Economics Letters 257 (2025) 112703

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Price discovery through wrapped tokens

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ARTICLE INFO

JEL classification:
G10
G12
G14

Keywords:
Blockchain
Wrapped bitcoin
Price discovery
Defi
Tokenization

ABSTRACT

We examine how wrapped tokens – tokenized representations of assets on other blockchains – contribute to cryptocurrency price discovery. Based on high-frequency data for Wrapped Bitcoin (wBTC), our results indicate that wBTC accounts for about 10% of the total price discovery of Bitcoin as measured by information shares. We show that wBTC's contribution to price discovery is positively related to wBTC liquidity and trading volume as well as to important measures of decentralized finance activity. Our results have significant implications for the relationships between crypto-assets on different platforms as well as for systemic risk in the crypto-ecosystem.

1. Introduction

Since the creation of Bitcoin (Nakamoto, 2008) there has been a surge of crypto-assets built on various blockchain platforms. However, the limited ability to span different blockchains, from Bitcoin to Ethereum, for instance, makes interoperability across blockchains challenging (Buterin, 2022). The introduction of wrapped assets such as wrapped Bitcoin (wBTC) alleviates this problem by locking assets from one blockchain and then issuing derivative tokens on another platform (wBTC, 2019). This integrates blockchain platforms, facilitating trades across networks and enhancing decentralized finance (DeFi). Thus, cross-platform assets such as wrapped Bitcoin play a significant role in the price discovery of Bitcoin itself.

In this paper, we examine the informational content of wrapped Bitcoin and how this novel asset drives the price discovery process of Bitcoin. Where Bitcoin traditionally has been a stand-alone cryptocurrency with a massive impact on other cryptocurrencies due to its position as the first crypto-asset, it is important to understand the feedback effect of other crypto-assets onto Bitcoin. Blockchain platforms such as Ethereum have significantly greater use flexibility than Bitcoin, allowing decentralized applications (dApps) such as the creation of decentralized exchanges (DEXs). New information from these decentralized platforms may then feed back on the fundamental price of Bitcoin, influencing the pricing mechanism.

Wrapped assets are unique in their involvement with multiple blockchains and certifying entities. Wrapped Bitcoins on the Ethereum Network are ERC-20 tokens that are secured by a custodian who holds one bitcoin for each wBTC in circulation. The custodian confirms ownership of outstanding Bitcoin assets through a proof-of-reserves technique, demonstrating sufficient ownership of Bitcoin to back the wBTC issued. This technique allows a fully-backed Bitcoin token on Ethereum or other networks, avoiding some of the difficulties seen in early years of stablecoins such as Tether (Griffin and Shams, 2020).[1]

Our examination of Bitcoin price discovery is based on high-frequency data from Coinbase and shows that wBTC is a significant determinant of Bitcoin price discovery, accounting for around 10% of the price discovery process on average. At times of higher wBTC spreads, price discovery is significantly reduced, consistent with the idea that traders trade where costs are lowest (Hautsch et al., 2024). In addition, higher volumes of wBTC are associated with higher price discovery, suggesting that arbitrage occurs between Bitcoin and wBTC prices. Finally, we find that as Ethereum becomes more important relative to Bitcoin, the relative importance of wBTC price discovery increases.

This paper is not the first to study the price discovery of crypto-assets. For instance, Brauneis and Mestel (2018) examine the price discovery and predictability of ten cryptocurrencies and find that prices are more difficult to predict as the volume of trading increases. While Alexander and Heck (2020) find that centralized exchange prices generally respond to prices in unregulated markets, Dimpfl and Peter (2021) examine the impact of the noise level on various exchanges and

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[1] Wrapped Bitcoin currently exists on Ethereum, and, to a smaller extent, on other networks such as Solana.

https://doi.org/10.1016/j.econlet.2025.112703
Received 2 October 2025; Received in revised form 23 October 2025; Accepted 28 October 2025
Available online 1 November 2025

the difficulty in creating a clean measure of price discovery due to these differences across exchanges. Barbon and Ranaldo (2025) and Capponi et al. (2025) provide empirical evidence regarding market quality at DEXs and their contribution to price discovery.[2]

Our approach is closely related to Kapar and Olmo (2019) who examine the relationship between Bitcoin spot and futures prices and Alexander et al. (2020a) who examine ether spot and swap prices. This literature generally finds that derivative prices dominate spot prices in the price discovery of Bitcoin and Ethereum. For instance, using high frequency data, Alexander et al. (2020b) find that futures prices significantly lead spot prices. Studying spot and futures prices, Entrop et al. (2020) find that price discovery is significantly driven by the volume of trading but unrelated to macroeconomic drivers or attention. Ibikunle et al. (2020) find that investor attention is unrelated to price discovery but leads to a significant increase in Bitcoin price noise.

Our research is different in that we examine the influence of an asset that cannot be directly used in DeFi applications (Bitcoin) and its price discovery from an asset that can be used for such purposes (wBTC). As such, we are able to examine the increasing importance of decentralized finance in the cryptocurrency landscape.

2. Institutional background

A major challenge in the blockchain space is facilitating effective communication and interoperability between different blockchain networks (Buterin, 2022). Traditionally, blockchains communicate across networks using bridges and oracles, but both have significant security risks (Lee et al., 2023). This has led to a cryptocurrency landscape with limited interactions for assets existing on different blockchain platforms. Wrapped assets are created to alleviate this challenge by utilizing a trusted custodian to hold the asset from one blockchain and create a new token on a different blockchain (wBTC, 2019).

Wrapped assets such as wBTC facilitate the trading of assets linked to Bitcoin on other blockchain platforms such as Ethereum. A major advantage of the Ethereum blockchain is its versatility and widespread use for DeFi applications. As the oldest cryptocurrency with the widest ownership, Bitcoin has a large trading volume and high liquidity, a benefit if this can be transferred to the typically lower liquidity DEX markets of Ethereum. In addition, wBTC is also available on networks beyond Ethereum, and trading takes place on both centralized exchanges (CEXs) and DEXs. This suggests that the traders of wBTC may provide new information and thus potentially provide a richer informational environment in the price discovery process of Bitcoin. Furthermore, having wBTC on the Ethereum network likely increases trading and liquidity on Ethereum DEXs.

3. Methodology and data

3.1. Data and variables

We obtain trading data from tardis.dev which includes tick-level trade and quote data for the exchange Coinbase for Bitcoin and Wrapped Bitcoin against the US dollar. We focus on trading data from a single centralized exchange to directly measure the contribution to price discovery of the two assets while keeping the trading environment constant. We measure liquidity by the relative effective spread and trading activity by the total trading volume in US dollars. To capture volatility, we compute the standard deviation of 1 millisecond logarithmic quote midpoint returns. We compute these measures for every 100 millisecond window of the sample, winsorize the data at 0.1% and 99.9% per day, and aggregate to a daily frequency by taking the sum (for trading volume) or the mean (for the other variables).

As a proxy for DeFi activity, we additionally collect the daily total trading volume across all decentralized exchanges for all liquidity pools from DeFi Llama. Finally, we collect data on the supply of wBTC and BTC from Dune and Blockchain.com, respectively, and compute the fraction of BTC that is locked in wBTC.

3.2. Measuring price discovery and its determinants

To measure price discovery, we broadly follow Alexander et al. (2020a) and Scharnowski and Jahanshahloo (2025) by utilizing the modified information share measure from Lien and Shrestha (2009). An advantage of this measure over the overall very similar one by Hasbrouck (1995) is that it provides a unique estimate of price discovery contribution rather than a range of upper and lower bounds. Both measures rely on expressing price changes via multiple cointegrated series within a multivariate vector error-correction model (VECM). While Hasbrouck (1995) employs a Cholesky factorization of the innovation covariance matrix, an approach that is sensitive to the ordering of the markets, the modified information share is based on a factorization of the corresponding correlation matrix. This removes the dependence on variable ordering and thus yields a single, order-invariant measure of each market's contribution (for a detailed discussion, see Lien and Shrestha, 2009, pp. 383 ff.). To complement our analysis, we also employ the component share measure of Gonzalo and Granger (1995). For selecting the lag length in the VECM, we use the Akaike information criterion, allowing for up to 40 lags. We use log quote midpoints sampled at a 1 s frequency and compute the measures separately for each day.

To understand the determinants of price discovery, we then regress the daily information shares on several explanatory variables, using Newey and West (1987) adjusted standard errors with $\lfloor N \rfloor = 6$ lags.

4. Results

4.1. Summary statistics

Fig. 1 illustrates the development of the supply and market capitalization of wBTC. The supply of wBTC is generally between 100,000 and 300,000 wrapped bitcoins. Due to volatile prices, the market capitalization fluctuates substantially more and closely co-moves with BTC prices during the second half of our sample.

Price differences between wBTC and its underlying asset are generally small as shown in Fig. 2. Relative price differences usually range within ± 10 basis points (bps).[3] Notable exceptions can be seen during the "crypto winter" following the bankruptcy of the cryptocurrency exchange FTX in late 2022.[4]

In Table 1 we show that average market capitalization of wBTC is USD 7.4 billion, representing about 0.96% of the overall supply of BTC. On average, price differences are small with wBTC trading at a 1.99 bps discount compared to BTC. While BTC is more liquid at Coinbase, average effective spreads of 7.8 bps for wBTC are still small compared to most other asset markets. Similarly, trading volume in BTC is much larger than in wBTC.

4.2. Price discovery in wrapped Bitcoin

Table 2 shows statistics on the price discovery process. wBTC contributes 10% to the price discovery process when measured by modified

[2] See also Borri et al. (2025) and Easley et al. (2024) for recent evidence regarding cryptocurrency pricing and market microstructure.

[3] In untabulated Johansen cointegration tests, we find BTC and wBTC prices to be significantly cointegrated.

[4] Before its November 2022 bankruptcy, FTX served as a major merchant for wBTC.

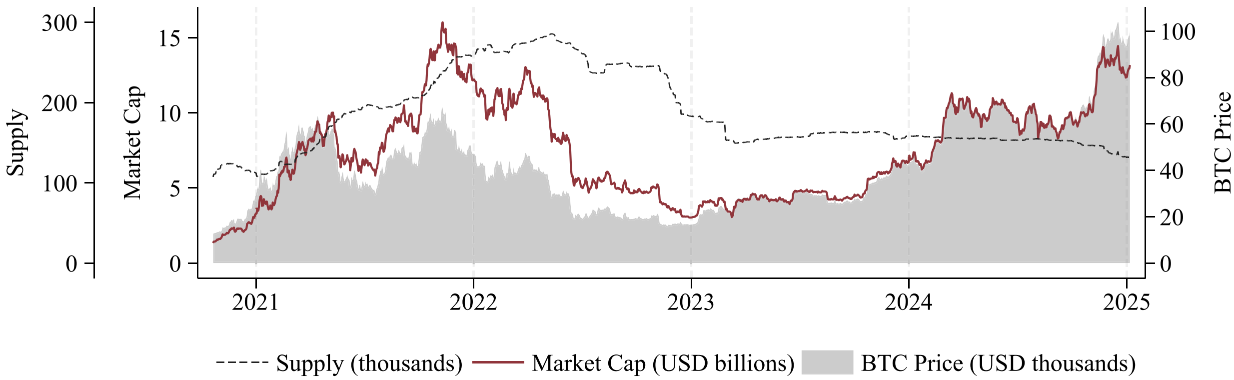

Fig. 1. Wrapped bitcoin supply and market capitalization.
This graph shows the development of the supply of wBTC (in 1k coins) and its total market capitalization (in USD 1bn). The shaded area shows the price of BTC in USD 1k.

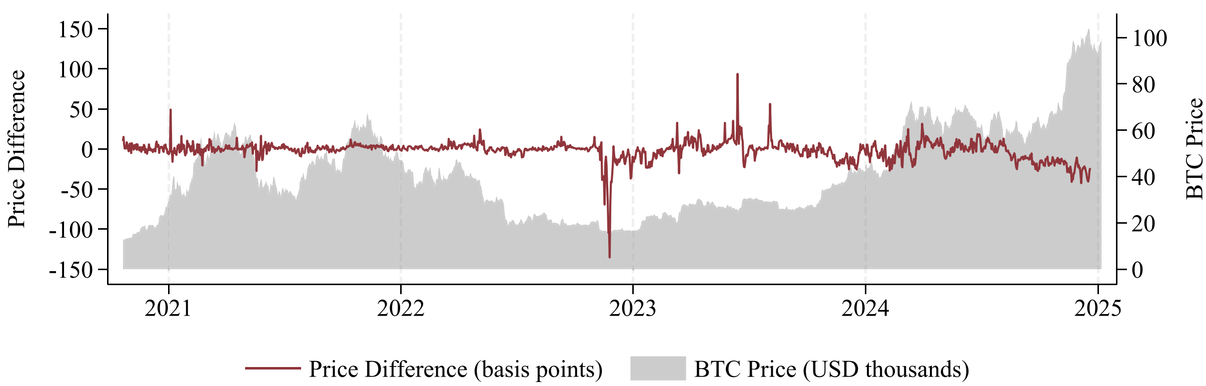

Fig. 2. Price differences.
This graph shows the development of the daily averages of the difference in 1 s log prices between wBTC and BTC in basis points. The shaded area shows the price of BTC in USD 1k.

Table 1
Descriptive statistics.

	Mean	SD	P1	P50	P99
***Panel A:** wBTC*					
Market Cap. $_{wBTC}$	7.432	3.275	3.062	6.809	13.228
Supply $_{wBTC}$	184.053	48.466	119.870	162.314	273.850
wBTC Share $_{\%}$	0.959	0.259	0.646	0.834	1.437
Price Difference	−1.991	11.838	−21.505	−0.025	11.484
Abs. Price Difference	8.243	9.355	1.491	5.265	23.373
***Panel B:** Aggr. DEX Volume*					
Aggr. DEX Volume	4.513	3.496	0.901	3.639	11.642
***Panel C:** Liquidity and Trading Activity*					
Effective Spread $_{wBTC}$	7.836	4.622	2.753	6.846	16.128
Effective Spread $_{BTC}$	0.350	0.324	0.038	0.282	0.855
Volume $_{wBTC}$	0.517	0.848	0.040	0.266	1.758
Volume $_{BTC}$	662.452	493.572	142.461	552.711	1566.174

This table shows daily summary statistics. *Market Cap.* is the market capitalization of wBTC in USD billions. *Supply* is the number of wBTC coins outstanding in thousands. *wBTC Share* $_{\%}$ is the share of WBTC of all BTC supply in percentage points. *Price Difference* is the daily average relative price difference between wBTC and BTC in basis points and *Abs. Price Difference* the daily average of the absolute values of relative price difference between in basis points. *Aggr. DEX Volume* is the total daily DEX trading volume across all protocols and pools in USD 1bn. *Effective Spread* is the average daily relative effective spread in basis points. *Volume* is the daily trading volume in USD millions.

information share and 11.2% when measured by component share. While this contribution is already stronger than what would be expected based on its market capitalization, information share also varies substantially over time. The 99th percentile of information and component share are above 30%, suggesting that there are times when these tokens are especially relevant for the price discovery process.

Table 2
Information share.

	Mean	SD	P1	P50	P99
***Panel A:** Modified Information Shares*					
Mod. Info. Share $_{\text{wBTC}}$	0.100	0.112	0.001	0.066	0.310
Mod. Info. Share $_{\text{BTC}}$	0.900	0.112	0.690	0.934	0.999
***Panel B:** Component Shares*					
Component Share $_{\text{wBTC}}$	0.112	0.103	0.007	0.082	0.319
Component Share $_{\text{BTC}}$	0.888	0.103	0.681	0.918	0.993

This table shows daily summary statistics for information shares. *Mod. Info. Share* and *Component Share* are the daily modified information share and daily component share, respectively, of a trading pair relative to the other trading pair at Coinbase.

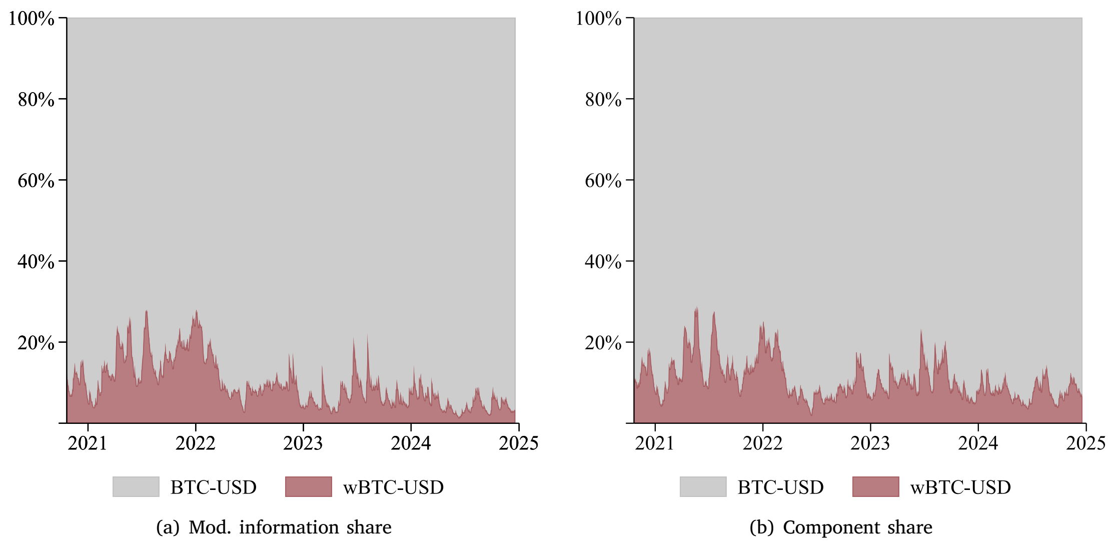

Fig. 3. Evolution of price discovery.
These graphs show daily modified information share and component share calculated using secondly log quote midpoints of BTC and WBTC against USD at Coinbase. For readability, the measures are smoothed with a trailing exponentially weighted moving average using 0.1 as the smoothing parameter.

This is corroborated by Fig. 3 which shows the development over time. There are some periods where there is significantly more price discovery information imputed into Bitcoin prices from wBTC, potentially driven by information from decentralized finance platforms. As the amount of wBTC increases, this impact on the price of Bitcoin is likely to increase.

We now turn to the analysis of the potential determinants of price discovery in Table 3. wBTC liquidity as measured by the effective spread is positively associated with its contribution to price discovery. However, the effect largely disappears when we include the measures related to DeFi importance. The liquidity of BTC itself does not materially affect price discovery, likely because the BTC-USD trading pair at Coinbase is one of the most liquid cryptocurrency markets. In a similar vein, we find that an increase in wBTC (BTC) trading volume is associated with an increase (decrease) in their contribution to price discovery. This is expected if trading volume is at least partially driven by informed traders and agrees with findings in other markets (see e.g. Frijns et al., 2015; Chen and Tsai, 2017).

We then control for the market environment by including the log of BTC prices, the daily return, and realized volatility, but find the effects of liquidity and trading volume remain qualitatively unchanged. Finally, we assess the influence of DeFi activity. A greater share of BTC locked in wBTC, higher aggregate DEX trading volume, and a stronger ETH/BTC exchange rate are all positively associated with wBTC's role in price discovery. This is consistent with our hypothesis that information from decentralized platforms play a meaningful role in shaping Bitcoin prices.

Robustness checks using shifted dependent variables and a logit-transformed specification confirm the main findings. When we use component share as the dependent variable, trading volume remains significant, though among the DeFi measures, only the relative ETH price remains statistically significant. Furthermore, in untabulated tests we find similar results when using ratios of wBTC and BTC trading volume and liquidity, respectively. Likewise, we obtain similar results regarding the determinants of price discovery when employing modified information leadership share as in Shen et al. (2025), although this measure generally attributes an even higher price discovery contribution to wBTC.

5. Conclusion

We examine a new class of asset backed tokens, wrapped Bitcoin (wBTC), which serves as an important asset within decentralized finance. We show that wBTC plays a meaningful role in the price discovery of Bitcoin, accounting for about 10% of information share. We find that as demand for decentralized finance and Ethereum increases, the price discovery impact of wBTC on Bitcoin increases. This result suggests that information from decentralized platforms is driving a significant portion of the incremental price discovery of Bitcoin through wBTC trading.

Data availability

The authors do not have permission to share data.

Table 3
Determinants of price discovery.

	(1) MIS	(2) MIS	(3) MIS	(4) MIS	(5) MIS	(6) MIS	(7) MIS	(8) MIS_{t+1}	(9) logit(MIS)	(10) CS
Effective Spread $_{wBTC}$	−0.004**	−0.003**	−0.003**	−0.002	−0.003**	−0.002	−0.001	−0.002*	−0.037	−0.000
	(−2.18)	(−2.00)	(−2.01)	(−1.33)	(−1.98)	(−1.06)	(−0.86)	(−1.74)	(−1.56)	(−0.07)
Effective Spread $_{BTC}$	0.016	0.010	−0.016	−0.007	−0.015	−0.020	−0.014	−0.034	−0.581	−0.017
	(0.76)	(0.50)	(−0.53)	(−0.24)	(−0.53)	(−0.71)	(−0.50)	(−1.61)	(−1.53)	(−0.56)
log Volume $_{wBTC}$		0.018***	0.016***	0.020***	0.022***	0.025***	0.023***	0.013***	0.287***	0.017***
		(4.39)	(3.74)	(4.38)	(4.59)	(5.39)	(4.97)	(2.83)	(3.36)	(3.54)
log Volume $_{BTC}$		−0.016**	−0.019**	−0.029***	−0.038***	−0.034***	−0.030***	0.003	−0.274*	−0.024**
		(−2.35)	(−2.29)	(−3.48)	(−3.66)	(−3.77)	(−3.03)	(0.36)	(−1.71)	(−2.56)
log BTC Price			−0.008	0.010	−0.044***	0.014	0.030	0.029	0.341	0.001
			(−0.63)	(0.79)	(−3.15)	(1.01)	(1.37)	(1.43)	(1.07)	(0.06)
BTC Return			−18.806***	−13.091**	−11.569*	−10.766*	−11.660*	−12.310	−54.200	−11.085*
			(−2.83)	(−2.04)	(−1.81)	(−1.75)	(−1.87)	(−1.55)	(−0.40)	(−1.68)
BTC Volatility			0.014	0.011	0.014	0.020**	0.017*	0.015*	0.414***	0.011
			(1.42)	(1.10)	(1.50)	(2.16)	(1.65)	(1.70)	(2.76)	(1.17)
wBTC Share $_{\%}$				0.092***			0.051**	0.053**	1.740***	−0.038
				(5.12)			(2.07)	(2.11)	(3.99)	(−1.57)
log Aggr. DEX Volume					0.035***		−0.011	−0.024**	−0.366*	0.003
					(3.64)		(−0.85)	(−1.99)	(−1.67)	(0.27)
ETH/BTC Ratio						1.883***	1.460**	1.420**	16.505*	1.510**
						(4.86)	(2.24)	(2.34)	(1.81)	(2.41)
Observations	1521	1521	1521	1521	1521	1521	1521	1520	1521	1521
Adj. R^2	0.02	0.04	0.04	0.08	0.06	0.09	0.09	0.08	0.10	0.03

This table shows time series regression results for the determinants of price discovery. MIS is the modified information share and CS the component share of wBTC-USD relative to BTC-USD at Coinbase. *Effective Spread* is the average daily relative effective spread in basis points. *Volume* is the daily trading volume in USD. *BTC Price* is the daily average price of BTC in USD. *BTC Return* is the daily average 1ms quote midpoint return in basis points and BTC Volatility the daily average standard deviation of these returns for each 100 ms window in basis points. *wBTC Share* $_{\%}$ is the share of WBTC of all BTC supply in percentage points. *Aggr. DEX Volume* is the total daily DEX trading volume across all protocols and pools in US dollars. Newey–West *t*-statistic are reported in parentheses.

*** denotes significance at the 1% level.

** denotes significance at the 5% level.

* denotes significance at the 10% level, respectively.

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