintechs covered by the study, provide at least one of the following services: issuing, distribution and redemption of electronic money, account information services, execution of credit transfers, execution of direct debits, execution of payment transactions, execution of payment transactions, execution of direct debits, issuing of payment instruments, acquiring of payment transactions, payment initiation services. Appendix B provides some overall statistics for the selected countries. These include the full dataset provided by the European Banking Authority, excluding Lichtenstein, because there is a lack of macroeconomic data for this small country for the examined period. The United Kingdom has the largest number of fintech births during the examined period (383), followed by the Czech Republic and the Netherlands. On the other side, five countries out of the 30 countries examined do not have any fintech in the examined period, which makes our sample ideal for our statistical analysis because it incorporates countries with licences and countries with a lack of Fintech.

The possibility of having permission to provide many types of services by entities with different licenses makes it difficult to distinguish the examined companies into clear market segments. In particular, all of the previously mentioned licenses, except Account Information Service Providers, may support various types of payments. In turn, both Payment institution and Electronic Money institution can also provide Account Information Services. Hence, we decided to examine the total number of paytech entities with the abovementioned licenses in the European Union, based on Article 15 of PSD2. The competent national authorities of the EEA Member States provided information on entities that obtained domestic licenses (according to PSD2 regulation) in the examined countries. The data on FinTech companies were retrieved from the EBA publicly available database on 4 April 2019. The number of non-bank institutions obtained licences is by type: 513 Payment institutions, 282 Electronic money institution, 54 Account Information Service Provider, 62 exempted Electronic-money institution, and 242 exempted Payment Institutions. Appendix B provides these statistics per country. Until 2017, most of the analysed entities had a Payments Institution license. Since 2018 - after the adoption of PSD2 and with the preparations for the full implementation of the directive in European Union countries the number of licenses for Electronic-money Institutions increased rapidly and they became the second most popular group of institutions. The number of Exempted Payment institutions and Exempted Electronic-money institutions systematically increased throughout the entire study period. At the same period, a new type of institution, the Account Information Service Provider, emerged. However, this still constitutes a small group of institutions, probably because the Account Information Service is part of a new business model that takes years to accept entrepreneurs and consumers.

3.1 Model description

To examine our hypotheses we assume that the total number of licences in a country, and the new licences during a particular year is a function of institutional factors, macroeconomic factors and bank sector factors, as follows (we restrain subscripts for notational convenience):

$$\mathbf{BIRTH} = a_0 + a_{1t}\mathbf{INST} + a_{2t}\mathbf{MACRO} + a_{3t}\mathbf{BANK_SECTOR} + \varepsilon \quad (1)$$

Where:

BIRTH is the birth of fintech licences.

INST are institutional factors, namely Voice and Accountability, Government Effectiveness, Regulatory Quality, Rule of Law, and Corruption Control. These factors are illustrated in Table 1.

MACRO are macroeconomic variables, as illustrated in Table 1 and provided by the World Bank.

BANK_SECTOR refers to financial stability variables, as illustrated in Appendix B and provided by the World Bank

The net birth rate (**BIRTH**) is widely used as depending variable in entrepreneurial studies, capturing the activity in a sector when national markets or local markets are examined (e.g. Hasan et al., 2017, Francis et al , 2008, Birley, 1986).

In this study, we use a logarithmic transformation of the total number of licences of fintech companies in a country at fiscal year-end t , measured as $(\log(N_t+1))$, where N_t is the net birth, the difference of the number of companies at the end of the period from the number of companies at the beginning of the period in each national market. Logarithmic transformations have the advantage of normalising growth rates.

To examine the ability of institutional factors (**INST**) to affect births of fintech institutions in the study, we use the World Bank Governance Indicators(WBGI) to capture perceptions of the governments' ability to implement effective policies and regulations that permit and promote private sector development.

The construction of the WBGI uses the unobserved components model, The concept behind this statistical approach is that each of the individual data sources provides an imperfect signal of some deeper underlying notion of governance that is difficult to observe directly. The unobserved components model isolates an informative signal about the unobserved governance component common to each individual data source. For each of the components of governance defined above, the authors assume that the score of country is a linear function of unobserved governance in a country and a disturbance term, with zero mean, unity as a standard deviation and range between minus 2.5 and plus 2.5.

Using institutional factors at a national level, we can capture the heterogeneity of country-related environment in the European area, where many common factors, also exist. We use five major World Bank institutional factors used in the Worldwide Governance Indicators (WGI) project that report aggregate and individual governance indicators for dimensions of governance (in parentheses the names used in this study): Voice and Accountability (**VOA**), Government Effectiveness (**GOV**), Regulatory Quality (**REG**), Rule of Law (**LAW**) and Control of Corruption (**COR**). There are several significant advantages to selecting these variables.

VOA(Voice and Accountability) measures how a country's citizens participate freely to choose their government. High Voice and Accountability indicates free speech, uncensored media, and citizens' ability to have an association. The index's value is a weighted average from the Economist Intelligence Unit (democracy index, human rights) and other sources. Voice and accountability determine investment decisions in several countries (Jadvah, 2012).

GOV(Government Effectiveness) gauges citizens perceptions of the quality of the provided services by public authorities. It also measures to what degree civil servants operate independently from politicians. It also examines if agreed policies are fully implemented and whether governments are committed to implementing them. Government effectiveness is found to affect investments (Cuervo-Cazurra, 2008).

REG(Regulatory Quality) evaluates perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development. Regulatory quality can significantly affect direct investments in service-related sector (Koenig and MacGarvie, 2011).

LAW(Rule of Law) examines the extent to which there is a restriction of the arbitrary exercise of power by subordinating it to well-defined and established legislation. The application of Rule of Law can be a significant part of government infrastructure and can encourage investments (Globerman and Shapiro, 2003)

COR(Control of Corruption) quantifies the extent public power is exercised for individuals' benefit, degree of corruption, and the degree elites and vested interests control the state. The Control of corruption may help to decrease the inefficient allocation of resources (Mauro, 1995, Habib and Zurawicki, 2002)

These factors are analysed in the site of the World Bank (<https://info.worldbank.org/governance/wgi>). We also use 119 Macroeconomic factors and financial indices, from World Bank, mentioned in the Appendix and explained in World Bank site, as well.

Using World Bank data has certain benefits. First, World Bank, which guarantees data publication is a reputable organisation and indices used are based on a variety of resources, statistically minimising the possibility the data will be biased or affected by errors. Second, the data are freely available, and therefore, the reliability of variables can be examined and tested by any researcher. Finally, they are standardised, which provides the ability to be easily used for comparative analysis. The score of these world bank indicators is expressed in terms of deviation from the average value. Standard deviation varies between -2.5 and 2.5.

The methodology of index construction for these variables is described in Kaufmann et al. (2011) and includes the unobserved components model. Indices use data from 31 different sources. In 2009, 26% of the data were from government organisations, 16% of the data sources were provided by companies that are specialised in business information, 29% was from non-government organisations, and 29% was from various. However, for the same year data, distribution of the points comes mainly from business information companies (34%), government data account for 26% per cent, and surveys and non-government organisations share equally the remaining 40% of data points (Kaufmann et al., 2011). To further normalise the data, to adjust the relative institutional performance, we use an adjusted measure of institutional variables⁴.

⁴ If VOA_u , GOV_u , REG_u , LAW_u and COR_u refer to the official variables that correspond to World bank indicators Voice and Accountability, Government efficiency, Regulation, Law and Control of Corruption, then the computed institutional factor will be $INST_{it} = \frac{n \cdot INS_{it}}{\sum_{i=1}^n INS_{it}}$, where $INS = VOA_u, GOV_u, REG_u, LAW_u, COR_u$

3.2 Control Variables

In line with literature in the area of entrepreneurship, the basic model contains six control variables that control for human capital that is proxied by education demographics of the domestic market, purchasing power per capita, bank sector competitiveness, and financial capital.

POPUL is the logarithm of the population and GDPPP, the gross domestic product per capita in US dollars, aiming to capture demographic characteristics that relate with the size of the consumer market, the purchasing power and the labour costs where the companies operate (Mauro, 1995, Bailey, 2018)

There are contradicting findings regarding the relation of Fintech and traditional financial industry. Li et al. (2017) found bidirectional dependency between Fintech and traditional banking, while Buchak et al. (2018) found a negative relationship between them. Several studies indicate that FinTech venture capital (VC) investments are found prominent in countries without a financial centre (Cumming and Schwienbacher, 2016), and non-bank Fintech flourished in countries with a poorly developed and not very competitive bank sector (Pénicaud and Katakam, 2013). Mobile payments, for example, became necessary for the economies of African countries and the countries of the southern part of Asia where there is a low level of banking penetration in the society and where the implementation of technically simple mobile payment systems constituted a response to the society's real needs (Pénicaud, 2012; Pénicaud and Katakam, 2013, Tasca et al., 2016, Iman, 2018). FinTech industry in more advanced economies reduces the funding gaps of small and medium-sized enterprises (SMEs) through crowdfunding (Dorfleitner et al., 2017) while prepaid systems in advanced economies were based on large-scale retailers and non-bank entities (Zucarro, Bridwell, 2016). Nevertheless, an efficient financial system facilitates the successful allocation of investment funds, fostering this way, developing new companies, and developing the economy in general (Schumpeter, 2017, Diamond, 1991). In particular, new companies' initiation largely depends on the availability of developed bank financing (Alessandrini et al., 2009). The banking sector reduces information asymmetries because of the access they have to small new firms' loan applications. Due to this superior access to information, banks can direct financing to these customers in an efficient way (Diamond, 1984, Berger et al. 2005, Roberts and Yuan, 2010). Demircuc-Kunt and Huizinga (1999) found that the enforcement of regulations and laws have led to more efficient banking. We argue, therefore, that an efficient banking system affects the development of fintech companies positively. We use **BANKCAP** and **BOONE** to examine the role of efficient banking for the growth of Fintech, following studies that use bank indicators of capital and efficiency as control variables for entrepreneurship (see Hasan et al., 2017).

BANKCAP, is the bank capital in billions of US dollars, that is used as a proxy for the existence of sizable financial resources in an economy or financial capital

BOONE is the boon indicator, which measures relative profit differences (RPD).

EDUCATION, is the percentage of the population that has higher education, used as a proxy for the human capital in the economy. Education is found to increase productivity for high-tech industries (Varsakelis, 2006) and new companies' birth (Hasan et al., 2017).

FDI, is the foreign direct investments to gross domestic product ratio. It is a proxy for investment-friendly policy to foreign businesspersons.

We describe the primary variables used in the study in Appendix A.

The correlation among the institutional variables appears very high in the Correlation matrix that is illustrated on Table 1, and the Variance Inflation Factor (VIF) tests that we run to check multicollinearity in our models indicate the findings of other studies that examined the institutional factors found, that there is multicollinearity between the institutional factors. Therefore, following the literature, we avoid placing more than one institutional factor in the same model. On the contrary, the relatively high correlation between the GDPCAPITA and other factors does not lead to high VIFs, so the plausibly high correlation is not a cause of multicollinearity concerns. In all other cases, correlation, as illustrated in Table 1, is at normal levels.

Table 1 here

4. Empirical findings

This part of the study demonstrates regression results that i. associate institutional factors to the development of Fintech, ii. examine the effect of PSD2 directive and financial crisis, iii. link alternative factors to the growth of Fintech and iv. deal with endogeneity issues.

4.1 Introduction to test structure

We initially run our models based on OLS regressions, and we select control variables based on existing literature. Then, we use several robustness tests, including the use of Lasso for the selection of a large set of variables, Poisson regressions, propensity sample matching (PSM) - based regressions and instrumental variables in two-stage least square regressions (2SLS). The data from 2005 to 2009 are used for the computation of instruments. Data from 2010 onwards are used in 2SLS regression analysis.

4.2 Basic findings

Table 2 provides statistics regarding the fit of year-clustered OLS regressions, based on the combination of institutional factors, macroeconomic variables and financial industry.

Table 2 here

We use one institutional factor at the time for two reasons. First, our models that use two or more of the institutional factors were found to have multicollinearity (high VIFs). Second, past literature found similar multicollinearity and uses the same approach, of using one institutional factor at the time, as in this study.

The first FE regressions results are illustrated on columns 1-5 of table 3 and provide evidence that institutional factors are statistically significant. In particular, we found that a Control of Corruption (**COR**) that is one standard deviation above the average, leads to an exponential increase of licences by 0.515. Similarly, a higher level of Government Effectiveness (**GOV**), Rule of Law(**LAW**), Regulatory Quality(**REG**) and Voice and Accountability(**VOA**) by one standard deviation above the average, effectively leads to 0.81, 0.925, 0.976 and 1.06 units increase of licences, in exponential terms. We should ideally expect that companies benefit from having a more substantial number of potential customers when they operate in populated countries. However, **GDPCAPITA** may affect negatively licencing, assuming that operating in countries where the GDP per capita is high, will be associated with high labour costs. The existence of sizable financial resources in an economy measured by bank capital (**BANKCAP**) should correlate with the number of licences. The more negative the **BOONE** indicator that measures relative profit differences (RPD), the more competitive the industry will be (Boone, 2008), and therefore more companies should pursue licences. Finally, we expect a positive association between education and licencing. While we expected that an investment-friendly policy to foreign businesspersons should affect licencing, we did not find any significant effect of **FDI** to the Fintech licensing, perhaps because fintech licences' growth does not correlate with the money inflows from large multinational companies that are signified by high FDI. Indeed, these regressions indicate that the population, education, bank efficiency (**BOONE**), and FDI investments positively affect the growth of the fintech industry. On the contrary, GDP per capita coefficient is negative, perhaps because countries where GDP per capita is high, have high labour cost that may be a negative factor for establishing these companies.

Table 3 here

Table 4 illustrates the effect of institutional factors on Fintech companies' births when we consider interactions with the economic crisis in each country and interaction with the legislative change of PSD2.

A large number of incompatible mobile payment systems lead to underdevelopment of fintech industry in itself . Regulatory changes, such as PSD2 Directive (EC, 2015) is believed to accelerate the development of Fintech that can benefit from Open API infrastructure (Steennot, 2018; Wolters and Jacobs, 2019). However, this regulatory development's effect to the fintech development and its interaction to institutional factors has not been examined

empirically so far. For that purpose, we incorporate in our regression model PSD2(**PSD**) and **CRISIS** as independent variables and the interactions of each of these variables with corruption and the other institutional factor.

There are several findings. First, PSD2 and crisis were found significant in all regressions. The PSD coefficient is positive and significant, indicating that the introduction of the PSD2 directive accelerated fintech births. Banking Crisis (CRISIS) has a significant negative effect, as intuitively expected; investments are postponed during times of economic crises. Second, PSD and CRISIS do not affect the significance of institutional factors or **POPUL**, **GDPCAPITA**, **BOONE** and **EDUCATION**. Third, bank capital appears insignificant, probably because PSD itself may also capture developments regarding the banking sector structure. The interactions of Control of corruption, Government Effectiveness, Rule of Law, Regulatory Quality and Voice and Accountability with the crisis are significant and negative. During the crisis, the effect of Government Effectiveness, Rule of Law, Regulatory Quality and Voice and Accountability is weaker, because their respective coefficients, appearing in the regressions appear smaller. Finally, interactions of institutional factors with PSD2 are insignificant, indicating that the introduction of PSD2 did not affect the importance of institutions for directly developing the industry. In a nutshell, institutional factors have a significant effect on Fintech licensing, irrespectively of the economic cycle phase or the significant regulatory change of the period examined.

Table 4 here

5. Robustness tests

Robustness tests include a more extensive set of variables, using lags, and instruments to account for possible endogeneity.

5.1 Extended set of variables

We use an advanced model to consider including control variables of high predictive ability among a full set of 150 variables provided from the World Bank. To examine all the variables together, we use Lasso methodology, as in Chinco et al. (2019). Lasso is useful mainly for two reasons. First, it enables using part of the data to form the model and another part of the data for model validation. Second, it provides a way to choose from a large number of candidate control variables to focus on a handful of useful variables (Chinco et al., 2019). The LASSO methodology has been introduced by Tibshirani (1996) and is discussed in Hastie et al. (2001). This new model is superior based on information criteria AIC and BIC, and brings overall higher statistical fit in R-sq-adj (31%-33% rather than 16%). The model indicates that the significance of all the five institutional factors that we examined remains high, even after accounting to these factors. Control variables such as bank riskiness(bank z-score), higher loans to deposits, and more bond loans are associated

with lower Fintech licencing, which is broadly in line with the conclusions of our basic model indicated that the bank competitiveness (**BOONE**) increases licencing.

Table 5 here

5.2 Lagged variables

We run first lagged and second lagged variables, to examine the regressions' validity under different assumptions. The results are illustrated in Table 6. The coefficients of all the institutional factors are positive and significant, in line with these basic models.

Table 6 here

5.3 Poisson analysis

We also attempt to measure institutional factors' significance by using Poisson analysis, following Zucker et al., 1998. The Poisson analysis enables to compute the odds of obtaining one more licence under different assumptions regarding institutional factors' value. The analysis indicates the robustness of our initial findings, as all the institutional variables are significant. An increase in institutional factors, such as Control of corruption, law, and accountability, leads to a significant increase in the *probability* of an additional licence. The reported Wald chi-sq and LR statistics are in all five regressions significant at one per cent level and the coefficients of the variables factors. The regression also shows that the control variables (**such as EDUCATION, BOONE, POPUL**) have a similar effect. For example, an increase in **EDUCATION** or bank efficiency, as expressed by **BOONE** leads to increasing probability to have fintech companies.

Table 7 here

5.4 Endogeneity and instruments

So far we assumed that institutional factors are exogenous factors that affect the growth of the fintech companies. To examine the validity of the model under the assumption of endogeneity, we employ the propensity score matching (PSM)

method as applied in Ben-Nasr et al. (2015) and Boubaker et al. (2016)⁵. First, we create a sample that includes all firms with positive institutional variable values (**COR**, **GOV**, **LAW**, **REG** and **VOA**) and a second sample that has zero or negative institutional variable values, respectively. We then identify matched samples by using the nearest neighbour method based on probabilities calculated by a probit model where the dependent variable is the treatment and independent variables that express factors that affect entrepreneurship birth rate as in Hasan et al. (2017). These independent variables express the legal and business environment, bureaucracy, market openness and labour market characteristics. **TIMEG** (percentage of time company management spends in government agencies) expresses bureaucracy. **COMLAW** (common law) dummy variable reflects whether the legal environment is related to common law or civil law, indicating the degree of property protection. Unemployment rate (**UNEM**) reflects the structure of the labour market. Finally, **TRADE**(foreign trade as a percentage of GDP) shows the market openness as being proxies of the business environment and related institutional development. These variables are widely used to reflect proxy variables of institutional factors. Common-Law countries(**COMLAW**), for example, have strong protection of outside investors,(La Porta et al., 2000) have different regulatory and business ethos and indicate different governance model (Liu et al., 2019).

Unemployment rate (**UNEM**) reflects the business environment(Hassan et al., 2017). Foreign trade (**TRADE**) is also a significant factor that reflects institutions' ability to be effective in attracting investments (Bailey, 2018). Time spent dealing with the requirements of government regulations (**TIMEG**), reflects the time a company takes to do business and has been a primary indication of institutionalisation (Mauro, 1995). These variables were found significant in propensity score matching, and had high power (Pseudo R-sq varied between 49% and 63%) in our model, as regressions 1 to 5 of Table 8 indicate. Foreign trade (**TRADE**) and unemployment (**UNEM**) were found significant in these models. **TIMEG** correlates negatively to institutional development for all five institutional factors, as expected. Finally, **COMLAW** is a significant variable used in PSM to predict corruption, Government effectiveness and Regulatory efficiency, as expected. Results using PSM sample had a decent overall statistical fit (R-sq-adjusted has been 10%-12%), and the institutional factors had positive and significant coefficient in all of them. The coefficients of the control variables were also significant.

Table 8 here

Then we utilise a two-stage instrumental variable approach. We employ IV-COR, IV-GOV, IV-LAW, IV-REG and IV-VOA as instruments. These instruments are the average values of the standardised institutional factors COR, GOV, LAW, REG and VOA, respectively during the period 2005-2009, which is before the examined 2010-2018 period. Using instruments based on this methodology is widely adopted in recent established management studies(see Waisman (2013)

⁵ A more detailed discussion about PSM validity as a method is provided inter alia in Boubaker et al. (2017) and Gounopoulos and Pham (2018).

and Boubaker et al. (2018), for discussion). We note that the institutional factors **COR, GOV, LAW, REG and VOA** are the standardised deviations from the average values of all sample countries for the corresponding years. Therefore, the value of the institutional factors also depends on the observations of the peer countries. These IVs incorporate the tendency for institutional underperformance or overperformance that used to exist in the past compared to other countries, a methodology widely used for groups with some similar characteristics (Lin et al., 2013, and Ben-Nasr et al., 2015). Panel A of the Table 9 depicts the first-stage regression coefficients of the instruments and the overall fit of the first-stage regression, while Panel B of the same table shows the second stage statistics respectively that include the exogenous variables and second stage fit. A good fit of the first stage instruments is indicated by the significance of the coefficients, while the high predictive strength of excluded instruments, expressed by Partial R-sq and F-test, should indicate a good overall fit at the first stage (Wooldridge, 2010). Indeed Partial R-sq and F-test at the first stage are high, and the instruments **IV-COR, IV-GOV, IV-LAW, IV-REG and IV-VOA** have a positive coefficient and are significant at one per cent level. Second stage regression statistics show that the significance of all the institutional variables, the exogenous variables **POPUL, GDPCAPITA, BANCAP, BOONE and EDUCATION** and their coefficients are largely in line with those we found at the initial regressions. **FDI** appears, however insignificant, revealing that the first stage regression reflects a significant part of the volatility that relates to FDI.

Table 9 here

6. Discussion and conclusion

The study analyses institutional factors' role to the growth of the fintech industry in an era of regulatory changes. Our findings confirm Mauro, 1995, Shleifer and Vishny, 1997, and Globberman and Shapiro, 2003 that the Control of Corruption, Rule of Law and well-structured regulation favours entrepreneurship and encourages investments. We extend the findings of Salge et al., 2015, Liu et al., 2015, Gomber et al., 2017, Zalan and Toufaily, 2017 and Lee and Shin, 2018, by providing empirical evidence that the institutional environment influences organisation's technology decisions. Entrepreneurs prefer to invest in countries where the legal environment is favourable. The study confirms the hypothesis that regulation enforcement is beneficial (Demirguc-Kunt and Huizinga, 1999) in Fintech. Our findings are in line with Resource Dependence Hypothesis (Pfeffer and Salancik, 1978) by evidencing that fintech investors try to reduce environmental uncertainty by establishing these companies in countries where environmental uncertainties and resource asymmetries are minimised. We implicitly extend Scott, 1995, hypothesis that institutions define social behaviour by providing evidence that institutions can influence investment behaviour in the fintech industry. Our study also empirically confirms the importance of open protocols (Steennot, 2018 and Wolters and Jacobs, 2019), by providing evidence that PSD2 has also fuelled the fintech sector's growth. Institutional factors were also significant during the period of regulatory transformation and bank crises. Overall these findings are robust under different assumptions about endogeneity and various types of regression models and could be useful for drawing further conclusions, and policy recommendations, at a global scale, due to the large size of the EU market. The study sheds new light and contributes

significantly to current literature regarding the role of institutional factors by providing novel and extended evidence that institutions accelerate rather than slow down the fintech industry's growth.

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Table 1. Correlation table

GOV	0.92										
LAW	0.94	0.94									
REG	0.86	0.84	0.89								
VOA	0.91	0.90	0.94	0.86							
BANKCAP	-0.10	-0.08	-0.10	0.01	-0.13						
BOONE	-0.19	-0.15	-0.17	-0.21	-0.21	0.01					
GDPCAPITA	0.71	0.62	0.68	0.63	0.71	-0.11	-0.58				
POPUL	-0.09	-0.12	-0.11	-0.06	-0.08	0.12	0.29	-0.17			
FDI	-0.02	0.00	0.06	-0.01	0.02	0.00	-0.01	-0.06	-0.24		
EDUCATION	0.01	0.08	0.04	0.09	0.00	0.04	0.02	0.09	0.12	-0.04	
	COR	GOV	LAW	REG	VOA	BANKCAP	BOONE	GDPCAPITA	POPUL	FDI	

Table 2. Descriptive statistics

VARIABLES	mean	sd	p25	p50	p75
COR	0.0789	0.806	-0.680	0	0.808
GOV	0.0119	0.513	-0.363	0	0.446
LAW	0.0144	0.532	-0.360	0	0.513
REG	0.0153	0.367	-0.243	0	0.340
VOA	-0.0098	0.298	-0.165	-5e-07	0.221
ATM	78.57	36.92	52.43	71.43	104.2
BANKCAP	7.168	8.623	4.871	6.520	8.440
BOND	7.792	4.621	5.256	7.023	8.792
BONISS	1.739	2.119	0.498	1.154	2.306
BOONE	-1.885	11.90	-0.116	-0.0510	-0.0006
BRANCH	33.23	22.37	16.38	27.98	40.71
GDPCAPITA	35,897	16,053	25,838	33,409	42,564
GINI	31.30	3.610	28	31.50	34.20
INSPREM	2.790	2.397	0.993	2.055	4.088
LIABI	29.94	55.53	2.697	14.06	30.27
LIST	26.61	24.39	8.611	18.52	37.00
LOTODEP	124.5	62.82	92.11	119.0	146.1
TIMEG	3.765	5.256	0	1.100	6
ZSC	11.64	7.845	6.215	9.329	15.54
POPUL	15.76	1.466	14.92	15.89	16.63
CRISIS	0.214	0.411	0	0	0
FDI	5e-10	4e-09	0	0	8e-11
EDUCATION	11.40	1.023	11.07	11.52	11.98
BIRTH	0.549	0.915	0	0	1.099

Table 3. Regression results

	(1)	(2)	(3)	(4)	(5)
COR	0.534*** (0.0915)				
GOV		0.816*** (0.132)			
LAW			0.881*** (0.197)		
REG				0.866*** (0.168)	
VOA					1.037*** (0.230)
POPUL	0.161*** (0.0301)	0.167*** (0.0296)	0.162*** (0.0303)	0.147*** (0.0339)	0.150*** (0.0322)
GDPCAPITA	-2.92e-05*** (8.20e-06)	-2.37e-05** (7.64e-06)	-2.93e-05** (1.06e-05)	-2.02e-05** (7.51e-06)	-2.04e-05** (8.23e-06)
BANKCAP	0.0292** (0.00928)	0.0294** (0.0100)	0.0349*** (0.00956)	0.0115 (0.0105)	0.0303** (0.00969)
FDI	1.105e+08** (4.533e+07)	9.911e+07* (4.591e+07)	8.794e+07* (4.329e+07)	8.807e+07* (4.312e+07)	9.181e+07* (4.185e+07)
BOONE	-0.0333*** (0.00863)	-0.0305*** (0.00855)	-0.0347** (0.0110)	-0.0248** (0.00784)	-0.0254** (0.00873)
EDUCATION	0.181*** (0.0376)	0.148*** (0.0408)	0.173*** (0.0373)	0.137** (0.0417)	0.173*** (0.0392)
Constant	-3.011** (0.915)	-2.884** (1.008)	-2.940** (1.016)	-2.462* (1.088)	-3.026** (0.966)
Year-Clustered	YES	YES	YES	YES	YES
R-squared	0.128	0.135	0.145	0.126	0.106
Observations	270	270	270	270	270

The table illustrates results of FE regressions. Dependent variable is Fintech Birth (BIRTH). Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4. Regression results, interaction effects

	(1)	(2)	(3)	(4)	(5)
COR	0.700*** (0.169)				
CRISIS X COR	-0.128 (0.112)				
PSDX COR	-0.0453 (0.0695)				
GOV		1.161*** (0.143)			
CRISIS X GOV		-0.257* (0.136)			
PSDX GOV		0.0968 (0.140)			
LAW			1.489*** (0.239)		
CRISIS X LAW			-0.536*** (0.139)		
PSD X LAW			-0.0547 (0.141)		
REG				1.668*** (0.237)	
CRISIS X REG				-0.902*** (0.258)	
PSD X REG				-0.0710 (0.145)	
VOA					1.981*** (0.343)
CRISIS X VOA					-0.651*** (0.191)
PSD X VOA					0.162 (0.189)
PSD	0.378** (0.142)	0.517*** (0.152)	0.518** (0.157)	0.455** (0.161)	0.588** (0.190)
CRISIS	-0.232* (0.103)	-0.279** (0.115)	-0.269** (0.105)	-0.136 (0.104)	-0.229* (0.103)
POPUL	0.187*** (0.0270)	0.203*** (0.0268)	0.195*** (0.0268)	0.174*** (0.0320)	0.177*** (0.0290)
GDPCAPITA	-3.62e-05*** (6.88e-06)	-3.60e-05*** (5.98e-06)	-4.40e-05*** (9.05e-06)	-3.06e-05*** (4.72e-06)	-4.00e-05*** (7.45e-06)
BANKCAP	0.0119 (0.00973)	0.00713 (0.00948)	0.0240** (0.00876)	0.00585 (0.00994)	0.0169 (0.00914)
FDI	1.0e+08* (4.8e+07)	9.0e+07 (4.9e+07)	6.8e+07 (4.4e+07)	7.8e+07 (4.2e+07)	7.4e+07 (4.2e+07)
BOONE	-0.0442*** (0.00680)	-0.0477*** (0.00565)	-0.0549*** (0.00892)	-0.0407*** (0.00471)	-0.0486*** (0.00709)
EDUCATION	0.203*** (0.0407)	0.164*** (0.0470)	0.220*** (0.0423)	0.208*** (0.0546)	0.219*** (0.0465)
Constant	-3.303*** (0.872)	-3.081** (1.063)	-3.406** (1.030)	-3.378** (1.157)	-3.242** (0.982)
Observations	270	270	270	270	270
R-squared	0.169	0.201	0.224	0.191	0.183

The table illustrates results of FE regressions. Dependent variable is Fintech Birth (BIRTH). PSD is a dummy variable having the value 1 if the period covered is after the implementation of PSD2 directive, zero otherwise. CRISIS is a dummy variable having the value one if it was a year a banking crisis took place in the respective country examined, zero otherwise. Appendix provides definition of the other, basic, variables used. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5. Regression results, where lagged variables of institutional factors were used

PANEL A. First Lag	(1)	(2)	(3)	(4)	(5)
COR(lag)	0.515*** (0.0862)				
GOV(lag)		0.818*** (0.123)			
LAW(lag)			0.925*** (0.228)		
REG(lag)				0.976*** (0.205)	
VOA(lag)					1.062*** (0.250)
POPUL	0.169*** (0.0342)	0.174*** (0.0338)	0.172*** (0.0328)	0.154*** (0.0383)	0.159*** (0.0364)
GDPCAPITA	-2.7e-05*** (7.7e-06)	-2.4e-05** (7.6e-06)	-3.1e-05** (1.1e-05)	-2.2e-05** (7.9e-06)	-2.1e-05* (8.9e-06)
BANKCAP	0.0240** (0.00792)	0.0235** (0.00875)	0.0285*** (0.00753)	0.00458 (0.00782)	0.0253** (0.00831)
FDI	1.1e+08 (7.5e+07)	9.5e+07 (8.6e+07)	9.5e+07 (7.3e+07)	8.8e+07 (7.6e+07)	9.3e+07 (7.2e+07)
BOONE	-0.0350*** (0.00784)	-0.0342*** (0.00833)	-0.0399** (0.0120)	-0.0301*** (0.00775)	-0.0290** (0.00862)
EDUCATION	0.200*** (0.0363)	0.167*** (0.0391)	0.196*** (0.0352)	0.158*** (0.0440)	0.193*** (0.0362)
Constant	-3.365*** (0.951)	-3.156** (1.023)	-3.224** (1.055)	-2.657* (1.126)	-3.329** (1.032)
Observations	240	240	240	240	240
R-squared	0.131	0.142	0.157	0.146	0.115
PANEL B. Second Lag	(6)	(7)	(8)	(9)	(10)
COR(second lag)	0.471*** (0.0968)				
GOV(second lag)		0.834*** (0.123)			
LAW(second lag)			0.999*** (0.242)		
REG(second lag)				1.151*** (0.165)	
VOA(second lag)					1.102*** (0.288)
POPUL	0.172*** (0.0421)	0.180*** (0.0391)	0.175*** (0.0391)	0.158** (0.0429)	0.165*** (0.0418)
GDPCAPITA	-2.6e-05** (7.53e-06)	-2.67e-05** (7.44e-06)	-3.64e-05** (1.21e-05)	-3.05*** (6.67e-06)	-2.37e-05** (9.16e-06)
BANKCAP	0.0179** (0.00549)	0.0160** (0.00508)	0.0214*** (0.00382)	-0.00447 (0.00663)	0.0199** (0.00575)
FDI	6.8e+07 (8.9e+07)	4.8e+07 (1.0e+08)	4.2e+07 (9.3e+07)	4.9e+07 (9.5e+07)	5.5e+07 (8.2e+07)
BOONE	-0.0344*** (0.00827)	-0.0374*** (0.00919)	-0.0454** (0.0129)	-0.035*** (0.00681)	-0.031** (0.00917)
EDUCATION	0.196*** (0.0421)	0.165*** (0.0412)	0.200*** (0.0428)	0.157** (0.0498)	0.192*** (0.0414)
Constant	-3.299** (1.109)	-3.015** (1.102)	-3.018** (1.171)	-2.373 (1.248)	-3.230** (1.141)
Year-Clustered	YES	YES	YES	YES	YES
Observations	210	210	210	210	210
R-squared	0.116	0.138	0.156	0.159	0.111

The table illustrates the results of FE regressions. The dependent variable is Fintech Birth (BIRTH). Panel A regressions use, alongside control variables, as independent variables the first lags of COR, GOV, LAW, REG and VOA. Panel B regressions use, alongside as independent variables the second lags of COR, GOV, LAW, REG and VOA. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 6. Regression results, extended number of variables

	(1)	(2)	(3)	(4)	(5)
COR	0.369*				
	(0.202)				
GOV		0.988***			
		(0.235)			
LAW			0.864**		
			(0.273)		
REG				0.781***	
				(0.163)	
VOA					0.534*
					(0.298)
POPUL	-0.114	-0.0514	-0.0526	-0.0993	-0.135*
	(0.0696)	(0.0766)	(0.0734)	(0.0658)	(0.0626)
GINI	0.0288	0.0497***	0.0307*	0.0208	0.0314*
	(0.0158)	(0.0138)	(0.0140)	(0.0158)	(0.0163)
ATM	-0.00430	-0.00665*	-0.00535*	-0.00271	-0.00302
	(0.00271)	(0.00309)	(0.00283)	(0.00233)	(0.00213)
BANKCAP	0.0457*	0.0425**	0.0605***	0.0338*	0.0301
	(0.0200)	(0.0175)	(0.0155)	(0.0167)	(0.0166)
BOND	0.0489***	0.0468***	0.0468***	0.0525***	0.0499***
	(0.0116)	(0.0123)	(0.0116)	(0.0122)	(0.0118)
BONISS	-0.0913*	-0.0844*	-0.0887*	-0.0839*	-0.0797
	(0.0479)	(0.0431)	(0.0444)	(0.0419)	(0.0444)
BRANCH	0.00711	0.00948**	0.0105**	0.00688**	0.00275
	(0.00441)	(0.00360)	(0.00433)	(0.00248)	(0.00215)
FDI	8.9e+07	9.0e+07	8.6e+07	7.8e+07	8.1e+07*
	(4.8e+07)	(5.2e+07)	(5.0e+07)	(5.0e+07)	(4.3e+07)
INSPREM	0.245***	0.267***	0.261***	0.256***	0.249***
	(0.0523)	(0.0555)	(0.0550)	(0.0523)	(0.0535)
LIST	-0.0107***	-0.0110***	-0.00865**	-0.00853**	-0.00810**
	(0.00298)	(0.00295)	(0.00281)	(0.00338)	(0.00301)
LIABI	-0.00676***	-0.00685***	-0.00769***	-0.00718***	-0.00631***
	(0.00191)	(0.00171)	(0.00174)	(0.00165)	(0.00177)
LOTODEP	-0.00587***	-0.00616***	-0.00587***	-0.00507***	-0.00518***
	(0.00169)	(0.00160)	(0.00143)	(0.00125)	(0.00142)
TIMEG	0.0306	0.0392*	0.0347*	0.0301*	0.0334*
	(0.0165)	(0.0174)	(0.0186)	(0.0157)	(0.0152)
ZSC	-0.0162	-0.0168*	-0.0235**	-0.0189**	-0.0105
	(0.0110)	(0.00816)	(0.00916)	(0.00789)	(0.00841)
Constant	0.699	-0.418	-0.341	0.593	0.460
	(1.161)	(1.169)	(1.103)	(1.151)	(1.249)
Observations	270	270	270	270	270
R-squared	0.314	0.335	0.330	0.322	0.305

The table illustrates the results of FE regressions. The dependent variable is Fintech Birth (BIRTH). Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. POPUL is the logarithm of population, GINI is the gini coefficient, ATM is the number of ATMs, BANKCAP is bank capitalisation, bond is Corporate bond average maturity (years), BONISS is corporate bond issuance over GDP, BRANCH is bank branches per 0.1 million adults, FDI is the foreign direct investment to GDP, INSPREM is the average insurance premium, LIST is number of listed companies per million inhabitants, LIABI is Gross portfolio equity liabilities to GDP (%), LOTODEP is the loans to deposits, TIMEG is per cent of senior management time spent dealing with the requirements of government regulations, ZSC is average bank z-score

Table 7. Poisson regression results

	(1)	(2)	(3)	(4)	(5)
COR	0.680*** (0.221)				
GOV		1.128*** (0.326)			
LAW			1.221** (0.483)		
REG				1.166*** (0.359)	
VOA					1.384*** (0.448)
POPUL	0.200*** (0.0299)	0.231*** (0.0282)	0.214*** (0.0286)	0.203*** (0.0312)	0.209*** (0.0303)
GDPCAPITA	-4.00e-05** (1.74e-05)	-3.47e-05** (1.58e-05)	-4.28e-05* (2.31e-05)	-2.87e-05** (1.34e-05)	-2.70e-05** (1.34e-05)
BANKCAP	0.0507*** (0.0157)	0.0569*** (0.0177)	0.0674*** (0.0178)	0.0356** (0.0159)	0.0563*** (0.0168)
FDI	1.19e+08*** (3.79e+07)	1.10e+08*** (3.81e+07)	9.46e+07** (3.90e+07)	1.01e+08*** (3.58e+07)	1.07e+08*** (3.58e+07)
BOONE	-0.0471*** (0.0166)	-0.0459*** (0.0166)	-0.0516** (0.0225)	-0.0370*** (0.0131)	-0.0345*** (0.0129)
EDUCATION	0.232*** (0.0477)	0.189*** (0.0505)	0.209*** (0.0453)	0.159*** (0.0517)	0.217*** (0.0511)
Constant	-5.109*** (1.140)	-5.296*** (1.203)	-5.065*** (1.317)	-4.594*** (1.256)	-5.513*** (1.182)
Wald-chi2(p. sig)	334***	262***	680***	974***	1151***
Pseudo R2	0.068	0.075	0.080	0.070	0.059
LR	18.81***	23.39***	26.42***	19.75***	12.42***
Observations	270	270	270	270	270

The table illustrates the results of the Poisson regressions. The Appendix defines the variables used.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 8. 2SLS regression results

Panel A. First stage regressions	(1)	(2)	(3)	(4)	(5)
IV-COR	0.967*** (0.0333)				
IV-GOV		0.856*** (0.024)			
IV-LAW			0.949*** (0.0327)		
IV-REG				1.044*** (0.053)	
IV-VOA					1.208*** (0.0507)
Partial R-sq of excluded instruments	0.90	0.91	0.91	0.79	0.89
F-test of excluded instruments	627	457	579	187	407
Panel B. Second stage regressions					
COR	0.362*** (0.0816)				
GOV		0.909*** (0.111)			
LAW			0.868*** (0.153)		
REG				1.161*** (0.109)	
VOA					1.297*** (0.258)
POPUL	0.158*** (0.0291)	0.169*** (0.0276)	0.162*** (0.0285)	0.145*** (0.0310)	0.150*** (0.0296)
GDPCAPITA	-2.02e-05*** (5.95e-06)	-2.62e-05*** (7.02e-06)	-2.88e-05*** (8.96e-06)	-2.67e-05*** (6.23e-06)	-2.52e-05*** (8.54e-06)
BANKCAP	0.0250*** (0.00832)	0.0309*** (0.00993)	0.0346*** (0.00919)	0.00986 (0.0103)	0.0338*** (0.00939)
FDI	1.116e+08*** (4.076e+07)	9.742e+07** (4.298e+07)	8.832e+07** (4.003e+07)	7.924e+07** (3.859e+07)	8.625e+07** (3.995e+07)
BOONE	-0.0261*** (0.00633)	-0.0327*** (0.00782)	-0.0344*** (0.00931)	-0.0295*** (0.00698)	-0.0290*** (0.00876)
EDUCATION	0.166*** (0.0317)	0.150*** (0.0385)	0.173*** (0.0350)	0.139*** (0.0406)	0.183*** (0.0351)
Constant	-3.085*** (0.848)	-2.843*** (0.943)	-2.944*** (0.936)	-2.196** (0.968)	-2.973*** (0.920)
R-squared	0.123	0.134	0.145	0.120	0.104
Wald-chi2(p. sig)	1251***	1356***	1626***	8026***	1562***
Observations	270	270	270	270	270

The table illustrates the results of IV-2SLS regressions. The Appendix defines the variables used. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 9. Regressions that use propensity scored matched (PSM) sample

Probit	(1)	(2)	(3)	(4)	(5)
TIMEG	-0.239*** (0.0304)	-0.244*** (0.0300)	-0.243*** (0.0299)	-0.176*** (0.0259)	-0.371*** (0.0578)
COMLAW	0.545* (0.315)	0.997*** (0.379)	0.282 (0.344)	0.792** (0.384)	-0.610 (0.380)
UNEM	-0.151*** (0.0257)	-0.204*** (0.0336)	-0.243*** (0.0368)	-0.258*** (0.0386)	-0.257*** (0.0405)
TRADE	-0.00367*** (0.00130)	-0.00231 (0.00148)	0.00103 (0.00189)	0.00647*** (0.00248)	0.0137*** (0.00411)
Constant	2.644*** (0.373)	2.927*** (0.440)	2.930*** (0.460)	2.121*** (0.431)	2.203*** (0.472)
LR chi2	186.83	209.6	216.89	191.2	238.19
Pseudo R2	0.4992	0.56	0.5795	0.5108	0.6364
Results using PSM sample	(6)	(7)	(8)	(9)	(10)
COR	0.414** (0.165)				
GOV		0.468** (0.183)			
LAW			0.524** (0.177)		
REG				0.426*** (0.123)	
VOA					0.589** (0.195)
POPUL	0.147*** (0.0357)	0.156*** (0.0367)	0.163*** (0.0373)	0.158*** (0.0332)	0.171*** (0.0390)
GDPCAPITA	-9.57e-06** (3.84e-06)	-7.33e-06 (4.35e-06)	-8.42e-06 (4.66e-06)	-4.88e-06 (3.78e-06)	-1.08e-05** (4.26e-06)
BANKCAP	0.0216* (0.0104)	0.0249*** (0.00725)	0.0263** (0.00811)	0.0261** (0.00802)	0.0284** (0.00985)
FDI	9.128e+07* (4.036e+07)	9.888e+07** (4.140e+07)	9.798e+07** (4.165e+07)	1.040e+08** (4.063e+07)	9.448e+07** (3.914e+07)
BOONE	-0.0186** (0.00585)	-0.0173** (0.00660)	-0.0187** (0.00674)	-0.0147** (0.00587)	-0.0214** (0.00680)
EDUCATION	0.180*** (0.0516)	0.153*** (0.0406)	0.154*** (0.0399)	0.141*** (0.0389)	0.156*** (0.0422)
Constant	-3.717** (1.112)	-3.737*** (1.035)	-3.885*** (1.031)	-3.718*** (0.929)	-3.983*** (1.092)
Year-Clustered	YES	YES	YES	YES	YES
F-stat(p. sig)	21.33***	30.85***	39.42***	17.92***	12.64***
R-squared	0.089	0.090	0.097	0.087	0.105
Observations	270	270	270	270	270

Table regressions (1) to (5) use probit regression to compute propensity-matched scores for COR , REG, VOA, LAW and GOV, respectively. Whilst the OLS regressions 6 to 10 use the respective PSM samples. The dependent variable in regressions (6) to (10) are Fintech Births. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix A. Variables examined in the study.

World Bank Governance indices

COR	Control of Corruption (Standardised world bank governance indicator)
REG	Regulatory Quality (Standardised world bank governance indicator)
VOA	Voice and Accountability (Standardised world bank governance indicator)
LAW	Rule of Law (Standardised world bank governance indicator)
GOV	Government Effectiveness (Standardised world bank governance indicator)

Macroeconomic factors and Financial indices

ATM	ATMs per 100,000 adults
BANKCAP	Bank capital to assets ratio (%)
BOND	Corporate bond average maturity (years)
BONISS	Corporate bond issuance volume to GDP (%)
BOONE	Boone indicator
BRANCH	Bank branches per 100,000 adults
COMLAW	Common Law Dummy variable, If countries adopt common law it takes the value one, otherwise zero.
CRISIS	Banking crisis dummy (1=banking crisis, 0=none)
FDI	Foreign direct investment, net inflows (% of GDP)
GDPCAPITA	GDP per capita, PPP (current international \$)
GINI	GINI index (World Bank estimate)
INSPREM	Life insurance premium volume to GDP (%)
LIABI	Gross portfolio equity liabilities to GDP (%)
LIST	Number of listed companies per 1,000,000 people
LOTODEP	Bank credit to bank deposits (%)
POPUL	Logarithm of Population, total
TRADE	Import and Export Trade (% of GDP)
TIMEG	Time spent dealing with the requirements of government regulations (% of senior management time)
UNEM	The percentage rate of unemployment
ZSC	Bank Z-score

Appendix B. Number of Fintech Licences by country

Countries	Number of Licenses Issued
Austria	5
Belgium	28
Bulgaria	17
Croatia	7
Cyprus	20
Czech	135
Denmark	33
Estonia	9
Finland	41
France	63
Germany	38
Greece	3
Hungary	10
Iceland	0
Ireland	0
Italy	40
Latvia	15
Lithuania	66
Luxembourg	18
Malta	28
Netherlands	100
Norway	0
Poland	34
Portugal	10
Romania	0
Slovakia	14
Slovenia	4
Spain	32
Sweden	0
United Kingdom	383