Cryptocurrencies and the Velocity of Money

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Velocity is employed in countless empiricial pricing studies for crypto-currencies.

What are the proxy-variables used so far—and how is their quality?

Can we improve the data quality for including velocity into pricing studies?

How is velocity defined?

$$V_p = \frac{\langle P_p, T_p \rangle}{M_p} \text{and } P_p, T_p \in \mathbb{R}^n. \qquad (5)$$

Velocity is the average number of coin turnovers per period.

We introduce velocity measures for UTXO-based cryptocurrencies focused on the subset of the money supply effectively in use for processing transactions. We show that each of the velocity estimators is approximated best by the simple ratio of on-chain transaction volume to total coin supply.

I. THEORY AND MEASURES

Adopted approximations:

- Coin days destroyed (DeLeo and Stull 2014, Georgoula et al. 2015, Bouoiyour and Selmi 2015, Luis, Fuente, and Perote 2019, ...)
- Coin-turnover (Smith 2017)
- Simplified velocity measure

Recently proposed measures:

Simplified: Bolt and Van Oordt 2016 and Ciaian, Kancs, and Rajcaniova 2018:

$$V^{\texttt{msr}}_{\texttt{triv}p} = \frac{\text{"on-chain transaction volume"}}{\text{"total coin supply"}} \qquad (2)$$

Adjusted transaction volume: Kalodner et al. 2017 and Athey et al. 2016:

$$V^{\texttt{msr}}_{\texttt{total}p} = \frac{\text{"adjusted on-chain transaction volume"}}{\text{"total coin supply"}} \qquad (3)$$

Based on money in effective circulation: Theoretically proposed in Bolt and Van Oordt 2016, **operationalized in this study**:

$$V^{\texttt{msr}}_{\texttt{circ}p} = \frac{\text{"adjusted on-chain transaction volume"}}{\text{"adjusted coin supply"}} \qquad (4)$$

II. PROPOSED OPERATIONALIZATION

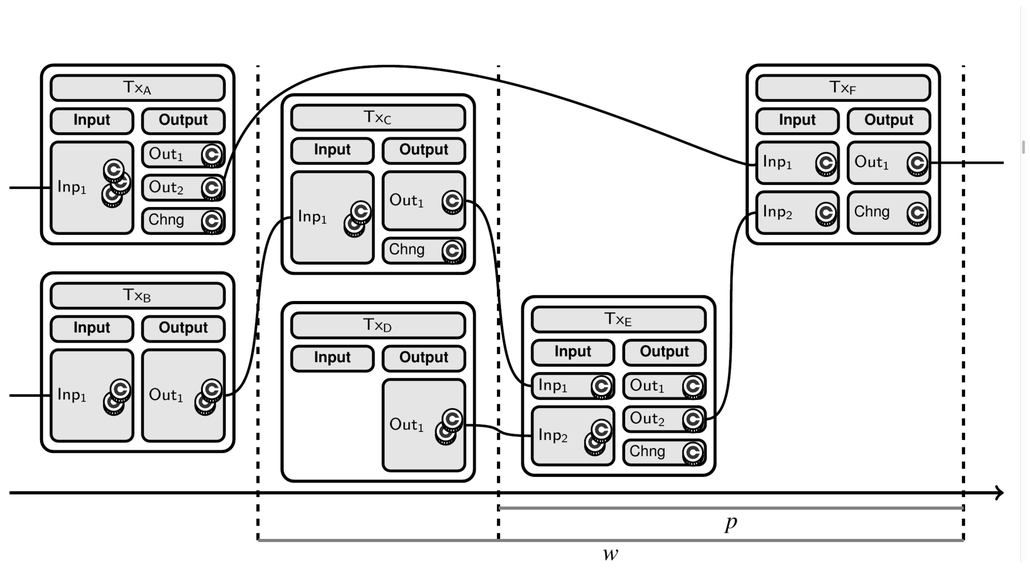

Figure: An example of a transaction chain.

Two issues:

- Change transactions
- Undetermined link between inputs and outputs

Three measures:

- “Whole-bill-approach”
- “Moved-coin-approach - First-in-first-out”
- “Moved-coin-approach - Last-in-first-out”

III. ON THE QUALITY OF APPROXIMATIONS

Results:

- For differenced data, $V^{\texttt{msr}}_{\texttt{triv}p}$ clearly superior
- For raw data less clear - but coin days destroyed mostly outperformed

Future research:

- Find look-back window suited best
- Add off-chain transaction data

Paper available at:

Table: MAE and MSE between velocity approximation methods compared to estimation methods. If the proxy-variable is part of the superiority set of the respective Model Confidence Set Tests (1% sig. levels) are marked with † (compare Hansen et al. 2011).

		Raw Data				First Differences			
		standardized		normalized		standardized		normalized	
Approximation	Estimator	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE
$V^{\texttt{app}}_{\texttt{cdd}}$	$V^{\texttt{msr}}_{\texttt{total}}$	1405.30	1405.30	152.42	30.15	1356.97	1356.97	116.79	28.06
$V^{\texttt{app}}_{\texttt{cdd}}$	$V^{\texttt{msr}}_{\texttt{circWba}}$	1611.26	1611.26	210.77	41.95	1600.15	1600.15	135.49	33.55
$V^{\texttt{app}}_{\texttt{cdd}}$	$V^{\texttt{msr}}_{\texttt{circMcaLifo}}$	1607.60	1607.60	221.03	43.47	1623.72	1623.72	136.76	33.48
$V^{\texttt{app}}_{\texttt{cdd}}$	$V^{\texttt{msr}}_{\texttt{circMcaFifo}}$	1607.61	1607.61	221.03	43.47	1623.72	1623.72	136.76	33.48
$V^{\texttt{app}}_{\texttt{turn}}$	$V^{\texttt{msr}}_{\texttt{total}}$	1570.56	1570.56	129.35	16.85	1470.08	1470.08	116.05	14.50
$V^{\texttt{app}}_{\texttt{turn}}$	$V^{\texttt{msr}}_{\texttt{circWba}}$	1328.73	1328.73	† 120.34	† 14.95	1542.02	1542.02	121.99	16.33
$V^{\texttt{app}}_{\texttt{turn}}$	$V^{\texttt{msr}}_{\texttt{circMcaLifo}}$	1373.43	1373.43	† 129.71	† 16.09	1549.60	1549.60	122.28	16.01
$V^{\texttt{app}}_{\texttt{turn}}$	$V^{\texttt{msr}}_{\texttt{circMcaFifo}}$	1373.40	1373.40	† 129.71	† 16.09	1549.61	1549.61	122.28	16.01
$V^{\texttt{app}}_{\texttt{triv}}$	$V^{\texttt{msr}}_{\texttt{total}}$	† 381.20	† 381.20	† 85.24	† 7.32	† 306.69	† 306.69	† 35.09	† 4.60
$V^{\texttt{app}}_{\texttt{triv}}$	$V^{\texttt{msr}}_{\texttt{circWba}}$	† 892.30	† 892.30	143.68	15.71	† 838.69	† 838.69	† 69.11	† 8.65
$V^{\texttt{app}}_{\texttt{triv}}$	$V^{\texttt{msr}}_{\texttt{circMcaLifo}}$	† 912.54	† 912.54	156.52	17.52	† 864.98	† 864.98	† 70.60	† 8.55
$V^{\texttt{app}}_{\texttt{triv}}$	$V^{\texttt{msr}}_{\texttt{circMcaFifo}}$	† 912.55	† 912.55	156.52	17.52	† 864.99	† 864.99	† 70.60	† 8.55

4th ForDigital Blockchain Workshop
Karlsruhe, Germany, March 2020