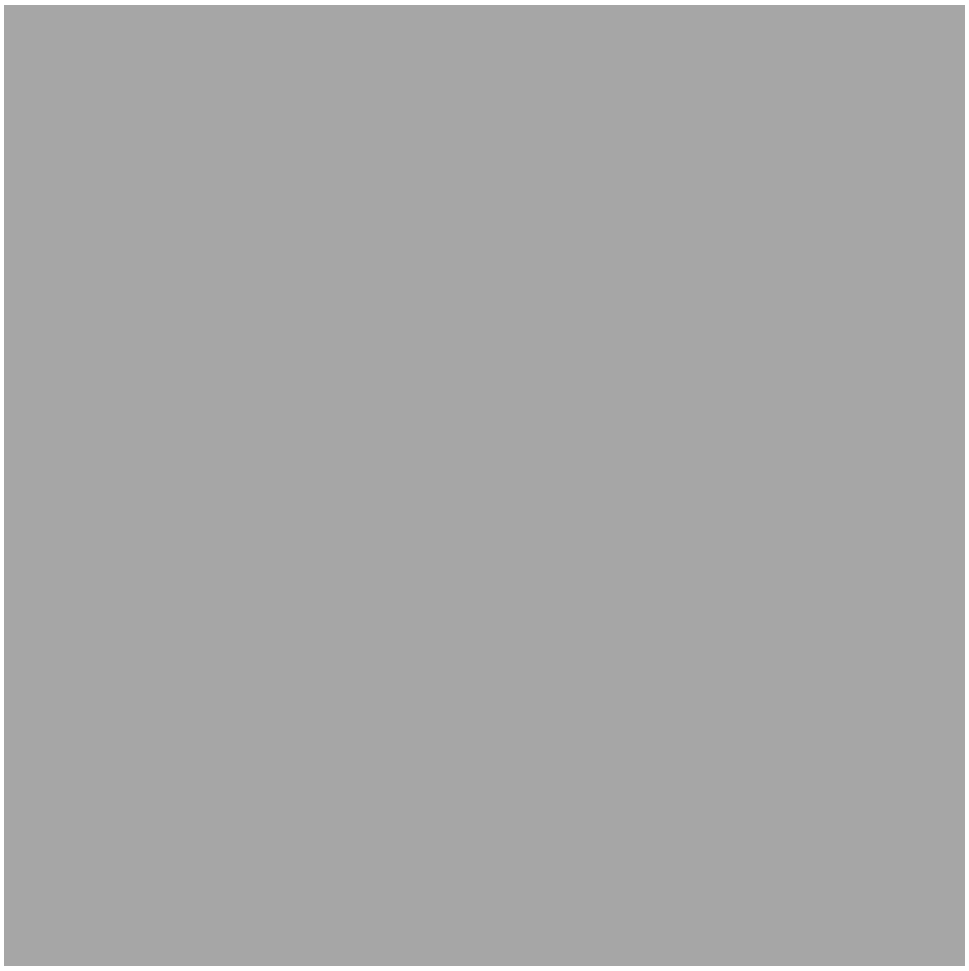

FACTS AND FANTASIES ABOUT DEFI: LENDING, DEX, AND DERIVATIVES

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Facts and fantasies about DeFi: Lending, DEX and Derivatives

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Abstract

We explore risk-return tradeoff of Decentralized Finance (DeFi). We construct three novel indices for different asset classes: Lending, Decentralized Exchanges (DEX) and Derivatives. Motivated by the cryptocurrency pricing framework of Liu and Tsyvinski (2021), we investigate how DeFi assets comove with financial primitives. We document limited correlation with traditional equities, currencies, interest rates and commodities. We further examine several DeFi-specific factors. Bitcoin and Ethereum returns show no significant association with subsequent DeFi returns, highlighting a decoupling between base-layer assets and application-layer protocols. Meanwhile, we find some in-sample associations with DeFi-specific factors such as momentum, investor attention and performance of centralized platforms. A novel book-to-market ratio constructed using Total Value Locked and market capitalization does not display a systematic relationship with returns. Finally, we find only limited and sector-specific associations with traditional equity industries.

Keywords: Decentralized Finance, cryptocurrency, asset pricing, risk management, factor analysis.

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1 Introduction

Decentralized Finance (DeFi) emerged rapidly as a new segment of the cryptocurrency ecosystem. It offers a wide variety of digital assets. Started from small projects, various crypto protocols gained momentum. Cryptocurrency trading has become an established component of modern financial technology.

More specifically, DeFi refers to a set of financial tools and applications that cut out the central counterparty. Therefore, it operates without traditional financial intermediaries. Most of these projects are built on the Ethereum blockchain, thanks to its robust support for smart contracts. Indeed, it offers self-executing agreements with the terms directly written into code. This shift is reshaping how we think about finance and technology.

Seminal work by Liu and Tsyvinski (2021) established a foundational asset pricing framework for cryptocurrencies. It identifies that their returns are driven primarily by cryptocurrency-specific factors like momentum and investor attention with limited exposure to traditional macroeconomic indicators. However, their analysis focused on the first generation of digital assets (Bitcoin, Ethereum, Ripple) that function primarily as stores of value or mediums of exchange.

The DeFi ecosystem presents an extension of this framework. Unlike early cryptocurrencies, DeFi tokens often represent claims on protocol governance, cash flows and economic activity (Auer et al. (2024)). On the one hand, DeFi uses smart contracts that promise to fundamentally change financial intermediation. On the other hand, many DeFi protocols in their current form replicate traditional financial functions such as lending, trading and asset management. This duality raises important questions: do DeFi assets represent a new class of financial instruments, or are they simply digital analogues of existing financial products? Can DeFi be analysed using the same frameworks applied to traditional financial indices, or do they exhibit fundamentally different risk-return dynamics? Does the Liu and Tsyvinski pricing model, successful for foundational cryptocurrencies, adequately explain the returns of these more complex DeFi assets?

To address these questions, we examine whether the behavior of DeFi aligns with that of conventional asset classes. In other words, we investigate how markets and investors currently interpret the value and potential of DeFi instruments. By examining general properties of

decentralized assets, we can better understand how to manage risk, optimize returns, and build portfolios in this rapidly evolving time.

To conduct the analysis, we classify DeFi protocols into three categories: Lending, Decentralized Exchanges (DEX) and Derivatives. Each of them consists of most liquid and popular protocols (Table 1). Most included protocols have market capitalizations exceeding $1 billion. Then we construct three novel, protocol-based indices representing the core pillars of DeFi. Our methodology directly mirrors that of Liu and Tsyvinski (2021), applying standard empirical asset pricing tools to a new universe of assets.

Table 1: DeFi Indices

Index	Included Protocols	Tokens
Lending	Aave, Compound, Maker	AAVE, COMP, MKR
DEX	Uniswap, Curve, Sushi Swap	UNI, CRV, SUSHI
Derivatives	Perpetual Protocol, Synthetix, dYdX	PERP, SNX, DYDX

Note: Indices consist of protocols' tokens with $1 billion market capitalization.

It is important to note that despite sharing a common financial framework, DeFi platforms differ significantly in terms of their development and operational models. Although they are built upon principles similar to those of traditional finance, decentralized finance functions in fundamentally different ways (Auer et al. (2024)). For instance, loans in the DeFi ecosystem are not necessarily backed by physical collateral, but rather by digital assets: another DeFi token, Non-Fungible Tokens, Bitcoin or Ethereum. So, once deposited, it enables users to borrow other digital tokens. In this context, lenders earn interest without the involvement of a central authority. Meanwhile, borrowers can reinvest the borrowed funds into other services like trading or portfolio management, all without intermediaries (Corbet et al. (2023)).

We start with examining basic characteristics of DeFi indices. The data reveal that returns exhibit significantly higher volatility than traditional financial assets, though not as extreme as that observed in individual cryptocurrencies. For instance, for the Lending index the average daily return is 0.25% with a standard deviation of 5.12%, resulting in a relatively low Sharpe ratio of 0.05. The return distribution is positively skewed across all frequencies, with skewness rising from 0.38 (daily) to 1.60 (monthly), indicating the presence of occasional large positive returns. Kurtosis values suggest the return distribution is leptokurtic, particularly at the daily and monthly levels. That reflects fat tails and a higher probability of extreme outcomes.

Then we assess whether the DeFi market exhibits return behavior similar to that of the traditional equity market. Specifically, we examine whether standard equity risk factors can explain the returns of DeFi indices. Our results indicate that while DeFi indices show modest positive CAPM betas, the corresponding alphas remain large and statistically significant, implying that traditional market risk does not fully account for DeFi performance. Additionally, DeFi indices display minimal and statistically insignificant exposure to the Fama-French six factors.

In the next stage of our analysis, we explore whether DeFi returns exhibit sensitivity to macroeconomic factors typically associated with traditional currencies and commodities. First, we assess the relationship between DeFi index returns and major fiat currencies (Australian Dollar, Canadian Dollar, Euro, Singaporean Dollar, British Pound) to evaluate the notion that DeFi assets might function as alternative mediums of exchange. Despite the strong comovement among these fiat currencies, our results show that DeFi indices display minimal and statistically insignificant exposure to them. The same results are obtained after exposure to the interest rates of the corresponding currencies.

Next, we examine the connection between DeFi returns and precious metals: gold, silver and platinum. Our findings indicate that DeFi indices generally show no meaningful exposure to these commodities.

Then we move to the DeFi-specific factors: classical cryptocurrencies (Bitcoin, Ethereum), momentum, investor attention and platform competition. In summary, the evidence proposes that Bitcoin and Ethereum returns from previous days do not significantly influence the short-term returns of DeFi indices. We show that the evidence for time-series momentum in DeFi indices appears weak and inconsistent with a few statistically significant coefficients emerge at specific horizons.

For the investor attention exposure, we use an approach similar to the Liu and Tsyvinski (2021) and Soiman et al. (2023) papers. Our findings show that the investor's attention drives DeFi returns. We use technical terms such as "decentralized finance" or "DeFi" retrieved from Google Trends.

In addition, we construct the book-to-market ratio for each DeFi index using Total Value Locked (TVL) and Market Capitalization of included protocols. TVL represents the total

amount of assets locked in a DeFi protocol. This valuation ratio does not yield any systematic explanatory power for DeFi indices.

Next, we examine the relationship between DeFi protocols and centralized financial (CeFi) platforms. In particular, we consider the role of Binance, the largest centralized crypto exchange. It offers a wide range of financial services including trading, lending and derivatives markets. In this sense, centralized exchanges can be viewed as competitors to DeFi protocols that aim to provide similar services in a decentralized environment.

To capture the performance of the centralized exchange ecosystem, we use the returns of Binances native token, BNB, as a proxy. The results indicate that lagged BNB returns are negatively associated with returns of several DeFi sector indices at the daily frequency. This pattern is consistent with the presence of competitive dynamics between centralized platforms and decentralized protocols, although the explanatory power of the regressions remains limited.

Finally, we explore whether DeFi returns are associated with the performance of traditional equity industries. Using the FamaFrench 30 industry portfolios, we find limited evidence of industry exposure to DeFi indices. A small number of industries, such as Clothing, exhibit positive associations with some DeFi indices. But the effects are not consistent across sectors or asset classes.

Overall, our main finding is that DeFi index returns are primarily driven by DeFi-specific factors. Also, we observe limited evidence of industry exposure. This suggests that decentralized assets are priced based on a unique set of dynamics. Therefore, DeFi may represent not just an evolution of existing financial systems, but a distinct paradigm with its own valuation mechanisms and risk factors.

The rest of the paper contains the following parts. In Section 2 we briefly present literature review. Section 3 describes the initial data and basic characteristics. Section 4 presents the risk exposure of indices to the traditional assets, and Section 5 delivers the DeFi-specific factors' exposure. Section 6 discusses the industry exposure to the DeFi market. Finally, Section 7 concludes the research.

2 Literature review

Firstly, we used a very popular paper about cryptocurrencies by Liu and Tsyvinski (2021) as a reference point for our analysis. However, DeFi area is not investigated properly now. The first attempt is done by Soiman et al. (2023). The authors construct their own DeFi index (DeFiX) and explore crypto-specific factors' exposure. But this paper does not present comprehensive analysis of risk and return of DeFi. Our paper does.

Secondly, our analysis employs standard empirical asset pricing techniques, the details of which we omit for brevity. Our findings on momentum are connected to a well-established literature, including seminal contributions by Jegadeesh and Titman (1993); as well as more recent work by Asness et al. (2013) and Daniel and Moskowitz (2016), who explore cross-sectional and time-series momentum in traditional asset classes.

Thirdly, our approach also relates to the growing literature on investor attention and behavioral finance. Notably, Da et al. (2011) use Google search volume as a proxy for investor attention, demonstrating its predictive power for asset returns. In the context of cryptocurrencies, Kristoufek (2015) is among the first to examine the empirical behavior of digital assets, drawing attention to their unique return dynamics and investor base. Bennett et al. (2023) introduce the term of Behavioral Finance (BeFi) in DeFi trading.

Then a number of recent studies have documented empirical patterns in cryptocurrency markets. For example, Liu and Tsyvinski (2021) provide evidence of momentum and investor attention effects in Bitcoin. Borri (2019) highlights the high volatility and tail risks associated with crypto assets. Corbet et al. (2019) examine the interconnectedness between cryptocurrencies and traditional financial markets. Additional contributions by Cong et al. (2022) and Zhao et al. (2021) explore the economics of initial coin offerings (ICOs) and blockchain governance.

Theoretical models of cryptocurrencies have also gained traction in recent years. For instance, Schilling and Uhlig (2019), Prat and Walter (2021) propose frameworks to understand the monetary properties and valuation of cryptocurrencies. Other contributions by Chiu and Koeppl (2019), and Makarov and Schoar (2020) extend these models to consider issues such as token liquidity, network effects, and price manipulation. In addition, recent empirical studies such as Zhang et al. (2024) investigate the role of stablecoins in decentralized markets. Also, Cong et al. (2022) explore the implications of decentralized governance and smart contract

design for financial intermediation.

As we can see, DeFi has not been properly studied yet. Our research contributes to this emerging literature by systematically examining the return dynamics, asset pricing exposures, and time-series momentum properties of DeFi indices. While prior work has largely focused on individual tokens or isolated use cases, we provide a broader empirical asset pricing perspective on DeFi as an evolving market segment.

3 Data and Basic Characteristics

Cryptocurrency and DeFi price data series are from the CoinDesk website. Financial data includes market capitalization, daily prices, trading volume information and Total Value Locked. To analyse DeFi returns, we use the relevant price data. The Google search data series is obtained directly from Google Trends. Since we consider emerging technologies, the time period is from October 2020 to April 2025.

We start with presenting main statistical facts and properties. Figures show the statistics of cryptocurrencies and DeFi indices at the daily, weekly and monthly frequencies.

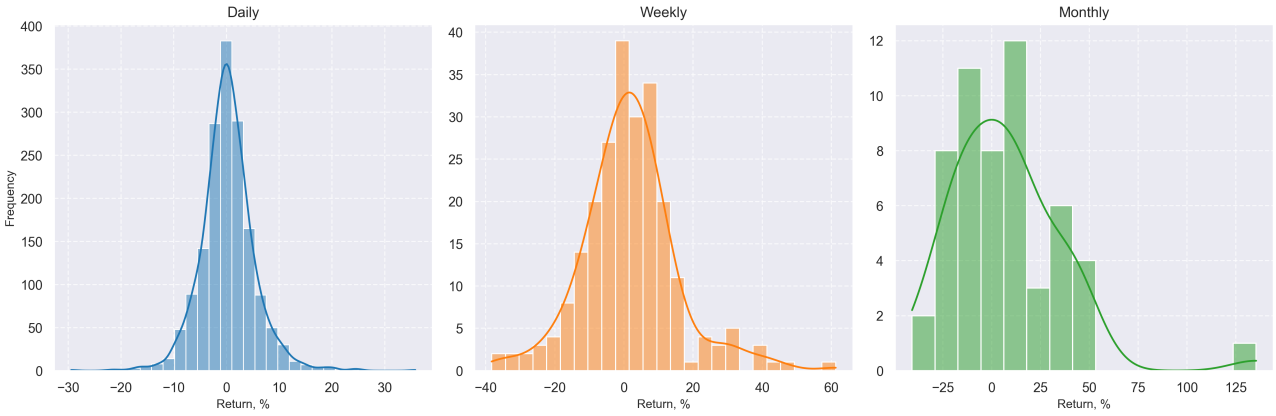

Figure 1: Lending Index Return Distributions. The figure shows right-skewed distributions at all frequencies, with occasional large positive returns (fat tails) evident in the monthly distribution.

Firstly, look at the DeFi asset classes: Lending (Table 2 and Figure 1), DEX (Table 3 and Figure 2) and Derivatives (Table 4 and Figure 3).

The Lending index stands out as the most consistent performer among the three. It has the highest average returns at all time horizons, with daily returns averaging 0.25%, weekly at 1.72%, and monthly at 7.33%. These returns are accompanied by relatively moderate levels of

Table 2: Lending Index Returns Summary Statistics

Lending	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.25%	5.12%	1.95	0.05	0.38	4.11	51.28
Weekly	1.72%	13.82%	1.90	0.12	0.57	2.39	54.04
Monthly	7.33%	29.00%	1.88	0.25	1.60	5.69	56.36

volatility compared to the other indices. We can say that it contributes to Lendings superior risk-adjusted performance. This is reflected in its Sharpe ratios that increase with the time horizon, reaching 0.25 at the monthly level.

In addition, the Lending index demonstrates positive skewness and moderate-to-high kurtosis. It indicates a tendency toward favorable extreme returns. More than half of its return observations are positive, especially at the monthly level, where 56.36% of returns are above zero.

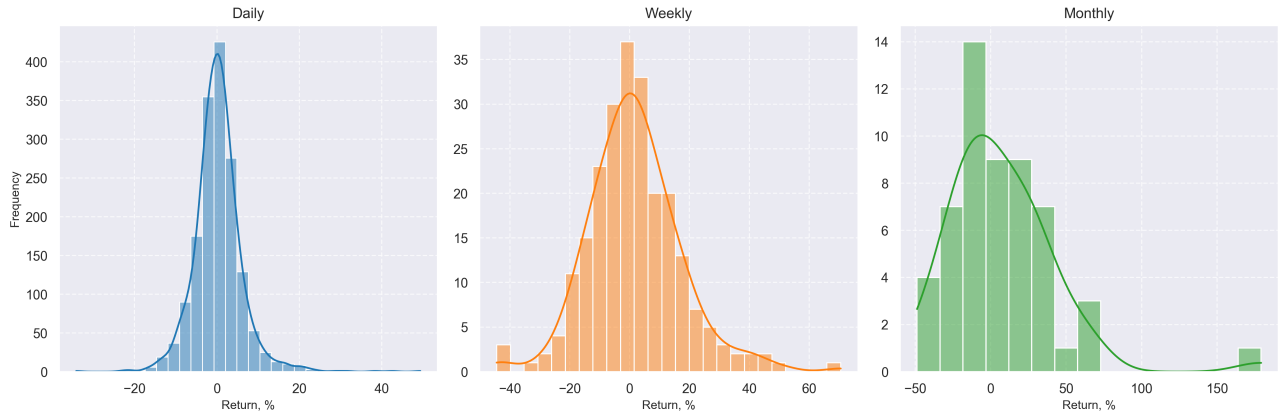

Figure 2: DEX Index Return Distributions. The figure shows right-skewed distributions at all frequencies, with occasional large positive returns (fat tails) evident in the monthly distribution.

Table 3: DEX Index Returns Summary Statistics

DEX	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.25%	5.88%	1.69	0.04	1.01	8.06	50.67
Weekly	1.71%	15.54%	1.69	0.11	0.56	2.18	53.62
Monthly	7.30%	36.25%	1.49	0.20	2.04	8.19	49.09

The DEX index, while similar to Lending in terms of average returns, shows slightly lower performance and higher risk. Its monthly average return is nearly identical to Lendings at 7.30%. But the associated volatility is higher, resulting in a lower Sharpe ratio of 0.20. The

DEX index also exhibits strong positive skewness and notably high kurtosis, especially at the monthly level. It suggests a distribution with more frequent extreme positive returns but also greater tail risk. It is worth noting that the percentage of positive returns for DEX declines at the monthly frequency to below 50%. Furthermore, it means that while large gains are possible, they occur less frequently than losses over longer horizons.

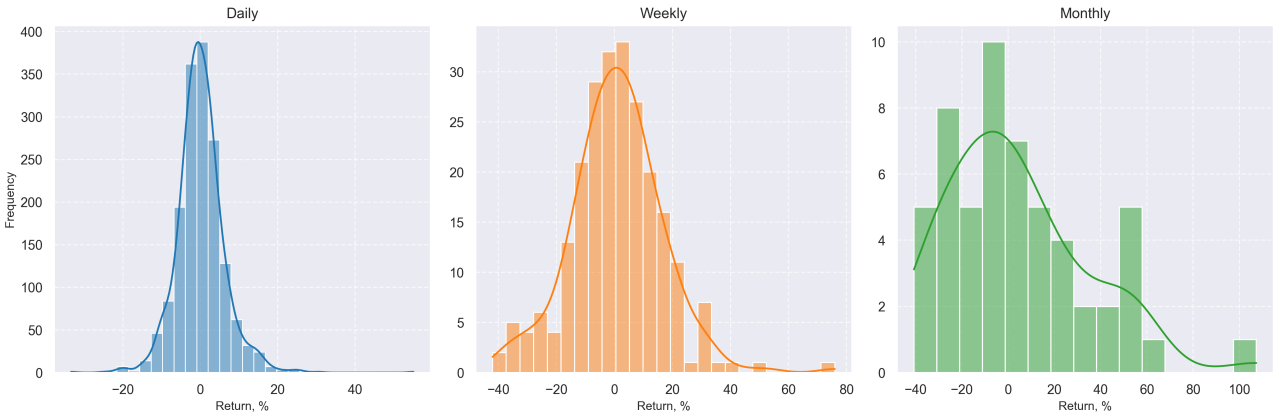

Figure 3: Derivatives Index Return Distributions. The figure shows right-skewed distributions at all frequencies, with occasional large positive returns (fat tails) evident in the monthly distribution.

Table 4: Derivatives Index Returns Summary Statistics

Derivatives	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.12%	6.16%	0.80	0.02	0.66	5.93	48.53
Weekly	0.85%	15.86%	0.82	0.05	0.37	2.19	51.91
Monthly	3.64%	30.58%	0.88	0.12	0.97	1.12	45.45

In contrast, the Derivatives index underperforms both Lending and DEX indices across all dimensions. It has the lowest mean returns — only 0.12% daily and 3.64% monthly. Also, we see the weakest risk-adjusted performance, with Sharpe ratios remaining low and below those of the other indices at all frequencies. The T-statistics for the Derivatives index are also below 1.0, suggesting that its returns are not statistically significant.

Its kurtosis is less extreme at the monthly level, indicating a more symmetrical return distribution with fewer extreme events. But the index does show some positive skewness. Moreover, the percentage of positive returns is lowest for Derivatives. That is especially notable at the monthly level, where fewer than half the observations (45.45%) are positive. So. it underscores its relatively poor performance profile.

Overall, the Lending index appears to offer the most attractive balance of return and risk, with consistently higher Sharpe ratios and positive return frequencies. The DEX index shows potential for high upside (high skewness), but with increased volatility and tail risk. The Derivatives index underperforms on most metrics, with low returns and Sharpe ratios, and a lower likelihood of positive returns.

A more detailed comparison of the DeFi indices to other assets is provided in Appendix A and B.

Table 5 documents the mean, standard deviation, and Sharpe ratios of the returns on different days of the week.

Returns tend to peak on Thursdays across most assets. Similarly to BTC and ETH, Lending and DEX classes perform best on Thursdays, with returns of 0.70% and 0.73%, respectively, and Sharpe ratios of 0.12 and 0.10. Derivatives also follow this pattern, yielding 0.44% with a Sharpe ratio of 0.07.

In contrast, Fridays and Wednesdays often exhibit weaker performance across all DeFi indices. In particular, Derivatives index has the lowest return on these days.

Weekend performance is mixed. While BTC and ETH show moderate returns on Sundays, Saturday returns are generally lower across most crypto and DeFi assets. For example, Lending and DEX sectors show Saturday returns of only 0.07% and 0.34%, with Sharpe ratios of 0.01 and 0.05, respectively. Derivatives, however, slightly outperform on Saturdays with a return of 0.45%, though this is accompanied by higher volatility (SD of 6.33%).

Figure 4 illustrates the cumulative returns of DeFi alongside those of two prominent cryptocurrencies. It is evident that there is a significant correlation between the returns of Bitcoin, Ethereum and the DeFi market. This finding aligns with the research by Corbet et al. (2022).

Throughout this paper, all time-series regressions are estimated via OLS. Given the daily frequency of the data and the potential presence of heteroskedasticity and serial correlation in returns, we report Newey-West HAC standard errors. Significance levels are indicated as follows: *** for 1%, ** for 5%, and * for 10%.

Table 5: Return Summary Statistics by Day of the Week

Day	BTC				ETH			
	Mean	SD	T-Stat	Sharpe	Mean	SD	T-Stat	Sharpe
Monday	0.16%	2.42%	0.99	0.06	0.34%	3.56%	1.48	0.10
Tuesday	0.27%	4.13%	1.00	0.07	0.25%	5.14%	0.75	0.05
Wednesday	0.11%	3.07%	0.57	0.04	-0.11%	3.68%	-0.45	-0.03
Thursday	0.50%	3.74%	2.04	0.13	0.62%	4.82%	1.95	0.13
Friday	-0.08%	3.28%	-0.39	-0.03	-0.11%	4.21%	-0.41	-0.03
Saturday	0.15%	3.39%	0.67	0.04	0.04%	4.21%	0.14	0.01
Sunday	0.13%	1.92%	1.02	0.07	0.28%	2.90%	1.48	0.10
	Lending				DEX			
	Mean	SD	T-Stat	Sharpe	Mean	SD	T-Stat	Sharpe
Monday	0.28%	4.33%	0.99	0.06	0.22%	5.10%	0.67	0.04
Tuesday	0.28%	6.01%	0.71	0.05	0.01%	6.44%	0.03	0.00
Wednesday	0.06%	4.65%	0.18	0.01	-0.00%	5.31%	-0.00	-0.00
Thursday	0.70%	5.98%	1.79	0.12	0.73%	7.13%	1.57	0.10
Friday	0.19%	5.28%	0.54	0.04	0.07%	5.25%	0.19	0.01
Saturday	0.07%	5.11%	0.21	0.01	0.34%	6.57%	0.80	0.05
Sunday	0.15%	4.20%	0.55	0.04	0.34%	4.99%	1.06	0.07
	Derivatives				S&P500			
	Mean	SD	T-Stat	Sharpe	Mean	SD	T-Stat	Sharpe
Monday	0.36%	6.00%	0.93	0.06	0.06%	0.91%	0.99	0.06
Tuesday	0.49%	7.77%	0.96	0.06	0.02%	1.04%	0.29	0.02
Wednesday	-0.43%	5.57%	-1.18	-0.08	0.04%	1.11%	0.62	0.04
Thursday	0.44%	6.79%	0.99	0.07	0.10%	1.08%	1.44	0.09
Friday	-0.49%	5.45%	-1.38	-0.09	0.00%	0.94%	0.04	0.00
Saturday	0.45%	6.33%	1.08	0.07	0.00%	0.00%		
Sunday	0.04%	4.76%	0.12	0.01	0.00%	0.00%		

Note: This table displays the summary statistics for cryptocurrencies, DeFi indices and traditional finance instrument (S&P500) by day of the week.

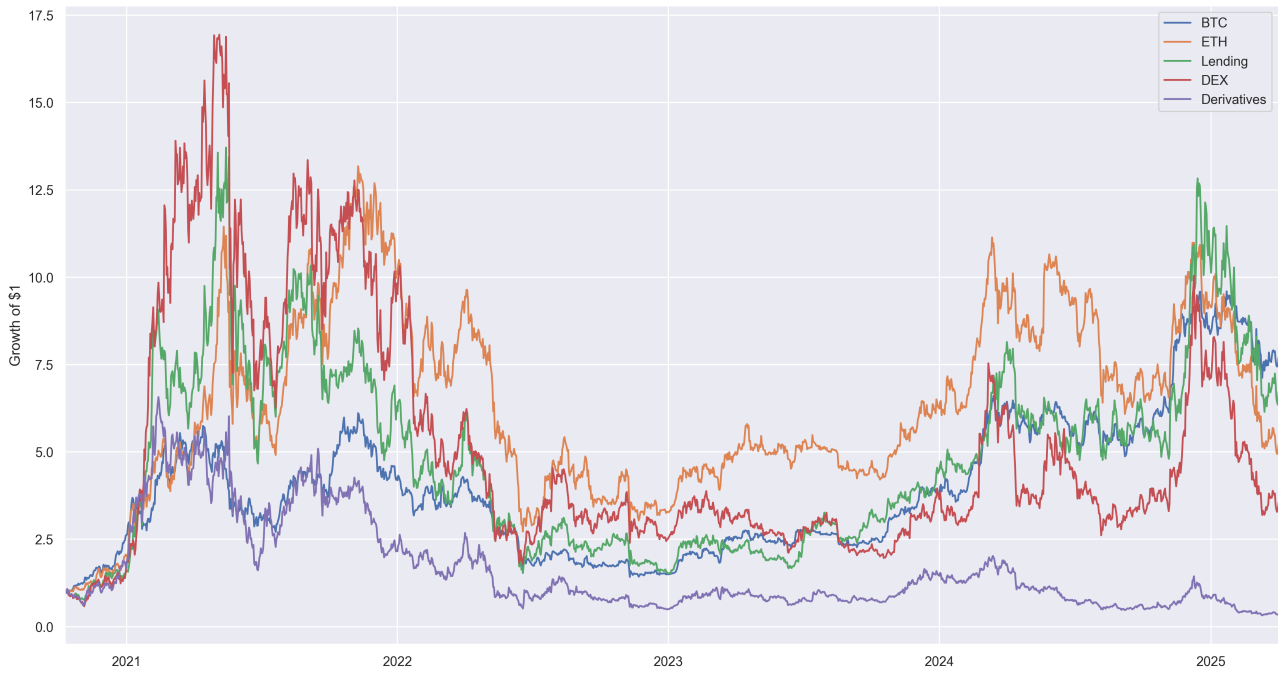

Figure 4: Cumulative Returns by Assets. The figure shows sharp increase in 2021, "crypto winter" in 2022 and further growth since 2024 across all assets.

4 Risk Exposure

In this section, we establish facts on factor loadings and on exposures to stocks, currencies, interest rates and commodities.

All regressions are estimated using daily excess returns expressed in percentage terms. The stock risk factors (CAPM, Fama-French, Carhart) are obtained from the Ken French data library and correspond to daily excess returns. Currency factors are computed as daily differences of spot exchange rates to the USD. Interest rate variables are policy rates.

4.1 Stock Factors Loadings

For the risk factors, we choose the CAPM, Fama-French 3-factor, Carhart 4-factor, Fama-French 5-factor and Fama-French 6-factor models. The alphas for all DeFi classes are positive but statistically insignificant across all considered models.

For Lending results are shown in Table 6. The unconditional alpha is approximately 0.27% per day. The CAPM adjusted alpha remains stable at 0.27%, with a market beta of 0.12 that lacks statistical significance. The beta increases to 0.25 in the 3-factor model but remains statistically insignificant across all specifications.

Note that Lending shows significant negative exposure to the SMB factor, particularly in the

Table 6: Factor Exposures for Lending

(Percentage)	CAPM	3-Fac	4-Fac	5-Fac	6-Fac
ALPHA	0.27	0.26	0.26	0.27	0.27
	(1.92)	(1.79)	(1.79)	(1.90)	(1.90)
Mkt-RF	0.12	0.25	0.21	0.19	0.17
	(0.84)	(1.60)	(1.36)	(1.20)	(1.10)
SMB		-0.34	-0.42	-0.62*	-0.70*
		(-1.57)	(-1.84)	(-2.38)	(-2.54)
HML		0.24	0.24	0.54	0.48
		(1.30)	(1.32)	(1.94)	(1.75)
MOM			-0.24		-0.24
			(-1.88)		(-1.83)
RMW				-0.63*	-0.65*
				(-2.15)	(-2.20)
CMA				-0.29	-0.10
				(-0.75)	(-0.26)
R-Squared	0.00	0.00	0.01	0.01	0.01

5-factor and 6-factor models (-0.62 and -0.70 respectively). It can be guessed that that Lending comoves more with large-cap rather than small-cap firms. The exposure to the RMW factor is consistently negative and statistically significant at -0.63 to -0.65, indicating that Lending returns tend to comove more with low-profit rather than high-profit entities.

Table 7: Factor Exposures for DEX

(Percentage)	CAPM	3-Fac	4-Fac	5-Fac	6-Fac
ALPHA	0.17	0.15	0.15	0.16	0.16
	(1.12)	(0.94)	(0.95)	(1.04)	(1.04)
Mkt-RF	-0.03	0.19	0.14	0.09	0.07
	(-0.17)	(1.04)	(0.76)	(0.48)	(0.37)
SMB		-0.53*	-0.65**	-0.80**	-0.90**
		(-2.39)	(-2.72)	(-2.97)	(-3.21)
HML		0.45*	0.44*	0.87**	0.79*
		(2.02)	(2.14)	(2.68)	(2.51)
MOM			-0.35*		-0.31
			(-2.30)		(-1.90)
RMW				-0.55	-0.58
				(-1.58)	(-1.68)
CMA				-0.72	-0.48
				(-1.55)	(-1.00)
R-Squared	0.00	0.01	0.01	0.01	0.02

As for DEX (Table 7), the unconditional alpha is lower at 0.17%, decreasing slightly to 0.15% in the 3-factor and 4-factor models. None of these alpha estimates are statistically significant.

The market beta switches from negative (-0.03) in CAPM to positive in other specifications but remains statistically insignificant. Similar to the Lending sector, this indicates limited exposure to broad equity market movements.

The DEX index exhibits stronger negative exposure to the SMB factor (-0.53 to -0.90) and significant positive exposure to the HML factor (0.44 to 0.87). It suggests that DEX returns comove more with value than growth firms. The momentum factor is negative and significant in the four-factor model, although this effect weakens once additional factors are included. Exposures to profitability and investment factors are negative but statistically insignificant.

Table 8: Factor Exposures for Derivatives

(Percentage)	CAPM	3-Fac	4-Fac	5-Fac	6-Fac
ALPHA	0.07	0.05	0.05	0.07	0.07
	(0.43)	(0.31)	(0.32)	(0.43)	(0.44)
Mkt-RF	0.04	0.22	0.17	0.15	0.13
	(0.22)	(0.90)	(0.67)	(0.64)	(0.53)
SMB		-0.51	-0.62	-0.94*	-1.06*
		(-1.59)	(-1.94)	(-2.19)	(-2.46)
HML		0.32	0.32	0.71	0.61
		(1.22)	(1.24)	(1.94)	(1.68)
MOM			-0.35		-0.38
			(-1.78)		(-1.90)
RMW				-1.00*	-1.03*
				(-2.19)	(-2.25)
CMA				-0.22	0.07
				(-0.47)	(0.16)
R-Squared	0.00	0.00	0.01	0.01	0.02

In Table 8, Derivatives show the lowest alphas at 0.07 percent, remaining consistent across specifications. The market beta remains small and statistically insignificant across all models, ranging from 0.04 to 0.13. As with the other sectors, this indicates limited sensitivity to aggregate equity market risk.

They demonstrate the strongest negative exposure to the SMB factor (-1.06 in the 6-factor model) and significant negative exposure to the RMW factor (-1.00 to -1.03 in 5-factor and 6-factor models). It suggests that derivatives-related returns are associated with firms exhibiting lower profitability. The exposures to other factors, including momentum and CMA, are generally imprecisely estimated across all three indices.

The R-squared values are notably low across all specifications and classes (ranging from 0.00

to 0.02), indicating that traditional factor models explain only a small portion of the variation in DeFi returns.

4.2 Currency Factors Loadings

The currency factors are constructed as the daily returns of major currencies relative to the US dollar. For our analysis, we consider five major currencies: Australian Dollar, Canadian Dollar, Euro, Singaporean Dollar, and UK Pound. The respective notation in tables is the following: AUD, CAD, EUR, SGD, GBP.

For Lending in Table 9 the alpha remains relatively stable at around 0.25% with t-statistics around 2.0. This suggests that Lending returns exhibit a small positive average return that is not explained by currency movements.

Table 9: Currency Exposures for Lending

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.25*	0.25*	0.25*	0.25*	0.25*
	(2.03)	(2.03)	(2.01)	(2.00)	(2.00)
AUD	33.20				
	(1.29)				
CAD		61.97			
		(1.60)			
EUR			22.81		
			(0.66)		
SGD				33.29	
				(0.57)	
GBP					16.62
					(0.52)
R-Squared	0.00	0.00	0.00	0.00	0.00

The estimated currency exposures themselves are not statistically significant. These results indicate that Lending returns display no meaningful sensitivity to exchange rate fluctuations.

The alpha for the DEX index maintains stability at approximately 0.25% (Table 10) and remains statistically insignificant across all specifications, with t-statistics around 1.7.

All estimated currency exposures are statistically insignificant. The coefficients vary in sign and magnitude across currencies, but none of the estimates are precisely estimated. For example, the SGD coefficient appears relatively large in absolute value (-60.39), yet its t-statistic remains far from statistical significance. The results suggest that DEX returns are

largely unrelated to exchange rate movements.

Table 10: Currency Exposures for DEX

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.25	0.25	0.25	0.25	0.25
	(1.76)	(1.78)	(1.76)	(1.77)	(1.76)
AUD	-7.60				
	(-0.25)				
CAD		21.38			
		(0.50)			
EUR			-13.82		
			(-0.35)		
SGD				-60.39	
				(-0.89)	
GBP					-20.19
					(-0.57)
R-Squared	0.00	0.00	0.00	0.00	0.00

Derivatives in Table 11 display the lowest alpha at around 0.12%, which remains statistically insignificant across all specifications.

As with the other sectors, none of the currency exposures are statistically significant. The estimated coefficients vary across currencies but remain imprecisely estimated, with t-statistics well below conventional significance thresholds.

Table 11: Currency Exposures for Derivatives

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.12	0.12	0.12	0.12	0.12
	(0.83)	(0.84)	(0.82)	(0.83)	(0.83)
AUD	-5.11				
	(-0.17)				
CAD		12.68			
		(0.27)			
EUR			-34.18		
			(-0.84)		
SGD				-33.01	
				(-0.49)	
GBP					-32.27
					(-0.90)
R-Squared	0.00	0.00	0.00	0.00	0.00

Across all three index categories, the R-squared values remain at 0.00. It suggests that currency factors alone explain very little of the variation in DeFi index returns. The indices exposure consistently remains insignificant across all indices and specifications.

Overall, these results suggest that DeFi sector returns do not exhibit systematic exposure to major currency movements and appear largely independent from traditional foreign exchange risk factors.

4.3 Rates Factors Loadings

Now we want to explore foreign interest rates exposure of our indices. We construct interest rate factors using policy rates of the central banks corresponding to the currencies analyzed in Section 4.2. Specifically, we consider the policy rates for Australia, Canada, the Euro area, Singapore, and the United Kingdom. Each regression includes the policy rate of one country to assess whether DeFi sector returns respond systematically to foreign interest rate changes. The results reveal that our indices exhibit minimal sensitivity to changes in foreign interest rates.

Table 12: Rates Exposures for Lending

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.32	0.33	0.27	0.31	0.31
	(1.29)	(1.26)	(1.23)	(1.18)	(1.28)
AUD	-0.03				
	(-0.43)				
CAD		-0.03			
		(-0.45)			
EUR			-0.01		
			(-0.18)		
SGD				-0.03	
				(-0.34)	
GBP					-0.02
					(-0.41)
R-Squared	0.00	0.00	0.00	0.00	0.00

For the Lending index (Table 12), the estimated coefficients on the interest rates are small in magnitude and statistically insignificant across all model specifications. The t-statistics associated with these coefficients are well below conventional thresholds for statistical significance. Furthermore, the R-squared values are consistently zero across all columns, suggesting that the variation in interest rates explains none of the variation in the Lending index.

The results for the DEX sector are shown in Table 13. The estimated alpha is somewhat higher than in the Lending sector, ranging from 0.37% to 0.43% per day. Although these estimates remain statistically insignificant.

Table 13: Rates Exposures for DEX

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.42	0.42	0.37	0.39	0.43
	(1.55)	(1.47)	(1.52)	(1.37)	(1.60)
AUD	-0.07				
	(-0.90)				
CAD		-0.06			
		(-0.85)			
EUR			-0.06		
			(-0.76)		
SGD				-0.07	
				(-0.71)	
GBP					-0.07
					(-0.97)
R-Squared	0.00	0.00	0.00	0.00	0.00

The estimated interest rate exposures are slightly larger in magnitude than those for Lending but remain economically small and statistically insignificant. All estimated coefficients are negative, ranging from approximately -0.06 to -0.07 across currencies, and their associated t-statistics remain well below conventional significance thresholds. As with the Lending sector, the R^2 values remain equal to zero. It indicates that foreign interest rates explain virtually none of the variation in DEX returns.

Table 14: Rates Exposures for Derivatives

(Percentage)	(1)	(2)	(3)	(4)	(5)
ALPHA	0.29	0.23	0.23	0.24	0.27
	(1.02)	(0.80)	(0.90)	(0.82)	(0.99)
AUD	-0.07				
	(-0.85)				
CAD		-0.04			
		(-0.54)			
EUR			-0.05		
			(-0.67)		
SGD				-0.05	
				(-0.57)	
GBP					-0.05
					(-0.80)
R-Squared	0.00	0.00	0.00	0.00	0.00

The Derivatives index also shows very limited exposure to foreign interest rates (Table 14). The estimated coefficients are generally close to zero and statistically insignificant, with low t-statistics across all specifications. As with the other two indices, the R-squared values are

zero. It reinforces the conclusion that foreign interest rate movements have no explanatory power for the returns of the Derivatives index.

We conclude that there is no consistent evidence of systematic foreign rates exposures in the DeFi market.

4.4 Precious Metals Factors Loadings

In this section, we examine whether DeFi sector returns exhibit exposure to precious metals. Here for the risk factors, we choose gold, platinum and silver. Tables 15 through 17 present the commodity exposures of the Lending, DEX, and Derivatives DeFi indices.

Note that the alphas are stable across all specifications and marginally statistically significant only for the Lending index.

Table 15: Commodity Exposures for Lending

(Percentage)	(1)	(2)	(3)
ALPHA	0.24*	0.24*	0.24*
	(1.97)	(1.98)	(1.97)
GOLD	7.84		
	(0.45)		
PLATINUM		15.74	
		(1.62)	
SILVER			11.99
			(1.49)
R-Squared	0.00	0.00	0.00

For the Lending sector (Table 15), the estimated alpha remains stable at approximately 0.24% per day and is marginally statistically significant with t-statistics around 2.0.

The estimated exposures to gold, platinum, and silver are all positive but statistically insignificant. Although the coefficients for platinum and silver appear somewhat larger in magnitude (15.74 and 11.99 respectively), their t-statistics remain below conventional significance thresholds. This indicates that Lending returns do not exhibit systematic comovement with precious metals prices.

The results for the DEX sector are presented in Table 16. The estimated alpha remains stable at approximately 0.25% per day across all specifications but is not statistically significant.

The estimated commodity exposures vary in sign and magnitude but remain statistically insignificant. Gold and silver exhibit negative coefficients, while platinum displays a coefficient

Table 16: Commodity Exposures for DEX

(Percentage)	(1)	(2)	(3)
ALPHA	0.25	0.25	0.25
	(1.78)	(1.76)	(1.77)
GOLD	-9.97		
	(-0.45)		
PLATINUM		0.68	
		(0.06)	
SILVER			-4.28
			(-0.42)
R-Squared	0.00	0.00	0.00

close to zero. None of the t-statistics approach conventional significance levels, suggesting that DEX returns are largely unrelated to movements in precious metals markets.

Table 17: Commodity Exposures for Derivatives

(Percentage)	(1)	(2)	(3)
ALPHA	0.12	0.12	0.12
	(0.81)	(0.82)	(0.82)
GOLD	9.11		
	(0.45)		
PLATINUM		12.66	
		(1.09)	
SILVER			4.86
			(0.49)
R-Squared	0.00	0.00	0.00

For the Derivatives index (Table 17), none of the commodity exposures are statistically significant. The estimated exposures to gold, platinum, and silver are positive but statistically insignificant. As a result, there is no evidence that derivatives-related DeFi returns are systematically related to precious metals prices.

Across all three sectors, the R^2 values remain effectively zero, indicating that precious metals provide no explanatory power for DeFi sector returns. These findings suggest that DeFi markets operate largely independently from traditional commodity markets. Similar results are reported by Liu and Tsyvinski (2021), who also find limited exposure of crypto-related assets to traditional commodity risk factors.

5 DeFi-Specific Factors

This section presents the DeFi-specific factors, including major cryptocurrencies such as Bitcoin and Ethereum, momentum indicators, investor attention, and the performance of competing protocols. Additionally, we construct a book-to-market ratio for each DeFi index by comparing the Total Value Locked to the Market Capitalization of the constituent protocols.

Table 18: Pearson Correlations between DeFi Indices and Cryptocurrencies

	Lending	DEX	Derivatives	BTC	ETH
Lending	1.00	0.77	0.75	0.65	0.79
DEX	0.77	1.00	0.69	0.61	0.72
Derivatives	0.75	0.69	1.00	0.59	0.69
BTC	0.65	0.61	0.59	1.00	0.80
ETH	0.79	0.72	0.69	0.80	1.00

Before carrying out a regression analysis, we study the correlation between classical cryptocurrencies and DeFi. The Pearson correlation matrix is shown in Table 18. The results show strong positive correlations among the DeFi indices themselves, with the highest correlation observed between Lending and DEX (0.77), followed closely by Lending and Derivatives (0.75), and DEX and Derivatives (0.69). The findings suggest that while DeFi indices move together closely, they are also linked to broader cryptocurrency market movements, particularly those of Ethereum. Indeed, the correlation coefficient for ETH is higher across all DeFi indices. This is consistent with the central role of Ethereum in the DeFi ecosystem (Celeste et al. (2020)).

5.1 Bitcoin and Ethereum

To start the analysis of DeFi exposure in the cryptocurrency market, we first assess the impact and influence of Bitcoin and Ethereum. The goal is to evaluate whether past movements in major cryptocurrencies can explain subsequent DeFi index returns.

Prior literature suggests a potential link between Ethereum and the growth of decentralized finance. In particular, Celeste et al. (2020) document a relationship between the success of Ethereum and the expansion of platforms built on the Ethereum network. Since a large share of DeFi protocols are deployed on Ethereum, it is plausible that movements in ETH could contain information related to the performance of DeFi assets.

To investigate this relationship, we regress DeFi index returns on lagged Bitcoin and Ethereum returns at horizons $t-1$ and $t-2$ (daily data). The results can be found in Table 19. These regressions are estimated in-sample and therefore should be interpreted as identifying associations rather than establishing true predictive relationships.

Table 19: Cryptocurrencies Exposures for DeFi Indices

	Lending		DEX		Derivatives	
	(1) BTC	(2) ETH	(1) BTC	(2) ETH	(1) BTC	(2) ETH
ALPHA	0.26*	0.26*	0.26	0.26	0.13	0.13
	(2.06)	(2.02)	(1.82)	(1.79)	(0.88)	(0.90)
BTC_{t-1}	-10.25*		-7.01		-2.33	
	(-2.11)		(-1.40)		(-0.47)	
BTC_{t-2}	2.56		0.65		-1.88	
	(0.53)		(0.12)		(-0.31)	
ETH_{t-1}		-9.79*		-7.86*		-4.37
		(-2.28)		(-2.16)		(-0.93)
ETH_{t-2}		3.51		2.67		-1.15
		(0.79)		(0.53)		(-0.24)
R-Squared	0.00	0.01	0.00	0.00	0.00	0.00

Note: This table reports regressions of DeFi index returns on lagged cryptocurrency returns. Significance levels are *** for 1%, ** for 5%, and * for 10%.

For the Lending index, lagged cryptocurrency returns display some statistically significant associations. The coefficient on BTC_{t-1} is negative and statistically significant, suggesting that higher Bitcoin returns on the previous day are associated with lower Lending returns on the following day. A similar pattern appears for Ethereum, where the coefficient on ETH_{t-1} is also negative and statistically significant. However, the second lag $t-2$ is not statistically significant in either case, indicating that any relationship is short-lived.

As for the DEX index, the results show a weaker relationship. The coefficient on ETH_{t-1} is negative and statistically significant. The Bitcoin coefficients are statistically insignificant. As with the Lending index, the second lag of cryptocurrency returns does not display a meaningful association with DeFi returns.

None of the lagged cryptocurrency returns are statistically significant for the Derivatives index. Both Bitcoin and Ethereum coefficients remain close to zero and imprecisely estimated. It suggests that past movements in major cryptocurrencies are not strongly associated with derivatives-related DeFi returns.

The R-squared values are effectively zero in all models, suggesting that past returns of

Bitcoin and Ethereum explain virtually none of the variation in DeFi index returns. This implies that lagged returns of major cryptocurrencies do not provide information about DeFi market movements. That is despite the high contemporaneous correlations observed earlier.

In summary, the evidence proposes that Bitcoin and Ethereum returns from previous dats do not significantly influence the short-term returns of DeFi indices. It highlights the limited explanatory spillover from major cryptocurrencies to DeFi in the examined time frame.

5.2 DeFi Momentum

We next want to establish a momentum factor for DeFi indices at various time horizons. That is, whether past returns are associated with future returns. Time-series momentum has been widely documented across asset classes, including equities, commodities, and currencies (Jegadeesh and Titman (1993); Moskowitz and Grinblatt (1999); Asness et al. (2013)).

To investigate this relationship, we estimate regressions of future returns on the current return at several horizons. Specifically, we regress R_{t+h} on R_t for multiple daily and weekly horizons h.

Table 20: Lending Momentum Regressions

Panel A: Daily	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}	R_{t+5}	R_{t+6}	R_{t+7}
R_t	-0.03	0.00	-0.01	0.03	-0.04	0.06	0.01
	(-0.94)	(0.02)	(-0.18)	(1.08)	(-1.11)	(1.77)	(0.46)
R-Squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: Weekly	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}			
R_t	0.02	0.03	0.01	0.10			
	(0.17)	(0.61)	(0.09)	(1.37)			
R-Squared	0.00	0.00	0.00	0.01			

Table 20 represents the time-series momentum for Lending index. The daily analysis examines whether todays return R_t can predict future returns over the next seven days. For daily returns, none of the coefficients are statistically significant at conventional levels. T-statistic remains below the conventional threshold for statistical significance.

For weekly returns, the current return is not statistically significant for future returns. The explanatory power of the regressions remains negligible, with R^2 values close to zero. Overall, the results provide little evidence of a consistent momentum pattern for the Lending index.

Table 21: DEX Momentum Regressions

Panel A: Daily	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}	R_{t+5}	R_{t+6}	R_{t+7}
R_t	-0.06*	0.02	-0.02	0.05	-0.06	0.05	0.00
	(-2.18)	(0.68)	(-0.76)	(1.52)	(-1.53)	(1.65)	(0.01)
R-Squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: Weekly	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}			
R_t	0.01	0.16	0.06	0.13			
	(0.07)	(1.67)	(0.73)	(1.74)			
R-Squared	0.00	0.02	0.00	0.02			

Table 21 represents the time-series momentum for the DEX index. For daily returns, the current return statistically significantly predicts 1-day ahead return. For longer horizons, the coefficients vary in sign and are statistically insignificant.

At the weekly frequency, the estimated coefficients are positive for several horizons but remain statistically insignificant. As in the case of the Lending index, the explanatory power of the regressions is extremely limited.

Table 22: Derivatives Momentum Regressions

Panel A: Daily	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}	R_{t+5}	R_{t+6}	R_{t+7}
R_t	-0.01	-0.04	-0.01	0.03	-0.04	0.01	-0.01
	(-0.25)	(-1.25)	(-0.49)	(0.97)	(-1.37)	(0.36)	(-0.40)
R-Squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: Weekly	R_{t+1}	R_{t+2}	R_{t+3}	R_{t+4}			
R_t	-0.06	0.06	0.01	0.13**			
	(-0.81)	(0.82)	(0.13)	(2.70)			
R-Squared	0.00	0.00	0.00	0.02			

Table 22 presents the time-series momentum for Derivatives index. For daily returns, none of the coefficients are statistically significant, and the estimates fluctuate around zero.

For weekly returns, the current return statistically significantly predicts only 4-week ahead return. In concrete terms, buying the Derivatives index at 11:59:59 UTC today and selling it at 11:59:59 UTC four weeks later results in a positive expected return of 0.13 percent due to momentum effects. However, the remaining weekly coefficients are statistically insignificant, indicating that this result is isolated rather than systematic.

Across all indices and horizons, the R^2 values remain extremely low, suggesting that past returns explain only a negligible fraction of the variation in future DeFi returns.

Overall, the evidence for time-series momentum in DeFi indices appears weak and inconsistent. While a few statistically significant coefficients emerge at specific horizons, the results do not reveal a robust or systematic momentum pattern.

5.3 Investor Attention

The influence of investor attention on financial market characteristics has been substantiated in both conventional markets and cryptocurrency markets. Among them are liquidity, returns and volatility. This hypothesis was proved in various studies: Andrei and Hasler (2015), Ciaian et al. (2016), Lin (2021), Liu et al. (2022). Usually investor attention can be driven by their overreaction to the news associated with the assets. Consequently, it may be a key part of market mispricing (Baker and Wurgler (2007), Shiller (2000), Andrei and Hasler (2015)).

In order to evaluate how investor attention affects DeFi returns, we use a method similar to the one described in the well-known paper by Liu and Tsyvinski (2021). Specifically, we create proxies for investor attention based on Google search data. For this purpose, we retrieved the number of Google searches related to DeFi using relevant keywords: "defi" and "decentralized finance". The last one is denoted by "$dcfn$". When considering the distinctive characteristics of the DeFi market, we chose these two keywords. Remind that DeFi is short for decentralized finance. Although terms such as "decentralization" and "decentralized finance" are commonly linked to blockchain and cryptocurrencies, DeFi platforms are the only technology that makes full financial decentralization possible.

The second keyword broadly refers to all tokens associated with DeFi platforms. We assume that while general blockchain-aware investors are familiar with the term "decentralized finance", while only more informed investors recognize and understand the abbreviation "DeFi".

Note that investor interest in a particular asset may not translate into immediate investment action. Therefore, we conduct our analysis using various time lags ranging from one to three weeks to account for the potential delay between an investor's initial interest (as captured by Google search activity) and their actual investment decision.

Results are shown in Table 23. Because Google Trends data are available at weekly frequency, the analysis is conducted using weekly aggregated returns.

The regression results indicate that investor attention, measured by lagged values of $dcfn$,

Table 23: Investor Attention

	Lending	DEX	Derivatives
ALPHA	7.10**	6.14*	6.25*
	(3.12)	(2.07)	(2.30)
$DeFi_{t-1}$	-0.12	-0.19	-0.19
	(-0.65)	(-0.85)	(-1.02)
$DeFi_{t-2}$	0.17	0.39	0.26
	(0.51)	(0.96)	(0.73)
$DeFi_{t-3}$	0.11	-0.01	0.12
	(0.50)	(-0.04)	(0.52)
$dcfn_{t-1}$	-0.11	-0.24*	-0.04
	(-1.33)	(-2.45)	(-0.53)
$dcfn_{t-2}$	-0.07	0.07	-0.10
	(-0.89)	(0.65)	(-1.22)
$dcfn_{t-3}$	-0.21*	-0.25*	-0.29**
	(-2.25)	(-2.10)	(-3.00)
R-Squared	0.07	0.07	0.07

Note: Significance levels are *** for 1%, ** for 5%, and * for 10%.

is negatively associated with subsequent returns in several DeFi sectors. In particular, the third lag of investor attention is negative and statistically significant across Lending, DEX, and Derivatives. This pattern suggests that periods of heightened attention tend to be followed by lower returns in the following weeks. The magnitude of this association is strongest in the Derivatives sector. In addition, the first lag of investor attention is negative and statistically significant for the DEX index.

Therefore, the results are consistent with the interpretation that increased investor attention may coincide with short-term overvaluation or heightened speculative interest, which is followed by weaker subsequent performance.

5.4 Valuation Ratio

In this section, we explore whether the "book-to-market" ratio specific to the DeFi market can be used to forecast returns in DeFi.

The traditional book-to-market ratio in the stock market estimates the relationship between a company's book value and its market value. The book value refers to the accounting data, calculated as the total value of assets minus total liabilities. The market value is determined by multiplying the market price of a single share by the total number of shares outstanding.

While market value is readily observable for both stocks and cryptocurrencies, there is no direct equivalent of book value for cryptocurrencies. To address this, Cong et al. (2022) introduce a fundamental-to-value ratio for cryptocurrencies, defined as the number of users divided by Market Capitalization (MC). The author finds that this ratio negatively predicts future returns. Similarly, there is no a standardized book value measure for DeFi. However, Corbet et al. (2022) suggests that Total Value Locked serves as a useful indicator of DeFi platform success. TVL represents the total amount of assets committed to a DeFi protocol and can be interpreted as a reflection of its intrinsic value. As more users join and transact on these platforms, TVL increases, signalling network growth. This view aligns with Cong et al. (2022), who argue that token valuation is driven in part by expected network expansion tied to platform productivity. Based on this, we adopt TVL as a proxy for the "book" value of DeFi tokens.

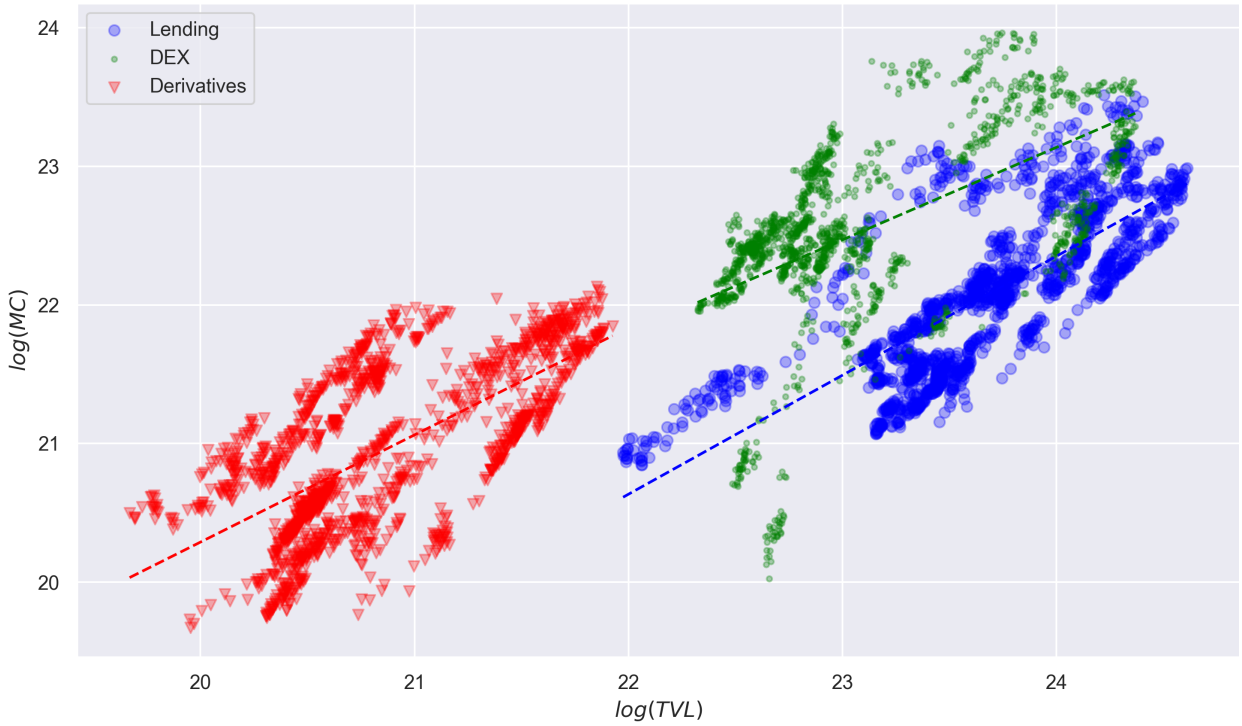

Figure 5: The relationship between DeFis market capitalization log. MC and log. TVL. This suggests that the bigger the market capitalization is, the bigger the TVL.

Before calculating the valuation ratio, we examine whether the market assesses the value of DeFi tokens based on their locked intrinsic value (i.e., TVL). To do this, we plot the logarithm of MC against the logarithm of TVL. The graph is in Figure 5. Our analysis reveals a linear relationship between these two variables, indicating that DeFi tokens with higher TVL tend to

have higher Market Capitalization.

Then to create the book-to-market ratio for the DeFi market, we divide the Total Value Locked by the Market Capitalization. This ratio can be interpreted as an analogue to the book-to-market ratio commonly used in traditional asset pricing This results in the TVL-to-MC ratio valuation, which we then assess for its ability to explain returns on DeFi tokens. We use regression for each index using weekly data. We look at the four weekly lags to catch the role of our ratios, since we do not imply any assumptions on the time horizon.

Table 24: Valuation Ratio TVL/MC

	Lending	DEX	Derivatives
ALPHA	6.19	-0.82	-3.19
	(1.60)	(-0.43)	(-1.26)
$ValuationRatio_{t-1}$	-2.13	-1.28	23.30*
	(-1.28)	(-0.34)	(2.01)
$ValuationRatio_{t-2}$	2.32	0.79	-30.35**
	(0.96)	(0.20)	(-3.22)
$ValuationRatio_{t-3}$	0.02	-1.03	-4.59
	(0.01)	(-0.21)	(-0.27)
$ValuationRatio_{t-4}$	-1.03	2.71	15.80
	(-0.74)	(0.84)	(1.67)
R-Squared	0.02	0.04	0.06

Note: Significance levels are *** for 1%, ** for 5%, and * for 10%.

The results are presented in Table 24. Overall, the valuation ratio does not exhibit a systematic relationship with returns across the DeFi sectors. For the Lending and DEX indices, none of the lagged valuation ratios are statistically significant.

For the Derivatives index, two coefficients are statistically significant. The first lag of the valuation ratio is positive and significant, while the second lag is negative and significant. However, these effects do not follow a consistent pattern across sectors or across lags. This limits the strength of the interpretation.

Taken together, we conclude that index returns are not driven by our ratios. This finding is broadly consistent with Soiman et al. (2023), who also report limited explanatory power of valuation metrics for the aggregated DeFiX index.

Note that unlike traditional financial markets, where valuation data such as the book-to-market ratio is updated on a monthly basis (see Ball et al. (2020), Pontiff and Schall (1998)), in cryptocurrency and DeFi markets financial information is available in real time. Because

blockchain data are publicly observable, metrics such as Total Value Locked can be updated continuously. Consequently, it may reduce the informational content of valuation ratios in these markets.

Given that the analysis is conducted in-sample and without out-of-sample validation, these results should be interpreted as descriptive associations rather than evidence of predictive relationships.

5.5 Platform Competition

An important feature of the cryptocurrency ecosystem is the coexistence of CeFi platforms and DeFi protocols. While DeFi applications aim to replace traditional financial intermediaries through blockchain-based smart contracts, centralized platforms continue to provide many of the same financial services. Among them are trading, lending and derivatives markets.

The interaction between these two models can be interpreted through the broader literature on FinTech competition and platform ecosystems. Prior research shows that digital platforms compete by offering overlapping financial services while benefiting from network effects and user liquidity (Vives (2019); Chen and Bellavitis (2020)). In the cryptocurrency context, centralized exchanges play a particularly important role as multi-sided platforms that facilitate trading, lending, and derivatives activity. At the same time, DeFi protocols attempt to replicate these services in a decentralized manner using automated market mechanisms and smart contracts.

For example, decentralized exchanges such as Uniswap (included in the DEX index) aim to provide an alternative to centralized exchanges like Binance or ByBit (Lehar and Parlour (2025)). Similarly, derivatives protocols such as Perpetual Protocol seek to compete with centralized derivatives exchanges including Deribit and Binance (Shah et al. (2023)). These examples suggest that many DeFi applications directly compete with services offered by centralized platforms.

To capture the performance of the centralized exchange ecosystem, we focus on Binance, the largest global cryptocurrency exchange. Binance provides a wide range of financial services including spot trading, derivatives markets, and crypto lending products ("Binance Loans"). Its native token, BNB, reflects the overall performance and activity of the Binance platform. Therefore, BNB returns can serve as a proxy for the performance of centralized financial services

within the cryptocurrency ecosystem.

Table 25: Binance Platform as a Competitor

Panel A: Daily			
	Lending	DEX	Derivatives
BNB_{t-1}	-0.13**	-0.12*	-0.08
	(-2.72)	(-2.36)	(-1.67)
BNB_{t-2}	0.02	0.05	-0.00
	(0.63)	(0.91)	(-0.08)
BNB_{t-3}	-0.03	-0.02	-0.00
	(-0.54)	(-0.33)	(-0.09)
BNB_{t-4}	-0.00	-0.03	-0.03
	(-0.08)	(-0.41)	(-0.41)
BNB_{t-5}	-0.09	-0.13*	-0.07
	(-1.66)	(-1.97)	(-1.28)
BNB_{t-6}	-0.02	-0.03	-0.02
	(-0.63)	(-0.65)	(-0.46)
BNB_{t-7}	-0.03	-0.05	-0.06
	(-0.62)	(-0.92)	(-0.92)
R-squared	0.02	0.03	0.01
Panel B: Weekly			
	Lending	DEX	Derivatives
BNB_{t-1}	-0.05	-0.08	-0.10
	(-0.90)	(-1.17)	(-0.93)
BNB_{t-2}	-0.02	0.08	-0.05
	(-0.20)	(1.05)	(-0.60)
BNB_{t-3}	0.07	0.10	0.01
	(0.94)	(1.35)	(0.14)
BNB_{t-4}	-0.01	0.02	0.03
	(-0.18)	(0.24)	(0.40)
R-squared	0.01	0.01	0.01

Note: Significance levels are *** for 1%, ** for 5%, and * for 10%.

Table 25 presents the results of regressions of DeFi sector returns on lagged returns of Binances native token BNB. Panel A reports daily regressions using seven lags of BNB returns.

The results show that BNB returns have statistically significant negative predictive power for both the Lending and DEX indices at short horizons. Specifically, the first lag of BNB return is negatively associated with returns in the Lending and DEX sectors, significant at the 5% and 10% levels, respectively. This suggests that positive performance of the Binance token tends to precede weaker performance in competing DeFi sectors, consistent with a competitive

dynamic between centralized platforms like Binance and decentralized protocols. Additionally, the fifth lag of BNB return is also negatively and significantly associated with DEX returns, reinforcing the inverse relationship. In contrast, the Derivatives index shows no statistically significant relationship with BNB returns at any lag.

Panel B presents weekly regressions with four lags of BNB returns. While the coefficients are generally negative for Lending and Derivatives, and mixed for DEX, none of the estimates are statistically significant.

Overall, the findings indicate that BNB returns contain short-term modest association with DeFi sector performance at the daily frequency, particularly for Lending and DEX protocols. But this relationship weakens at the weekly level.

6 Industry Exposures to DeFi Risk

This section presents the industry exposure to DeFi. We use Fama-French dataset consisting of 30 industries. These risks and opportunities can be considered as an indicator that shows which parties are likely to win or lose from the current and future evolution of DeFi technology. Throughout this section, t-statistics in parentheses are based on regular standard errors.

Table 26 reports the Fama-French 30 industries' exposures to Lending index returns, controlling for the excess market returns. Specifically, we regress each industrys stock daily returns on the contemporaneous Lending index returns and the excess stock market returns.

The Clothing (Clths) and Business Equipment (BusEq) industries are statistically significantly affected by Lending index returns. A one-standard-deviation increase in the Lending index is associated with an estimated 8.04% increase in the return of the Clothing industry and 4.04% decrease in the return of the Business Equipment industry. The Other industry exhibits a statistically significant positive alpha, suggesting it earns excess returns beyond what is explained by market and Lending factors, although this is not directly linked to Lending risk. Meanwhile, industries often associated with financial innovation — such as Finance (Fin), Retail (Rtail) and Wholesale (Whlsl) — show no statistically significant exposure to Lending returns.

In summary, Lending return exposure appears to be concentrated in a few sectors, most notably Clothing, while the majority of industries show limited or no significant sensitivity to

Table 26: Industry Exposure to Lending

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Lending	-0.28	-0.36	1.20	-0.31	1.12	-0.41	1.57*	-0.12	0.26	-1.12
	(-0.72)	(-0.78)	(1.65)	(-0.46)	(1.56)	(-0.96)	(2.30)	(-0.31)	(0.59)	(-1.31)
Mkt-RF	0.41***	0.42***	0.36***	1.29***	0.92***	0.52***	1.15***	0.65***	0.92***	1.19***
	(14.80)	(13.80)	(9.56)	(33.79)	(31.15)	(18.26)	(30.81)	(33.67)	(34.72)	(21.75)
ALPHA	0.01	-0.00	0.05	-0.02	0.02	-0.01	-0.05	-0.00	-0.02	-0.01
	(0.29)	(-0.08)	(1.36)	(-0.58)	(0.67)	(-0.29)	(-1.40)	(-0.17)	(-0.81)	(-0.14)
R-Squared	0.29	0.23	0.12	0.58	0.50	0.34	0.52	0.57	0.60	0.38
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Lending	-0.58	0.42	-0.16	-0.42	1.11	-0.51	0.33	-1.53	1.09	0.06
	(-1.07)	(0.43)	(-0.37)	(-0.68)	(0.86)	(-0.76)	(0.44)	(-0.88)	(1.05)	(0.11)
Mkt-RF	1.14***	1.21***	1.12***	1.31***	1.73***	0.87***	1.02***	0.91***	0.71***	0.49***
	(41.81)	(23.47)	(49.81)	(40.34)	(24.21)	(26.89)	(25.87)	(10.31)	(12.21)	(14.68)
ALPHA	0.04	0.06	0.02	-0.03	0.04	0.03	0.01	0.19*	0.10	0.02
	(1.33)	(1.09)	(0.70)	(-0.98)	(0.57)	(1.15)	(0.33)	(2.14)	(1.78)	(0.82)
R-Squared	0.61	0.37	0.71	0.65	0.40	0.46	0.39	0.10	0.17	0.26
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Lending	0.18	-0.03	-0.79*	-0.31	0.36	-0.11	0.54	0.27	0.32	0.01
	(0.37)	(-0.08)	(-2.11)	(-0.82)	(0.72)	(-0.32)	(1.26)	(0.73)	(0.69)	(0.02)
Mkt-RF	0.66***	1.25***	1.30***	0.65***	0.98***	0.82***	1.03***	0.86***	0.89***	0.66***
	(24.13)	(60.80)	(55.02)	(24.66)	(43.14)	(38.47)	(37.03)	(33.42)	(35.47)	(34.71)
ALPHA	-0.02	0.00	0.04	-0.02	-0.01	0.03	-0.00	0.01	0.03	0.04*
	(-0.90)	(0.10)	(1.90)	(-0.74)	(-0.28)	(1.83)	(-0.01)	(0.41)	(1.34)	(2.09)
R-Squared	0.44	0.82	0.79	0.45	0.67	0.67	0.71	0.66	0.64	0.59

Lending market movements.

Table 27 reports the industries' exposures to the DEX index on daily level data. Almost all industries exhibit statistically insignificant results except for Other industry. Again, many industries commonly associated with fintech, technology, and innovation — such as Finance (Fin), Retail (Rtail), Wholesale (Whlsl) and Business Equipment (BusEq) — show no statistically significant exposure to DEX returns. So, the estimated exposures are generally small and statistically insignificant across most industries.

Table 28 reports the Fama-French 30 industries' exposures to the Derivatives index returns, controlling for the excess market returns.

The estimated exposures are generally small and statistically insignificant across most industries. One notable exception is the Clothing (Clths) industry, which shows a positive and statistically significant coefficient with respect to the Derivatives index. A one-standard-deviation increase in the Derivatives index is associated with an estimated 6.7% increase in the return of the Clothing industry. The results suggest that returns in this industry exhibit some comovement with DeFi derivatives activity during the sample period.

However, the majority of industry coefficients are statistically insignificant, and the overall

Table 27: Industry Exposure to DEX

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
DEX	0.10	-0.21	0.87	-0.87	1.08	-0.29	0.78	0.03	0.10	-0.36
	(0.26)	(-0.52)	(1.38)	(-1.35)	(1.65)	(-0.67)	(1.41)	(0.11)	(0.23)	(-0.43)
Mkt-RF	0.41***	0.42***	0.36***	1.29***	0.92***	0.52***	1.15***	0.65***	0.92***	1.19***
	(14.77)	(13.79)	(9.59)	(33.66)	(31.39)	(18.26)	(30.79)	(33.50)	(34.76)	(21.71)
ALPHA	0.01	-0.00	0.05	-0.02	0.02	-0.01	-0.05	-0.00	-0.02	-0.01
	(0.25)	(-0.11)	(1.42)	(-0.56)	(0.71)	(-0.31)	(-1.31)	(-0.19)	(-0.79)	(-0.19)
R-Squared	0.29	0.23	0.12	0.58	0.50	0.34	0.52	0.57	0.60	0.38
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
DEX	-0.43	0.46	0.12	-0.41	0.35	-0.19	-0.29	0.26	0.57	0.11
	(-0.69)	(0.48)	(0.31)	(-0.62)	(0.30)	(-0.31)	(-0.42)	(0.18)	(0.61)	(0.22)
Mkt-RF	1.14***	1.21***	1.12***	1.31***	1.73***	0.87***	1.02***	0.90***	0.71***	0.49***
	(41.77)	(23.54)	(49.90)	(40.23)	(24.24)	(26.79)	(26.02)	(10.30)	(12.20)	(14.66)
ALPHA	0.04	0.06	0.02	-0.03	0.04	0.03	0.02	0.19*	0.10	0.02
	(1.30)	(1.10)	(0.67)	(-0.99)	(0.60)	(1.11)	(0.36)	(2.09)	(1.82)	(0.83)
R-Squared	0.61	0.37	0.71	0.65	0.40	0.46	0.39	0.10	0.17	0.26
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
DEX	0.45	-0.28	-0.68	0.12	0.33	0.33	0.10	0.05	0.75	0.16
	(0.91)	(-0.86)	(-1.79)	(0.30)	(0.76)	(0.97)	(0.26)	(0.13)	(1.58)	(0.43)
Mkt-RF	0.66***	1.25***	1.30***	0.65***	0.98***	0.82***	1.04***	0.86***	0.89***	0.66***
	(24.12)	(60.65)	(55.18)	(24.62)	(43.36)	(38.49)	(37.09)	(33.37)	(35.87)	(34.66)
ALPHA	-0.02	0.00	0.04	-0.02	-0.01	0.03	0.00	0.01	0.03	0.04*
	(-0.92)	(0.12)	(1.86)	(-0.79)	(-0.26)	(1.79)	(0.05)	(0.44)	(1.32)	(2.08)
R-Squared	0.44	0.82	0.79	0.45	0.67	0.67	0.71	0.66	0.64	0.59

pattern of exposures does not appear systematic across sectors. Therefore, the results should be interpreted cautiously. The findings suggest that any potential links between DeFi activity and traditional industry returns are limited and may reflect sample-specific correlations. Robustness checks are presented in Appendix C.

7 Conclusion

This paper provides a systematic asset pricing analysis of the DeFi ecosystem by constructing and evaluating novel indices for its core sectors: Lending, DEX and Derivatives. Our study serves as a direct test of the cryptocurrency asset pricing framework established by Liu and Tsyvinski (2021) within the more complex and structured environment of application-layer DeFi protocols. We conclude that the returns on DeFi indices have little correlation with the performance of traditional asset classes such as stocks, currencies, rates and commodities. This suggests that DeFi assets may reflect distinct economic mechanisms compared with conventional financial markets.

Also, we exploit DeFi-specific valuation ratios based on Total Value Locked (TVL) and

Table 28: Industry Exposure to Derivatives

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Derivatives	-0.30	-0.64	-0.03	-1.20	0.74	-0.30	1.31*	-0.26	-0.01	-1.11
	(-0.80)	(-1.40)	(-0.05)	(-1.51)	(1.02)	(-0.70)	(2.22)	(-0.86)	(-0.02)	(-1.44)
Mkt-RF	0.41***	0.42***	0.36***	1.29***	0.92***	0.52***	1.15***	0.65***	0.92***	1.19***
	(14.81)	(13.84)	(9.55)	(33.75)	(31.09)	(18.26)	(30.79)	(33.53)	(34.77)	(21.83)
ALPHA	0.01	-0.00	0.05	-0.02	0.02	-0.01	-0.05	-0.00	-0.02	-0.01
	(0.27)	(-0.10)	(1.47)	(-0.58)	(0.75)	(-0.33)	(-1.30)	(-0.17)	(-0.78)	(-0.19)
R-Squared	0.29	0.23	0.11	0.59	0.50	0.34	0.52	0.57	0.60	0.38
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Derivatives	-0.83	-0.14	-0.08	-0.19	0.37	-0.38	-0.73	-1.75	0.98	-0.34
	(-1.70)	(-0.17)	(-0.23)	(-0.34)	(0.36)	(-0.69)	(-1.12)	(-1.08)	(0.98)	(-0.68)
Mkt-RF	1.14***	1.21***	1.12***	1.31***	1.73***	0.87***	1.02***	0.90***	0.71***	0.49***
	(41.95)	(23.52)	(49.88)	(40.32)	(24.25)	(26.83)	(26.19)	(10.32)	(12.22)	(14.70)
ALPHA	0.04	0.06	0.02	-0.03	0.04	0.03	0.02	0.19*	0.10	0.02
	(1.30)	(1.11)	(0.68)	(-1.01)	(0.61)	(1.11)	(0.36)	(2.11)	(1.82)	(0.84)
R-Squared	0.61	0.37	0.71	0.65	0.40	0.46	0.39	0.10	0.17	0.26
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Derivatives	-0.17	0.04	-0.30	-0.27	0.43	-0.13	0.30	0.32	0.43	-0.12
	(-0.44)	(0.10)	(-1.01)	(-0.85)	(1.10)	(-0.44)	(0.75)	(0.92)	(1.04)	(-0.41)
Mkt-RF	0.66***	1.25***	1.30***	0.65***	0.98***	0.82***	1.04***	0.86***	0.89***	0.66***
	(24.14)	(60.79)	(55.01)	(24.60)	(43.09)	(38.34)	(37.10)	(33.47)	(35.61)	(34.67)
ALPHA	-0.02	0.00	0.04	-0.02	-0.01	0.03	0.00	0.01	0.03	0.04*
	(-0.88)	(0.09)	(1.80)	(-0.77)	(-0.25)	(1.81)	(0.04)	(0.43)	(1.36)	(2.10)
R-Squared	0.44	0.82	0.79	0.45	0.67	0.67	0.71	0.66	0.64	0.59

Market Capitalization. However, our findings do not support the popular explanation that the blockchain behavior is driven by book-to-value ratio like traditional assets. It highlights differences between DeFi valuation metrics and traditional book-to-market ratios used in equity markets.

We also explore several DeFi-specific factors. The results suggest that past returns, investor attention measured by Google search activity, and the performance of centralized platforms such as Binance exhibit some in-sample associations with DeFi sector returns. However, these relationships are not uniform across sectors and horizons. And the explanatory power of the regressions remains limited.

This study has several limitations. First, the sample period is relatively short due to the recent emergence of DeFi markets. As a result, the statistical relationships documented in this paper should be interpreted cautiously, as they may reflect sample-specific dynamics. Second, our analysis relies primarily on in-sample regressions, and future work could explore out-of-sample validation and alternative modeling approaches. In addition, it is hard to state that the obtained results will endure over time.

Several directions for future research remain open. One of the promising extension of the

work can be to dive into different DeFi classes. For instance, it would be interesting to look at the automated market-making in the DEX area and use classical asset pricing tools along with the mathematical finance approaches. Further work could also examine how evolving regulatory environments and technological developments influence the interaction between DeFi protocols and traditional financial markets.

Overall, our findings contribute to the growing literature on the financial economics of decentralized finance by providing an early empirical characterization of the return dynamics of major DeFi sectors.

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Appendix

A Crypto Characteristics

Look at the classic cryptocurrencies: Bitcoin (Table A1 and Figure A1) and Ethereum (Table A2 and Figure A2). We obtain several notable trends.

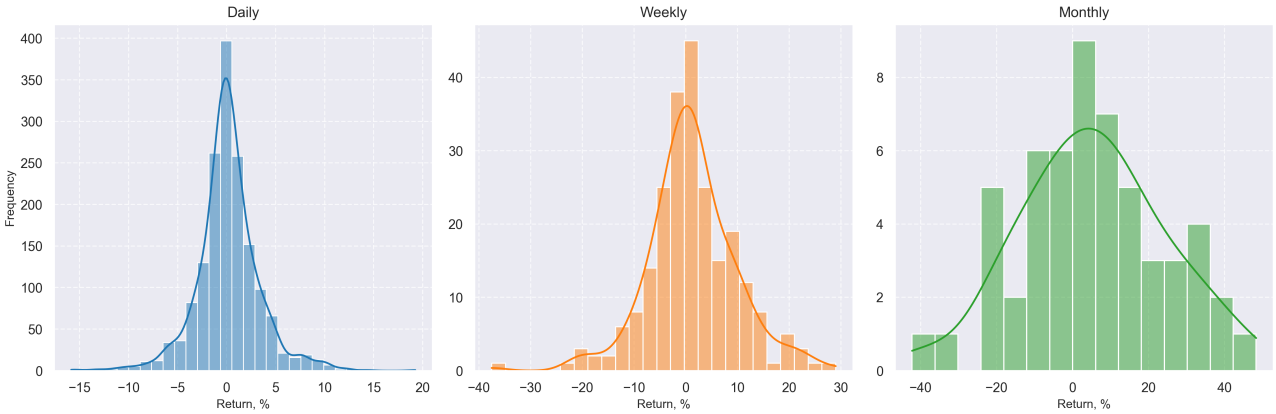

Figure A1: BTC return distributions.

Table A1: BTC Returns Summary Statistics

BTC	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.18%	3.21%	2.22	0.05	0.14	3.36	50.89
Weekly	1.23%	8.59%	2.19	0.14	-0.11	2.25	56.17
Monthly	5.24%	19.05%	2.04	0.28	-0.01	-0.02	61.82

In terms of average returns, the DeFi indices (especially Lending and DEX) tend to outperform BTC and ETH across daily, weekly, and monthly intervals. For instance, the Lending index achieves a monthly return of 7.33%, while BTC and ETH yield 5.24% and 5.55%, respectively. However, this higher return potential goes with increased volatility. BTC and ETH show lower standard deviations at the monthly level resulting in relatively favorable Sharpe ratios of 0.28 and 0.24.

Look at risk-adjusted returns. BTC stands out with the strongest Sharpe ratio on a monthly basis. We can treat it as more efficient returns per unit of risk despite lower nominal gains. ETH also performs well in this regard. Both BTC and ETH exhibit nearly symmetric return distributions with low skewness and moderate kurtosis. Comparing to the DEX index with elevated kurtosis values, the last one suggests more extreme return behavior.

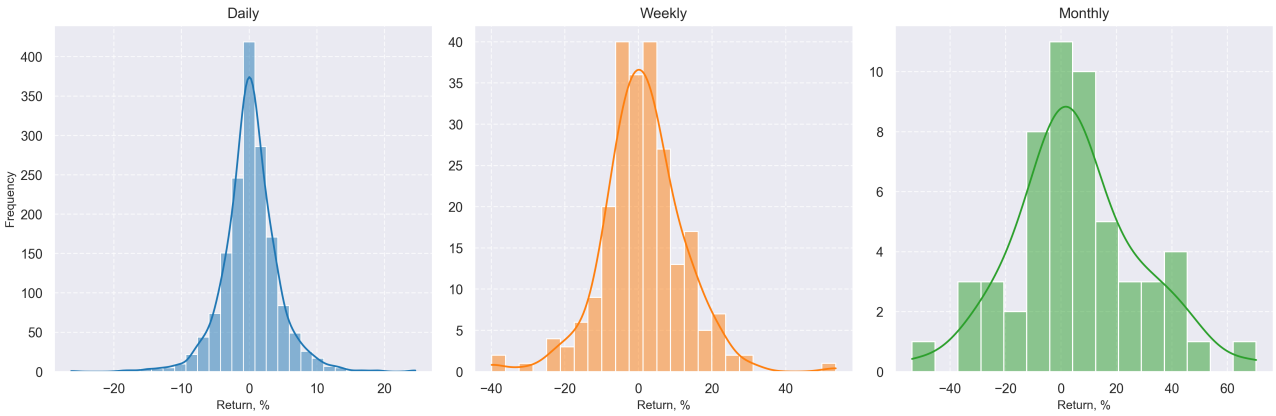

Figure A2: ETH return distributions.

Table A2: ETH Returns Summary Statistics

ETH	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.19%	4.13%	1.83	0.05	0.09	4.47	51.68
Weekly	1.30%	11.14%	1.79	0.12	0.07	3.01	55.74
Monthly	5.55%	22.73%	1.81	0.24	0.28	0.76	60.00

Furthermore, BTC and ETH demonstrate a higher proportion of positive monthly returns, with 61.82% for BTC and 60.00% for ETH. This highlights their consistency in generating gains. On the other hand, the Derivatives index trails behind in both return levels and the frequency of positive outcomes.

In summary, while DeFi indices may offer greater return potential, classic cryptocurrencies provide a more consistent and statistically robust performance profile.

B Traditional Finance Characteristics

For general facts' comparison, look at traditional finance. In particular, we document S&P500 (Table B1 and Figure B1).

Table B1: S&P500 Returns Summary Statistics

S&P500	Mean	SD	T-Statistics	Sharpe	Skewness	Kurtosis	% Return > 0
Daily	0.03%	0.86%	1.53	0.04	-0.22	3.98	36.09
Weekly	0.23%	2.22%	1.56	0.10	-0.33	1.57	57.02
Monthly	0.96%	4.67%	1.53	0.21	-0.39	-0.54	63.64

The DeFi indices show much higher average returns over all time periods especially in

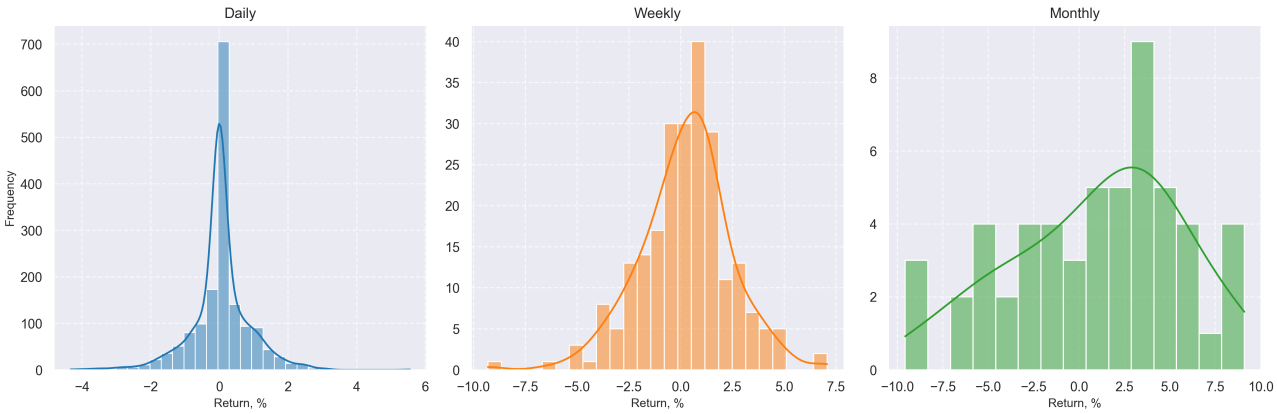

Figure B1: S&P500 return distributions.

Lending and DEX sectors. Indeed, the monthly returns for Lending are 7.33% and for DEX they are 7.30%, which are significantly higher than the S&P 500's 0.96%. Surely, these higher returns come with increased volatility.

On the other hand, the S&P 500 shows lower risk and more consistent return distributions. It has the highest percentage of positive monthly returns, at 63.64%, and a relatively strong Sharpe ratio of 0.21. Although DeFi indices offer greater potential for high returns, the S&P 500 proves to be a more stable and reliable investment option.

C Industry Exposures to DeFi Risk: Robustness Checks

In this section, we want to perform a robustness check for our results from Section 6. Specifically, we add more controls in industry regressions. The results show that our conclusions from the main part of the paper hold.

Tables C1, C2 and C3 report the Fama-French 30 industries' exposures to the DeFi index returns, controlling for Fama-French 3-factor model.

Given the number of coefficients estimated, the few statistically significant results are consistent with what would be expected by random chance. This suggests that any apparent industry exposures may reflect statistical noise rather than genuine economic relationships.

Tables C4, C5 and C6 report the Fama-French 30 industries' exposures to the DeFi index returns, controlling for Fama-French 5-factor model.

Table C1: Industry Exposure to Lending with Additional Controls: Fama-French 3-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Lending	-0.47	-0.58	0.93	0.05	1.26	-0.54	1.77**	-0.01	0.22	-0.94
	(-1.29)	(-1.29)	(1.40)	(0.07)	(1.85)	(-1.28)	(2.65)	(-0.02)	(0.55)	(-1.27)
Mkt-RF	0.51***	0.51***	0.49***	1.12***	0.89***	0.57***	1.08***	0.60***	0.98***	1.18***
	(16.48)	(15.34)	(12.04)	(28.91)	(28.76)	(16.99)	(25.18)	(28.73)	(33.56)	(21.14)
SMB	-0.13***	-0.26***	-0.13**	0.27***	0.50***	-0.17***	0.33***	0.09**	0.31***	0.84***
	(-3.84)	(-6.36)	(-2.79)	(5.13)	(10.39)	(-4.40)	(5.62)	(3.17)	(9.27)	(11.61)
HML	0.25***	0.17***	0.40***	-0.42***	0.19***	0.09*	-0.07	-0.12***	0.37***	0.42***
	(8.76)	(5.39)	(8.87)	(-10.92)	(4.76)	(2.21)	(-1.43)	(-4.88)	(11.59)	(7.40)
ALPHA	-0.01	-0.01	0.03	0.00	0.02	-0.01	-0.05	0.00	-0.03	-0.02
	(-0.27)	(-0.51)	(0.84)	(0.02)	(0.63)	(-0.54)	(-1.24)	(0.15)	(-1.73)	(-0.39)
R-Squared	0.36	0.28	0.22	0.63	0.61	0.36	0.54	0.59	0.74	0.55
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Lending	-0.37	0.27	-0.16	-0.03	1.63	-0.64	0.28	-1.75	0.56	-0.16
	(-0.76)	(0.35)	(-0.41)	(-0.06)	(1.28)	(-1.10)	(0.39)	(-1.10)	(0.70)	(-0.29)
Mkt-RF	1.08***	1.34***	1.15***	1.18***	1.50***	0.97***	1.08***	1.09***	1.02***	0.61***
	(32.80)	(28.73)	(51.05)	(37.39)	(18.45)	(27.59)	(24.36)	(12.62)	(17.88)	(17.78)
SMB	0.58***	0.57***	0.27***	0.80***	0.57***	0.23***	0.30***	0.58***	0.11	-0.11*
	(13.40)	(9.28)	(6.95)	(18.00)	(5.18)	(4.50)	(5.30)	(4.77)	(1.59)	(-2.55)
HML	0.12*	0.77***	0.25***	-0.02	-0.47***	0.46***	0.38***	0.93***	1.09***	0.32***
	(2.40)	(15.24)	(8.87)	(-0.62)	(-5.56)	(7.92)	(6.39)	(8.34)	(16.60)	(9.09)
ALPHA	0.04	0.03	0.01	-0.02	0.07	0.02	0.00	0.16	0.05	0.01
	(1.57)	(0.68)	(0.39)	(-0.84)	(0.96)	(0.66)	(0.02)	(1.88)	(1.21)	(0.29)
R-Squared	0.70	0.58	0.78	0.76	0.43	0.60	0.47	0.23	0.51	0.34
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Lending	0.06	0.12	-0.73*	-0.42	0.34	-0.17	0.61	0.27	0.05	-0.25
	(0.14)	(0.53)	(-2.26)	(-1.17)	(0.77)	(-0.50)	(1.54)	(0.74)	(0.23)	(-0.98)
Mkt-RF	0.73***	1.15***	1.25***	0.72***	1.02***	0.87***	0.99***	0.87***	1.04***	0.79***
	(24.28)	(65.84)	(52.72)	(26.78)	(40.03)	(42.09)	(32.96)	(31.43)	(47.54)	(47.92)
SMB	0.04	-0.12***	-0.20***	0.14***	0.22***	0.18***	-0.07*	0.06	0.08**	-0.08**
	(0.94)	(-5.82)	(-6.83)	(3.95)	(6.43)	(7.01)	(-2.01)	(1.95)	(3.01)	(-3.25)
HML	0.24***	-0.39***	-0.28***	0.34***	0.23***	0.27***	-0.19***	0.06*	0.56***	0.41***
	(7.06)	(-22.51)	(-13.43)	(10.56)	(9.96)	(13.50)	(-6.55)	(2.19)	(20.43)	(20.86)
ALPHA	-0.03	0.02	0.05**	-0.03	-0.01	0.02	0.01	0.01	0.01	0.02
	(-1.39)	(1.21)	(2.73)	(-1.55)	(-0.70)	(1.50)	(0.37)	(0.31)	(0.38)	(1.45)
R-Squared	0.49	0.90	0.84	0.58	0.73	0.76	0.73	0.66	0.87	0.76

Table C2: Industry Exposure to DEX with Additional Controls: Fama-French 3-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
DEX	-0.19	-0.51	0.44	-0.36	1.21	-0.47	1.02	0.19	-0.05	-0.25
	(-0.56)	(-1.30)	(0.81)	(-0.62)	(1.93)	(-1.11)	(1.84)	(0.61)	(-0.13)	(-0.38)
Mkt-RF	0.51***	0.51***	0.50***	1.12***	0.90***	0.57***	1.08***	0.60***	0.98***	1.17***
	(16.48)	(15.39)	(12.10)	(28.80)	(28.92)	(17.06)	(25.22)	(28.67)	(33.66)	(21.03)
SMB	-0.13***	-0.26***	-0.13**	0.27***	0.50***	-0.17***	0.32***	0.09**	0.31***	0.84***
	(-3.82)	(-6.39)	(-2.80)	(5.07)	(10.39)	(-4.42)	(5.63)	(3.20)	(9.28)	(11.60)
HML	0.25***	0.17***	0.40***	-0.41***	0.18***	0.09*	-0.07	-0.12***	0.37***	0.42***
	(8.78)	(5.38)	(8.88)	(-10.93)	(4.70)	(2.23)	(-1.42)	(-4.90)	(11.61)	(7.37)
ALPHA	-0.01	-0.01	0.03	0.00	0.02	-0.01	-0.04	0.00	-0.03	-0.02
	(-0.31)	(-0.54)	(0.90)	(0.04)	(0.69)	(-0.57)	(-1.14)	(0.14)	(-1.69)	(-0.43)
R-Squared	0.36	0.28	0.22	0.63	0.61	0.36	0.54	0.59	0.74	0.55
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
DEX	-0.21	0.10	0.06	0.06	1.08	-0.47	-0.46	-0.23	-0.32	-0.23
	(-0.39)	(0.14)	(0.16)	(0.10)	(0.97)	(-0.86)	(-0.69)	(-0.16)	(-0.43)	(-0.49)
Mkt-RF	1.08***	1.34***	1.15***	1.18***	1.50***	0.97***	1.08***	1.08***	1.02***	0.61***
	(32.82)	(28.75)	(51.03)	(37.39)	(18.46)	(27.61)	(24.50)	(12.59)	(17.94)	(17.85)
SMB	0.58***	0.57***	0.27***	0.80***	0.57***	0.23***	0.30***	0.58***	0.11	-0.11*
	(13.38)	(9.24)	(6.97)	(17.98)	(5.19)	(4.48)	(5.21)	(4.80)	(1.52)	(-2.56)
HML	0.12*	0.77***	0.25***	-0.02	-0.47***	0.46***	0.38***	0.93***	1.09***	0.32***
	(2.42)	(15.27)	(8.79)	(-0.63)	(-5.56)	(7.96)	(6.42)	(8.28)	(16.54)	(9.08)
ALPHA	0.04	0.03	0.01	-0.02	0.07	0.02	0.00	0.15	0.05	0.01
	(1.55)	(0.69)	(0.36)	(-0.84)	(0.99)	(0.62)	(0.05)	(1.83)	(1.26)	(0.28)
R-Squared	0.70	0.58	0.78	0.76	0.43	0.60	0.47	0.23	0.51	0.34
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
DEX	0.26	-0.01	-0.55	-0.10	0.25	0.20	0.23	0.03	0.30	-0.24
	(0.58)	(-0.05)	(-1.79)	(-0.28)	(0.64)	(0.68)	(0.66)	(0.08)	(1.17)	(-0.97)
Mkt-RF	0.73***	1.15***	1.25***	0.72***	1.02***	0.87***	0.99***	0.87***	1.04***	0.79***
	(24.32)	(65.73)	(52.84)	(26.64)	(40.13)	(42.16)	(33.08)	(31.43)	(47.72)	(48.09)
SMB	0.04	-0.12***	-0.20***	0.14***	0.22***	0.18***	-0.07*	0.06	0.08**	-0.08**
	(0.97)	(-5.84)	(-6.87)	(3.95)	(6.43)	(7.07)	(-2.04)	(1.92)	(3.07)	(-3.28)
HML	0.24***	-0.39***	-0.28***	0.33***	0.23***	0.27***	-0.19***	0.06*	0.56***	0.41***
	(7.08)	(-22.60)	(-13.59)	(10.57)	(9.86)	(13.52)	(-6.62)	(2.23)	(20.42)	(20.83)
ALPHA	-0.03	0.02	0.05**	-0.03	-0.01	0.02	0.01	0.01	0.01	0.02
	(-1.40)	(1.24)	(2.67)	(-1.59)	(-0.68)	(1.45)	(0.43)	(0.34)	(0.36)	(1.43)
R-Squared	0.49	0.90	0.84	0.58	0.73	0.76	0.73	0.66	0.87	0.76

Table C3: Industry Exposure to Derivatives with Additional Controls: Fama-French 3-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Derivatives	-0.48	-0.85*	-0.28	-0.88	0.91	-0.42	1.50**	-0.17	-0.02	-0.87
	(-1.38)	(-2.06)	(-0.54)	(-1.21)	(1.38)	(-1.06)	(2.69)	(-0.53)	(-0.06)	(-1.30)
Mkt-RF	0.51***	0.51***	0.50***	1.12***	0.90***	0.57***	1.08***	0.60***	0.98***	1.17***
	(16.50)	(15.44)	(12.09)	(28.76)	(28.58)	(17.05)	(25.18)	(28.71)	(33.64)	(21.20)
SMB	-0.13***	-0.26***	-0.13**	0.27***	0.50***	-0.17***	0.33***	0.09**	0.31***	0.84***
	(-3.85)	(-6.42)	(-2.88)	(5.05)	(10.39)	(-4.38)	(5.65)	(3.15)	(9.21)	(11.63)
HML	0.25***	0.17***	0.40***	-0.41***	0.19***	0.09*	-0.07	-0.12***	0.37***	0.42***
	(8.76)	(5.40)	(8.90)	(-11.07)	(4.76)	(2.22)	(-1.43)	(-4.86)	(11.63)	(7.45)
ALPHA	-0.01	-0.01	0.03	0.00	0.02	-0.01	-0.04	0.00	-0.03	-0.02
	(-0.31)	(-0.55)	(0.92)	(0.04)	(0.74)	(-0.59)	(-1.12)	(0.16)	(-1.70)	(-0.43)
R-Squared	0.36	0.28	0.22	0.63	0.61	0.36	0.54	0.59	0.74	0.55
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Derivatives	-0.60	-0.21	-0.06	0.22	0.87	-0.47	-0.75	-1.89	0.55	-0.54
	(-1.35)	(-0.28)	(-0.19)	(0.48)	(0.81)	(-1.01)	(-1.22)	(-1.30)	(0.76)	(-1.14)
Mkt-RF	1.08***	1.34***	1.15***	1.18***	1.50***	0.97***	1.08***	1.09***	1.02***	0.61***
	(33.02)	(28.86)	(51.10)	(37.42)	(18.59)	(27.55)	(24.57)	(12.58)	(17.96)	(17.86)
SMB	0.58***	0.56***	0.27***	0.80***	0.56***	0.23***	0.30***	0.57***	0.11	-0.11**
	(13.34)	(9.24)	(6.94)	(18.06)	(5.19)	(4.49)	(5.16)	(4.73)	(1.60)	(-2.61)
HML	0.12*	0.77***	0.25***	-0.02	-0.47***	0.46***	0.38***	0.93***	1.09***	0.32***
	(2.44)	(15.35)	(8.84)	(-0.64)	(-5.59)	(7.93)	(6.44)	(8.37)	(16.71)	(9.06)
ALPHA	0.04	0.03	0.01	-0.02	0.07	0.02	0.00	0.15	0.05	0.01
	(1.55)	(0.69)	(0.37)	(-0.84)	(1.01)	(0.60)	(0.04)	(1.83)	(1.24)	(0.28)
R-Squared	0.70	0.58	0.78	0.76	0.43	0.60	0.47	0.24	0.51	0.35
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Derivatives	-0.27	0.15	-0.28	-0.36	0.44	-0.16	0.35	0.33	0.21	-0.34
	(-0.68)	(0.60)	(-0.99)	(-1.12)	(1.22)	(-0.58)	(0.96)	(0.95)	(1.00)	(-1.46)
Mkt-RF	0.73***	1.15***	1.25***	0.72***	1.02***	0.87***	0.99***	0.87***	1.04***	0.79***
	(24.42)	(66.09)	(52.78)	(26.72)	(39.88)	(41.98)	(33.07)	(31.51)	(47.50)	(47.90)
SMB	0.03	-0.12***	-0.19***	0.14***	0.23***	0.18***	-0.07*	0.06*	0.08**	-0.08***
	(0.90)	(-5.77)	(-6.77)	(3.92)	(6.46)	(7.03)	(-2.03)	(1.97)	(3.04)	(-3.30)
HML	0.25***	-0.39***	-0.28***	0.34***	0.23***	0.27***	-0.19***	0.06*	0.56***	0.41***
	(7.10)	(-22.51)	(-13.49)	(10.63)	(9.96)	(13.49)	(-6.57)	(2.19)	(20.47)	(20.75)
ALPHA	-0.03	0.02	0.05**	-0.03	-0.01	0.02	0.01	0.01	0.01	0.02
	(-1.38)	(1.24)	(2.63)	(-1.59)	(-0.68)	(1.47)	(0.44)	(0.34)	(0.38)	(1.42)
R-Squared	0.49	0.90	0.84	0.58	0.73	0.76	0.73	0.66	0.87	0.76

Table C4: Industry Exposure to Lending with Additional Controls: Fama-French 5-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Lending	-0.25	-0.33	1.09	-0.31	1.36*	-0.24	1.97**	-0.01	0.29	-0.64
	(-0.69)	(-0.76)	(1.60)	(-0.52)	(1.98)	(-0.59)	(2.97)	(-0.03)	(0.74)	(-0.88)
Mkt-RF	0.56***	0.56***	0.54***	1.06***	0.91***	0.62***	1.08***	0.63***	0.99***	1.19***
	(17.90)	(16.64)	(13.21)	(29.48)	(28.48)	(19.66)	(27.03)	(28.69)	(39.24)	(23.37)
SMB	-0.01	-0.11*	-0.04	0.06	0.57***	0.02	0.48***	0.06	0.35***	1.06***
	(-0.17)	(-2.56)	(-0.79)	(0.96)	(8.84)	(0.39)	(7.53)	(1.71)	(8.85)	(12.34)
HML	0.04	-0.05	0.23***	-0.14**	0.11*	-0.14*	-0.14*	-0.18***	0.31***	0.29***
	(1.06)	(-0.99)	(3.57)	(-2.76)	(2.18)	(-2.45)	(-2.06)	(-5.04)	(5.61)	(3.48)
RMW	0.26***	0.30***	0.17**	-0.46***	0.15*	0.40***	0.37***	-0.09*	0.10*	0.54***
	(6.43)	(6.30)	(2.65)	(-6.68)	(2.07)	(8.88)	(5.56)	(-2.31)	(2.46)	(6.12)
CMA	0.36***	0.35***	0.34***	-0.38***	0.07	0.30***	-0.11	0.26***	0.08	-0.12
	(5.39)	(4.22)	(3.38)	(-4.25)	(0.74)	(3.53)	(-1.00)	(3.95)	(0.96)	(-0.94)
ALPHA	-0.01	-0.02	0.02	0.01	0.01	-0.02	-0.05	0.00	-0.04	-0.03
	(-0.64)	(-0.88)	(0.68)	(0.38)	(0.49)	(-1.03)	(-1.44)	(0.20)	(-1.85)	(-0.65)
R-Squared	0.42	0.33	0.24	0.65	0.61	0.43	0.56	0.61	0.74	0.57
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Lending	-0.09	0.43	-0.06	-0.09	1.21	-0.69	0.16	-1.89	0.23	-0.08
	(-0.19)	(0.55)	(-0.15)	(-0.17)	(0.97)	(-1.17)	(0.23)	(-1.23)	(0.31)	(-0.14)
Mkt-RF	1.10***	1.37***	1.17***	1.15***	1.41***	0.98***	1.10***	1.15***	1.02***	0.64***
	(35.54)	(28.23)	(50.90)	(35.91)	(17.32)	(30.27)	(26.35)	(13.38)	(21.07)	(18.92)
SMB	0.79***	0.67***	0.34***	0.78***	0.33**	0.18**	0.19**	0.40**	-0.16*	-0.08
	(16.10)	(8.89)	(6.85)	(16.98)	(2.61)	(2.99)	(2.79)	(2.88)	(-2.19)	(-1.52)
HML	-0.03	0.65***	0.17***	0.07	-0.08	0.44***	0.35***	0.81***	1.18***	0.21***
	(-0.38)	(8.59)	(3.82)	(1.64)	(-0.68)	(5.73)	(3.95)	(6.84)	(12.96)	(4.51)
RMW	0.48***	0.22*	0.13**	-0.01	-0.47**	-0.13*	-0.30***	-0.50*	-0.68***	0.04
	(9.15)	(2.27)	(2.74)	(-0.30)	(-3.15)	(-2.15)	(-3.34)	(-2.47)	(-6.25)	(0.68)
CMA	-0.01	0.15	0.11	-0.24**	-0.67**	0.15	0.35**	0.79***	0.36**	0.30***
	(-0.07)	(1.20)	(1.40)	(-3.17)	(-3.13)	(1.63)	(2.59)	(3.69)	(2.72)	(3.83)
ALPHA	0.03	0.02	0.00	-0.02	0.08	0.02	0.01	0.16*	0.06	0.01
	(1.21)	(0.55)	(0.22)	(-0.78)	(1.17)	(0.74)	(0.14)	(1.99)	(1.59)	(0.21)
R-Squared	0.73	0.59	0.78	0.77	0.45	0.61	0.49	0.25	0.55	0.36
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Lending	0.03	0.03	-0.53	-0.15	0.33	0.06	0.68	0.31	-0.06	-0.23
	(0.06)	(0.14)	(-1.68)	(-0.43)	(0.78)	(0.19)	(1.85)	(0.87)	(-0.27)	(-0.92)
Mkt-RF	0.72***	1.11***	1.30***	0.76***	1.00***	0.90***	0.97***	0.87***	1.01***	0.80***
	(23.77)	(70.63)	(55.07)	(31.30)	(41.92)	(44.66)	(33.88)	(32.67)	(57.71)	(47.86)
SMB	0.01	-0.15***	-0.09**	0.31***	0.24***	0.34***	0.01	0.09*	0.02	-0.07*
	(0.26)	(-5.73)	(-3.05)	(8.16)	(5.78)	(10.99)	(0.23)	(2.37)	(0.90)	(-2.55)
HML	0.27***	-0.26***	-0.48***	0.16***	0.27***	0.12***	-0.17***	0.03	0.70***	0.39***
	(5.48)	(-10.20)	(-14.21)	(3.61)	(7.16)	(4.34)	(-3.44)	(0.64)	(19.21)	(13.81)
RMW	-0.05	-0.04	0.21***	0.39***	0.05	0.35***	0.20***	0.06	-0.09**	0.02
	(-0.80)	(-1.15)	(5.14)	(9.57)	(1.08)	(11.24)	(4.35)	(1.34)	(-2.89)	(0.57)
CMA	-0.03	-0.35***	0.39***	0.16**	-0.16*	0.10	-0.26***	0.04	-0.29***	0.03
	(-0.46)	(-7.60)	(5.31)	(2.67)	(-2.46)	(1.93)	(-3.57)	(0.55)	(-5.20)	(0.67)
ALPHA	-0.03	0.02	0.05*	-0.04*	-0.01	0.02	0.00	0.00	0.01	0.02
	(-1.35)	(1.45)	(2.52)	(-2.12)	(-0.73)	(1.08)	(0.22)	(0.23)	(0.66)	(1.42)
R-Squared	0.49	0.91	0.86	0.62	0.73	0.79	0.75	0.66	0.88	0.76

Table C5: Industry Exposure to DEX with Additional Controls: Fama-French 5-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
DEX	0.06	-0.24	0.65	-0.72	1.30*	-0.17	1.13*	0.26	0.02	-0.06
	(0.19)	(-0.60)	(1.14)	(-1.29)	(2.03)	(-0.45)	(2.08)	(0.83)	(0.07)	(-0.10)
Mkt-RF	0.56***	0.56***	0.54***	1.06***	0.91***	0.62***	1.09***	0.63***	0.99***	1.19***
	(17.91)	(16.70)	(13.23)	(29.33)	(28.79)	(19.68)	(27.04)	(28.71)	(39.26)	(23.29)
SMB	-0.00	-0.11*	-0.04	0.05	0.57***	0.02	0.48***	0.06	0.35***	1.07***
	(-0.11)	(-2.56)	(-0.82)	(0.90)	(8.91)	(0.39)	(7.53)	(1.76)	(8.87)	(12.33)
HML	0.04	-0.04	0.23***	-0.13**	0.11*	-0.14*	-0.14*	-0.19***	0.31***	0.28***
	(1.02)	(-0.98)	(3.56)	(-2.72)	(2.11)	(-2.46)	(-2.02)	(-5.05)	(5.61)	(3.44)
RMW	0.26***	0.30***	0.16**	-0.46***	0.15*	0.40***	0.37***	-0.09*	0.10*	0.54***
	(6.50)	(6.31)	(2.63)	(-6.78)	(2.08)	(8.87)	(5.45)	(-2.26)	(2.43)	(6.15)
CMA	0.36***	0.35***	0.34***	-0.38***	0.07	0.30***	-0.11	0.27***	0.08	-0.11
	(5.42)	(4.20)	(3.39)	(-4.31)	(0.79)	(3.53)	(-0.98)	(3.96)	(0.94)	(-0.93)
ALPHA	-0.01	-0.02	0.02	0.01	0.01	-0.02	-0.05	0.00	-0.04	-0.03
	(-0.67)	(-0.90)	(0.74)	(0.39)	(0.55)	(-1.05)	(-1.33)	(0.17)	(-1.81)	(-0.69)
R-Squared	0.42	0.33	0.24	0.65	0.61	0.43	0.55	0.61	0.74	0.57
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
DEX	-0.00	0.25	0.16	-0.05	0.60	-0.46	-0.45	-0.11	-0.48	-0.10
	(-0.00)	(0.35)	(0.43)	(-0.08)	(0.54)	(-0.85)	(-0.66)	(-0.09)	(-0.70)	(-0.20)
Mkt-RF	1.10***	1.37***	1.17***	1.15***	1.41***	0.98***	1.10***	1.14***	1.02***	0.64***
	(35.51)	(28.22)	(50.94)	(35.83)	(17.34)	(30.28)	(26.45)	(13.33)	(21.19)	(18.96)
SMB	0.79***	0.67***	0.34***	0.78***	0.33**	0.18**	0.18**	0.41**	-0.17*	-0.08
	(16.10)	(8.85)	(6.85)	(16.99)	(2.59)	(2.99)	(2.72)	(2.97)	(-2.25)	(-1.52)
HML	-0.03	0.65***	0.17***	0.07	-0.08	0.44***	0.35***	0.80***	1.19***	0.21***
	(-0.39)	(8.56)	(3.74)	(1.65)	(-0.67)	(5.76)	(3.96)	(6.72)	(12.97)	(4.49)
RMW	0.48***	0.22*	0.13**	-0.01	-0.48**	-0.13*	-0.31***	-0.49*	-0.68***	0.04
	(9.17)	(2.25)	(2.76)	(-0.30)	(-3.16)	(-2.12)	(-3.40)	(-2.41)	(-6.28)	(0.68)
CMA	-0.01	0.15	0.11	-0.24**	-0.67**	0.15	0.35*	0.80***	0.35**	0.30***
	(-0.07)	(1.20)	(1.41)	(-3.17)	(-3.12)	(1.62)	(2.54)	(3.69)	(2.69)	(3.81)
ALPHA	0.03	0.03	0.00	-0.02	0.08	0.02	0.01	0.16	0.06	0.01
	(1.21)	(0.57)	(0.20)	(-0.79)	(1.20)	(0.70)	(0.17)	(1.93)	(1.62)	(0.20)
R-Squared	0.73	0.59	0.78	0.77	0.45	0.61	0.49	0.25	0.55	0.36
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
DEX	0.22	-0.17	-0.30	0.14	0.21	0.40	0.21	0.07	0.14	-0.22
	(0.51)	(-0.75)	(-1.03)	(0.43)	(0.55)	(1.39)	(0.66)	(0.20)	(0.60)	(-0.89)
Mkt-RF	0.72***	1.11***	1.30***	0.76***	1.00***	0.90***	0.97***	0.87***	1.01***	0.80***
	(23.77)	(70.55)	(55.10)	(31.15)	(41.99)	(44.79)	(34.06)	(32.67)	(57.76)	(47.88)
SMB	0.01	-0.16***	-0.09**	0.31***	0.24***	0.34***	0.01	0.09*	0.03	-0.07*
	(0.29)	(-5.80)	(-3.02)	(8.18)	(5.78)	(11.09)	(0.17)	(2.33)	(0.96)	(-2.56)
HML	0.27***	-0.26***	-0.48***	0.15***	0.27***	0.12***	-0.17***	0.03	0.70***	0.39***
	(5.47)	(-10.20)	(-14.14)	(3.57)	(7.16)	(4.20)	(-3.42)	(0.67)	(19.15)	(13.79)
RMW	-0.05	-0.04	0.21***	0.39***	0.05	0.35***	0.20***	0.06	-0.09**	0.02
	(-0.78)	(-1.20)	(5.18)	(9.61)	(1.06)	(11.44)	(4.27)	(1.31)	(-2.86)	(0.58)
CMA	-0.03	-0.35***	0.39***	0.16**	-0.16*	0.10*	-0.26***	0.04	-0.29***	0.03
	(-0.44)	(-7.60)	(5.28)	(2.71)	(-2.46)	(1.96)	(-3.54)	(0.54)	(-5.18)	(0.65)
ALPHA	-0.03	0.02	0.05*	-0.04*	-0.01	0.02	0.01	0.01	0.01	0.02
	(-1.37)	(1.48)	(2.46)	(-2.15)	(-0.70)	(1.05)	(0.30)	(0.27)	(0.63)	(1.40)
R-Squared	0.49	0.91	0.86	0.62	0.73	0.79	0.75	0.66	0.88	0.76

Table C6: Industry Exposure to Derivatives with Additional Controls: Fama-French 5-Factor

	Food	Beer	Smoke	Games	Books	Hshld	Clths	Hlth	Chems	Txtls
Derivatives	-0.28	-0.62	-0.14	-1.22	1.02	-0.13	1.74***	-0.20	0.05	-0.54
	(-0.78)	(-1.47)	(-0.27)	(-1.70)	(1.56)	(-0.32)	(3.30)	(-0.68)	(0.16)	(-0.82)
Mkt-RF	0.56***	0.56***	0.54***	1.06***	0.91***	0.62***	1.09***	0.63***	0.99***	1.19***
	(17.94)	(16.74)	(13.22)	(29.35)	(28.24)	(19.67)	(27.23)	(28.76)	(39.29)	(23.39)
SMB	-0.01	-0.12**	-0.05	0.05	0.57***	0.02	0.48***	0.06	0.35***	1.06***
	(-0.20)	(-2.64)	(-0.94)	(0.80)	(8.86)	(0.39)	(7.55)	(1.66)	(8.75)	(12.31)
HML	0.04	-0.04	0.24***	-0.13**	0.11*	-0.14*	-0.15*	-0.18***	0.31***	0.29***
	(1.07)	(-0.92)	(3.64)	(-2.67)	(2.18)	(-2.46)	(-2.06)	(-4.97)	(5.62)	(3.48)
RMW	0.26***	0.30***	0.16*	-0.47***	0.15*	0.40***	0.38***	-0.10*	0.10*	0.54***
	(6.37)	(6.18)	(2.53)	(-6.87)	(2.10)	(8.81)	(5.58)	(-2.34)	(2.41)	(6.09)
CMA	0.36***	0.35***	0.34***	-0.38***	0.07	0.30***	-0.12	0.26***	0.08	-0.12
	(5.39)	(4.22)	(3.34)	(-4.28)	(0.72)	(3.54)	(-1.02)	(3.94)	(0.95)	(-0.94)
ALPHA	-0.01	-0.02	0.02	0.01	0.02	-0.02	-0.05	0.00	-0.04	-0.03
	(-0.66)	(-0.90)	(0.78)	(0.39)	(0.61)	(-1.06)	(-1.32)	(0.20)	(-1.81)	(-0.68)
R-Squared	0.42	0.33	0.24	0.65	0.61	0.43	0.56	0.61	0.74	0.57
	Cnstr	Steel	FabPr	ElcEq	Autos	Carry	Mines	Coal	Oil	Util
Derivatives	-0.29	-0.05	0.04	0.18	0.49	-0.54	-0.91	-2.13	0.15	-0.49
	(-0.70)	(-0.07)	(0.13)	(0.40)	(0.47)	(-1.16)	(-1.47)	(-1.57)	(0.24)	(-1.05)
Mkt-RF	1.10***	1.37***	1.17***	1.15***	1.41***	0.98***	1.10***	1.15***	1.02***	0.64***
	(35.60)	(28.29)	(50.98)	(35.91)	(17.41)	(30.29)	(26.57)	(13.35)	(21.11)	(19.02)
SMB	0.78***	0.66***	0.34***	0.78***	0.33**	0.18**	0.18**	0.39**	-0.16*	-0.08
	(15.95)	(8.86)	(6.83)	(16.96)	(2.61)	(2.97)	(2.63)	(2.82)	(-2.19)	(-1.61)
HML	-0.03	0.65***	0.17***	0.07	-0.08	0.44***	0.36***	0.82***	1.18***	0.21***
	(-0.36)	(8.68)	(3.79)	(1.58)	(-0.66)	(5.74)	(4.04)	(6.88)	(13.00)	(4.55)
RMW	0.48***	0.21*	0.13**	-0.01	-0.47**	-0.13*	-0.31***	-0.51*	-0.68***	0.03
	(9.05)	(2.24)	(2.75)	(-0.25)	(-3.17)	(-2.16)	(-3.44)	(-2.51)	(-6.24)	(0.60)
CMA	-0.01	0.14	0.11	-0.24**	-0.67**	0.16	0.35**	0.79***	0.35**	0.30***
	(-0.08)	(1.19)	(1.40)	(-3.15)	(-3.14)	(1.64)	(2.58)	(3.71)	(2.71)	(3.83)
ALPHA	0.03	0.03	0.00	-0.02	0.08	0.02	0.01	0.16	0.06	0.01
	(1.22)	(0.58)	(0.21)	(-0.80)	(1.21)	(0.68)	(0.17)	(1.94)	(1.60)	(0.21)
R-Squared	0.73	0.59	0.78	0.77	0.45	0.61	0.49	0.25	0.55	0.36
	Telcm	Servs	BusEq	Paper	Trans	Whlsl	Rtail	Meals	Fin	Other
Derivatives	-0.30	0.09	-0.10	-0.09	0.46	0.08	0.46	0.37	0.12	-0.33
	(-0.78)	(0.38)	(-0.38)	(-0.30)	(1.30)	(0.32)	(1.33)	(1.09)	(0.61)	(-1.41)
Mkt-RF	0.72***	1.11***	1.30***	0.76***	1.00***	0.90***	0.97***	0.87***	1.01***	0.80***
	(23.89)	(70.85)	(55.07)	(31.20)	(41.83)	(44.67)	(34.07)	(32.73)	(57.65)	(47.88)
SMB	0.01	-0.15***	-0.08**	0.31***	0.24***	0.34***	0.01	0.09*	0.03	-0.07**
	(0.20)	(-5.65)	(-2.95)	(8.11)	(5.81)	(11.04)	(0.23)	(2.40)	(0.95)	(-2.64)
HML	0.27***	-0.26***	-0.48***	0.16***	0.27***	0.12***	-0.17***	0.02	0.70***	0.39***
	(5.54)	(-10.21)	(-14.17)	(3.62)	(7.10)	(4.31)	(-3.43)	(0.62)	(19.20)	(13.77)
RMW	-0.05	-0.03	0.21***	0.39***	0.05	0.35***	0.20***	0.07	-0.09**	0.01
	(-0.86)	(-1.12)	(5.18)	(9.58)	(1.13)	(11.22)	(4.32)	(1.37)	(-2.83)	(0.51)
CMA	-0.03	-0.35***	0.39***	0.16**	-0.16*	0.10	-0.26***	0.04	-0.29***	0.03
	(-0.47)	(-7.62)	(5.32)	(2.67)	(-2.45)	(1.93)	(-3.56)	(0.55)	(-5.17)	(0.67)
ALPHA	-0.03	0.02	0.04*	-0.04*	-0.01	0.02	0.01	0.01	0.01	0.02
	(-1.35)	(1.46)	(2.44)	(-2.14)	(-0.70)	(1.08)	(0.30)	(0.26)	(0.64)	(1.39)
R-Squared	0.49	0.91	0.86	0.62	0.73	0.79	0.75	0.66	0.88	0.76