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FinTech:
Disrupting or constructing?

A study on the impact of FinTech digital banking start-ups on the incumbent retail banks

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Abstract:
The objective of this paper is to develop a better understanding of what role the FinTech digital banking start-ups play in the financial industry. This has been investigated by studying the impact of the funding of FinTech digital banking start-ups on the stock returns of incumbent US retail banks, using the time period of 2010 to 2016. To capture the size of funding, both the FinTech funding volume and number of deals have been utilized. After data transformations, regressions applying the Fama-French three-factor and five-factor models have been generated both on an individual bank-by-bank level and aggregate industry level. Results show that for the majority of retail banks the coefficients of the FinTech variables are not statistically significant. This may suggest that the FinTech industry is either too small in terms of size, that its substitute effects offset its complementary effects, or that the start-ups provide a new channel causing competition to stay at a low level.

Keywords: FinTech, innovative disruption, Fama-French three-factor model, Fama-French five-factor model, funding, stock returns
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1. Introduction

From Uber to Airbnb, disruptions have transformed many industries. Until recently, the financial sector remained largely untouched. This has however changed with the breakthrough of FinTech firms, which are defined as "companies that use technology for banking, payments, financial data analytics, capital markets and personal financial management" (Huang, 2015). In 2015, global FinTech investment grew with 75 per cent, exceeding the great amount of 22 billion USD and has continued to rise ever since (Dickerson, Masood, & Skan, 2015). This growing number has threatened incumbent retail banks as a new wave of digital banking start-ups has emerged.

Different scenarios however exist regarding their long-term impact. The first scenario is optimistic towards the newcomers' survival, as it poses that the start-ups will gobble up key parts of the franchise of traditional retail banks. The other scenarios are more sceptical as they suggest either that the digital banking start-ups will simply fail or that the traditional banks are so powerful that they will acquire the newcomers through takeovers (Sorkin, 2016).

This paper will examine which scenario society is most likely to encounter, as individuals and institutions need to react in case of potential disruption. Although the FinTech revolution will positively affect the efficiency and quality of services, society should recognize the negative consequences and take preventive actions to mitigate the effects. For instance, privacy of consumers will be significantly decreased as the connected world makes protection of personal financial details more difficult (Ernst and Young, 2014). Furthermore, many jobs could disappear as roughly 60 to 70 per cent of retail banking employees are doing manual-processing-driven jobs that would be replaced due to automation. Moreover, other industries could be affected. If banks shut their desired branches on the corners of large cities, the commercial real estate will be affected due to vacant buildings (Sorkin, 2016).

To investigate what role digital banking start-ups will play in the financial industry, the following question will be answered:

What is the impact of the funding of FinTech digital banking start-ups on the stock returns of incumbent US retail banks?

This research specifically focuses on digital banking start-ups since these offer the same type of services as retail banks: taking deposits of consumers, facilitating payments and lending money (Chishti & Barberis, 2016). The start-ups' funding will serve as an indicator of

their potential values. To estimate its impact on the performance of traditional banks, stock returns are used. If the returns react negatively, the entrants might disrupt the industry, while a positive effect might imply complementarity. To specify the research, the United States is chosen because this country has the largest FinTech industry, as well as the highest number of FinTech adopters (Ernst and Young, 2014).

As FinTech has only developed recently, not much scientific research has been conducted yet. However, existing research mainly stresses the disrupting ability of start-ups (Chishti & Barberis, 2016; Dickerson, Masood, & Skan, 2015). Kauffman, Liu, and Ma (2015) support this by stating that current financial firms mainly depend on underlying technology innovations and not on their historical market position. As a result, traditional banks are forced to enhance their service quality and to reduce transaction costs, acting according to strategic necessity rather than competitive advantage (Goh & Kauffman, 2013). Jun and Yeo (2016) however discourage competition and potential substitution by stressing the complementary effect of FinTech. Due to the contradicting views on the future of FinTech and the largely descriptive based research, we are stimulated to reassess the role of digital banking start-ups in the traditional banking industry using a quantitative approach.

The paper proceeds as follows. The second section reviews conceptual and empirical literature on disruptive innovation and FinTech-related studies. The third section presents the data used for analyses followed by a methodology description in the fourth section. In the fifth section, results are discussed in two subsections, addressing the volume of funding and the number of deals. Finally, the conclusion of this research is presented as well as its limitations and future recommendations.

2. Theoretical framework

As technology evolves, products, critical success factors and industry characteristics change (Afuah & Utterback, 1997). This phenomenon has greatly affected the taxi and hotel industry in which Uber and Airbnb have largely replaced the traditional services by offering online decentralized peer-to-peer platforms (Cannon & Summers, 2014). Since FinTech start-ups follow the same customer-centric approach by offering alternatives as peer-to-peer lending, one might expect a shift in the banking industry as well. To examine whether digital banking start-ups indeed negatively affect traditional retail banks, the consumer theory has been applied. This theory states that a new service will act as a complement in case it is utilized jointly with an old service and will serve as a substitute if it can replace the old service by satisfying the same needs (Aaker & Keller, 1990; Frank, 2009). This would mean that in case of complementarity, the services offered by the digital banking start-ups would benefit

the traditional retail banks. In contrast, substitution would negatively affect the incumbents' performance (Kaul, 2012). It might also be possible that no effect can be observed when examining the stock returns, which could indicate that the complementary and substitution effect offset each other. Other explanations are that the start-ups are simply too small or serve a new channel.

2.1. Substitution effect and disruptive innovation

If FinTech start-ups succeed in offering substitutes for traditional services, the retail banking industry might be disrupted. The term "disruptive innovation" was first brought up by Clayton Christensen (1997) and involves entrants that successfully target overlooked segments. According to this theory, the start-ups eventually end up displacing the incumbents. The fact that FinTech companies could potentially spark such a disruptive evolution results from their new alternatives that enhance the efficiency and quality of services (Ferrari, 2016).

Efficiency increases are mainly due to loan personalization and the disintermediation of processes by eliminating middlemen, which significantly lowers transaction costs for consumers (PwC, 2016; KPMG, 2016). Efficiency is also enhanced by new technologies such as the "blockchain" (Peters & Panayi, 2015; Wood & Buchanen, 2015). These innovations will benefit FinTech firms more as banks often rely on decades-old IT infrastructure (Laven & Bruggink, 2016). Moreover, banks are usually less likely to adopt new technologies quickly due to the regulatory environment (Hannan & McDowell, 1984).

The quality of financial services is also increased as the entrants have alternative methods to assess risk, such as social-media. Furthermore, FinTech enables a credit landscape that is more diverse and thus more stable (The Economist, 2015). The entrants are therefore able to attract smaller risky enterprises, which traditional retail banks would normally reject (Dunkley, 2015).

2.2. Complementary effect and collaborations

On the other hand, one might argue that the FinTech firms will complement the retail banking services. A plausible reason is that many incumbent banks have seen the significance of FinTech and have tried incorporating these start-ups or technologies in their businesses either through joint partnerships, service outsourcing, venture capital funding or acquisitions. For these banks, the FinTechs seem to have benefited them more than have disrupted them (PwC, 2016). Moreover, collaborations between banks and FinTech start-ups also benefit the small players. By cooperating with banks, FinTechs may get access to global payment systems and the banks' own customer base. This lowers the barriers of entry

for FinTech firms into the financial sector and enables them to gain more trust from their customers (Juengerkes, 2016).

2.3. No impact observed

In case no effect is found, FinTechs might serve a new channel, as these firms often attract clients that are normally not covered by traditional banking services. For instance, risky small companies, consumers with lacking credit history or the small-dollar loan market (Demos, 2016; Hayashi, 2016). No effect could also imply that the start-ups are still too small in comparison to the large-established banks as these deal in trillions instead of billions. Furthermore, incumbents benefit from their ability to create credit easily and from ingrained strengths, such as their current account. This account allows clients to securely store their money and enables them to permanently access it. Since this part of finance is heavily regulated, not many Fintechs are attracted to compete in this field (The Economist, 2015). Finally, it can be assumed that no effect could also result from the substitution and complementary effect offsetting each other.

2.4. Hypotheses

To answer the research question, one needs to test if the FinTech start-ups have a significant effect on the retail banking industry. If this is the case, the estimated stock returns of incumbent banks should be affected (Benner, 2007). Liu and Miller (2014) and Sood and Tellis (2009) add to this that in prospect of disruptive pressures the stock prices of established firms should decline. Therefore, it is presumed that the stock returns of the incumbent retail banks will encounter a negative effect when disruption is expected.

To examine the likelihood of the innovative disruption, a reasonable proxy is needed. Research has shown that external funding events provide a relevant and credible measure to compare the future success of start-ups, as external financing is critical for growth and survival (Dean & Giglierano, 1990; Davila, Foster, & Gupta, 2003; Mina, Lahr, & Hughes, 2013). Therefore it is reasonable to assume a positive relationship between the FinTech start-up's value and the external funding it receives. In this way, funding of the digital banking start-ups can be used to examine Hypothesis I:

Hypothesis I. The volume of funding in the US FinTech digital banking industry has a negative effect on the stock returns of US incumbent banks

Besides the volume of funding, the number of deals might signal additional information about the potential value of the start-ups. This is because a large volume of funding does not

necessarily imply a large number of investors. Therefore, this paper introduces the number of funding deals as another measurement of the industry. This leads to Hypothesis II:

Hypothesis II. The number of funding deals in the US FinTech digital banking industry has a negative effect on the stock returns of US incumbent banks

2.5. Fama-French Models

To test the hypotheses, a model that estimates the stock returns is needed. Often, the capital asset pricing model (CAPM) of William Sharpe (1964) is used. However, the empirical implementation of the model is sufficiently poor to deny its validity (Fama & French, 2004).

In order to better explain average returns on stocks and bonds, Fama and French (1993) extended the CAPM model. For the stock market, there are three factors: an overall market factor capturing the excess return of the market portfolio, a factor related to firm size and a factor for book-to-market equity values, leading to the following model[1] (Davis, Fama, & French, 2000):

$$E(R_i) - R_f = b_i\left[E(R_M) - R_f\right] + s_i E(SMB) + h_i E(HML)$$

Here $\mathrm{R_i}$ is the return on asset i, $\mathrm{R_f}$ is the risk free interest rate, and $\mathrm{R_M}$ is the return on the value-weight market portfolio.

SMB is the equal-weight averages of the returns on the three small stock portfolios minus the three big stock portfolios:

$$SMB = (S/L + S/M + S/H)/3 - (B/L + B/M + B/H)/3$$

Similarly, HML is the average return on a portfolio of high book-to-market equity stocks minus the average return on a portfolio of low book-to-market equity stocks, constructed to be neutral with respect to size:

$$HML = (S/H + B/H)/2 - (S/L + B/L)/2$$

[1] Davis, Fama and French (2000) formed six value-weight portfolios, S/L, S/M, S/H, B/L, B/M, and B/H, as the intersections of the size and book-to-market equity (B/M) groups. For example, S/L is the value weight return on the portfolio of stocks that are below the NYSE median in size and in the bottom 30 percent of B/M.

Despite its high empirical validity in asset pricing, the three-factor model still has a theoretical shortcoming. The SMB and HML explanatory returns in the model are not variables that capture the concerns of investors, but are "brute force constructs" instead (Fama & French, 2004). Furthermore, the three-factor model as well as the CAPM model suffer from the momentum effect, indicating that stocks that do well tend to continue to do well and vice versa (Jegadeesh & Titman, 1993).

As an extension of the three-factor model, a five-factor model (Fama & French, 2015) was introduced, adding profitability and investment factors:

$$E(R_i) - R_f = b_i\left[E(R_M) - R_f\right] + s_i E(SMB) + h_i E(HML) + r_i E(RMW) + c_i E(CMA)$$

Here R_i is the return on asset i, R_f is the risk free interest rate, and R_M is the return on the value-weight market portfolio.

In contrast to the three-factor model, the five-factor model[2] requires two additional size factors besides the $SMB_{B/M}$, which are SMB_{OP} (Operating Profitability) and SMB_{Inv} (Investment).

$$SMB_{B/M} = (SH + SN + SL)/3 - (BH + BN + BL)/3$$
$$SMB_{OP} = (SR + SN + SW)/3 - (BR + BN + BW)/3$$
$$SMB_{Inv} = (SC + SN + SA)/3 - (BC + BN + BA)/3$$

SMB is the average of the returns on the nine small stock portfolios minus the average of the returns on the nine big stock portfolios.

$$SMB = (SMB_{B/M} + SMB_{OP} + SMB_{Inv})/3$$

HML is the average of small and big value factors constructed with portfolios of only small stocks and portfolios of only big stocks.

[2] Fama and French (2015) used independent sorts to assign stocks to two Size groups, and three book-to-market equity (B/M), operating profitability (OP), and investment (Inv) groups. The value weight portfolios defined by the intersections of the groups are the building blocks for the factors. These portfolios are labeled with two letters. The first always describes the Size group, small (S) or big (B). The second describes the B/M group, high (H), neutral (N), or low (L), the OP group, robust (R), neutral (N), or weak (W), or the Inv group, conservative (C), neutral (N), or aggressive (A).

$$HML = (SH + BH)/2 - (SL + BL)/2 = [(SH - SL) + (BH - BL)]/2$$

RMW is the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios.

$$RMW = (SR + BR)/2 - (SW + BW)/2 = [(SR - SW) + (BR - BW)]/2$$

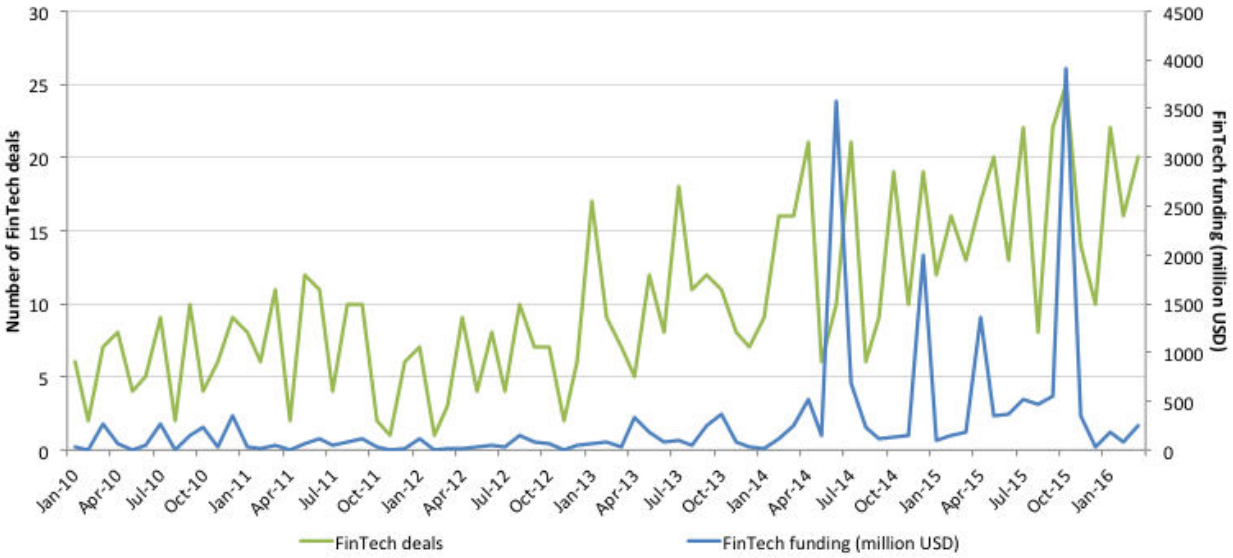
CMA is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios.

$$CMA = (SC + BC)/2 - (SA + BA)/2 = [(SC - SA) + (BC - BA)]/2$$

In this paper both the Fama-French three-factor model and five-factor model will be used to capture the estimated stock returns of the incumbent retail banks.

3. Data

This paper used data from the venture finance-data firm CB Insights[3] to identify US digital banking start-ups that are closely related to retail banks. First, 558 Fintech start-ups were selected which are located in the United States and received investments from January 2010 till March 2016. This period was chosen because most FinTech firms began to operate from 2010. By excluding the branch InsurTech, the sample was narrowed down to 522. CB Insights also provided the volume of funding[4] committed to these start-ups and the number of deals since January 2010.



[3] https://www.cbinsights.com

[4] Funding data obtained from CB Insights includes all types of financing available, such as venture capital, angel, IPO and private equity investments.

Figure 1. **Evolution of FinTech Funding Volume and FinTech Deals (2010-2016)**

As shown in Figure 1, funding volume has been volatile across months, with extreme values as a result. In order to reduce their effect, two methods of data transformation have been applied. One transformed the funding data into standardized values using the group mean and standard deviation. The other transformed the absolute amounts of funding into growth rates. The natural logarithm difference between month t and month $t-1$ was taken as a proxy for the growth rate of month t. For similar reasons, these transformations were applied to the data of the number of deals. All transformations are presented in Table 1.

Table 1.
Data Transformation

Original variable	Transformed variable	Formula
FinTech funding volume	Standardized FinTech funding volume	$z_t = \frac{x_t - \bar{x}}{s}, t = 1, 2, \dots, n$
	FinTech funding volume growth rate	$g_t = ln\, x_t - ln\, x_{t-1}, t = 2,3, \dots, n$
FinTech number of deals	Standardized FinTech number of deals	$z_t = \frac{x_t - \bar{x}}{s}, t = 1, 2, \dots, n$
	FinTech number of deals growth rate	$g_t = ln\, x_t - ln\, x_{t-1}, t = 2,3, \dots, n$

A list of 138 US retail banks was retrieved from Credio.com, which is a finance website that compares US financial services[5]. The Bloomberg database was used to obtain the monthly total return indices of the banks. The total return index (TRI) is an equity index that measures both the capital gain movements of a group of stocks over time and assumes that all cash distributions are invested back into the index. It gives a more accurate indication of a stock's performance because it effectively accounts for firms that do not distribute dividends but instead reinvest their earnings (Bloomberg L.P., 2016). The development of the total return indices of the financial sector and US market is presented in Figure 2[6]:

[5] http://www.credio.com

[6] In order to compare, the S&P Composite 1500 Financials (Sector) Total Return is adjusted to start from the same level as the S&P US Composite 1500 Index Total Return does

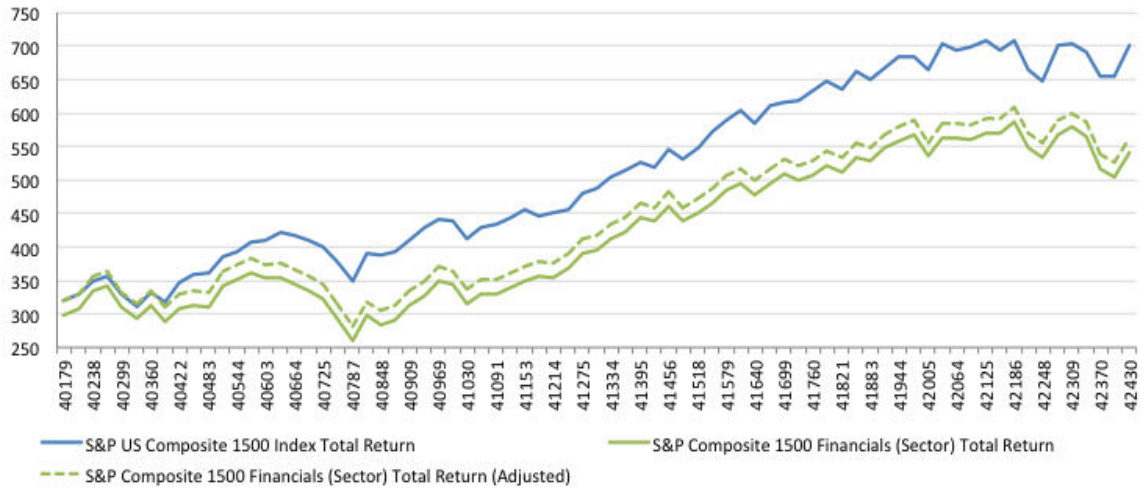


Figure 2. **Comparison Total Return Indices of the US Market and the US Financial Sector**

Out of the 138 retail banks, 47 had total return indices available. This could be explained by the nature of the excluded banks, as these were often regional banks. However, since this research is mainly done on an industry level, the representativeness of the sample is still justified and the aggregation of the 47 selected banks will nevertheless serve as a decent sample for the industry. Using the bank's total return index, the stock return for month t was calculated by the formula:

$$R_t = \frac{TRI_t - TRI_{t-1}}{TRI_t}, t = 2,3, \dots, n$$

In order to apply the Fama-French models, the historical monthly values of the factors in Table 2 were retrieved from Kenneth French's web page[7] for January 2010 till March 2016.

[7] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Table 2.
List of Fama-French Factors

Variable	Explanation
$R_M - R_f$	The excess return of the market portfolio
SMB	The average of the returns on the small stock portfolios minus the average of the returns on the big stock portfolios **(Small Minus Big)**
HML	The average return on the high book-to-market ratio portfolios minus the average return on the low book-to-market ratio portfolios **(High Minus Low)**
RMW	The average return on the robust operating profitability portfolios minus the average return on the weak operating profitability portfolios **(Robust Minus Weak)**
CMA	The average return on the conservative investment portfolios minus the average return on the aggressive investment portfolios **(Conservative Minus Aggressive)**

4. Methodology

The Fama-French models were used to investigate whether the funding of digital banking start-ups had a significant effect on the stock prices of retail banks. These financial models capture the market well, as the variables $R_M - R_f$, SMB and HML are included in the case of the three-factor model, accompanied with RMW and CMA in the five-factor model. However, before applying the models they were first tested.

Firstly, an augmented Dickey-Fuller (ADF) test was performed to test for the unit root problem since this might cause unreliable results due to spuriously significant parameters. Based on the data plots (see appendix A), the second ADF test was applied to the standardized variables while the first test was utilized for the remaining variables:

$$\text{ADF test 1: } \Delta y_t = \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

$$\text{ADF test 2: } \Delta y_t = \alpha + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

In case the null hypothesis $\gamma = 0$ was rejected, no unit root would be present.

Subsequently, the Fama-French models were examined without FinTech variables. To test whether the asset-pricing model would capture the excess returns well, the Gibbons, Ross and Shanken test (GRS) (1989) was used. This test confirms the validity of an asset-pricing model if the intercept δ_{i0} of the following regression is significantly different from zero (Fama & French, 2015):

$$R_{it} = \delta_{i0} + \sum_{j=1}^{L+1} \delta_{ij} R_{jt} + \eta_{it}$$

Afterwards, the Fama-French three-factor model was applied to conduct a bank-by-bank analysis for each bank i, using the regression:

$$R_{i,t} - R_{f,t} = a_i + b_i\left[R_{M,t} - R_{f,t}\right] + s_i SMB_t + h_i HML + \gamma_i FinTech_t + \varepsilon_{i,t}$$

Here $\mathrm{FinTech_t}$ represents the standardized FinTech funding volume and the funding volume growth rate. We tested the γ-coefficient for sign and significance and whether the results were the same for different retail banks. By studying the γ-coefficients on an individual level we were able to analyze which banks seemed to be more affected by FinTech. Afterwards, we investigated whether the same sign effect and level of significance would be found when looking at the retail banking industry as a whole, using the regression:

$$\overline{R_t} - R_{f,t} = a + b\left[R_{M,t} - R_{f,t}\right] + sSMB + hHML + \gamma FinTech_t + \varepsilon_t$$

Finding a significantly positive γ-coefficient in both cases would indicate that the investments done in the digital banking start-ups increase the stock returns of retail banks, implying complementarity. A negative sign would provide evidence for a potential disruption in the retail banking industry. No significant effect could have multiple explanations.

Next to the Fama-French three-factor model, the Fama-French five-factor model was applied both on a bank-by-bank and industry level.

$$R_{i,t} - R_{f,t} = a_i + b_i\left[R_{M,t} - R_{f,t}\right] + s_i SMB_t + h_i HML + r_i RMW + c_i CMA + \gamma_i FinTech_t + \varepsilon_{i,t}$$

$$\overline{R_t} - R_{f,t} = a + b\left[R_{M,t} - R_{f,t}\right] + sSMB + hHML + rRMW + cCMA + \gamma FinTech_t + \varepsilon_t$$

Same methods were used when examining the effect of the standardized number of FinTech deals and the FinTech deals growth rate. In all cases, heteroscedasticity-robust standard errors were utilized to allow the fitting of models that would contain heteroscedastic residuals.

5. Results

The ADF tests show that the z-statistics of the relevant time-series variables are significantly smaller than all critical values (see Appendix B). Therefore, the unit root problem could be disregarded.

The GRS tests used to examine the robustness of the Fama-French three-factor and five-factor models result in p-values larger than 5% on an industry level. On a bank-by-bank level, this is the case for 42 out of the 47 three-factor regression models and for 43 out of the 47 five-factor regression models (see Appendix C). Hence, the null hypothesis $\delta_{i0} = 0$ could not be rejected for the vast majority. This implies that the Fama-French models still have high explanatory power when applied to this research.

Due to these results, the Fama-French models could be applied to assess the effect of FinTech funding on the incumbents' stock returns, using both the volume of funding and the number of deals.

5.1. Volume of funding

Bank-by-bank level

Based on the three-factor model, the standardized volume of funding shows a significant effect for only three (OZRK, TRST and WAFD) of the 47 US retail banks at a 5% level and one (MTB) at a 10% level. The five-factor models led to similar results: only four (OZRK, MTB, TRST and WAFD) of the 47 models have significant coefficients for the standardized volume of funding.

Using the three-factor model, the growth rate (log-difference) of the volume of funding reveals a significant effect for three banks (BXS, TD and WAFD) at a 5% level and three banks (TRMK, UMBF and WFC) at a 10% level. The findings of the five-factor model differ from the three-factor model as only three banks (TD, TRMK, and WAFD) have a significant effect at a 5% significance level and only two (BXS and WFC) at a 10% level.

Industry level

Analysis of the standardized volume of funding on the aggregate level results in no significant effect at a 10% level for both the Fama-French three-factor and five-factor models. This was also observed for the models of the growth rate (log-difference).

Based on these results we rejected the first hypothesis since in most cases no significant effect has been observed.

5.2. Number of deals

Bank-by-bank level

Regression results of the standardized number of deals show hardly any significant effect on the incumbents' stock returns. When applying the three-factor model, only three banks (UCBI, CFG and WAFD) are found to have significant effects at a 5% level and one (VLY) at a 10% level. The five-factor models reveal only two (CFG and WAFD) with significant coefficients at a 5% level and two (UCBI and VLY) at the 10% level.

When using the three-factor model, the growth rate (log-difference) of the number of deals has a significant effect for three (PNC, WAFD and WFC) out of the 47 banks at a 5% level. The coefficients of FRC, PNBI, TD and PRK are significant at a 10% level. When applying the five-factor model, similar results were found as with the three-factor model. Only four models (PNC, CFG, WAFD and WFC) have significant coefficients at a 5% level and four (BK, IBKC, TD and PRK) at a 10% level.

Industry level

When looking at the industry as a whole, no significant effect of the standardized number of deals was observed at a 10% significance level using both the three- and five-factor models. These results were also found when examining the growth rate of the number of deals.

Due to these findings, we rejected the second hypothesis since hardly any significant effects were observed.

From both subsections we conclude that the FinTech volume of funding and number of deals do not have a significant effect on the stock returns of the retail banks, both on an individual and aggregate level. However, as indicated, certain exceptions exist. For instance, for the banks OZRK, TRST and WAFD, the standardized volume of funding has significant effect at a 5% level for both the three- and five-factor model. All of these exceptions are summarized in Table 3. Full results are shown in Appendix D.

Table 3.
Results of Models with Significant FinTech Variable Coefficients

Model	Standardized Volume of Funding		Growth Rate of Volume of Funding		Standardized Number of Deals		Growth Rate of Number of deals	
	3-factor model	5-factor model	3-factor model	5-factor model	3-factor model	5-factor model	3-factor model	5-factor model
WAFD	.777*** (.188)	.727*** (.231)	.634*** (.193)	.645*** (.199)	1.119** (.447)	1.124** (.479)	1.395** (.569)	1.466** (.564)
WFC			.410* (.219)	.405* (.214)			1.28** (.586)	1.219** (.572)
TD			.442** (.166)	.446** (.172)			.738* (.432)	.846* (.444)
CFG					-3.361** (1.421)	-4.067** (1.360)		4.667** (1.970)
OZRK	1.154*** (.274)	.953** (.399)						
MTB	-.675* (.345)	-.849*** (.222)						
TRST	.563** (.265)	.765*** (.226)						
BXS			.702** (.343)	.728* (.375)				
TRMK			.498* (.251)	.442** (.206)				
UCBI					2.661** (1.192)	2.378* (1.198)		
VLY					.916* (.463)	.881* (.457)		
PNC							1.312** (.528)	1.273** (.5071)
PRK							.988* (.576)	.989* (.590)
UMBF			.434* (.260)					
FRC							1.176* (.655)	
PNBI							1.585* (.941)	
BK								.950* (.542)
IBKC								.769* (.448)

Notes: Heteroskedastic-consistent standard errors in parentheses
*p<.1, **p<.05, ***p<.01

6. Conclusion and Discussion

This paper aims to provide a new perspective to the debate concerning the impact of US digital banking start-ups on the performance of US retail banks by using quantitative analysis. Based on the results, we rejected both hypotheses incorporating the effect of the volume of funding and the number of deals, as nearly all coefficients proved to be insignificant. Therefore, we conclude that although the large sum of investments has raised public awareness, the funding of digital banking start-ups does not seem to have a significant effect on the incumbents' stock returns.

Because of this conclusion, several scenarios are possible. First of all, one might expect that while the FinTech start-ups are growing rapidly, they are still too small to have an impact on the incumbent US retail banks. Within a time span of less than five years, it is difficult for consumers to adapt to the new changes brought by the newcomers and to gain trust in their online and automatic services. Also, retail banks benefit from their ingrained advantages such as their ability to create credit instantly. Secondly, the substitute and complementary effects may offset each other, leading to an inconspicuous net effect. On the one hand successful FinTech firms may have weakened the banks' dominate position by improving the quality and efficiency of traditional services, while on the other hand banks have been taking actions to response to these challenges. This might have been either through acquiring FinTech start-ups or setting up their own FinTech affiliates. Thirdly, FinTechs could have established a new channel for distributing financial services, as the customer base of the start-ups and incumbents might differ. If this is the case, direct competition may remain at a low level, which makes it difficult to observe evident relations.

Limitations of this research should be recognized. First of all, FinTech funding was used as a proxy for the potential value of the FinTech start-ups due to data insufficiency. Although reasonable assumptions have been made, it is unavoidable that this proxy might have lead to biases in the analysis. Secondly, the sample might be considered too small to draw conclusions for the time-series regressions. This is due to the examined period of January 2010 until March 2016. Thirdly, as discussed in the theoretical framework, the Fama-French three-factor model suffers from shortcomings, such as its ignorance of the momentum effect. Although the Fama-French model was improved by introducing two extra factors in the five-factor model, the momentum effect and the low volatility factor are still of concern (Blitz & van Vliet, 2015). Another limitation can be found in utilizing the average mean of the stock returns instead of the weighted average when assessing the effect of the start-ups. Lastly, it is unclear whether the results can be applied externally. Since the research is based on US data, retail banks of other countries might experience a different impact.

Recommendations for future research include an extended cross-sectional analysis of the effect of start-ups by studying different countries, as this may lead to different results. Moreover, examining the effect of different investment stages on the incumbents' stock returns might help to gain more insight in the fast-growing FinTech industry.

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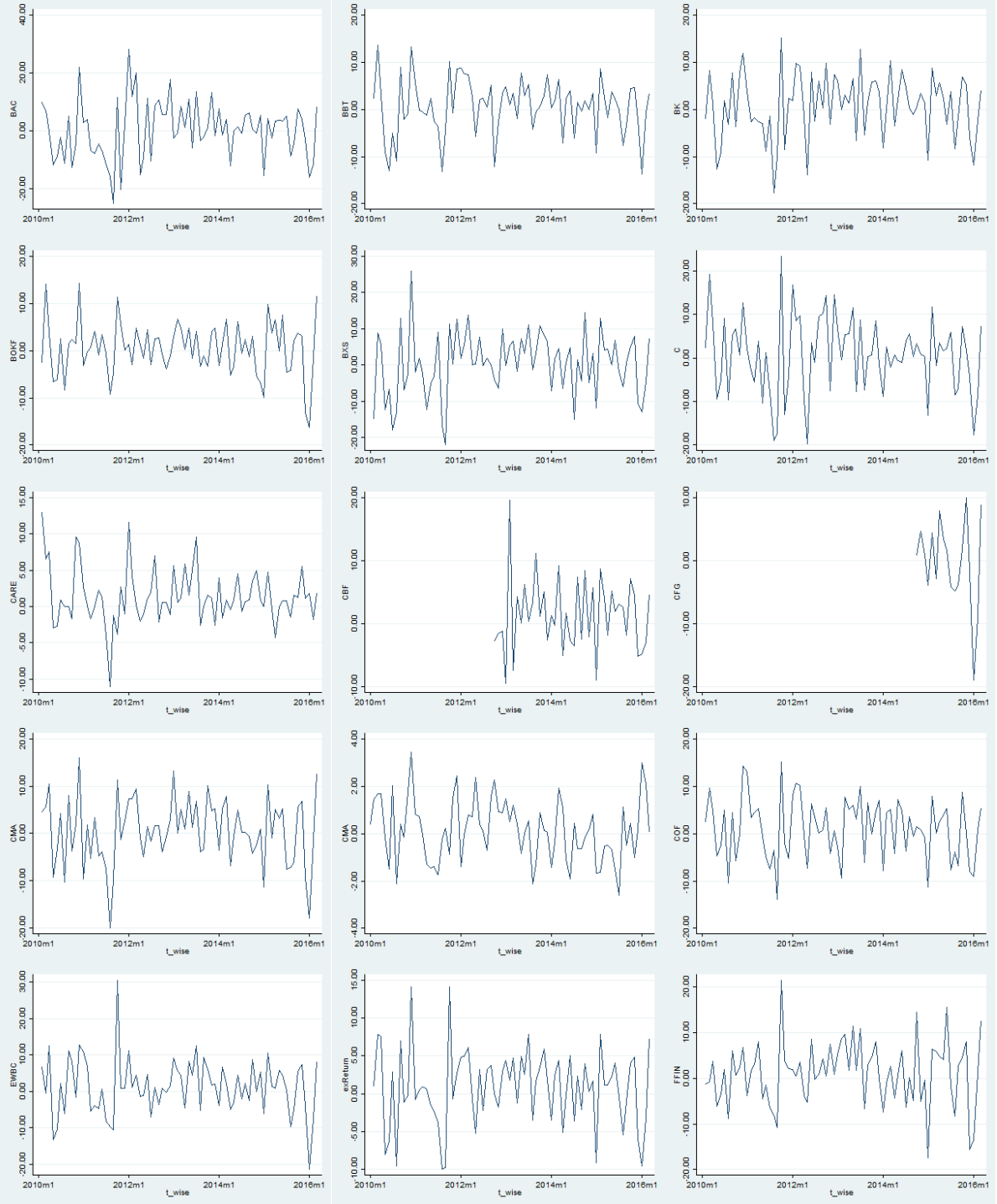
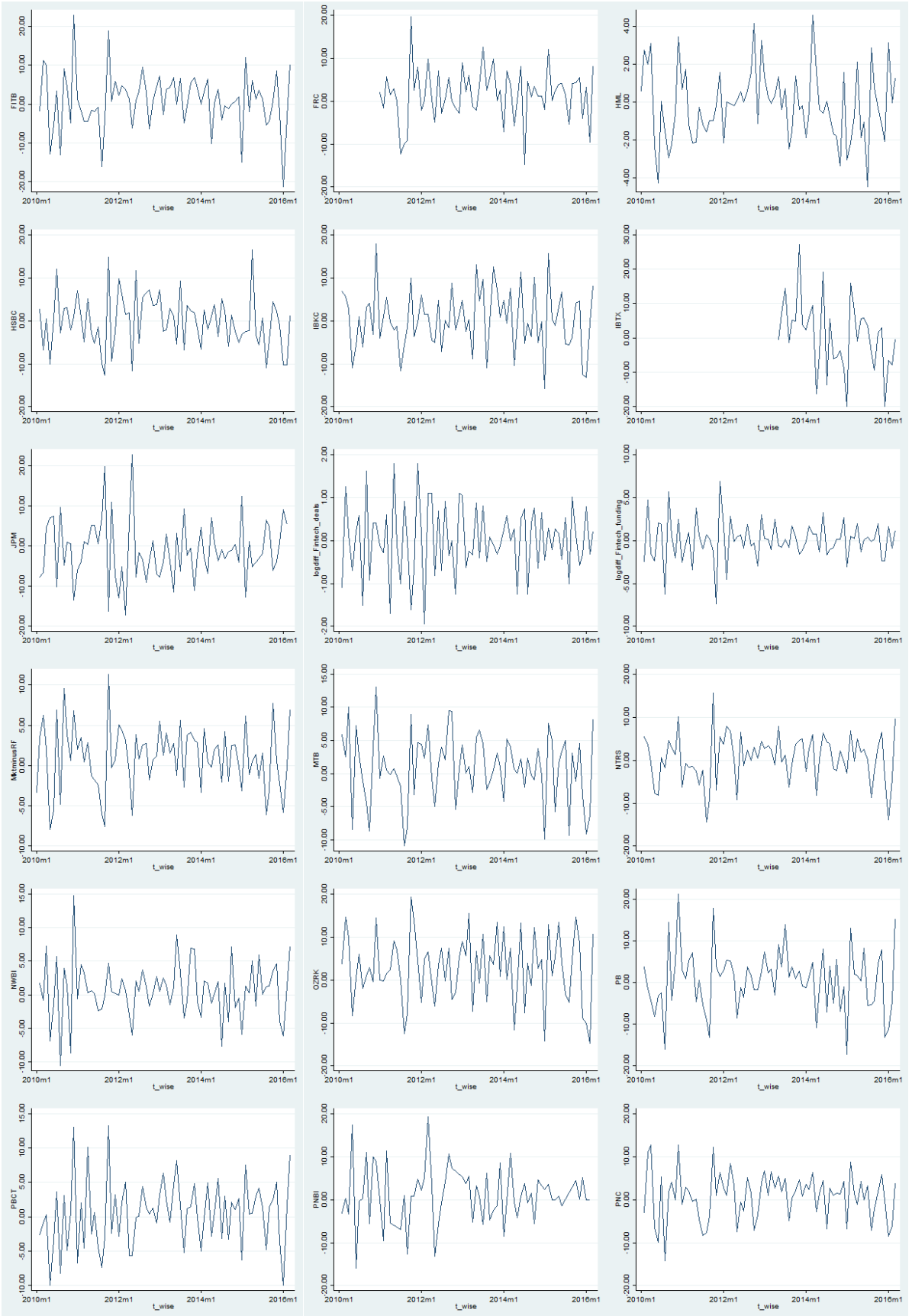
Appendix A. Plots of Data[8]



[8] Arranged in alphabetical order by variable name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FRC
HML
HSBC
IBKC
IBTX
JPM
logdiff_Fintech_deals
logdiff_Fintech_funding
MktminusRF
MTB
NTRS
NWBI
OZRK
PB
PBCT
PNBI
PNC
t_wise
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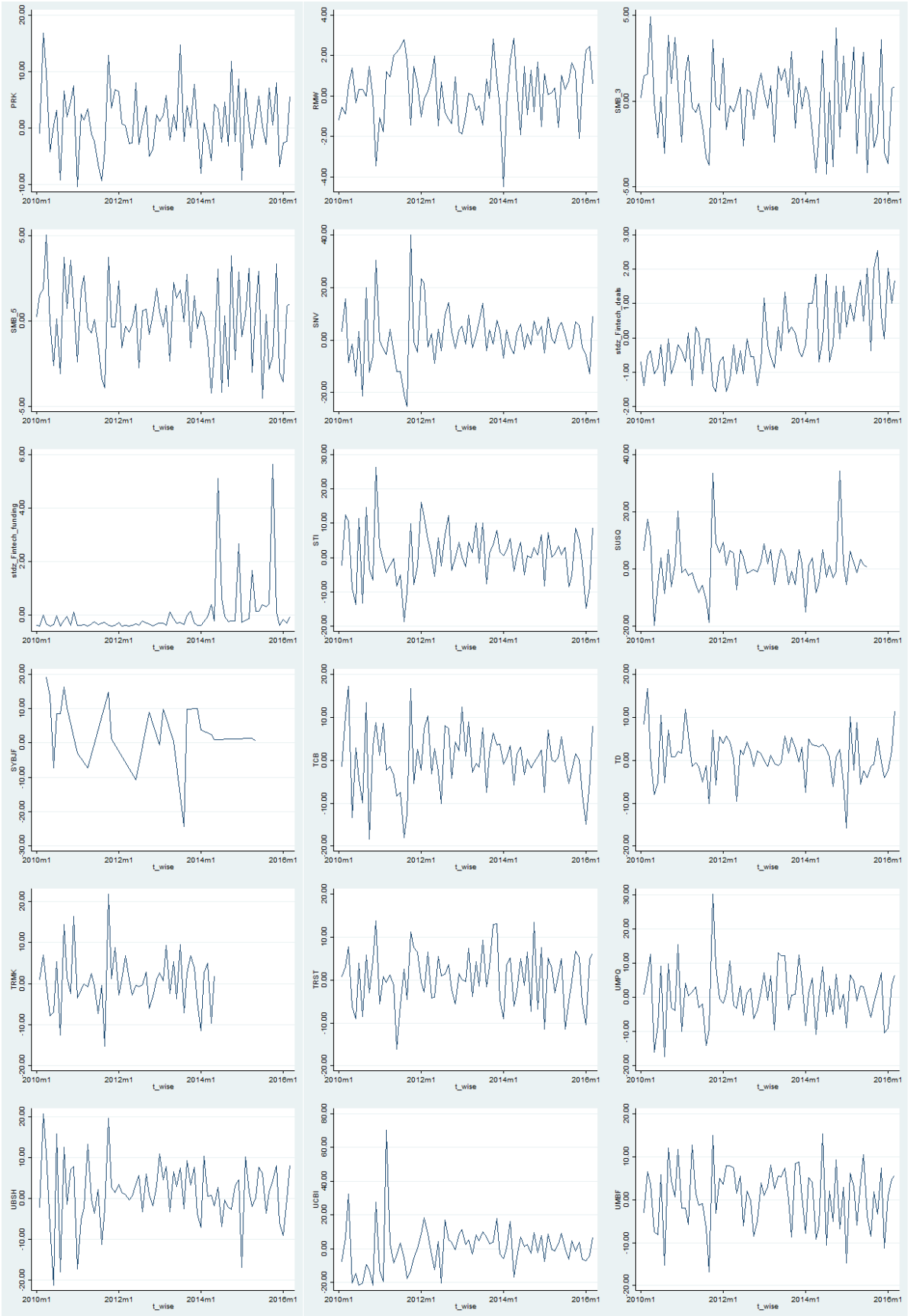
2012m1
2014m1
2016m1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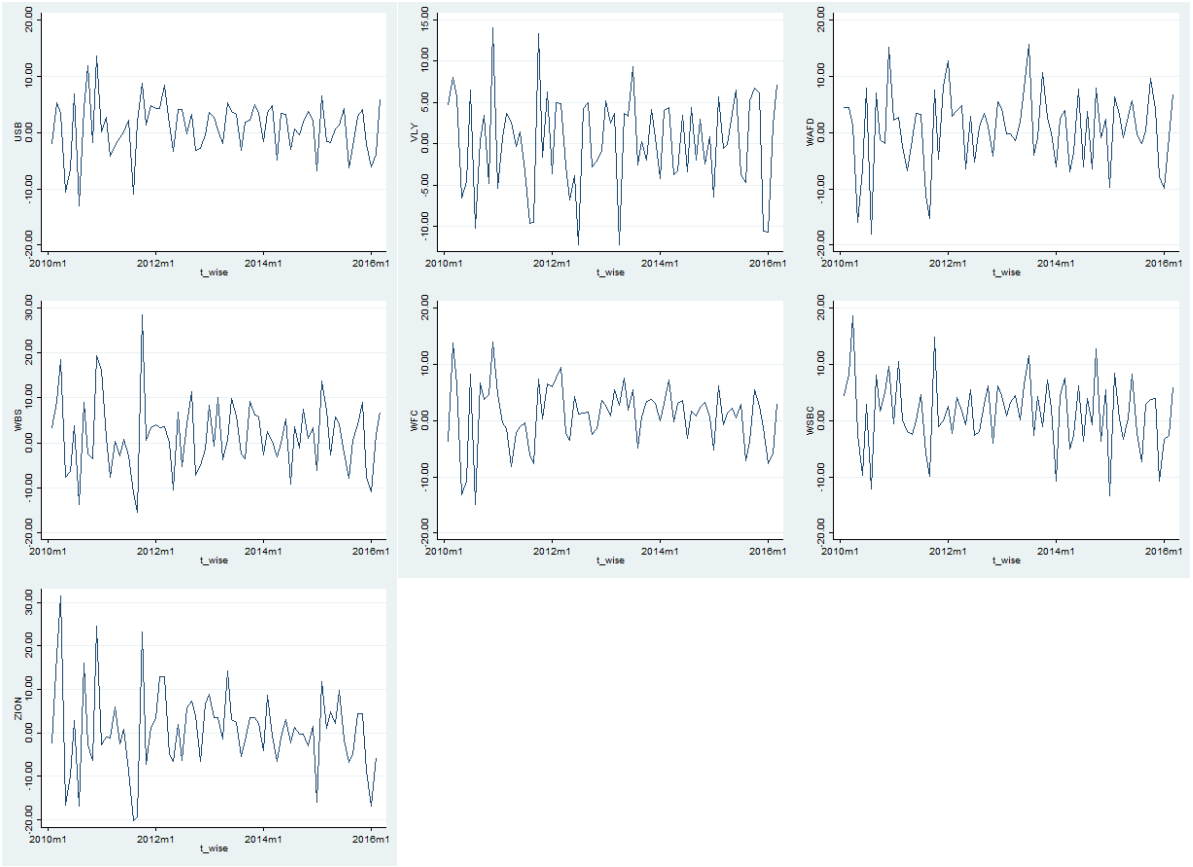
RMW
SMB_3
SMB_5
SNV
stdz_Fintech_deals
stdz_Fintech_funding
STI
SUSQ
SYBJF
TCB
TD
TRMK
TRST
UMPQ
UBSH
UCBI
UMBF
t_wise
2010m1
2012m1
2014m1
2016m1


USB
VLY
WAFD
WBS
WFC
WSBC
ZION
2010m1
2012m1
2014m1
2016m1
t_wise

Appendix B. Augmented Dickey-Fuller Test (ADF) Results

Variable Name		Test Type	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	H_0: $\gamma = 0$
Standardized volume of funding		ADF test 2	-7.560	-2.379	-1.666	-1.293	Rejected
Standardized number of deals		ADF test 2	-5.588	-2.379	-1.666	-1.293	Rejected
Growth rate of volume of funding		ADF test 1	-13.718	-2.611	-1.950	-1.610	Rejected
Growth rate of number of deals		ADF test 1	-14.123	-2.611	-1.950	-1.610	Rejected
Excess returns of market portfolio		ADF test 1	-8.685	-2.611	-1.950	-1.610	Rejected
SMB (3-factor model)		ADF test 1	-10.468	-2.611	-1.950	-1.610	Rejected
SMB (5-factor model)		ADF test 1	-10.480	-2.611	-1.950	-1.610	Rejected
HML		ADF test 1	-7.306	-2.611	-1.950	-1.610	Rejected
RMW		ADF test 1	-7.020	-2.611	-1.950	-1.610	Rejected
CMA		ADF test 1	-6.387	-2.611	-1.950	-1.610	Rejected
Industry Average Excess Return		ADF test 1	-8.597	-2.611	-1.950	-1.610	Rejected
BAC	Bank of America Corp	ADF test 1	-7.953	-2.611	-1.950	-1.610	Rejected
BBT	BB&T Corp	ADF test 1	-7.315	-2.611	-1.950	-1.610	Rejected
BK	Bank of New York Mellon Corp	ADF test 1	-8.733	-2.611	-1.950	-1.610	Rejected
BOKF	BOK Financial Corp	ADF test 1	-7.547	-2.611	-1.950	-1.610	Rejected
BXS	BancorpSouth Inc	ADF test 1	-8.723	-2.611	-1.950	-1.610	Rejected
C	Citigroup Inc	ADF test 1	-8.540	-2.611	-1.950	-1.610	Rejected
CARE	Carter Bank & Trust	ADF test 1	-6.856	-2.611	-1.950	-1.610	Rejected
CBF	Capital Bank Financial Corp	ADF test 1	-9.166	-2.611	-1.950	-1.610	Rejected
CFG	Citizens Financial Group Inc	ADF test 1	-3.167	-2.611	-1.950	-1.610	Rejected
CMA*	Comerica Inc	ADF test 1	-6.387	-2.611	-1.950	-1.610	Rejected
COF	Capital One Financial Corp	ADF test 1	-8.324	-2.611	-1.950	-1.610	Rejected
EWBC	East West Bancorp Inc	ADF test 1	-8.164	-2.611	-1.950	-1.610	Rejected
FFIN	First Financial Bankshares Inc	ADF test 1	-8.253	-2.611	-1.950	-1.610	Rejected
FITB	Fifth Third Bancorp	ADF test 1	-8.855	-2.611	-1.950	-1.610	Rejected
FRC	First Republic Bank/CA	ADF test 1	-8.360	-2.611	-1.950	-1.610	Rejected

HSBC	HSBC Holdings PLC	ADF test 1	-9.773	-2.611	-1.950	-1.610	Rejected
IBKC	IBERIABANK Corp	ADF test 1	-9.642	-2.611	-1.950	-1.610	Rejected
IBTX	Independent Bank Group Inc	ADF test 1	-5.543	-2.611	-1.950	-1.610	Rejected
JPM	JPMorgan Chase & Co	ADF test 1	-9.373	-2.611	-1.950	-1.610	Rejected
MTB	M&T Bank Corp	ADF test 1	-8.502	-2.611	-1.950	-1.610	Rejected
NTRS	Northern Trust Corp	ADF test 1	-8.033	-2.611	-1.950	-1.610	Rejected
NWBI	Northwest Bancshares Inc	ADF test 1	-10.343	-2.611	-1.950	-1.610	Rejected
OZRK	Bank of the Ozarks Inc	ADF test 1	-7.880	-2.611	-1.950	-1.610	Rejected
PB	Prosperity Bancshares Inc	ADF test 1	-8.685	-2.611	-1.950	-1.610	Rejected
PBCT	People's United Financial Inc	ADF test 1	-9.675	-2.611	-1.950	-1.610	Rejected
PNBI	Pioneer Bankshares Inc	ADF test 1	-8.986	-2.611	-1.950	-1.610	Rejected
PNC	PNC Financial Services Group Inc	ADF test 1	-8.242	-2.611	-1.950	-1.610	Rejected
PRK	Park National Corp	ADF test 1	-9.367	-2.611	-1.950	-1.610	Rejected
SNV	Synovus Financial Corp	ADF test 1	-9.251	-2.611	-1.950	-1.610	Rejected
STI	SunTrust Banks Inc	ADF test 1	-8.866	-2.611	-1.950	-1.610	Rejected
SUSQ	Susquehanna Bancshares Inc	ADF test 1	-7.881	-2.611	-1.950	-1.610	Rejected
SYBJF	Security Bank Corp	ADF test 1	-4.082	-2.611	-1.950	-1.610	Rejected
TCB	TCF Financial Corp	ADF test 1	-9.155	-2.611	-1.950	-1.610	Rejected
TD	Toronto-Dominion Bank	ADF test 1	-8.472	-2.611	-1.950	-1.610	Rejected
TRMK	Trustmark Corp	ADF test 1	-9.780	-2.611	-1.950	-1.610	Rejected
TRST	TrustCo Bank Corp NY	ADF test 1	-9.487	-2.611	-1.950	-1.610	Rejected
UBSH	Union Bankshares Corp	ADF test 1	-9.982	-2.611	-1.950	-1.610	Rejected
UCBI	United Community Banks Inc/GA	ADF test 1	-8.802	-2.611	-1.950	-1.610	Rejected
UMBF	UMB Financial Corp	ADF test 1	-10.547	-2.611	-1.950	-1.610	Rejected
UMPQ	Umpqua Holdings Corp	ADF test 1	-9.693	-2.611	-1.950	-1.610	Rejected
USB	US Bancorp	ADF test 1	-8.937	-2.611	-1.950	-1.610	Rejected
VLY	Valley National Bancorp	ADF test 1	-9.403	-2.611	-1.950	-1.610	Rejected
WAFD	Washington Federal Inc	ADF test 1	-8.978	-2.611	-1.950	-1.610	Rejected
WBS	Webster Financial Corp	ADF test 1	-8.779	-2.611	-1.950	-1.610	Rejected

WFC	Wells Fargo & Co	ADF test 1	-7.738	-2.611	-1.950	-1.610	Rejected
WSBC	WesBanco Inc	ADF test 1	-9.823	-2.611	-1.950	-1.610	Rejected
ZION	Zions Bancorporation	ADF test 1	-8.717	-2.611	-1.950	-1.610	Rejected

Notes: CMA is distinguished from CMA*. The former is a factor of the Fama-French five-factor model, while the latter is an abbreviation for a bank.

Appendix C. Gibbons, Ross and Shanken Test (GRS) Results

Model Name		Fama-French 3-factor model		Fama-French 5-factor model	
		p-value	$H_0: \delta_{i0} = 0$	p-value	$H_0: \delta_{i0} = 0$
Industry		.68315848	Accepted	.87646381	Accepted
BAC	Bank of America Corp	.26192504	Accepted	.9338074	Accepted
BBT	BB&T Corp	.38344526	Accepted	.66450833	Accepted
BK	Bank of New York Mellon Corp	.23866173	Accepted	.66891903	Accepted
BOKF	BOK Financial Corp	.74775126	Accepted	.97552213	Accepted
BXS	BancorpSouth Inc	.50638157	Accepted	.77143619	Accepted
C	Citigroup Inc	.10500695	Accepted	.44055582	Accepted
CARE	Carter Bank & Trust	.00968588	Rejected	.00488202	Rejected
CBF	Capital Bank Financial Corp	.07376448	Accepted	.08120275	Accepted
CFG	Citizens Financial Group Inc	.27420586	Accepted	.52229517	Accepted
CMA	Comerica Inc	.18556687	Accepted	.34779579	Accepted
COF	Capital One Financial Corp	.98292369	Accepted	.75466337	Accepted
EWBC	East West Bancorp Inc	.86621932	Accepted	.65782919	Accepted
FFIN	First Financial Bankshares Inc	.77369963	Accepted	.67381054	Accepted
FITB	Fifth Third Bancorp	.40382644	Accepted	.76526132	Accepted
FRC	First Republic Bank/CA	.19919321	Accepted	.26028589	Accepted
HSBC	HSBC Holdings PLC	.01959763	Rejected	.10232509	Accepted
IBKC	IBERIABANK Corp	.51596116	Accepted	.92339445	Accepted
IBTX	Independent Bank Group Inc	.74630079	Accepted	.73029038	Accepted
JPM	JPMorgan Chase & Co	.49141677	Accepted	.79179794	Accepted
MTB	M&T Bank Corp	.51031594	Accepted	.18679501	Accepted
NTRS	Northern Trust Corp	.19327264	Accepted	.66690107	Accepted
NWBI	Northwest Bancshares Inc	.50912681	Accepted	.47895454	Accepted
OZRK	Bank of the Ozarks Inc	.02003785	Rejected	.0037755	Rejected
PB	Prosperity Bancshares Inc	.37780055	Accepted	.74293349	Accepted
PBCT	People's United Financial Inc	.47666321	Accepted	.74333798	Accepted
PNBI	Pioneer Bankshares Inc	.32478947	Accepted	.59068019	Accepted

PNC	PNC Financial Services Group	.9792692	Accepted	.80123412	Accepted
PRK	Park National Corp	.18587173	Accepted	.24524993	Accepted
SNV	Synovus Financial Corp	.38645935	Accepted	.74770819	Accepted
STI	SunTrust Banks Inc	.30859176	Accepted	.65148345	Accepted
SUSQ	Susquehanna Bancshares Inc	.53898311	Accepted	.38581909	Accepted
SYBJF	Security Bank Corp	.00082412	Rejected	.00057446	Rejected
TCB	TCF Financial Corp	.18787517	Accepted	.30090643	Accepted
TD	Toronto-Dominion Bank	.93931306	Accepted	.7848208	Accepted
TRMK	Trustmark Corp	.03339844	Rejected	.00170273	Rejected
TRST	TrustCo Bank Corp NY	.92087449	Accepted	.52445841	Accepted
UBSH	Union Bankshares Corp	.75114128	Accepted	.86171224	Accepted
UCBI	United Community Banks Inc/GA	.8115261	Accepted	.66485196	Accepted
UMBF	UMB Financial Corp	.87602473	Accepted	.70933772	Accepted
UMPQ	Umpqua Holdings Corp	.68014896	Accepted	.65266544	Accepted
USB	US Bancorp	.98845233	Accepted	.96706812	Accepted
VLY	Valley National Bancorp	.32841373	Accepted	.40521413	Accepted
WAFD	Washington Federal Inc	.44133556	Accepted	.60593176	Accepted
WBS	Webster Financial Corp	.67404232	Accepted	.51422561	Accepted
WFC	Wells Fargo & Co	.98283663	Accepted	.97861934	Accepted
WSBC	WesBanco Inc	.07165057	Accepted	.10846066	Accepted
ZION	Zions Bancorporation	.30937617	Accepted	.61844658	Accepted

Appendix D. OLS Regression Results

Table D.1. OLS Regression Results of Models with Standardized FinTech Variables

Model		Fintech funding		Fintech deals	
		3-factor model	5-factor model	3-factor model	5-factor model
Industry		.0786103 (.1897403)	.0051561 (.1343047)	.1876072 (.2697741)	.1911433 (.2513171)
BAC	Bank of America Corp	.0784623 (.4052711)	-.273533 (.6471158)	-.2244403 (.8912546)	-.1125372 (.7869931)
BBT	BB&T Corp	-.089316 (.2180447)	-.1429934 (.177328)	-.1445199 (.407273)	-.0905225 .3784013
BK	Bank of New York Mellon Corp	.5615852 (.516621)	.3756028 (.3636993)	.5195219 (.5402527)	.50005 .4790538
BOKF	BOK Financial Corp	.1661011 (.4647289)	.0031341 (.4366088)	.0175693 (.5610946)	-.096302 .5553112
BXS	BancorpSouth Inc	.2443404 (.3511384)	.0349414 (.3882102)	.5966325 (.8162882)	.5317659 (.852459)
C	Citigroup Inc	-.3326496 (.3684881)	-.6895751 (.4474505)	-.2839896 (.6340993)	-.3696132 .5400549
CARE	Carter Bank & Trust	-.1039625 (.2689726)	-.0709436 (.2626948)	.0204252 (.3830315)	.1349768 .3940492
CBF	Capital Bank Financial Corp	.1555989 (.7699736)	-.0369368 (.8722308)	.2914161 (.7554851)	.234571 .7350874
CFG	Citizens Financial Group Inc	-.0442275 (.8781924)	-.4374261 (.4982505)	-3.360937** (1.420667)	-4.067326** (1.36017)
CMA	Comerica Inc	.1521903 (.2635212)	.0561877 (.2227872)	-.1334911 (.5229741)	-.1518741 .5202498
COF	Capital One Financial Corp	.0338557 (.2446324)	-.0441197 (.267363)	-.7300778 (.4590237)	-.7584362 .4756502
EWBC	East West Bancorp Inc	-.0301456 (.3076098)	-.2094653 (.333218)	.253698 (.5453278)	.239065 .5364743
FFIN	First Financial Bankshares Inc	.171873 (.312365)	.0184512 (.2781828)	.4652085 (.5380497)	.3465463 .5339219
FITB	Fifth Third Bancorp	-.2786845 (.5123531)	-.4153693 (.4008267)	-.4765664 (.5910491)	-.4682871 .5766196
FRC	First Republic Bank/CA	-.0074102 (.417208)	.019028 (.4631789)	.5351472 (.6326661)	.5610141 .6810018
HSBC	HSBC Holdings PLC	-.3410533 (.4423615)	-.6132059 (.399849)	-.4375251 (.515614)	-.5256725 .4550614
IBKC	IBERIABANK Corp	.5763497 (.4300516)	.4165535 (.3634161)	.6469537 (.4548254)	.6367263 .4436302
IBTX	Independent Bank Group Inc	-.0480083 (1.321572)	-.354134 (1.134034)	-2.379166 (1.708315)	-2.034152 1.779816
JPM	JPMorgan Chase & Co	.028336 (.4238371)	.2904562 (.277012)	.0125705 (.5668716)	.0354053 .4776267
MTB	M&T Bank Corp	-.6752371* (.3447437)	-.8491028*** (.2223882)	-.126367 (.5074625)	-.1052735 .4352202
NTRS	Northern Trust Corp	.1845273 (.4403827)	-.0540636 (.2651949)	-.3536917 (.4766194)	-.4411226 .4144254
NWBI	Northwest Bancshares Inc	.1553384 (.2064307)	.0874056 (.1999567)	.4025868 (.340394)	.3473656 .3475652
OZRK	Bank of the Ozarks Inc	1.154187*** (.2743478)	.9530075** (.3990644)	.1584832 (.732946)	.1256979 .7332949
PB	Prosperity Bancshares Inc	.1228969 (.3147677)	-.0379035 (.2841961)	.3056207 (.4740745)	.3025798 (.473695)

PBCT	People's United Financial Inc	.3065645 (.3526712)	.2143369 (.300588)	.3648539 (.4108221)	.3433022 .4128236
PNBI	Pioneer Bankshares Inc	.0621002 (.2858898)	.2924587 (.2964468)	.2324295 (.7500359)	.2656806 .762775
PNC	PNC Financial Services Group Inc	-.0476085 (.3245744)	-.0300604 (.2930086)	.2992322 (.4329005)	.4042831 (.4321292)
PRK	Park National Corp	.0556281 (.3654825)	.1001854 (.3751632)	.7250785 (.48847)	.7806064 (.4912834)
SNV	Synovus Financial Corp	-.0227214 (.5098443)	-.0656776 (.4579958)	.0902127 (.8409879)	.3109831 (.8591028)
STI	SunTrust Banks Inc	.3962033 (.357602)	.367736 (.3489728)	.3267689 (.5216048)	.4635525 (.5040697)
SUSQ	Susquehanna Bancshares Inc	.1592158 (.3685752)	.7077639 (.6462622)	-.7095401 (.707343)	-.4209385 (.7764502)
SYBJF	Security Bank Corp	1.350137 (2.418318)	3.029933 (3.93064)	-2.14997 (1.83343)	-1.801048 (2.032369)
TCB	TCF Financial Corp	-.3071197 (.2438175)	-.2990385 (.2177049)	-.1051884 (.6044319)	.0134219 (.593277)
TD	Toronto-Dominion Bank	-.1068677 (.380142)	-.1747451 (.3884642)	.0410637 (.3965904)	-.0808487 (.3816944)
TRMK	Trustmark Corp	-.2193178 (4.637219)	-2.066576 (5.13402)	-.1468495 (.8808447)	-.045233 (.953689)
TRST	TrustCo Bank Corp NY	.5626042** (.2654837)	.7652334*** (.2261912)	.5959582 (.4948025)	.6672894 (.5111521)
UBSH	Union Bankshares Corp	-.0929163 (.3431129)	.0100774 (.4140184)	.5647714 (.6722511)	.53556 (.6988686)
UCBI	United Community Banks Inc/GA	.3506982 (.5690632)	-.1086306 (.6111226)	2.660652** (1.192351)	2.378233* (1.198028)
UMBF	UMB Financial Corp	.1335766 (.9356367)	.172367 (1.001499)	.1339104 (.6484657)	.1095119 (.6633146)
UMPQ	Umpqua Holdings Corp	-.0297215 (.3906059)	-.0716365 (.3968521)	.3987136 (.5897343)	.3608635 (.5967609)
USB	US Bancorp	-.1435821 (.292652)	-.1132136 (.3000847)	-.137138 (.394001)	-.0849981 (.4169088)
VLY	Valley National Bancorp	.3847183 (.2560061)	.3163201 (.2781233)	.9157898* (.4632502)	.8814146* (.4574241)
WAFD	Washington Federal Inc	.7768811*** (.1880989)	.7265656*** (.2308413)	1.118793** (.4466786)	1.124488** (.4790017)
WBS	Webster Financial Corp	-.3325462 (.2923251)	-.3769596 (.2679866)	.2081275 (.4981048)	.2724632 (.4847928)
WFC	Wells Fargo & Co	-.0129825 (.2349123)	.0714384 (.2746899)	.047115 (.4551903)	.1477634 (.4802363)
WSBC	WesBanco Inc	.11801 (.158109)	.1060537 (.1773513)	.5284845 (.4068093)	.4978711 (.4348088)
ZION	Zions Bancorporation	-.2564602 (.3611434)	-.5130477 (.3602224)	.017251 (.683617)	-.0504101 (.6475624)

Notes: Heteroskedastic-consistent standard errors in parentheses

**p<.1, **p<.05, ***p<.01*

Table D.2. OLS Regression Results of Models with FinTech Growth Rate Variables

Model		Fintech funding		Fintech deals	
		3-factor model	5-factor model	3-factor model	5-factor model
Industry		.1174162 (.1039003)	.127156 (.1072357)	.3646668 (.3036068)	.399745 (.2911985)
BAC	Bank of America Corp	.445855 (.4435492)	.5051256 (.3621995)	.9350318 (1.036816)	.9509647 (.9516675)
BBT	BB&T Corp	.2125084 (.2199904)	.2220991 (.2287504)	.7653712 (.5473325)	.7620969 (.5459031)
BK	Bank of New York Mellon Corp	.0864954 (.2339943)	.1152542 (.1957315)	.8645877 (.6024686)	.9504649* (.5416702)
BOKF	BOK Financial Corp	.1054818 (.2511679)	.1218644 (.2661973)	.2964606 (.5643709)	.428009 (.5549318)
BXS	BancorpSouth Inc	.7015277** (.342893)	.7278866* (.3751116)	1.450532 (1.047556)	1.596068 (1.043911)
C	Citigroup Inc	.0835665 (.3519331)	.1285536 (.2848688)	.0324173 (.7819771)	.160508 (.6879073)
CARE	Carter Bank & Trust	-.2180203 (.1671065)	-.2175218 (.1720367)	.0274183 (.5939756)	-.0585675 (.5961934)
CBF	Capital Bank Financial Corp	.7858731 (.6137312)	.6317915 (.6132734)	-2.140567 (1.373213)	-2.5135 (1.510178)
CFG	Citizens Financial Group Inc	-1.229415 (1.026807)	-1.380945 (.8581995)	-3.166233 (1.991495)	4.666712** (1.969904)
CMA	Comerica Inc	-.0336538 (.1928223)	-.0213747 (.1940737)	-.0599776 (.5309705)	-.0176918 (.5268302)
COF	Capital One Financial Corp	-.1431812 (.2393619)	-.1334364 (.2303304)	-.457365 (.6396883)	-.4362227 (.6349126)
EWBC	East West Bancorp Inc	-.3276791 (.2209061)	-.3062799 (.2189146)	-.408336 (.7213749)	-.3496329 (.7175568)
FFIN	First Financial Bankshares Inc	-.2214548 (.2324534)	-.20965 (.2476223)	-.5572181 (.6592937)	-.4228862 (.6682575)
FITB	Fifth Third Bancorp	.2778989 (.2184639)	.2970171 (.2335041)	.3896026 (.5825926)	.4143525 (.5816898)
FRC	First Republic Bank/CA	.4258127 (.2636659)	.4371699 (.2613655)	1.143641 (.6636251)	1.175828* (.6554118)
HSBC	HSBC Holdings PLC	-.259796 (.2813045)	-.2259328 (.2475079)	-.4195331 (.5392047)	-.3346226 (.5282985)
IBKC	IBERIABANK Corp	.1486536 (.1970071)	.1718572 (.1691745)	.6819583 (.4824203)	.7686393* (.4475356)
IBTX	Independent Bank Group Inc	.80782 (1.400618)	.5748811 (1.410797)	-.5066736 (2.164329)	-.9677175 (2.235902)
JPM	JPMorgan Chase & Co	-.3073978 (.2704461)	-.3451374 (.2324967)	-.8989122 (.622054)	-.9818559 (.5948756)
MTB	M&T Bank Corp	-.0532393 (.2528478)	-.0317582 (.2327633)	.2809212 (.6199131)	.3034339 (.5628181)
NTRS	Northern Trust Corp	-.0730225 (.2349312)	-.0428985 (.2088169)	-.3519996 (.5196556)	-.2453025 (.4922056)
NWBI	Northwest Bancshares Inc	.1835146 (.1653171)	.1902118 (.1693882)	-.0278831 (.3800676)	.036883 (.3664721)
OZRK	Bank of the Ozarks Inc	-.1114616 (.3854277)	-.0788802 (.4215178)	.3399625 (.8056374)	.4350861 (.7976061)
PB	Prosperity Bancshares Inc	.0530956 (.2549595)	.074046 (.2853334)	.2448217 (.5441671)	.3090702 (.5571987)
PBCT	People's United Financial Inc	.0231019 (.1860335)	.0355486 (.1865737)	-.4752321 (.5382197)	-.4297981 (.5366286)

PNBI	Pioneer Bankshares Inc	-.0102253 (.3311003)	-.0799446 (.3157915)	1.585177* (.9405726)	1.37642 (1.022958)
PNC	PNC Financial Services Group Inc	.3275364 (.2226294)	.3301071 (.228342)	1.312369** (.5281104)	1.273263** (.507165)
PRK	Park National Corp	.3271641 (.2301734)	.3213676 (.2308393)	.9882255* (.5756368)	.9892646* (.5896399)
SNV	Synovus Financial Corp	-.1657433 (.364496)	-.1487853 (.3693842)	-.7724007 (1.164478)	-.9125524 (1.171235)
STI	SunTrust Banks Inc	.3270163 (.2443765)	.3413983 (.2363404)	.9023805 (.6716388)	.8476718 (.6773222)
SUSQ	Susquehanna Bancshares Inc	-.1602246 (.3333078)	-.1993726 (.3077891)	-.3491993 (.9917748)	-.6052506 (1.036568)
SYBJF	Security Bank Corp	.0401444 (.598578)	.028775 (.7695246)	-1.771295 (2.22646)	-2.796928 (2.437209)
TCB	TCF Financial Corp	.1145243 (.2385333)	.1171206 (.2321115)	.5022108 (.7483649)	.434346 (.7485913)
TD	Toronto-Dominion Bank	.4424121** (.16611)	.4456532** (.1723349)	.7375312* (.4324964)	.8463603* (.4444782)
TRMK	Trustmark Corp	.4975045* (.2509105)	.4422605** (.2055313)	1.122336 (.7763156)	.9637681 (.7441912)
TRST	TrustCo Bank Corp NY	.0121606 (.2583624)	-.0127701 (.2379081)	.7259807 (.5624747)	.6787991 (.5812832)
UBSH	Union Bankshares Corp	.2862194 (.3313495)	.2658017 (.3025887)	.3719423 (.7979187)	.4077172 (.7738256)
UCBI	United Community Banks Inc/GA	.3210701 (.5871111)	.3637612 (.5725872)	2.287125 (1.940938)	2.711808 (1.986537)
UMBF	UMB Financial Corp	.434181* (.2599937)	.4253166 (.2621063)	.761402 (.8097353)	.8122298 (.8020288)
UMPQ	Umpqua Holdings Corp	-.1108031 (.3132995)	-.1122781 (.3172572)	.2386146 (.7918541)	.3124343 (.780597)
USB	US Bancorp	.2718688 (.1890627)	.2704345 (.1875518)	.3330908 (.5032195)	.2947125 (.5000124)
VLY	Valley National Bancorp	.0730953 (.2163435)	.0799063 (.2185991)	.2542343 (.5687695)	.333439 (.5615657)
WAFD	Washington Federal Inc	.6342072*** (.1933794)	.6452297*** (.1989483)	1.39538** (.5694333)	1.466129** (.56449)
WBS	Webster Financial Corp	-.277743 (.2464479)	-.2732329 (.2475695)	-.2828168 (.6496308)	-.3050328 (.662396)
WFC	Wells Fargo & Co	.40994* (.2191336)	.4045097* (.2137375)	1.280729** (.5863511)	1.218721** (.5721678)
WSBC	WesBanco Inc	.1846252 (.1509775)	.181543 (.1517976)	.6053679 (.4990321)	.6728092 (.5044137)
ZION	Zions Bancorporation	.2785577 (.2986514)	.3068252 (.2967931)	.5730437 (.8005445)	.7097156 (.7843865)

Notes: Heteroskedastic-consistent standard errors in parentheses

**p<.1, **p<.05, ***p<.01*