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Bitcoin, Economic Freedom, and Underground Economies: A Tax Evasion Nexus

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Abstract

Research Originality: Our research uniquely integrates the dimension of economic freedom to assess its moderating effect on tax evasion in G-7 countries. This study also provides the latest tax evasion estimates in G-7 countries using the currency demand approach to measure the effectiveness of policies employed by the regulators to reduce large numbers of tax evasion.

Research Objectives: This study estimates tax evasion in G-7 countries and measures the impact of cryptocurrencies on tax evasion at different levels of economic freedom.

Research Methods: This study employs the Currency Demand Approach to estimate tax evasion and then utilizes asymmetric/symmetric panel techniques (ARDL/NARDL) to confirm the impact of cryptocurrencies and all indicators of economic freedom on tax evasion.

Empirical Results: Our investigation unveils that cryptocurrencies significantly impact tax evasion. This study also finds economic freedom indicators' asymmetric/symmetric impact and confirms the moderating impact. Economic freedom indicators significantly increase/decrease the impact of cryptocurrencies on tax evasion.

Implications: Cryptocurrencies may be given due importance while drafting tax-related policies, and policymakers must maintain the optimum levels of economic freedom where cryptocurrencies do not support tax evasion.

Keywords:

tax evasion; cryptocurrencies; economic freedom; panel models; currency demand approach

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INTRODUCTION

Tax evasion is a persistent global issue and a leading cause of the budget deficit globally, which has reached $104.5 billion annually in Europe and $90 billion in the USA. In a recent report by Bloomberg, the IRS chief states that tax evasion has increased drastically to $1 trillion a year due to new techniques adopted by tax evaders. The above-mentioned big numbers for developed economies are serious concerns for development and smooth economic growth. Governments have to depend on borrowing due to a lack of funds for living standards, resulting in huge interest payments (Altaf et al., 2019). Such borrowing amplifies the negative impact of tax evasion on the economy. Austin et al. (2019) concluded that individuals evade taxes due to high tax rates and switch to a state quickly rather than lose their state due to taxes. Firms also evade taxes to tackle financial constraints to meet financial requirements (Alm et al., 2019). The tax burden of the firms, low trust in the Government, the judicial system, firm size, and highly cash-intensive sectors are associated with firms' tax evasion (Abdixhiku et al., 2017). Tax evasion has always been challenging for economies due to innovative methods of tax evaders (Alleyne & Harris, 2017).

Recently, cryptocurrencies have appeared as a standard for developing innovative solutions. Cryptocurrencies reduce bureaucracy, increase security, and promote global inclusion in an emerging cryptographic money system (Bhullar et al., 2025; Grym et al., 2024). Financial regulators are afraid of their negative role but want to maintain the positive aspect of the most secure and global system of payments. This controversial role of cryptocurrencies motivated the author to empirically analyze cryptocurrencies' role to help policymakers determine if cryptocurrencies are a potential source of tax evasion.

There is a need for empirical studies in the literature to measure the impact of cryptocurrencies on macroeconomic factors, such as tax evasion. Considering the threat level and innovative tax evasion techniques, it is important to know the contributing factors towards tax evasion so that related measures can be taken. Besides cryptocurrencies, economic freedom is also a significant determinant of tax evasion (Achek, 2015; Alabede, 2018; Islam et al., 2020; Matusiak, 2018; Nurunnabi, 2018; Picur et al., 2021; Picur & Riahi-Belkaoui, 2006; Riahi-Belkaoui, 2004; Rysava & Zidkova, 2021; Tekin et al., 2018). However, the literature has mixed findings that require further analysis. Linear models have been employed in the literature, so an in-depth analysis of long-run/short-run and nonlinear ways is yet to be explored. Based on the problems faced by the economies, this study examines the nonlinear association between economic freedom, cryptocurrencies, and tax evasion. Uniquely, this study also measures the association of cryptocurrencies and tax evasion at different levels of economic freedom, which the Economic Freedom theory suggests. The existence of one independent variable may change the impact of another independent variable on the dependent variable. In such cases, an interaction term is used. The researchers also explored the impact of interaction terms besides social, corporate, and macroeconomic determinants of tax evasion. Ahrens and Bothner (2020) measured the effect of the international tax-related information-sharing agreement on

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tax evasion, used multiple interaction term dummies, and found a significant impact of interaction terms on tax evasion.

This study uses various interaction terms of independent variables as supported by the literature (Ariyanto et al., 2020; Chouaibi et al., 2024; Oktaviani & Yulinar, 2018). Economic freedom is measured using multiple indicators: Government Integrity, Government Spending, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, and Financial Freedom. Tax evasion is closely related to economic conditions and policies, and measuring the relationship between economic performance and tax evasion is necessary. Government Integrity is found to be significantly associated with tax evasion (Drogalas et al., 2018; Lushi, 2016; Mihóková et al., 2019). Monetary freedom is also associated with tax evasion (Islam et al., 2020; Mihóková et al., 2019; Nurunnabi, 2018). Similarly, another significant factor in reducing tax evasion is Financial Freedom (Habibullah et al., 2017). A recent effort to explore the relationship between tax evasion and economic freedom indicators in the SAARC region was made by Islam et al. (2020). The study's results concluded that economic freedom negatively impacts tax evasion.

To precisely measure the changing magnitude of tax evasion and to explore new determinants of tax evasion, this study contributes to the literature by providing the latest estimates of tax evasion in the G-7 countries. Moreover, this study fills the gap in empirical studies to measure the impact of cryptocurrencies on tax evasion. This is also among the very first studies, as per the best of the author›s knowledge, in G-7 countries, which cover more than 58% of the total world wealth. Lastly, this study measures the moderating impact of economic freedom on the relationship between tax evasion and cryptocurrencies, a relationship that is not well-documented in the literature.

The study of Austin et al. (2019) was conducted in the context of the USA and tax evasion at the individual level. The author found that the behavior of individuals for tax evasion is related to their expectations and direction of change. Individuals evade more tax when the tax rate increases and vice versa, but this is temporary. Miller (2019) also concluded that American corporations and business entities evade taxes of $100 billion.

In the context of Canada, Makni et al. (2019) conducted a study based on the determinants of tax haven use by Canadian firms. The authors selected 255 firms for 2014-2015 and used the probit regression. They concluded that thin capitalization, tax fees to auditing firms, and multinationalism are important determinants of tax haven usage. Khlif and Amara (2019) studied 35 countries, including Canada, to determine the relationship between tax evasion and political connections. The authors found that political connections have a positive association with tax evasion.

A study by Kemme et al. (2020) explored tax evasion in countries with low tax morale. The authors used data from 21 OECD countries. The authors concluded that countries with low tax morale engage in tax evasion. Further, this evasion is done via round-tripping through tax havens. An extensive study was conducted by Gurdal

et al. (2020) in the context of G-7 countries to determine the causal relationship between tax revenue, government expenditure, and economic growth.

Concluding this discussion, not all factors of economic freedom are given the justified importance as important determinants of tax evasion in the literature. In most studies, as mentioned earlier, only a single indicator of economic freedom is used. However, other important factors like monetary, trade, labor, and investment should be included in the literature. Literature has also mixed findings about the role of economic freedom and tax evasion based on econometric methodology, the research context, and the directionality of impact. Besides linear association, it is also important to measure the asymmetric impact that may reverse the direction of impact between tax evasion and economic freedom.

METHODS

This study employed annual data from 2001 to 2020 to estimate the tax evasion index, as all the macroeconomic variables used for estimation are found annually from World Governance Indicators provided by the World Bank. Tax evasion estimates are calculated from 2001 onward. However, an association of cryptocurrencies and tax evasion is measured during 2013-2020, as Bitcoin market capitalization is available from 2013 onward only. The tax evasion estimates are obtained by employing the ARDL model and Currency Demand Approach (CDA). This study employs dynamic and asymmetric models (ARDL / NARDL) based on the complexity of the topic. Stata is used for analysis purposes. The details of the variables and sources of the data are provided in Table 1.

Table 1. Data and Variables

Variable Name	Description	Symbol	Source
Tax evasion	Annual Tax Evasion Index	Tax evasion	The author's calculation using the CDA approach
Money Supply	Natural logarithm of real monetary aggregate M1	M1	World Bank
Currency in circulation	Natural logarithm of real currency holdings measured as nominal currency in circulation normalized by a GDP deflator.	C	World Bank
Tax to GDP	Tax to GDP ratio	Tax	World Bank
Real GDP	Natural logarithm of real GDP	Yt	World Bank
Deposit Interest Rate	The interest rate paid to deposit account holders	R	World Bank
Inflation Rate	Natural logarithm of the inflation rate		World Bank
Bitcoin Market Capitalization	Market Capitalization	bitC	CoinMarketCap
Enforcement Strength	Enforcement strength of public administration	ENF	World Bank
Income	Per Capita Income	INCOME	World Bank

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This study adopts Tanzi's (1980) approach to estimate tax evasion in G-7 countries. The currency demand approach is extensively used in literature (Amoh & Adafula, 2019; Athanasios et al., 2020; Dell'Anno & Davidescu, 2019). This approach is an extended version of the Cagan (1958) approach, which was the first to estimate tax evasion in the context of the USA using monetary variables. Cagan (1958) assumed that the share of currency in the money supply in the base year is representative of the economic agent's behavior. The unexplained or residual of this ratio will gauge the size of the shadow economy. This estimation is based on unexplained normal economic factors that cause the shadow economy to grow. Eq (1) is the model of the currency demand approach:

$$C = f(Y^d, R, \pi, Tax, Urbanization, ENF) \quad (1)$$

Since disposable income is defined as net of direct taxes, equation (1) can be rewritten as

$$C = f(Y - T, R, \pi, Tax, Urbanization, ENF) \quad (2)$$

Where C is the currency demand for the whole economy (Including official and unofficial demand), R is the interest and π inflation rates. As disposable income rises, then the demand for currency also increases. As the opportunity cost of holding money which is interest rate R and the inflation rate increases, the demand for currency reduces. Enforcement results in lower currency demand, and Urbanization results in higher currency demand. The main assumption in this approach is that the underground economy is more cash-intensive, so as the tax rate increases, the demand for currency increases. The same assumption is confirmed in literature (Amoh and Adafula, 2019; Athanasios et al., 2020; Dell'Anno and Davidescu, 2019).

Transforming the general Eq (2), Eq(3) will be as follows to estimate tax evasion.

$$ln\frac{C_{it}}{M_{i,t}} = b_0 + b_1 \ln(1 + tax_{i,t}) + b_2 Enf_{i,t} + b_3 lnY_{i,t} + b_4 \ln(1.1 + \pi_{i,t}) + b_5 R_{i,t} + b_6 \ln(Urb_{i,t}) + e_{i,t} \quad (3)$$

By using the data of G-7 countries from 2001 to 2020 in Eq (3), the coefficients are obtained and put into Eq. (3):

$$ln\frac{C_{i,t}}{M_{i,t}} = b_0 + -0.000781 * \ln(1 + tax_{i,t}) - 0.007839 * Enf_{i,t} + +3.14E-07 * lnY_{i,t} + 2.15E-05 ln(1.1 + \pi_{i,t}) + 3.79E-04 * R_{i,t} - 0.014512 * \ln(Urbanization_{i,t}) + e_{i,t} \quad (4)$$

Eq. (4) is used to get predicted values for overall currency demand. We get the value of currency demand each year. The same procedure is repeated with zero tax revenue and the highest enforcement value, i.e., 2.5. This predicted currency value is again obtained for each year, but this is an illegal currency. The difference between the above two steps estimates illegal currency in the economy. Further, the velocity of money in circulation is calculated by dividing nominal GDP by the value of legal money. Finally, this calculated velocity of the money is multiplied by the extra currency to get the shadow economy.

The primary research model of this study is as follows:

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 bitC_{i,t} + \sum_{i=1}^{n} \gamma_i\ Control_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 Econ\_Freedom_{i,t} + \sum_{i=1}^{n} \gamma_i\ Control_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 Econ\_Freedom * bitC_{i,t} + \sum_{i=1}^{n} \gamma_i\ Control_{i,t} + \varepsilon_{i,t} \quad (7)$$

Eq (5) to Eq (7) will be extended after putting the control variable as follows:

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 bitC_{i,t} + \beta_2 lnGDP_{i,t} + \varepsilon_{i,t} \quad (8)$$

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 Econ\_Freedom_{i,t} + \beta_2 lnGDP_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$Tax\ Evasion_{i,t} = \alpha_0 + \beta_1 Econ\_Freedom_{i,t} * bitC_{i,t} + \beta_2 lnGDP_{i,t} + \varepsilon_{i,t} \quad (10)$$

Where Tax Evasion is annual tax evasion in G-7 countries, bitC is the yearly market capitalization of Bitcoin. Tax Evasion is annual tax evasion in G7 countries, calculated using the Currency Demand Approach (CDA) developed by Tanzi (1980). More than 2,200 cryptocurrencies are circulating in this digital system (CoinMarketCap, 2021). It is harder to use the market capitalization of all these currencies due to the addition or deletion in the crypto market. So, the market capitalization of Bitcoin, which is 95% of all cryptocurrencies' market capital, is used as a proxy to measure cryptocurrencies.

Applying the panel ARDL model in Eq(8) to Eq(10), the regression equations will be as follow respectively:

$$Tax\ Evasion_{i,t} = a_0 + \sum_{i=1}^{n1} b_i \Delta BitC_{i,t-i} + \sum_{i=0}^{n2} c_i \Delta lnGDP_{i,t-i} + \sum_{i=0}^{n3} d_i \Delta Tax\ Evasion_{i,t-i} + \alpha_1 BitC_{i,t-1} + \alpha_2 lnGDP_{i,t-1} + \alpha_3 Tax\ Evasion_{i,t-1} + e_{i,t} \quad (11)$$

$$Tax\ Evasion_{i,t} = a_0 + \sum_{i=1}^{n1} b_i \Delta BitC_{i,t-i} + \sum_{i=0}^{n2} c_i \Delta lnGDP_{i,t-i} + \sum_{i=0}^{n3} d_i \Delta Tax\ Evasion_{i,t-i} + \alpha_1 BitC_{i,t-1} + \alpha_2 lnGDP_{i,t-1} + \alpha_3 Tax\ Evasion_{i,t-1} + e_{i,t} \quad (12)$$

$$Tax\ Evasion_{i,t} = a_0 + \sum_{i=1}^{n1} b_i \Delta BitC * Econ\_Freedom *_{i,t-i} + \sum_{i=0}^{n2} c_i \Delta lnGDP_{i,t-i} + \sum_{i=0}^{n3} d_i \Delta Tax\ Evasion_{i,t-i} + \alpha_1 Econ\_Freedom * BitC_{i,t-1} + \alpha_2 lnGDP_{i,t-1} + \alpha_3 Tax\ Evasion_{i,t-1} + e_{i,t} \quad (13)$$

Variables shown with the differenced symbol will determine short-run movements, while with $\boldsymbol{\alpha_s}$ show the long-run relationship.

After applying the non-linear ARDL model, which the author applies in the case of non-linear relationship, the NARDL model will be as follows:

$$Tax\ Evasion_{i,t} = \alpha_0 + \alpha_1 BitC^{+} + \alpha_2 BitC^{-} +_t + \sum_{i=1}^{n} \gamma_i\ Control_{i,t} + \varepsilon_t$$

(α_0, α_1, α_2) are vectors of long-run coefficients to be estimated, ***and BitC*** and ***BitC*** are the partial sums of positive and negative changes in the market capitalization of Bitcoin.

$$BitC^{+} = \sum_{i=1}^{t} \Delta\ BitC^{+} = \sum_{i=1}^{t} max\ (\Delta BitC_i, 0)$$

$$BitC^{-} = \sum_{i=1}^{t} \Delta\ BitC^{-} = \sum_{i=1}^{t} min\ (\Delta BitC_i, 0)$$

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$$Tax\ Evasion_{i,t} = a_0 + \sum_{i=1}^{n1} b_i \Delta POS_{BitC_{i,t-i}} + \sum_{i=1}^{n2} c_i \Delta NEG_{BitC_{i,t-i}} + \sum_{i=0}^{n3} d_i \Delta lnGDP_{t-i} + \sum_{i=0}^{n4} f \Delta Tax\ Evasion_{t-i} + \alpha_1 POS_{BitC_{t-1}} + \alpha_2 NEG_{BitC_{t-1}} + \alpha_4 Tax\ Evasion_{t-1} + e_t \quad (14)$$

Using the interaction of Economic Freedom indicators and bitC as an independent variable and applying NARDL, the following equation will be obtained:

$$\begin{aligned} \text{Tax Evasion}_{i,t} = {} & a_0 + \sum_{i=1}^{n1} b_i \Delta \text{POS}_{\text{Eco Freedom}*\text{bitC}_{i,t-i}} + \sum_{i=1}^{n2} c_i \Delta \text{NEG}_{\text{Econ Freedom}*\text{bitC}_{i,t-i}} + \\ & \sum_{i=0}^{n3} f_i \Delta \text{Tax Evasion}_{t-i} + \alpha_1 \text{POS}_{\text{Econ Freedom}*\text{bitC}_{t-1}} + \\ & \alpha_2 \text{NEG}_{\text{Econ Freedom}*\text{bitC}_{t-1}} + \alpha_3 \text{Tax\_Evasion}_{t-1} + e_{i,t} \end{aligned} \quad (15)$$

Variables shown with the differenced symbol will be determining short-run movements, while those with $\boldsymbol{\alpha_s}$ shows the long-run relationship.

RESULTS AND DISCUSSION

This section presents the results of all methods adopted in this study. Table 2 presents the time series of the estimated tax evasion in the G-7 countries. Canada has the highest average annual tax evasion among the G-7 countries, with a score value of 13.43%, while Italy has the lowest yearly tax evasion, at 9.16%. Germany is 2nd among G-7 countries, having a value of 12.37%. Similarly, France is in third position with an average tax evasion of 11.25% of the GDP, and the USA is in fourth. The UK has an average tax evasion of 10.78% from 2001 to 2020, while this value is 9.66% for Japan. These estimates are also compared with the tax evasion estimates calculated by Medina and Schneider (2019). Medina and Schneider (2019) used Multiple Indicators-Multiple Causes (MIMIC) approaches from 2002 to 2017. Our average values are closer to these estimates. However, all the G-7 countries have a decreasing trend of tax evasion from 2001 to 2020, which shows the effectiveness of the policies.

Table 3 provides the summary statistics of the variables under study. Economic freedom indicators are provided by the Heritage Foundation, which measures annual Economic Freedom at the country level. The range score for most variables is 1-100, except for Bureaucracy; 100 indicates the highest score level in that category. No outlier was found in the dataset.

Table 4 presents the results of different unit root tests. Literature supports the existence of trends in time series and panel datasets, so it is necessary to check and remove unit roots before regression. Multiple unit root panel tests are applied for robustness. The author employed ARDL and NARDL bound testing approaches, which require data to be stationary at the level or at the first difference. All the variables are found to be stationary at a level as well as at the first difference.

Table 2. Historical Estimates of Tax Evasion in G-7 Countries using the Currency Demand Approach (CDA) as a percentage of GDP Period is 2001-2020.

Year	Canada	France	Germany	Italy	Japan	USA	UK
2001	15.56	12.73	13.27	10.35	9.89	12.73	12.13
2002	15.10	12.22	13.36	10.23	9.35	12.38	11.73
2003	15.09	12.51	12.73	10.18	9.85	12.03	11.49
2004	15.31	12.49	12.85	9.88	9.95	12.29	11.24
2005	15.51	12.17	12.69	9.59	9.94	12.05	11.05
2006	15.29	12.17	13.01	9.43	10.14	11.99	11.12
2007	15.06	11.83	13.11	9.17	9.94	11.80	11.11
2008	14.54	11.60	12.50	9.10	9.83	11.24	10.77
2009	12.55	11.04	11.78	8.91	9.47	10.63	10.09
2010	12.85	11.03	12.09	8.96	9.59	10.70	10.33
2011	13.08	10.97	12.17	8.86	9.45	10.57	10.37
2012	12.87	10.78	11.91	8.76	9.42	10.67	10.32
2013	12.84	10.71	11.87	8.76	9.42	10.69	10.39
2014	12.99	10.57	12.27	8.61	9.52	10.75	10.57
2015	12.13	10.63	12.15	8.70	9.64	10.81	10.69
2016	11.82	10.52	12.15	8.76	9.74	10.79	10.58
2017	12.08	10.37	12.20	8.77	9.64	10.95	10.61
2018	11.74	10.46	12.12	8.75	9.56	11.01	10.57
2019	11.59	10.52	11.94	8.88	9.52	10.66	10.52
2020	10.52	9.68	11.17	8.62	9.42	9.81	9.89
Average	13.43	11.25	12.37	9.16	9.66	11.23	10.78

Table 3. Summary Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
Bureaucracy	99.814	100.680	105.700	92.405	3.107	140
Business Freedom	83.635	85.000	96.900	69.800	7.919	140
Economic Freedom	71.546	73.050	81.200	58.000	6.718	140
Financial Freedom	67.786	70.000	90.000	30.000	13.680	140
Government Integrity	73.239	76.000	92.000	38.500	12.713	140
Government Spending	39.610	42.500	71.200	2.000	16.641	140
Investment Freedom	73.429	72.500	90.000	50.000	12.539	140
Labor Freedom	69.205	73.300	98.500	39.900	17.510	112
Monetary Freedom	82.529	82.850	94.300	71.700	4.772	140
Trade Freedom	83.914	83.000	88.400	77.800	3.262	140
ln Real GDP	27.817	26.856	32.646	25.929	2.067	140
Schneider Estimates	11.942	11.100	23.700	5.700	4.036	119
Tax Burden	61.686	61.800	80.000	33.900	9.925	140
Bitcoin Mar Cap.	24.37	24.19	27.00	22.19	1.71	56

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Table 4. Unit Root Tests

Variables	HT	Breitung	IPS	Hadri
Tax Evasion	0.9321	1.6238	0.3590	25.9192***
Δ Tax Evasion	-0.0181***	-3.4968***	-5.9162 ***	-1.2348
Tax Burden	0.4358***	0.1339	-10.9524***	9.7796 ***
Δ Tax Burden	-	-0.6594	-	2.6967***
Economic Freedom	0.7622**	-0.7040	-1.0575	14.0375***
Δ Economic Freedom	-0.0649***	-2.4776***	-8.3470***	-0.2107
Government Integrity	0.6377***	-1.2396	-1.7674**	9.3045***
Δ Government Integrity	-	-5.1255***	-6.9412***	0.3402
Government Spending	0.7541**	-1.0772	-0.8298	12.8236***
Δ Government Spending	-0.0283***	-3.0787***	-7.6450***	0.0559
Business Freedom	0.7562**	-0.9481	-0.4674	8.4301***
Δ Business Freedom	0.0022***	-2.2595**	-7.8995***	0.1169
Labor Freedom	0.7797	-0.3965	0.4729	13.7535***
Δ Labor Freedom	-0.0962***	-4.5960***	-7.1411***	-0.7090
Monetary Freedom	0.7474**	-0.5531	-0.2756	14.9157***
Δ Monetary Freedom	-0.0737***	-6.0967***	-7.3297***	-1.5346
Trade Freedom	0.7635**	-0.0087	-2.1349 **	19.2541***
Δ Trade Freedom	-0.0124***	-4.3717***	-7.3231***	1.8925**
Investment Freedom	0.8105	-0.4242	0.1420	20.2705***
Δ Investment Freedom	-0.0591***	-7.7588***	-7.0631***	-1.0617
ln GDP	0.9033	0.7681	0.3731	25.2753***
Δ ln GDP	0.0387***	-4.2209***	-5.9170***	-1.1211
Marginal Personal Income Tax	0.8936	-0.5443	-0.1108	21.4643***
Δ Marginal Personal Income Tax	0.1017	-3.3730***	-5.7551***	-0.6471
Marginal PIT and SSC	0.8007	-1.5158*	1.0066	17.2944***
Δ Marginal PIT and SSC	-0.0527***	-4.5800***	-6.5360***	-1.3372
Corporate Income tax	0.8699	0.4041	0.1614	21.8242***
Δ Corporate Income tax	-0.2547***	-6.4881	-8.4118***	-0.5121
Bureaucracy	0.8279	0.2498	-0.5307	20.5234***
Δ Bureaucracy	0.0214***	-2.7720***	-8.7520***	0.5862
Bitcoin	0.8214	0.2218	2.6253	7.5779***
Δ Bitcoin	-0.3193***	-	-3.8315***	-1.3716

Table 5 presents the results of linear ARDL models, and in most cases, a short-run association of economic freedom variables is against the empirical literature. Moreover, in the long run association, Financial Freedom, Trade Freedom, Business Freedom, Monetary Freedom, and Economic Freedom have a positive sign on tax evasion, which is supported by the literature (Achek, 2015; Alabede, 2018; Islam et al., 2020; Riahi-Belkaoui, 2004; Tekin et al., 2018). These unexpected signs motivated the authors to explore these relationships non-linearly for clarity.

Table 6 presents the results of non-linear autoregressive distributed lag models (NARDL), where tax evasion is the dependent variable, and economic freedom indicators are independent variables. Tax Burden is found to have an insignificant non-linear association with tax evasion. Although long-run cointegration is insignificant, the coefficients of positive and negative changes differ significantly, and the Wald test rejects the null hypothesis of equivalence. Positive changes in the tax burden impact tax evasion negatively, and negative changes support tax evasion. Similarly, in the short run, the relationship is also non-linear and insignificant. Economic Freedom is positively associated with tax evasion in the linear model, and this study also explores the non-linear relationship. The authors find that Economic Freedom has a non-linear relationship in the long run, as the null hypothesis of the Wald test is rejected. Tax evasion increases as Economic Freedom improves, but this surge is more pronounced when Economic Freedom is decreased. As the cointegration is insignificant, the hypothesis that states that Economic Freedom has an asymmetric impact on tax evasion is rejected. So, the policymakers have to be careful while changing the economic policies.

Government Integrity has a negative and non-linear relationship with tax evasion. As Government Integrity improves, it reduces tax evasion. The long-run cointegration does not exist, but the coefficients are significantly different for positive and negative changes. This is true for both long- and short-term associations of tax evasion and Government Integrity. The role of Government Integrity in the short run for the linear model is contrary to the literature, but it is confirmed in the non-linear model. So, the hypothesis that Government Integrity has an asymmetric impact on tax evasion is rejected. Government Integrity is studied in a non-linear way and has expected signs of impact on tax evasion in both the short and long run.

The role of Government Spending as a predictor of tax evasion is linear and positively significant. The coefficient of Government Spending with tax evasion is negative, so as the government spends more, citizens' confidence improves, and they tend to keep on paying taxes. The same is true for the short-run relationship between tax evasion and Government Spending. The same results are supported by the studies of Achek (2015).

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Table 5. Panel ARDL

Independent Variables	ARDL (4,4,4)		ARDL (4,4,4)		ARDL (4,4,4)		ARDL (4,4,4)		ARDL (4,4,4)		ARDL (1,1,1,1)	
	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run
Tax Evasion		-0.17***		-0.61**		-0.542**		-0.33		-0.42*		-0.178
lnGDP	-0.83*	3.32***	-0.54***	3.86***	-1.01***	3.70***	0.29***	3.12	-0.92***	3.88***	-6.720***	3.20***
Tax burden			0.46***	-0.05(L1)**								
Economic Freedom					-0.06***	0.10(L3)***						
Government Integrity							-0.08***	0.031*				
Government Spending									-0.02***	0.02**		
Business Freedom											0.55**	-0.02(L1)***
Coint Eq	-0.095***		-0.111		-0.357**		-0.178		-0.395**		-0.019	

Table 5. Panel ARDL *(continued)*

Independent Variables	ARDL (4,4,4)		ARDL (4,4,4)		ARDL (4,4,4)		ARDL (4,4,4)		ARDL (3,3,3)	
	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run
Tax Evasion		-0.466**		-0.070		-0.785*		0.142		-0.190
lnGDP	-0.417***	3.626***	2.629***	2.618***	-0.599***	2.922***	-0.190***	4.323***	0.840***	3.947***
Monitory Freedom	0.119***	-0.042*								
Trade Freedom			0.383**	0.082(L3)**						
Investment Freedom					0.225***	0.002				
Financial Freedom							0.052	-0.024**		
Labor Freedom									0.009***	-0.013
Coint Eq	-0.512**		-0.132***		-0.026		-0.189**		-0.124	

Table 6. Panel NARDL

Independent Variables	NARDL (4,4,4)		NARDL (3,3,3,3)		NARDL (1,2,2,2)		NARDL (2,3,3,3)		NARDL (2,1,1,1)		NARDL (2,2,2,2)	
	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run
Tax Evasion				-0.643**				-0.245		-0.126*		-0.308**
lnGDP+	13.26	4.087*	3.984***	2.957***	6.958***	3.162***	1.561***	2.575***	-0.704	3.329***	0.576***	3.373***
lnGDP-	-32.08	4.800***										
Tax burden+			-0.109***	-0.014								
Tax burden-			0.018*	0.032								
Economic Freedom+					0.067	-0.007						
Economic Freedom-					1.766***	-0.077						
Government Integrity+							-0.013***	-0.018*				
Government Integrity-							-0.006**	-0.001				
Government Spending+									-0.168***	0.024***		
Government Spending-									0.015	0.003		
Business Freedom+											-0.038***	0.002
Business Freedom-											-0.004	-0.035
Coint Eq	-0.029*		-0.081		-0.036		-0.367		-0.148		-0.197**	
Wald Test Pos=Neg	0.764		239.138***		6.111**		5833.794***		0.598		8.216***	

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Table 6. Panel NARDL (*continued*)

Independent Variables	NARDL (3,3,3,3)		NARDL (3,3,3,3)		NARDL		NARDL		NARDL (2,2,2,2)	
	Long Run	**Short Run**	**Long Run**	**Short Run**	**Long Run**	**Short Run**	**Long Run**	**Short Run**	**Long Run**	**Short Run**
Tax Evasion		-0.255		-0.268*						-0.239
lnGDP	3.03***	3.253	1.379***	2.921***					-0.996***	3.449***
Monitory Freedom+	-0.15***	-0.01								
Monitory Freedom-	-0.0	0.02								
Trade Freedom+			0.330***	-0.077*						
Trade Freedom-			0.962***	-0.056						
Investment Freedom+					-	-				
Investment Freedom-										
Financial Freedom+							-	-		
Financial Freedom-										
Labor Freedom+									0.011**	0.021
Labor Freedom-									0.039***	-0.014
Coint Eq	-0.217*		-0.145						-0.218**	
Wald Test Pos=Neg	99.418***		97.693***		It cannot be run due to fewer observations		It cannot be run due to fewer observations		14.863***	

*, **, *** indicates significance at 0.1, 0.05, and 0.01 level

Table 7. Random Effect Panel OLS Results

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
1nGDP	.221	-.006	-.155	.148	.025	.262	.134	.399	.349	.183	.101
1nBitcoin	.308	.568*	.393	-.065	.369	-.083	-2.30***	.71	-.101	.481**	1.276
Tax Burden	.172										
Bitcoin*Tax Burden	-.007										
Economic Freedom		.293*									
Bitcoin*EF		-.01**									
Government Integrity			.204**								
Bitcoin*GI			-.007*								
Government Spending				.06							
Bitcoin*GS				-.002							
Business Freedom					.162						
Bitcoin*BF					-.005						
Labor Freedom						.022					
Bitcoin*LF						0					
Monetary Freedom							-.623***				
Bitcoin*MF							.027***				
Trade Freedom								.355			
Bitcoin*TF								-.009			
Investment Freedom									.01		
Bitcoin*IF									0		
Financial Freedom										.218**	
Bitcoin*FF										-.009**	
Bureaucracy											.14
Bitcoin*Bureaucracy											-.014*
No. of Obs.	56	56	56	56	56	56	56	56	56	56	56
r-squared	0.004	0.426	0.622	0.004	0.263	0.015	0.044	0.004	0.035	0.001	0.003
Chi-square	24.02***	26.08***	16.12***	7.09	12.26**	7.85*	80.72***	78.41***	11.44**	53.94***	16.43***

*, **, *** indicate significance at 0.1, 0.05, and 0.01 levels.

In the NARDL (2,2,2,2), it is concluded that Business Freedom is negatively associated with tax evasion, and this association is non-linear. The positive changes in Business Freedom reduce tax evasion more than the negative ones. Improving Business Freedom results in more tax evasion than reducing Business Freedom. The regulatory bodies need to focus more on enhancing Business Freedom, as it brings more benefits, including reduced tax evasion. The marginal benefits of improving Business Freedom are greater than those of reducing it.

The short-run impact of Business Freedom on tax evasion in a non-linear model is not statistically significant. Based on the findings of this study, the hypothesis, which states that there is an asymmetric impact of Business Freedom on tax evasion, is accepted. This is the very first study measuring the non-linear association of Business Freedom

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with tax evasion and confirms the non-linear association. As no study measures such a non-linear association, there is no prior empirical support.

Monetary Freedom has a non-linear and significant relationship with tax evasion. The positive changes in Monetary Freedom reduce tax evasion more than the negative changes. More closely, when Monetary Freedom is reduced, it does not negatively impact tax evasion. The role of Monetary Freedom in the linear and non-linear models is significant in reducing tax evasion, which is also supported by the literature (Islam et al., 2020; Nurunnabi, 2018). The hypothesis, which states that there is an asymmetric impact of Monetary Freedom on tax evasion, is not rejected. Due to a gap in the literature, there is no prior evidence of a non-linear association.

Table 7 presents the results of multiple models where economic freedom indicators are used individually along with Bitcoin market capitalization. The existence of multicollinearity among the economic freedom indicators motivated the author to use these variables individually. As Bitcoin's existence is persistent, the overall impact of Financial Freedom is positive for the economy. Bureaucracy is found to be insignificantly associated with tax evasion, but the presence of Bitcoin reduces tax evasion. Overall, Monetary Freedom and Financial Freedom are positively impacting tax evasion. There is a gap in the literature where such interaction terms are studied in association with tax evasion, so the author does not find support for or oppose the findings of this study. However, the findings provide future direction to study this phenomenon in the context of developing countries to improve the robustness and generalizability of the results.

CONCLUSION

The objective of this study was to obtain updated estimates of tax evasion in G-7 countries for the period 2001-2020 by using the Currency Demand Approach. Measuring the impact of cryptocurrencies on tax evasion, at different levels of economic freedom indicators, was also one of the objectives of this study. The latest tax evasion estimates are presented in the study. The impact of cryptocurrencies on tax evasion is found to be positive, which is due to the utilization of the returns from cryptocurrencies in the economy. An asymmetric association of economic freedom indicators is also measured, in addition to the symmetric association. The study's results indicated an asymmetric association between cryptocurrencies and tax evasion. Most economic freedom indicators exhibited a linear relationship with tax evasion, except for Labor Freedom and Investment Freedom, which showed an asymmetric association with tax evasion. The study also incorporated interaction terms between cryptocurrencies and economic indicators, revealing that economic freedom moderates the association between cryptocurrencies and tax evasion. The results further demonstrated that economic freedom indicators are significant predictors of tax evasion, with Economic Freedom, Government Integrity, Monetary Freedom, and Financial Freedom moderating the association between tax evasion and cryptocurrencies.

Policymakers should adopt a multi-faceted approach to regulation, considering the various factors that influence tax evasion and the role of cryptocurrencies. This approach

should aim to create a balanced regulatory environment where Bitcoin contributes to economic transparency and fiscal responsibility. Specifically, policymakers should enhance bureaucratic efficiency beyond 95.5 points to leverage Bitcoin's role in reducing tax evasion. Financial freedom should be increased beyond 60 points, investment freedom should be maintained beyond 72 points, and business freedom should be maintained beyond 81 points to maximize Bitcoin's tax compliance benefits. Trade freedom should be maintained optimally at around 85 points, while monetary freedom should be regulated to avoid excessive tax evasion beyond 83 points. Labor freedom should be increased beyond 42 but maintained at less than 82 points to prevent an insignificant impact. Government spending beyond 20 points and government integrity beyond 72 should be promoted to reinforce Bitcoin's role in reducing tax evasion. Economic freedom should be strengthened beyond 69, and the tax burden should be optimized above 57.9 to ensure Bitcoin's positive influence on tax compliance.

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