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# ZLOČIN PROTIV IMOVINE KAO POSLJEDICA EKONOMSKE BIJEDE: JE LI SOCIJALNA POMOĆ BITNA?

## PROPERTY CRIME AS A CONSEQUENCE OF ECONOMIC MISERY: DOES SOCIAL WELFARE MATTER?

**SAŽETAK:** Indeks bijede se pogoršao u zemlji, a kako je ekonomska dobrobit narušena, život je postao nemoguć. Kako bismo razriješili ovu vezu između indeksa bijede i zločina protiv imovine, koristili smo godišnje podatke za Nigeriju od 1970. do 2013. godine. Podatke smo analizirali pomoću Autoregressive Distributed Lag Modela kako bismo testirali jednosmjernu vezu jer se modificirani pristup Waldovom testu Grangerovom testu kauzalnosti (uzročnosti) koristi kod utvrđivanja dvosmjerne veze. Rezultati su ustanovili da postoji dugoročna i negativna veza između indeksa bijede i zločina protiv imovine kod jednosmjernog pristupa. Kod dvosmjernog pristupa, indeks bijede prema Grangerovom testu uzročnosti uzrokuje zločin protiv imovine. Osim toga, rezultati idu na ruku pretpostavkama o motivaciji za zločin te ukazuju na to da socijalna pomoć mora biti odgovarajuća, naročito za nezaposlene, kako bi se smanjila stopa zločina protiv imovine jer bi to ublažilo učinak indeksa bijede u zemlji.

**KLJUČNE RIJEČI:** zločin protiv imovine, indeks bijede, socijalna pomoć, autoregressive distributed lag model

JEL Classification: K42, E24, E31, I31

**ABSTRACT:** The misery index worsened in the country and the situation has made life unbearable to the people as their economic well-being is eroded. To unravel this link between misery index and property crime, we control for social welfare and further, employed annual data on Nigeria from 1970 to 2013. Data is analyzed with the Autoregressive Distributed Lag Model to test for the unidirectional relationship as the Modified Wald Test approach to Granger Causality is used to ascertain the bidirectional link. The results suggested that a long run and negative relationship exists between misery index and property in the unidirectional approach. In the bidirectional approach, misery index Granger causes property crime. Besides, the results favored the postulation of criminal motivations and thus, suggested that social welfare must be made adequate especially for the unemployed to reduce property crime as it would cushion the effect of misery index in the country.

**KEY WORDS:** Property crime, misery index, social welfare, autoregressive distributed lag model

JEL Classification: K42, E24, E31, I31

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## UVOD

Slijedeći teoretsku povezanost nezaposlenosti sa zločinom, prema McKayu i Shawu (1942.) te Beckeru (1968.), Becker-Ehrlichov model tvrdi da su nezaposlenost i zločin pozitivno povezani, uz stanovište da dolazi do umanjenja marginalne korisnosti koja proizlazi iz gubitka prihoda te je taj efekt dostatan motiv za zločin. Suprotno tome, Cantor i Land (1985.) slažu se da, iako nesumnjivo postoji veza između nezaposlenosti i zločina, takva je veza (ukoliko je ima) negativna. To je djelomično tako zbog činjenice da su cijene imovine u vrijeme recesije relativno niske pa to ostavlja manje mogućnosti za krađu. Također, prisustvo nezaposlenih osoba kod kuće predstavlja zaštitu imovine i obeshrabruje kriminalne radnje. Međutim, o ovom neslaganju između motivacije za počinjenjem zločina i prilikom za počinjenje piše se u kriminalističkoj literaturi punih dvadeset godina, ali bez konačnog konsenzusa.

Devine, Sheley and Smith (1988.) posebno naglašavaju da nezaposlenost nije dostatna da gospodarske uvjete svrsta u model zločina. Oni, stoga, predlažu da se inflaciju, kao faktor povećanja stresa, promatra ruku pod ruku s nezaposlenošću kako bi se ekonomske nedaće u funkciji zločina predstavilo na odgovarajući način. To je iz razloga što inflacija umanjuje korisnost stvarnog prihoda i tako povećava dobit od nezakonitih poslova. Teles (2004.) je teoretski pokazao da povećanje cijena predstavlja poticaj prijestupniku da se optimalno angažira oko zločina. Osim toga, ekonomske nedaće koje se sastoje od nezaposlenosti i inflacije uzrokuju emocionalni strah i nelagodu kod nezaposlenih i kod osoba s niskim prihodima, te tako narušavaju funkcionalni sustav i oslabljuju društvene odnose (Devine *et al*., 1988.). Sukladno tome, obitelji koje su suočene s ekonomskim nedaćama nižeg su obrazovanja, nemaju pristup kvalitetnoj zdravstvenoj zaštiti, imaju višu stopu smrtnosti, izloženije su pothranjenosti i nesigurnosti u opskrbi hranom (Ferguson, Bovaird & Mueller, 2007.; Chen, Martin & Matthews, 2006. i Engle & Black, 2008.).

## INTRODUCTION

Following the theoretical link of unemployment to crime by McKay and Shaw (1942) and Becker (1968). The Becker-Ehrlich model contended that unemployment is positively related to crime, with the notion that there is a decrease in marginal benefit resulting from loss of income and this effect is enough to motivate crime. On the contrary, Cantor and Land (1985) affirmed that while there is no doubt that unemployment does have a relationship with crime, such relationship if existent is negative. This is partly due to the fact that purchase of property in the recession time are relatively low which provide less opportunity for theft. Also, that the presence of unemployed ones at home would serve as protective guard to properties which assist in discouraging criminal activities. However, this contention between motivation to crime and opportunity to crime featured prominently in the crime literature for over two decades with indefinite consensus.

Most especially that Devine, Sheley and Smith (1988) emphasized that unemployment is not enough to capture economic conditions in crime model. They therefore suggested that inflation as a stress builder be studied along with unemployment to adequately represent economic distress in crime function. This is because inflation reduces the benefits of the real income and thus increase gain on the illegal work. Teles (2004) theoretically showed that increase in price serves as incentive for the offender to optimally engage his time in crime. Besides, economic distress that comprise of unemployment and inflation causes emotional fear and discomfort among the unemployed and other poor income earners and thus, disrupts functional system and weaken social relations (Devine *et al*., 1988). Relatedly, families coping with economic distress have low educational attainment, poor access to good health care, higher mortality and high exposure to undernutrition and food insecurity (Ferguson, Bovaird & Mueller, 2007; Chen, Martin & Matthews, 2006 and Engle & Black, 2008).

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U nastavku radu kojeg su objavili Devine *et al.* (1988.), nekoliko je studija ispitivalo ekonomske nedaće / bijedu kao jedini faktor u modelu zločina (Tang & Lean, 2009.; Omotor, 2009.; Piraee & Barzegar, 2011.; Piraee, Barzegar & Rezaee, 2014.; Lorde, Jackman, Naitram & Lowe, 2016.; Saboor, Sadiq, Khan & Hameed, 2016.; Munir, Asghar & Rehman, 2017.). Do toga dolazi kako bi se izbjegao problem multikolinearnosti zbog inverzne veze koja postoji između nezaposlenosti i inflacije kada su dvije varijable pojedinačno dio modela (Ralston, 1999.). Tang (2009.) tvrdi da indeks bijede pomaže odrediti čistu dobit od nezaposlenosti i inflacije. Ne narušavajući važnost ekonomske bijede, rezultati studija na ove teme su raznoliki, ovisno o tome predstavlja li ekonomska bijeda motiv, priliku i / ili oboje u modelu zločina.

Na primjer, dok efekt motiva za zločin o kojem piše Becker nalazi uporište i u rezultatima do kojih su došli Tang i Lean (2009.), Lorde *et al.*, (2016.), Saboor *et al.*, (2016.) te Munir *et al.*, 2017.; Piraee i Barzegar (2011.) kao i Piraee *et al.*, (2014.) rezultati su mješoviti. Premda rezultati njihovih istraživanja dugoročno podupiru efekt motiva za zločin, s druge strane oni kratkoročno podupiru efekt prilike za zločin, prema pisanju Canta i Landa, budući da rezultat do kojeg je došao Omotor (2009.) nije značajan. S obzirom na prirodu neuvjerljivih rezultata, ova studija predstavlja doprinos raspravi o tome je li ekonomska bijeda motiv ili prilika za zločin u slučajevima poput recimo Nigerije. Posebice je tome tako jer Omotoru (2009.) nije pošlo za rukom uvjerljivo dokazati slučaj Nigerije korištenjem Okunovog indeksa bijede. Dapače, u našu smo studiju uvrstili i socijalnu pomoć kako bi se ova studija razlikovala od ranije objavljene literature, a zbog nigerijskih radnika koji su uznemireni i traže poboljšanje socijalne pomoći (Oluwole & Ahmad, 2017.). Njihova uznemirenost je u skladu s činjenicom da veliki broj mladih nezaposlenih ljudi ima niske prihode i visoke životne troškove što sprečava radnike da uštede stvarni dio svojih prihoda u Nigeriji (Bawa

Sequel to Devine *et al.* (1988), several studies examined economic distress/misery as a single factor in crime model (Tang & Lean, 2009; Omotor, 2009; Piraee & Barzegar, 2011; Piraee, Barzegar & Rezaee, 2014; Lorde, Jackman, Naitram & Lowe, 2016; Saboor, Sadiq, Khan & Hameed, 2016; Munir, Asghar & Rehman, 2017). This is necessitated by avoidance of multicollinearity problem because of the inverse link between unemployment and inflation when the two variables are included individually in a model (Ralston, 1999). Tang (2009) provided that misery index helps to determine the net of unemployment and inflation. By not undermining the relevance of economic misery, findings of studies on this subject area are diverse as regard to whether economic misery is motivational or opportunity and or both in the crime model.

For instance, while criminal motivation effect of Becker is supported by findings in Tang and Lean (2009), Lorde *et al.*, (2016), Saboor *et al.*, (2016) and Munir *et al.*, 2017; Piraee and Barzegar (2011) and Piraee *et al.*, (2014) findings are mixed. Although, their findings support the criminal motivation effect in the long run, they on the other hand support criminal opportunity effect of Canto and Land in the short run as Omotor (2009) result is not significant. Based on the nature of inconclusive findings, this study is necessitated to contribute to the ongoing debate on whether economic misery remain motivational or opportunity effect to crime as the case of Nigeria. Especially when Omotor (2009) failed to produce a decisive result on Nigeria data using Okun misery index. Moreover, we included social welfare in our study to differ from the previous literature because of agitation by the Nigeria workers over the need to improve the masses welfare (Oluwole & Ahmad, 2017). The agitation is in consonance with poor income benefits that barely exist for high number of unemployed youths and high cost of living which prevent workers to save substantive part of their income in Nigeria (Bawa & Abdullahi, 2012). Considering the economic predicaments, we used

& Abdullahi, 2012.). Uzevši u obzir gospodarske neprilike, koristili smo Okunov i Barrov indeks bijede prateći Saboor *et al.*, (2016.). Dakle, ova je studija dobila na važnosti jer želi izbjeći bilo kakav nezakoniti izbor kojeg mogu napraviti pripadnici ekonomski nepovlaštenih skupina, naročito u Nigeriji. U nastavku, istražujemo je li zločin počinjen trenutačno ili izvan zemlje. U svakom slučaju, naša studija može biti vrlo korisna tvorcima politika kako bi se umanjila stopa zločina. Stoga je ostatak ovog rada strukturiran na sljedeći način; Dio 2 se koncentrira na specifikaciju modela i ekonometrijske tehnike. Rezultat empirijske analize predstavljen je u Dijelu 3, a Dio 4 predstavlja zaključak i učinke politike.

## SPECIFIKACIJA MODELA I EKONOMETRIJSKE TEHNIKE

Empirijski model specificiran da procijeni dugoročnu vezu između zločina protiv imovine, indeksa bijede i socijalne pomoći definiran je dolje u jednadžbi 1. Izuzev indeksa bijede, ostale varijable su zapisane kao *ln*; $ptcr_t$ predstavlja varijablu zločina protiv imovine; $mi_t$ predstavlja Okunov i Barrov indeks bijede, a $sw_t$ označava socijalnu pomoć. $\alpha_0$ je konstanta, $\beta_1$ i $\beta_2$ su parametarske, a $\mu_t$ je bijeli šum. Model u jednadžbi 1 slijedi Piraee *et al.* (2014.).

$$lnptcr_t = \alpha_0 + \beta_1 lnmi_t + \beta_2 lnsw_t + \mu_t \qquad (1)$$

### Dugoročna kointegracijska analiza

Kako bi se ustanovilo postoji li mogućnost kointegracije među proučavanim socioekonomskim varijablama, priroda potrebnih podataka mora biti takva da možemo provesti *unit root* test i provjeriti je li vremenska serija stacionarna ili nije, te postoji li možda prekid kako bi se izbjegao lažni regresijski problem. Ispitan je Augmented Dickey-Fullerovim testom (ADF) – proširenim Dickey-Fullerovim testom jediničnog korijena u jednadžbama 2 i 3, a Phillip-Perronovim (PP) u jednadžbama 3 i 5. Dok

Okun and Barro misery index following Saboor *et al.*, (2016). Thus, this study becomes important with the need to circumvent any illegal choice among the economically disadvantaged ones especially in Nigeria. Sequel, we examine whether crime is instantaneously committed or not in the country. In any of the case, our study would provide vital information to the policy makers to minimize crime. Therefore, the rest of the paper is arranged as follows; Section 2 focuses on model specification and econometric techniques. Result of the empirical analysis is presented in Section 3 and Section 4 presents the conclusion and policy implications.

## MODEL SPECIFICATION AND ECONOMETRIC TECHNIQUES

The empirical model specified to estimate the long-run relationship among property crime; misery index and social welfare are defined below in equation 1. With exception of misery indexes, other variables are logged as indicated as *ln*; $ptcr_t$ represents the property crime variable; $mi_t$ represents Okun and Barro misery Index as and $sw_t$ denotes the social welfare. $\alpha_0$ *is constant*, $\beta_1$ and $\beta_2$ are parameters as $\mu_t$ is the white noise. The model in equation 1 follows Piraee *et al.* (2014).

$$lnptcr_t = \alpha_0 + \beta_1 lnmi_t + \beta_2 lnsw_t + \mu_t \qquad (1)$$

### Long-run co-integration analysis

To ascertain whether there is possibility of co-integration among the studied socioeconomic variables, the nature of the data required that we conduct unit root test to see whether the time series is stationary or not and possibly if a break exists or not to avoid spurious regression problem. The Augmented Dickey-Fuller (ADF) in equation 2 and 3 and Phillip-Perron (PP) in equation 3 and 5 are tested. While equation 2 and 4 are specified in level with trend, equation 3 and 5 are specified at first different with trend and it is capable of detecting up to two breaks (Phillip & Perron, 1988). Where $y_t$

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su jednadžbe 2 i 4 specificirane u razini s trendom, jednadžbe 3 i 5 su specificirane različito od trenda i moguće je detektirati čak dva prekida (Phillip & Perron, 1988.). Dok $y_t$ i $\Delta y_t$ označavaju varijable u razini I s prvom razlikom; $\mu$ je konstantan, $\rho t$ i $\theta_t$ predstavljaju trend; $\tau$, $\alpha$ i $\beta$ su parametri lag varijable $y_{t-1}$ (*varijabla vremenskog zaostajanja*), a $\varepsilon_t$ je bijeli šum. Osim toga, u ADF-u, nulta hipoteza izražena je kao $H_0{:}\tau = 1$, a alternativna hipoteza kao $H_A{:}\tau \neq 1 \; or \; \tau < 0$. To znači, ako su statistički podaci viši od kritične vrijednosti, hipoteza $H_0{:}\tau = 1$ se odbacuje. Na osnovu hipoteze, varijable bi se prvo ispitalo na razini I(0) i ako nulta hipoteza o nestacionarnosti ($H_0{:}\tau = 1$) ne bude odbačena, tada je potrebno transformirati varijablu. Transformaciju varijable u promijenjenu formu će se također testirati pomoću istih testnih procesa (Huang, 2007.). Osim toga, u PP-u se nultu hipotezu testira u odnosu na alternativnu hipotezu. To, izraženo jednadžbom, u 4 izgleda ovako: $H_0{:}\alpha = 0$, $\mu_1 = 0$; $H_1{:}\alpha \neq 0$ i $\mu_1 \neq 0$. Isto tako, u 5 $H_0{:}\beta = 0$, $\theta = 0$ i $\mu_2 \neq 0$; $H_1{:}\beta \neq 0$, $\theta \neq 0$ i $\mu_2 \neq 0$.

$$y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \qquad (2)$$

$$\Delta y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \qquad (3)$$

$$y_t = \mu_1 + \theta_t + \alpha \, y_{t-1} + \varepsilon_{1t} \qquad (4)$$

$$\Delta y_t = \mu_2 + \theta_t + \beta \, y_{t-1} + \varepsilon_{1t} \qquad (5)$$

Predloženi *bound* test za dugoročnu vezu o kojoj pišu Pesaran *et al*. (2001.) pokazao je da je ovaj test prikladan za procjenu kointegracije među varijablama kojima je pomiješan integracijski red I(0) i I(1), i kojima su međusobno isključivi I(0) i I(1), ali se ne odnosi na varijable s I(2). Ako su sve varijable I(0), odluka će se temeljiti na I (0); to znači da F statistika samo treba biti veća od I(0) i ne nužno I(1). Prednost ARDL-a je njegova mogućnost stvaranja dostatnih pomaka (lagova) za varijable u modelu te superiornost testa koji

and $\Delta y_t$ indicates variables at level and first difference respectively; $\mu$ term is the constant, $\rho t$ and $\theta_t$ are trend; $\tau$, $\alpha$ and $\beta$ are parameters of the lag variable of $y_{t-1}$ and $\varepsilon_t$ is the white noise. Besides in ADF, the null hypothesis is stated as $H_0{:}\tau = 1$ and the alternate hypothesis is stated as $H_A{:}\tau \neq 1 \; or \; \tau < 0$. That is, when test statistics are greater than critical value, $H_0{:}\tau = 1$ would be rejected. Based on the hypothesis, variables would first be tested at level I(0) and where the null hypothesis of non-stationarity ($H_0{:}\tau = 1$) fails to be rejected, then such a variable would then be transformed. The transformation of the variables into a differentiated form would also be put to test by applying the same testing processes (Huang, 2007). Also, in PP, the null hypothesis is tested against the alternate hypothesis. That is, in equation 4 $H_0{:}\alpha = 0$ and $\mu_1 = 0$; $H_1{:}\alpha \neq 0$ and $\mu_1 \neq 0$. Likewise, in 5 $H_0{:}\beta = 0$, $\theta = 0$ and $\mu_2 \neq 0$; $H_1{:}\beta \neq 0$, $\theta \neq 0$ and $\mu_2 \neq 0$.

$$y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \qquad (2)$$

$$\Delta y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \qquad (3)$$

$$y_t = \mu_1 + \theta_t + \alpha \, y_{t-1} + \varepsilon_{1t} \qquad (4)$$

$$\Delta y_t = \mu_2 + \theta_t + \beta \, y_{t-1} + \varepsilon_{1t} \qquad (5)$$

The proposed bound test for long run relationship by Pesaran *et al*. (2001) indicated that this test is suitable to estimate co-integration among variables where the variables are having mixture of integration order I(0) and I(1), and where they mutually exclusive I(0) and I(1), but it does not consider variables with I(2). Where all the variables are I(0), the decision would base on I (0); this implies that the F-statistic needs only to be greater than I(0) only and not necessarily I(1). The advantage of ARDL lies in its ability to generate sufficient lags for variables in the model and its superiority to sufficiently provide for means to ascertain residual correlation. The dynamism is based on the transformation of the

omogućava utvrđivanje rezidualne korelacije. Dinamičnost temelji na transformiranju varijable u vremenu jednog laga u modelu uz korištenje optimalne duljine laga. Varijable se transformira pomoću Akaike informacijskog kriterija (AIC) zbog male veličine uzorka koji je korišten u ovoj studiji (vidi Adekoya & Abdul Razak, 2017.).

Za manji uzorak, Liew (2004.) je zaključio da je AIC najprikladniji za određivanje optimalne duljine laga za varijablu. Štoviše, *bound* test se koristi kako bi se utvrdilo postoji li kointegracija dugoročno pomoću statistike F testa. F-statistika ispituje zajedničku značajnost koeficijenta u jednom periodu laga, kao što je prikazano jednadžbom 6. Nulta hipoteza ne-kointegracije pokazuje da je $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ (znači nepostojanje kointegracije), a alternativa je $H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$, pri čemu je barem jedan $\beta_1$ *to* $\beta_7 \neq 0$ (znači postojanje kointegracije). Kratkoročna dinamika ARDL modela prikazana je jednadžbom 1, a ECT jednadžbama 7 i 8.

$$\Delta lnptcr_t = \alpha_0 + \beta_1 lnptcr_{t-1} + \beta_2 lnmi_{t-1} + \beta_3 lnsw_{t-1}$$
$$+ \sum_{i=1}^{p} \gamma_1 \Delta lnptcr_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta lnmi_{t-1} + \sum_{i=0}^{p} \gamma_3 \Delta lnsw_{t-1}$$
$$+ \mu_t \qquad (6)$$

$$\Delta lnptcr_t = \alpha b_0 + \sum_{i=1}^{p} \gamma_1 \Delta lnptcr_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta lnmi_{t-1}$$
$$+ \sum_{i=0}^{p} \gamma_3 \Delta lnsw_{t-1} + \mu_t \qquad (7)$$

$$ECT_{t-1} = \beta_1 lnptcr_t - (\beta_2 lnmi_t + \beta_3 lnsw_t + \alpha c_0) \qquad (8)$$

### Test uzročnosti

ARDL će samo utvrditi jednosmjerne veze među proučavanim varijablama, a bitno je i utvrditi je li veza dvosmjerna. Razlog tome je činjenica da visoka stopa kriminalnih radnji može obeshrabriti investiranje, što će imati daljnji negativni učinak na gospodarski rast (Pan, Widner & Enomoto, 2012.), a to može dovesti do smanjenja zaposlenosti.

variable at the period of one lag in the model using the optimal lag length. The transformation of the variables is done using Akaike information criterion (AIC) due to the small sample size used in this study (see Adekoya & Abdul Razak, 2017).

For smaller sample size, Liew (2004) found that AIC is most suitable to determine the optimal lag length for the variable. Moreover, the bound test is used to determine the existence of co-integration in the long-run using the F-test statistic. This F-statistic tested the joint significance of the coefficients at one period of lag as shown in equation 6. The null hypothesis of no co-integration shows that $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ (implies non-existence of cointegration) and the alternative is $H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$ and where at least one of the $\beta_1$ to $\beta_7 \neq 0$ (implies the existence of cointegration). The short-run dynamics of ARDL model in equation 1 and the ECT are presented in equation 7 and 8.

$$\Delta lnptcr_t = \alpha_0 + \beta_1 lnptcr_{t-1} + \beta_2 lnmi_{t-1} + \beta_3 lnsw_{t-1}$$
$$+ \sum_{i=1}^{p} \gamma_1 \Delta lnptcr_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta lnmi_{t-1} + \sum_{i=0}^{p} \gamma_3 \Delta lnsw_{t-1}$$
$$+ \mu_t \qquad (6)$$

$$\Delta lnptcr_t = \alpha b_0 + \sum_{i=1}^{p} \gamma_1 \Delta lnptcr_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta lnmi_{t-1}$$
$$+ \sum_{i=0}^{p} \gamma_3 \Delta lnsw_{t-1} + \mu_t \qquad (7)$$

$$ECT_{t-1} = \beta_1 lnptcr_t - (\beta_2 lnmi_t + \beta_3 lnsw_t + \alpha c_0) \qquad (8)$$

### Test of Causality

The ARDL would only establish the unidirectional relations among the studied variables but it is also important to ascertain if the relation is bidirectional. This is due to the fact that high level of criminal activities may discourage investment with further negative effect on economic growth (Pan, Widner & Enomoto, 2012), a situation that may lead to reduction in employment. Therefore, we used

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Stoga smo koristili modificirani Wald test kako bismo ispitali Granger uzročnost, budući da se tim testom može ispitati jesu li varijable integrirane ili nisu. U svakom slučaju, integracija varijabli ne smije premašiti stvarnu duljinu laga modela, bez obzira jesu li ove varijable kointegrirane ili nisu (Toda & Yamamoto, 1995.). Ovaj se pristup naziva *augmented VAR model* prema Todi and Yamamotu (1995.) jer je dokazao da Wald test pokazuje određena ograničenja u parametrima – VAR $(k)$ ima asimptotičku $\chi^2$ distribuciju ako je VAR $(k + d_{max})$ procijenjen, pri čemu je $d_{max}$ optimalna duljina laga u modelu koji će se odviti u sustavu (Zapata & Rambaldi, 1997.).

Nadalje, Grangerova neuzročnost implicira utvrđivanje duljine laga $k$ kroz Schwarz Bayesianov kriterij ili AIC (Huang, 2007.). Odabir VAR-a $k$ s integracijom $d_{max}$ pokazuje da je model statistički *over-fitted*, radi dodatnih lagova. $d_{max}$ kao dodatni lag potvrđuje da je test proveden sigurno čak i ako nije sigurno jesu li varijable I(1) ili I(0) (Zapata & Rambaldi, 1997.). Isto tako, procijenjeni VAR poredak bi bio $p = k + d_{max}$ (Farhani, Shahbaz, Arouri & Teulon, 2014.). Bit jednadžbe $p = k + d_{max}$ je da ona osigurava t-statistiku u testu kauzalnosti prema Grangeru i ima asimptotičku $\chi^2$ distribuciju kroz proces statističkih podataka dobivenih modificiranim Wald testom za ograničenja parametra VAR-a. Stoga je model u jednadžbi 1 transformiran u modificirani Wald test model prema Todi i Yamamotu (1995.), kao što su proučavali Detotto i Pulina (2010.) te Farhani *et al*. (2014.) i prikazan je u jednadžbi 9. U jednadžbi 9, ako je $\beta_{12i} = 0 \forall_i$ znači da postoji uzročnost od indeksa bijede prema zločinu protiv imovine, ali ako je $\beta_{12i} \neq 0 \forall_i$, to znači da indeks bijede uzrokuje zločin protiv imovine.

the modified Wald test to examine the Granger causality, as it is capable of accommodating variables that is integrated or not, in any case the integration of the variable must not exceed true lag length of the model and with little concern of whether these variables are co-integrated or not (Toda & Yamamoto, 1995). This approach is referred to as the augmented VAR model of Toda and Yamamoto (1995) because it showed that the Wald test had restrictions on the parameters of a VAR $(k)$ has an asymptotic $\chi^2$ distribution when a VAR $(k + d_{max})$ is estimated, where $d_{max}$ is the optimal lag length in the model that is supposed to take place in the system (Zapata & Rambaldi, 1997).

Moreover, the Granger non-causality entails determination of lag length $k$ through the Schwarz Bayesian criterion or AIC (Huang, 2007). Selection of VAR $k$ with the integration $d_{max}$ indicate that the model is over-fitted, because of the additional lags. The $d_{max}$ as an additional extra lag confirms that the test is carried out on a safer side even when there is no certainty that variables are I(1) or I(0) (Zapata & Rambaldi, 1997). Also, the estimated VAR order would be $p = k + d_{max}$ (Farhani, Shahbaz, Arouri & Teulon, 2014). The essence of $p = k + d_{max}$ provided the t-statistic in Granger causality to have the asymptotic $\chi^2$ distribution through the process of the modified Wald test statistics for restrictions on the parameter of VAR. Thus, the model in equation 1 is transformed to the modified Wald test model by Toda and Yamamoto (1995) as studied in Detotto and Pulina (2010) and Farhani *et al*. (2014) and it is presented in equation 9. In equation 9, if $\beta_{12i} = 0 \forall_i$ implies that causality does exist from misery index to property crime but if $\beta_{12i} \neq 0 \forall_i$, it means that misery index Granger causes property crime.

$$\begin{bmatrix} \Delta lnptcr_t \\ \Delta lnmi_t \\ \Delta lnsw_t \end{bmatrix} = \begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \varphi_3 \end{bmatrix} + \sum_{i=1}^{d} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} \end{bmatrix} \times \begin{bmatrix} \Delta lnptcr_{t-i} \\ \Delta lnmi_{t-i} \\ \Delta lnsw_{t-i} \end{bmatrix}$$

$$(9) \quad + \sum_{i=k+1}^{d_{max}} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} \end{bmatrix} \times \begin{bmatrix} \Delta lnptcr_{t-i} \\ \Delta lnmi_{t-i} \\ \Delta lnsw_{t-i} \end{bmatrix} + \begin{bmatrix} v_{1,t} \\ v_{2,t} \\ v_{3,t} \end{bmatrix}$$

## Podaci

Ova studija koristila se godišnjim vremenskim serijama od 1970. do 2013. Statistički podaci o zločinu protiv imovine dobiveni su od nigerijske policije i Državnog zavoda za statistiku (NBS). Zločin protiv imovine (*ptcr*) je zbroj oružanih pljački, provala, nezakonitog otuđivanja imovine, paleži i ostalih zločina protiv imovine. Mjeri se kao omjer godišnje prijavljenih zločina i stanovnika kroz 100 000 u Nigeriji, a prikazano je na sljedeći način:

$$ptcr_t = \frac{Svi\ prijavljeni\ zločini\ protiv\ imovine_t}{(Stanovništvo_t/100\ 000)}$$

Podaci o indeksima bijede po Okunu i Barrou izračunati su prema podacima Svjetske banke i Državnog zavoda za statistiku NBS. Kao i Saboor *et al.*, (2016.), koristili smo Okunov indeks bijede (OMI) i Barrov indeks bijede (BMI). Kao što je spomenuto ranije u Uvodu, svrha korištenja ovih indeksa je izbjegavanje multikolinearnosti koja može prouzročiti lažnu regresiju. Osnovna je razlika među njima da OMI uključuje dodavanje brojki nezaposlenih i inflaciju, a BMI dodaje kamatu na OMI umanjen za stvarne stope rasta (vidi Saboor *et al.*, 2016.).

Podaci o korisnicima socijalne pomoći te godišnjoj potrošnji na socijalne i javne službe dobiveni su uglavnom iz Statističkog glasila nigerijske središnje banke. Godišnji trošak izražen je u milijardama nigerijskih naira, te uključuje ukupan trošak na obrazovanje, zdravstvenu zaštitu i ostale javne službe. Osim toga, zločin protiv imovine i socijalna pomoć pretvoreni su u logaritamske oblike (*ln*), ali indeksi bijede nisu.

## REZULTATI I DISKUSIJA

Tablica 1 prikazuje rezultate *unit root* testova koji su provedeni putem ADF-a i PP-a uz korištenje Schwarzovog informacijskog kriterija uz maksimalan lag od 9. Sve su varijable integrirane u

## Data

This study used annual time series from 1970 to 2013. The property crime statistics are obtained from the Nigeria Police and National Bureau of Statistics (NBS). The property crime (*ptcr*) is the sum of armed robbery, burglary, unlawful possession of property, arson and other property crime. This is measured as a ratio of annually reported crimes to population per 100,000 in Nigeria which is expressed as follow.

$$ptcr_t = \frac{all\ reported\ property\ crimes_t}{(Population_t/100\ 000)}$$

The data on Okun and Barro Misery Indexes are calculated as extracted from The World Bank and NBS. Following Saboor *et al.*, (2016), we employed Okun Misery Index (OMI) and Barro Misery Index (BMI). As mentioned earlier in Introduction, the purpose of using these indexes is to avoid problem of multicollinearity which may cause spurious regression. The main difference in these indexes is that, while OMI includes addition of unemployment and inflation, BMI is the addition of interest rate to OMI minus real growth rates (see Saboor *et al.*, 2016).

Data on social welfare proxy with annual expenditure on social and community service was obtained mainly from Central Bank of Nigeria Statistical Bulletin. The annual expenditure is Billion in Naira that includes total expenditure on education, health and other community services. Thus, property crime and social welfare are transformed into logarithm forms (*ln*) but the misery indexes were not.

## RESULTS AND DISCUSSION

Table 1 reveals the results of the unit root tests conducted with ADF and PP using Schwarz Information Criterion at maximum lags of 9. All the variables are found to be integrated at order zero at appropriate level of significance

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## TABLICA 1. REZULTATI UNIT ROOT TESTOVA
### TABLE 1. RESULT OF THE UNIT ROOT TESTS

| VARIJABLE<br>VARIABLES | AUGMENTED DICKEY-FULLER (ADF)<br>AUGMENTED DICKEY-FULLER (ADF) | | PHILLIP-PERRON (PP)<br>PHILLIP-PERRON (PP) | | ODLUKE<br>DECISIONS |
|---|---|---|---|---|---|
| | RAZINA<br>Intercept i trend<br>LEVEL<br>Intercept and trend | 1. RAZLIKA<br>Intercept i trend<br>1ST DIFFERENCE<br>Intercept and trend | RAZINA<br>Intercept i trend<br>LEVEL<br>Intercept and trend | 1. RAZLIKA<br>Intercept i trend<br>1ST DIFFERENCE<br>Intercept and trend | |
| $lnptcr_t$ | -3.803** | -10.322*** | -3.674** | -15.003*** | I(0) |
| $omi_t$ | -5.004*** | -7.407*** | -3.513* | -12.896*** | I(0) |
| $bmi_t$ | -7.633*** | -6.284*** | -14.965*** | -26.883*** | I(0) |
| $lnsw_t$ | -5.485*** | -6.473*** | -4.290*** | -6.473*** | I(0) |

*Napomena*: ovi brojevi su t-omjer i prikazuju p-vrijednosti prema MacKinnonu (1996.), jednostrano na različitim razinama statističke značajnosti. Zvjezdice *** su na 1%, ** na 5%, a * na 10%.

*Note*: the figures reported are t-ratio and showed the p-values of MacKinnon (1996) one-sided at various levels of significance. The asterisks (***) is at 1%, (**) is at 5% and (*) is at 10%.

## TABLICA 2. REZULTATI TESTOVA GRANGEROVE UZROČNOSTI
### TABLE 2. RESULT OF THE GRANGER CAUSALITY TESTS

| | $k$ | $k + d_{max}$ | Obs | KRITERIJ (AIC)<br>CRITERION (AIC) | $\chi^2_{sc}$ | F – stat | P. vrijednost<br>P. value |
|---|---|---|---|---|---|---|---|
| **Nulta hipoteza<br>(ako se uzme u obzir OMI)**<br>**Null Hypothesis<br>(when OMI is considered)** | | | | 11.783* | 16.765<br>(0.052) | | |
| $omi_t$ ne uzrokuje $lptcr_t$<br>$omi_t$ does not Granger cause $lptcr_t$ | 1 | 2 | 42 | | | 1.322 | 0.050* |
| $lnptcr_t$ ne uzrokuje $omi_t$<br>$lnptcr_t$ does not Granger cause $omi_t$ | 1 | 2 | 42 | | | 0.069 | 0.791 |
| **Nulta hipoteza<br>(ako se uzme u obzir BMI)**<br>**Null Hypothesis<br>(when BMI is considered)** | | | | 12.602* | 16.009<br>(0.066) | | |
| $bmi_t$ ne uzrokuje $lptcr_t$<br>$bmi_t$ does not Granger cause $lptcr_t$ | 1 | 2 | 42 | | | 2.828 | 0.092* |
| $lnptcr_t$ ne uzrokuje $bmi_t$<br>$lnptcr_t$ does not Granger cause $bmi_t$ | 1 | 2 | 42 | | | 0.048 | 0.825 |

*Napomena*: $k$ je duljina laga, $k + d_{max}$ je optimalna duljina laga u modelu. $\chi^2_{sc}$ je LM test za serijsku korelaciju. Zvjezdice * su na razini od 10% statitičke značajnosti.

*Note*: $k$, $k + d_{max}$ is the lag length and the optimal lag length in the model respectively. $\chi^2_{sc}$ is the LM test for serial correlation. The asterisks * is at the 10% level of significance.

**TABLICA 3. PROCJENE ARDL MODELA**
TABLE 3. ESTIMATES OF THE ARDL MODELS

| ZAVISNA VARIJABLA: ZLOČIN PROTIV IMOVINE / DEPENDENT VARIABLE: PROPERTY CRIME | | | |
|---|---|---|---|
| Kritična ograničenja (F-test)<br>Critical bounds (F-test) | 1% razina značajnosti / 1% significance level | | |
| Donja / Lower | 4.13 | 4.13 | |
| Gornja / Upper | 5.00 | 5.00 | |
| | Model zločina 1<br>Crime model 1 | Model zločina 2A<br>Crime model 2A | Model zločina 2B<br>Crime model 2B |
| ARDL specifikacija<br>ARDL specification | 1, 0, 0 | 1, 1, 0 | |
| F-stat / F-stat | 5.339 | 5.239 | |
| Zaključak (razina stastičke značajnosti)<br>Conclusion (significance level) | Kointegriran (1%)<br>Co-integrated (1%) | Kointegriran (1%)<br>Co-integrated (1%) | |
| K | 2 | 2 | |

| ARDL TEST STATISTIČKE ZNAČAJNOSTI SPECIFIKACIJE / TEST OF ARDL SPECIFICATION SIGNIFICANCE | | | |
|---|---|---|---|
| AIC* | 2.099 | 2.158 | |
| SB | 2.262 | 2.364 | |
| HQ | 2.159 | 2.233 | |
| Adj-R-square | 0.422 | 0.414 | |

| DUGOROČNE PROCJENE / LONG-RUN ESTIMATES | | | |
|---|---|---|---|
| $omi_t$ | 0.022 (2.136)** | | |
| $bmi_t$ | | 0.031 (1.799)* | 0.031(1.727)* |
| $lnsw_t$ | -0.175 (-2.992)*** | -0.171 (-2.393)** | -0.171 (-2.617)** |
| $c$ | 4.939 | 5.498 | 5.498 |

| KRATKOROČNE PROCJENE / SHORT-RUN ESTIMATES | | | |
|---|---|---|---|
| $lptcr_{t-1}$ | -0.625 (-4506)*** | -0.557 (-4.011)*** | -0.557 (-4.011)*** |
| $omi_t$ | 0.014 (2.061)** | | |
| $bmi_{t-1}$ | | 0.017 (2.030)** | 0.017 (2.030)** |
| $\Delta bmi_t$ | | 0.008 (1.472) | 0.008 (1.472) |
| $lnsw_t$ | -0.109 (-2.701)** | -0.095 (-2.136)** | -0.095 (-2.136)** |
| $ect_{t-1}$ | -0.625 (-4.795)*** | -0.557 (-4.760)*** | 0.557 (-4.760)*** |

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| DIJAGNOSTIČKI TESTOVI / DIAGNOSTICS TESTS | | |
|---|---|---|
| Test standardnosti ($\chi^2_N$)<br>Normality test ($\chi^2_N$) | $JB$ = 17.273 (0.000) | $B$ = 11.134 (0.003) |
| Kurtosis / Kurtosis | 4.898 | 4.673 |
| Test funkcionalnosti($\chi^2_{FF}$)<br>Functional test ($\chi^2_{FF}$) | $F$ = 0.122 (0.728) | $F$ = 0.122 (0.728) |
| Test serijske korelacije ($\chi^2_{SC}$)<br>Serial Correlation test ($\chi^2_{SC}$) | $\chi^2$ = 1.564 (0.211) | $\chi^2$ = 5.633 (0.017) |
| Test heteroskedastičnosti($\chi^2_H$)<br>Heterokedasticity test ($\chi^2_H$) | $\chi^2$ = 0.722 (0.867) | $\chi^2$ = 2.065 (0.723) |

*Napomena*: zvjezdica (*) pokazuje da su procijenjeni koeficijenti statistički značajni kod 1% (***); 5% (**) i 10% (*) i nalaze se u zagradama. Isto tako, dijagnostički testovi $\chi^2_N$, $\chi^2_{SC}$ i $\chi^2_H$ su značajni kod 5% osim $\chi^2_{SC}$ koji nije odbačen u Modelu 2. Rezultati u 2B su otporni na standardne pogreške nakon korekcija koje koriste HAC standarne pogreške i kovarijancu (*Bartlett kernel* i *Newey-West fixed bandwidth* 4.000) bez laga. Rezultat u Modelu 1 je otporan u prvom slučaju. $\chi^2_{FF}$ je odbačen, ali Kurtosis za Modele 1 i 2 iznosi više od 3.00, pretpostavlja se da je rezidual normalan. Varijable su definirane kao Zločin protiv imovine *lnptcr$_t$*. Okunov indeks bijede (*omi$_t$*), Barrov indeks bijede (*bmi$_t$*), Socijalna pomoć (*lnsw$_t$*) su nezavisne varijable. U ARDL specifikaciji, F-statistički podaci u testovima ograničenja temeljeni su na nižim kritičkim ograničenjima.

*Note*: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*) and they are in parenthesis. Also, the diagnostic tests $\chi^2_N$, $\chi^2_{SC}$ and $\chi^2_H$ are significant at 5% except $\chi^2_{SC}$ that is not failed to be rejected in Model 2. Results in 2B are in robust standard error after correcting for serial correlation using HAC standard errors and covariance (Bartlett kernel and Newey-West fixed bandwidth 4.000) without lag. The result in Model 1 is robust at first instance of running it. $\chi^2_{FF}$ is rejected but the Kurtosis for the model 1 and 2 are above 3.00, it is assume that residual is normal. Variables are defined as Property crime is *lnptcr$_t$* as DV. Okun misery index (*omi$_t$*), Barro misery index (*bmi$_t$*), Social welfare (*lnsw$_t$*) are independent variables. In the ARDL specification, the F-stat in the bounds test is based on critical lower bounds.

nultom redu na odgovarajućoj razini značajnosti, ali ne iznad 10%. To znači da su ovi podaci pouzdani za valjanu regresiju i, u konačnici, zaključak smo donijeli pomoću ARDL tehnike. Tehnika ARDL je prikazana u Tablici 3. Osim toga, Tablica 2 pokazuje da dva indeksa bijede uzrokuju zločin protiv imovine, prema Grangeru.

U dvama modelima, specificirali smo lag 1, ugrađeni alat u ARDL koji je odabrao odgovarajući model temeljen na AIC-u, i stoga su testirani ARDL 1, 0, 0 za Model 1 zločina protiv imovine, a ARDL 1, 1, 0 za Model 2 zločina protiv imovine. Nakon što smo utvrdili da su sve varijable 1(0), rezultati *bound* testova koji su bazirani na nižim kritičnim vrijednostima nalaze se na 1% razine značajnosti. ECT vrijednosti -0,625 i -0,557 za Model 1 i 2 značajni su na 1% razini značajnosti. To znači da, bez obzira na distorziju modela, ove modele moguće je podesiti i dovesti u ravnotežu tijekom prve godine

not beyond 10%. It suggests that the data is reliable for a valid regression and consequently, we employed the ARDL technique to draw our conclusion. The ARDL is presented in Table 3. Besides, Table 2 reveals that the two misery indexes Granger causes property crime.

In the two models, we specified lag 1, the inbuilt tool in ARDL selected appropriate model based on AIC, and therefore, ARDL 1, 0, 0 for property crime Model 1 and ARDL 1, 1, 0 for property crime Model 2 are tested. Having found that all the variables are 1(0), the bound tests results are based on lower bound critical values at 1% level of significance. The ECT values of -0.625 and -0.557 for Model 1 and 2 are significant at 1% level of significance. It means that irrespective of distortion in the models, these models are able to readjust to equilibrium by 62.5% and 55.7% respectively over the first year. Although, it would

– Model 1 za 62,5%, a Model 2 za 55,7%. Premda, potrebno je razdoblje od godine i pol kako bi se ta kratkoročna odstupanja u Modelu 2 u potpunosti uravnotežila.

Kako bismo validirali ECT i ostale procijenjene rezultate, dijagnostički testovi u Modelu 1 i 2 su izdržljivi i pouzdani za formuliranje politike zločina protiv imovine u zemlji, na temelju rezultata različitih dijagnostičkih testova. Ti testovi su testovi standardnosti, funkcionalnosti, serijske korelacije, heteroskedastičnosti i stabilnosti. Jarque-Berin test standardnosti pokazuje da standardnost ne postoji u rezidualu, ali je JB test odbačen i potvrđeno je postojanje standardnosti. To je tako jer višak koji je dokazao Kurtosis u svojoj studiji pokazuje da je model standardan Saridakisu (2011.). Osim toga, rezultati kasnijih testova pokazali su da funkcionalni oblik Ramseyevog RESET testa dokazuje prisutnost pogrešne specifikacije od 5%. Također, proučavani $R^2$ u Breusch-Pagan-Godfreyevom testu heteroskedastičnosti pokazuje odsutnost heteroskedastičnosti u modelu od 5%. Ne postoji serijska korelacija na temelju proučavanih $R^2$ vjerojatnosti od 5% u testu LM-a Breusch-Godfreyjeve serijske korelacije za Model 1, pa Model 2 ima serijsku korelaciju. Međutim, standardne HAC pogreške i kovarijance (*Bartlett kernel* i *Newey-West fixed bandwidth* 4.000) bez laga koriste se za ispravak radi serijske korelacije. Stoga su rezultati u 2B standardna pogreška nakon ispravka radi serijske korelacije. Osim toga, parametri studije su stabilni u vremenu u skladu sa svojim pomicanjem, koje ovisi o rezultatu testova stabilnosti (Pesaran & Pesaran, 2009.). Test stabilnosti sastoji se od kumulativnog zbroja i kumulativnog zbroja kvadrata (na drugu potenciju). Rezultati kumulativnog zbroja i kumulativnog zbroja kvadrata (na drugu potenciju) na Prikazu 1 i 2 pokazuju da su dva modela položila test na 5%.

Rezultati u Modelu 1 (zločin protiv imovine, Okunov indeks bijede i socijalna pomoć) otkrivaju da su Okunov indeks bijede i socijalna pomoć statistički značajni za utvrđivanje zločina protiv imovine. $OMI_t$ uzrokuje zločin protiv imovine za

take 1.5 years for the short-run deviations for instance in Model 2 to fully restore to equilibrium.

To validate the ECT and other estimated results, the diagnostic tests in model 1 and 2 are robust and reliable for formulating policy on property crime in the country based on the results of various diagnostics tests carried out. These tests are normality test; functional test; serial correlation test; heteroscedasticity test and stability tests. The tests of normality of Jarque-Bera showed that normality does not exist in the residual but had to reject JB test and affirmed that there is normality. This is because the excessiveness of Kurtosis in the study shows that the model is normal following Saridakis (2011). Moreover, the results of other post-tests indicate that the functional form of Ramsey RESET test shows that there is no absence of misspecification at 5%. Also, the observed $R^2$ in Breusch-Pagan-Godfrey Heteroscedasticity test indicated that there is no presence of heteroscedasticity in the models at 5%. Besides, while there is no serial correlation based on observed $R^2$ probabilities at 5% in the tests of LM of Breusch-Godfrey serial correlation for Model 1, Model 2 has serial correlation. However, the HAC standard errors and covariance (Bartlett kernel and Newey-West fixed bandwidth 4.000) without lag is used to correct for serial correlation. Thus, the results in 2B are in robust standard error after correcting for serial correlation. In addition, the parameters in the study are stable over time as they move together based on the result of the stability tests (Pesaran & Pesaran, 2009). The stability test comprises of cumulative sum and cumulative sum of squares. The results of cumulative sum and cumulative sum of squares in Figure 1 and 2 shows that the two models passed the test at 5%.

The results in Model 1 (property crime, Okun misery index and social welfare) revealed that the Okun misery index and social welfare are significant in determining property crime. $OMI_t$ causes property crime by 2.2% at the 5% level of significance in the long-run. This means

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2,2% pri 5% razini značajnosti dugoročno. To znači da povećanje $OMI_t$ za 1% uzrokuje 2,2% svih zločina protiv imovine u zemlji. Do sličnih su rezultata došli Piraee i Barzegar (2011.), Piraee *et al.* (2014.), Saboor *et al.* (2016.) te Munir *et al.* (2017.). Analogno tome, kratkoročni rezultati pokazuju da $OMI_t$ pospješuje zločin protiv imovine (Piraee i Barzegar, 2011.; Piraee *et al.*, 2014.). Mjerenje socijalne skrbi služi kao katalizator smanjenja zločina protiv imovine u zemlji na razini statističke značajnosti od 1% dugoročno te razini statističke značajnosti od 5% kratkoročno. To znači da bi 1%-tno povećanje programa socijalne pomoći smanjilo zločine protiv imovine za 17,5% dugoročno i 10,9% kratkoročno. Devine *et al.* (1988.) utvrdili su negativan učinak socijalne zaštite na provale. Oni tvrde da socijalna zaštita kao oblik socijalne politike ima dvostruki karakter socijalne kontrole u gospodarstvu, budući da amortizira ekonomske nedaće i umanjuje utjecaj koji ekonomske nedaće imaju na zločin.

U Modelu 2, koji je usredotočen na Barrov indeks bijede i socijalnu pomoć kao neovisne varijable zločina protiv imovine, neovisne varijable djelovale su prema očekivanjima. $BMI_t$ povećava stopu zločina protiv imovine za 10% statističke značajnosti dugoročno, kao što i 1%-tno povećanje $BMI_t$-a povisuje stopu zločina protiv imovine za 3,1% u Nigeriji. Saboor *et al.* (2016.) došli su u svojoj studiji do sličnih rezultata. Osim toga, socijalna pomoć igra značajnu ulogu kod smanjenja zločina protiv imovine ako postoje ekonomske poteškoće pri statističkoj značajnosti od 5%. To znači da povećanje socijalne pomoći od 1% dovodi do smanjenja zločina protiv imovine za 17,1% dugoročno te 9,5% kratkoročno. To je slično radu koji su objavili Devine *et al.* (1988.). Međutim, kratkoročno rezultat prema Sabooru *et al.* (2016.) nije statistički značajan, ali mi smo došli do značajnog rezultata od 5% statističke značajnosti za godinu s vremenskim pomakom $BMI_t$-a.

Ako uzmemo u obzir Modele 1 i 2, Barrov indeks bijede je beznačajniji kao uzrok zločina protiv imovine u usporedbi s Okunovim indeksom bijede,
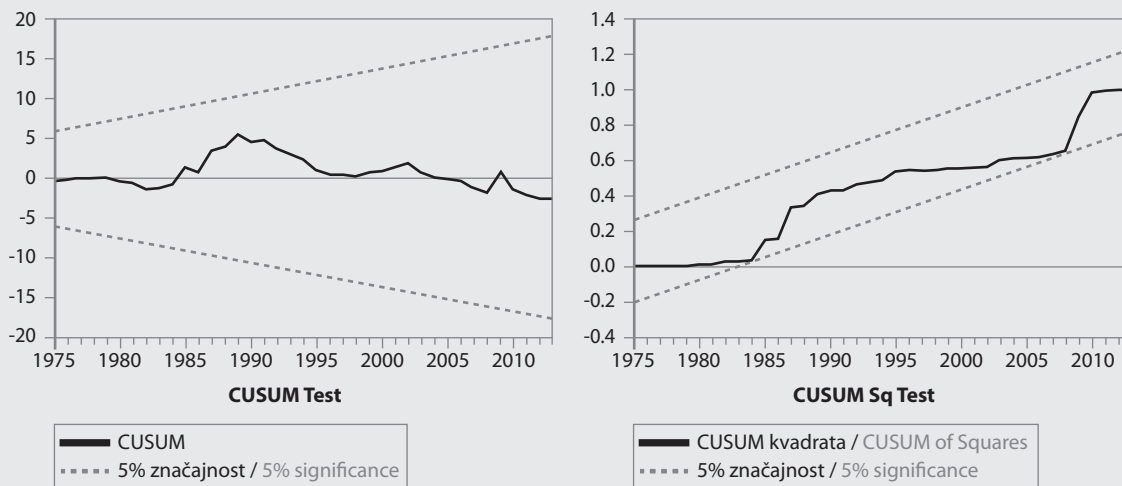
that 1% rise in the $OMI_t$ would cause 2.2% of property crime in the country. A similar result is obtained in Piraee and Barzegar (2011), Piraee *et al.* (2014), Saboor *et al.* (2016) and Munir *et al.* (2017). Likewise, the short-run result revealed that $OMI_t$ encourage property crime (Piraee and Barzegar, 2011; Piraee *et al.*, 2014). Moreover, the social welfare measurement serves as catalyst to reduce property crime in the country at 1% level of significance in the long-run and at 5% level of significance in the short-run. That is, a rise by 1% in social welfare programme would reduce property crime by 17.5% and 10.9% in the long-run and short-run respectively. Likewise, Devine *et al.* (1988) found a negative impact of social relief on burglary crime. They argued that social relief as a social policy has dual nature of social control in an economy as it cushions the effect of economic distress and further reduces the influence of economic distress on crime.

In the Model 2 which focuses on Barro misery index and social welfare as independent variables on property crime, the independent variables performed as expected. The $BMI_t$ increases property crime at the 10% level of significance in the long-run as 1% increase in $BMI_t$ encourages property crime by 3.1% in Nigeria. Saboor *et al.* (2016) obtained similar result in their study. Besides, social welfare is significant to reduce property crime in the presence of economic distress at 5% level of significance. That is, a rise by 1% in social welfare would reduce property crime by 17.1% and 9.5% in both long run and short run respectively. This is similar to Devine *et al.* (1988). However, in the short-run the result in Saboor *et al.* (2016) is not significant but we managed to obtain a significant result at 5% level of significance in a year lagged of $BMI_t$.
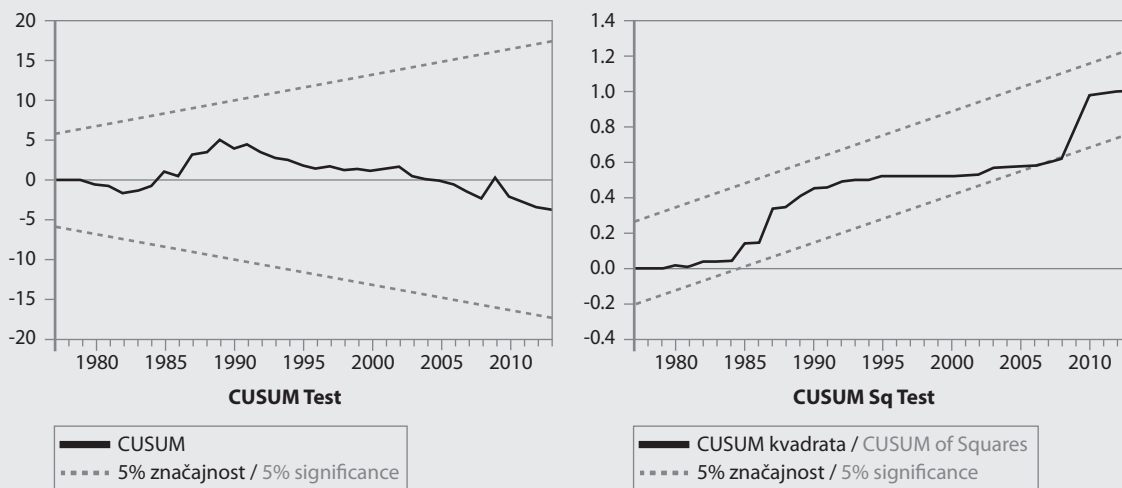
Considering Model 1 and 2, the Barro Misery Index is more negligible to cause property crime when compared to Okun Misery Index both in long run and short run. Additionally, the inclusion of economic growth in the *BMI* may have some impact on the *BMI*, this might contribute to

**PRIKAZ 1. TEST STABILNOSTI /** FIGURE 1. STABILITY TEST



CUSUM Test

CUSUM
5% značajnost / 5% significance

CUSUM Sq Test

CUSUM kvadrata / CUSUM of Squares
5% značajnost / 5% significance

**PRIKAZ 2. TEST STABILNOSTI /** FIGURE 2. STABILITY TEST



CUSUM Test

CUSUM
5% značajnost / 5% significance

CUSUM Sq Test

CUSUM kvadrata / CUSUM of Squares
5% značajnost / 5% significance

i dugoročno i kratkoročno. K tome, uvrštavanje ekonomskog rasta u *BMI* može imati utjecaja na *BMI*, te to može pridonijeti beznačajnosti, osobito prirodi podataka *BMI*-a u drugom obliku. Uključivanjem socijalne pomoći u model, to se

its negligibility especially the nature of *BMI* data in different form. With the inclusion of social welfare in the model it becomes worse. Notwithstanding, none of the two misery index should be deemphasized because of their negative

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pogoršava. Unatoč tome, nijedan od dva indeksa bijede ne smije biti ekonomiziran zbog njihovih negativnih uloga u gospodarstvu (vidi Devine *et al*., 1988.; Tang & Lean, 2007.).

Krenuvši od jednostrane prema dvostranoj vezi, Tablica 3 prikazuje rezultate Toda-Yamamotovog pristupa Grangerovoj uzročnosti. Kad se uzme $OMI_t$ u obzir u jednadžbi 10, to pokazuje da samo Okunov indeks bijede uzrokuje zločin protiv imovine uz statističku značajnost od 10%. Do sličnih su rezultata došli Munir, Asghar i Rehman (2017.). Ovim rezultatima Grangerov test uzročnosti potvrđuje jednosmjerni ARDL test, iako je ta potvrda na slaboj razini statističke značajnosti. Unatoč tome, indeks bijede može izazvati kriminalne radnje u zemlji. Weatherburn (1992.) je potvrdio da ekonomske neprilike pojedincima umanjuju mogućnost dostatne zarade prihoda na zakonit način. Velike ekonomske neprilike ne samo da slabe društvenu vezu između mladih i velikog društva već i pospješuju antisocijalno ponašanje u društvu.

## ZAKLJUČAK

Rezultati ARDL Modela 1 i 2 analizirali su pozitivan učinak indeksa bijede na zločin protiv imovine kao i na smanjenje stope zločina protiv imovine pomoću socijalne pomoći u Nigeriji. To pokazuje da su naši podaci proturječni pretpostavkama o prilikama za zločin, ali govore u korist motivaciji o kojoj piše Becker (1968.). Zločin protiv imovine buja u periodima gospodarskih problema, naročito kad vlada visoka stopa nezaposlenosti, visoka stopa inflacije te loši gospodarski rezultati. Recesija u zemlji dovela je do povećanja indeksa bijede (Okereocha, 2016.). Za vrijeme recesije ili financijske krize, ljudi se počnu baviti zločinom, ne samo iz razloga što nemaju posla već im je vrlo privlačna činjenica da u periodima inflacije dolazi do povećanja cijene imovine (Sidebottom, Ashby & Johnson, 2014.). To postaje još privlačnije ako postoji prilika za

roles in the economy (see Devine *et al*., 1988; Tang & Lean, 2007).

Moving from unilateral to bilateral relationship, Table 3 revealed the results of Toda-Yamamoto approach to Granger causality. When $OMI_t$ is considered in equation 10, it shows that only the Okun Misery Index Granger causes property crime at 10% level of significance. The consideration of in equation 10, the Barro Misery Index Granger causes property crime at 10% level of significance. Similar results are found in Munir, Asghar and Rehman (2017). With these results, the Granger causality test supports the unilateral test of the ARDL even though this support is found at weak significance level. Notwithstanding, misery index as demonstrated could induce criminal activities in the country. Weatherburn (1992) affirmed that presence of economic adversity reduces the ability of an individual to earn income through legal means. That it high existence in the economy is not only enough to weaken the social bond between the youths and the larger society but further encourage antisocial behavior in the society.

## CONCLUSION

The results in ARDL Model 1 and 2 analyzed the positive impact of misery indexes on property crime as well as the reduction of property crime by social welfare in Nigeria. This shows that our results contradict the postulation of criminal opportunities but favor criminal motivations postulation of Becker (1968). Property crime will flourish in times of economic strife especially with high unemployment rate, high inflation rate and poor economic performance. The recession in the country has increased misery indexes in the country (Okereocha, 2016). During recession or when there is financial crisis, people engage in crime not only because they are unemployed but the increase in price of property in inflation period provides a high attraction rate to crime (Sidebottom, Ashby & Johnson, 2014). This attraction increased with

preprodajom takve robe na tržištu radi financijske dobiti (Allen, 1996.). Štoviše, s obzirom na loše ekonomsko stanje u Nigeriji, socijalna pomoć nije bila adekvatna budući da su radnici nastavili zarađivati kako bi poboljšali svoj status (Oluwole & Ahmad, 2017.).

Podrazumijeva se da se u vrijeme gospodarskih teškoća u zločin ne upuštaju samo nezaposleni, već i oni koji imaju posao. Dok je uzrok počinjenja zločina od strane nezaposlenih osoba nedostupnost poslova, oni koji imaju posao frustrirani su i traže dodatni izvor prihoda jer ne uspjevaju zadovoljiti sve ekonomske potrebe svojih kućanstava. Dapače, bilo recesije ili ne, stanje i nezaposlenih i zaposlenih moguće je poboljšati odgovarajućim sustavom i programima socijalne skrbi (vidi Meloni, 2014.). Stoga je najvažnije uvidjeti da će postojanje paketa socijalne pomoći spriječiti zločin protiv imovine u zemlji. Osim toga, vlada se treba potruditi da snizi indeks bijede koristeći metode poput stimuliranja zapošljavanja, smanjivanja inflacije, onemogućavanja visokih kamatnih stopa te pospješivanja aktivnosti koje će potaknuti rast gospodarstva.

the available opportunity to resell such goods in the market for financial gains (Allen, 1996). Moreover, in respect of the poor economic well-being in Nigeria, social welfare is inadequate as workers kept garnering for improvement in their welfare (Oluwole & Ahmad, 2017).

It is implied that in times of economic strife, it is not only the unemployed ones who would be involved in crime but the employed ones as well. While the unemployed 's involvement in crime is caused by non-availability of jobs for them, the employed ones may be frustrated to source for additional income as they find it difficult to satisfy their household economically. Moreover, whether there is recession or not, both the unemployed and employed's welfare may be improved or taken care of with adequate social welfare facilities and programmes (see Meloni, 2014). Therefore, it is paramount that high existence of social welfare packages would discourage people from committing property crime in the country. Also, an attempt must be made by the government to reduce the misery indexes through methods such as stimulating means of employment, reducing inflation, discouraging high interest rate and further, encourage activities that promote the growth of the economy.

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