THE FOOD IMPORT – INTERNATIONAL TOURISM NEXUS IN CROATIA: AN APPLICATION OF THE ARLD AND NARDL APPROACH AND CAUSALITY

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A R T I C L E I N F O

Original Article

Received: *01 December 2020*

Accepted *03 June 2021*

doi:10.5937/ekoPolj2102275S

UDC 339.562:338.48-44(497.5)

Keywords:

food import, tourism, ARDL, NARDL, causality, Croatia

JEL*: C1, 013, Z32*

A B S T R A C T

The purpose of this study is to examine the relationship between food import dependency and the international tourist arrivals in Croatia during the period spanning 1969-2018. In this paper, we provide empirical evidence on the above hypothesis by detecting the causality between foods imports represented as various food products and international tourism arrivals, that suit as a proxy for tourism consumption. The study method was able to capture symmetries in the relationship between some food import products and tourism, known as autoregressive-distributed lags, but not for all imported food items designed for this study. Since an asymmetric analysis, in such cases, requires the use of nonlinear models, we use nonlinear models and find evidence of asymmetric cointegration. For almost two decades before the global COVID-19 crisis, we conclude, Croatia's food imports grew rapidly, and these imports appear to be mainly driven by exports of services linked to pervasive tourism expansion.

Introduction

The all-important tourism sector in Croatia generates large revenue inflows while increasingly driving the imports of food products up to unsustainable levels (Orsini, 2017). Croatia is ironically in the European club of food insecurity, although it possesses a huge amount of fertile land. The food-import dependency index in Croatia exceeds the food export dependency index (Sahin, 2019; Blagojević et al., 2020). With it, instead of healing tourism's effect on the economy, come some unrecognisable social costs in its rural areas: under-employment, resources vesting, idle capacity. The mass over-tourism so emblematic before the pre-COVID-19 era, for better or worse had deepened food dependency. If

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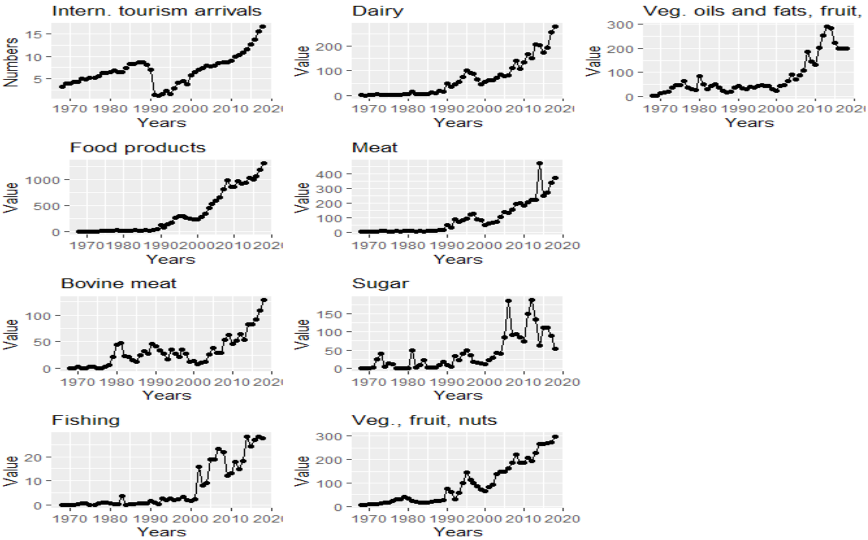
tourism does not change its negative impact on the food trade misbalance, in Croatia, it will continue to diminish its domestic agrarian output, downgrading rural regions' landscape and demoralising the new generation of the country's inhabitants, nudging and coercing them to leave the country. The present paper addresses a literature gap by examining the impact of international tourism on food product imports growth in this country.

Despite the fact that food imports have skyrocketed over the past few decades (see *Fig.1*), we do not know, without a formal analysis, if that was mainly driven by international tourism.

The data regarding food imports in Croatia during the studied period (1969-2018), in the long term, shows that food supply from imports increased very quickly after 1990. We observe similar trends in almost all types of food imports (meat, dairy, vegetables, and even fishing). According to the up-to-date statistics, the food trade deficit has increased since the last year of our analysis: it jumped up to 23% in 2019, concerning the year before on a short-term basis. Furthermore, the food imports covering exports decreased, in the same year, from 67 to 64%.

After a sharp time contraction of international tourism arrivals – followed by a one-time food import decrease – indicated by a structural break in years around 1990, international tourist arrivals, along with food imports, were trending steadily upward. We argue, in this paper, that tourism pivotally affected the food import boom because the food import growth here paralleled, very closely, that movement by international tourist arrivals. Those overlapping occurrences, which so long have gone hand in hand, motivated us to reconsider research on a more formal basis. Is it likely that increased imports stem from increased food consumption by the international tourists who fill the restaurants in Croatia? Does the lack of a punitive tariff on those kinds of imported goods mainly from the EU countries sustain the aforementioned trends?

Figure 1. Tourist arrivals and food imports in Croatia 1969-2018



Notes: arrivals in millions; otherwise in million USA $; source: own calculation

In this context of prolonged food dependency, assumed to be caused by tourism, we will try to find some evidence of a symmetric, as well as an asymmetric (where positive and negative shocks to the food import due to tourism are unequally likely) causality impact of tourism on food import.

After searching recent similar literature adhering to this topic, we found subsequent papers based on the idea of linkage between tourism demand and food product imports. The increased demands for food consumption surged during active tourism periods to provide energy for temporary newcomers from abroad; that food provides with it essential nutrients needed for bodily functions, and thus eating is simultaneously regarded as an 'obligatory' tourist activity (Richards, 2003) and enjoyment. Pirani and Arafat (2016), after assessing the food trade-in balance over the Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) are investigating several avenues to secure food imports, mainly through foreign agricultural land ownership. The rapidly-expanding tourism sector has raised the issue of the relevance of food security and sustainability in that region. Bhutan, one of the landlocked lands, relies heavily on imported goods (food and beverages) from neighbouring countries such as India and Thailand, trying to develop the tourism industry, which in turn leads to significant economic leakages, primarily in agriculture (Pratt et al., 2018). Tourist food imports also mean that Jamaica's food manufacturing and processing sectors miss out on opportunities to develop, diversify, and, potentially, revitalise (Belisle, 1984). Another example is documented by Njoya and Nikitas (2020), who explain how to minimise imports of manufactured food in Senegal, reflecting on the effect of food and beverage processing, caused by tourism hotels and restaurants operating; and argue, by government backing agritourist development initiatives, such as farm-based accommodation, agricultural festivals, and farm-tours.

Mazilu et al. (2014) underline that tourism per se decreases dependence on local resources, as an increasing number of technologies, food, and health services are imported in today's globalised economy. Food imports for tourist consumption not only represent a waste of the Caribbean's precious foreign cash reserve, but also a loss of potential employment and income in agriculture, the poorest and slowest-growing sector of the economy (Belisle, 1994). Fisher (2004) examines the effect of immigration and international tourism in food product imports, which, may have an impact on the (trans-)formation of tastes in Germany.

Other papers, written by the same author, investigate the association between German wine imports from Spain and the amount of German tourists that visit the nation (Fisher and Gil-Alana, 2009). Therefore, we have paid serious attention to the 'tourism arrivals' nexus which affects demand for imported food. To that end, we have used a different approach to investigate the relationship among tourism growth and food import, namely the ARDL and NARDL cointegration tests developed by Pesaran and Shin (1999) and Pesaran et al. (2001), as well as the Granger approaches of causality analysis, based on annual data for the period spanning 1967-2018.

Materials and methods

Theoretical considerations

We defined demand for imported food products in an assumed country, in a broader sense, as a function of the income of the residents and foreign visitors. We may also assume that foreign tourists, who spend their income, are the sole, isolated food consumer in a hypothetical country. The residents do not consume that food; they prefer to eat exclusively food from domestic food growers, manufacturers, and processors. Other variables, which usually theoretically imply an impact on food import demand (such as the product's own price, the prices of close substitutes, and consumer preferences, Young and Burton, 1996), are abstracted and are out of the scope of our interest. Therefore, we will neglect those forces' impact on consumption and omit their effect on food import.

The consumer preferences hypothesis used previously had an important repercussion in simplifying our theoretical narrative: with it, we eliminate domestic breach of food demand, from the story. We also assume that tourist income, in the long run, approximately follows the magnitude of tourist arrivals; so, for purely practical reasons, we will replace the variable of foreign tourist income spending with the variable of tourist arrivals from abroad.

To set up a simple log-linear relation between the only two variables which we will deal with in this paper, we construct the following formula:

FOODIMPi= alfa + beta*ARRIVi +residual (1)

According to eq. (1), food import depends on the number of tourist arrivals. Because we need to distinguish among various imported food products, we use subscripts i. In theory, beta is expected to be positive, indicating that increased international tourist arrivals lead to a rise in imported food products; alfa is constant and e is the error term that includes all other factors affecting the food imports.

ARDL cointegration and bounds tests

Eq. (1) is generally specifying a long-run model. Since Granger causality is based on time series data short-run dynamics, and in order to not lose information from the data, we will transform eq. (1) into an error-correction form based on the short-run ARDL equation to detect the symmetric causality between two variables (FOODIMP and ARRIV). However, prior to this, we propose a few steps of pre-testing.

To analyse the long-term relationship between a set of variables, Pesaran et al. (2001) suggest the use of an autoregressive distributed lag procedure or bounds test that does not require stationary pre-testing, and which can be used regardless of whether the variables are I(0), I(1), or mutually cointegrated, given that none of the series are I(2). Despite these relaxing circumstances, we have made a verification to ascertain whether second-order integration in some time series exists; this is determined by conducting an ADF and the

DF-GLS test unit root test to eliminate further exercises with data that encompass some of the variables. Consequently, if those tests show that the FOODIMP and ARRIV time series variable is either I(0) or I(1), an analysis with that imported group of food products will continue with the bounds test. The bounds test is particularly appropriate for small samples, such as that used in this paper, in which the order of integration of the variables of interest is not known or may not necessarily be the same. The bounds test is based on the following unrestricted error correction model (UECM):

$$\Delta FOODIMP_t = const + \sum_{i=1}^{k} \beta \Delta FOODIMP_{t-1} + \sum_{i=1}^{k} \gamma \Delta ARRIV_{t-1} + \omega Y_{t-1} + \theta ARRIV_{t-1} + \varepsilon_t$$

(2)

where both variables are expressed in natural logarithms. An appropriate lag selection is based on the Schwarz Bayesian Criterion (hereinafter "SBC"). The automated model selection process involves choosing the maximum lag for each regressor, and is set up to be 6 (because the data is annual). The ARDL procedure allows for the possibility that the variables may have different optimal lags (after the searching process has ended), whereas this is impossible with conventional cointegration procedures. The null hypothesis, i.e. there is no long-term relationship between imported food product growth and tourist arrivals variable growth, is not rejected, after testing the *F*-statistic, when:

$H0$: $\omega=\theta=0$, against the alternative $H0$: $\omega\neq\theta\neq0$.

Pesaran et al. (2001) offer a bounds test for two sets of crucial variables instead of the traditional critical values. All variables in the first set are assumed to be zero, while all variables in the second set are assumed to be one (1). The null hypothesis of a non-existent cointegration connection cannot be rejected if the tested F-statistic (or Wald statistic) value falls below the lower bound critical value; but, if it exceeds the appropriate upper bound critical value, the null hypothesis is rejected. The inference is inconclusive if the tested F-statistic value falls between the lower and upper critical value ranges.

The set of the bound critical values for limited data was recently developed by Narayan (2005) (30 to 80 observations), and is the benchmark for *F*-statistic assessing. Furthermore, because of the potential existence of a trend in the series (if the former case is unable to find cointegration between two series), estimations are completed to satisfy the unrestricted intercept and no trend case (as an auxiliary test). Estimations are completed using an ordinary least squares procedure with a White's test for cross-sectional heteroscedasticity-consistent standard errors, and a covariance matrix, appropriate serial correlation diagnostics (the Breusch–Godfrey LM test), and the Jarque–Bera statistic for the normality test.

Symmetric causality analysis

The bounds approach is useful for determining how tourism input affects a specific group of imported food products, either by performing independent estimations of eq. (1) using ΔFOODIMPt1 as dependent variables or by determining the likelihood of a cointegration link.

If there is a cointegration relationship between the variables, the next step is to assess the short-run and long-run dynamics of the series. Hence, the ARDL eq. (2) can be re-parameterised after replacing FOODIMPt−1 and ARRIVt−1 with the lagged residuals, and becomes:

$$\Delta FOODIMP_t = const + \alpha ECT_{t-1} \sum_{i=1}^{n} \rho \Delta FOODIMP_{t-1} + \sum_{i=1}^{p} \sigma \Delta ARRIV_{t-1} + \mu_t$$

(3)

e.g., the error correction model *via* the two-step procedure of Engle and Granger.

In this error-correction model (please see eq. (3)), Granger predicts the possibility of two potential sources of symmetric causality.

The first is based on a first-differenced variable where ARRIV causes FOODIMP, in case significance of $\sum \sigma_i \neq 0$ is demonstrated. This type of Granger causality is short-run causality – the Wald test – which is applied for all the lag independent ARRIV variables using the joint F test. Furthermore, if the coefficient of ECTt-1 is statistically significant (by t-value), then it indicates long-run causality, specifically the second source of causality. ECTt-1 should be between 0 and 1 with a negative sign, which implies convergence of the system back to the long-run equilibrium position.

Additionally, μt represents the error terms and should be white noise and serially uncorrelated.

We will also assess reverse causality which goes from food import to tourist arrivals (a rather weird and counterintuitive direction of events). In the case of this bizarre statistical causality, we will adopt the theory that the tastes of tourists contribute to the phenomenon itself. More precisely, the Granger representation theorem states that if there is cointegration, then there is short-run Granger causality in at least one direction, i.e., the error correction term enters at least one of the equations of the error correction model. For pure statistical curiosity, a vice-versa type of causality, run out, test exercise will be done to check the validity of cointegration evidence (or implicitly the affirmation of the Granger representation theorem). Causation can, of course, be mutual.

NARDL cointegration and bounds tests

The main assumption so far in our narrative, based on eq. (2), is that if an increase in the ARRIV causes the FOODIMP to jump up, a decrease in the ARRIV must cause the FOODIMP to fall, by the same proportion. However, those two occurrences, in which we are interested, are only microscopic elementary particles framed in the broader complex economic system, which is prone to chaotic behaviour. Albu (2006) shows that slight changes to the usual linear form of economic models make the behavior of systems simulated using the new nonlinear models more complicated, and hence more realistic. This means a lot of nonlinearity, which can distort the linear behaviour of our variables. Hence, nonlinearity changes in the ARRIV could have asymmetric effects on FOODIMP. For instance, when the ARRIV increases, more foreign mega-stores quickly open, and the number of shelves containing imported food multiplies soon after. Expected increases in tourists' future income spending because of a swift rise in ARRIV may have, in the country, a disproportionally larger impact on food imports.

When or if the imported food product paired with tourism arrivals time series in mutual relation shows the ARDL model inadequacy, we will pursue the case by applying an asymmetric NARDL model put forth by Shin et al. (2014), which solves the problem of long-run and short-run asymmetries. It is a standard approach, as it provides a dynamic error correction specification combined with the asymmetric long-run cointegration regression by separating a given time series, namely ARRIVt, into its oppositely signed partial sums positive and negative one, which will address possible asymmetries.

That conceptualised partial sum generates two new time series variables, as is outlined by eq. (4) below:

$$POS_t = \sum_{j=1}^{t} \Delta\, ARRIV_j^{+} \qquad (4)$$

$$NEG_t = \sum_{j=1}^{t} \Delta\, ARRIV_j^{-}$$

In eq. (4), the positive (POS) variable, which is the partial sum of the positive dynamics, only translates itself into an increase in the ARRIV. The negative (NEG) variable, which is the partial sum of the negative dynamics, reflects a decrease in the ARRIV. Now, we propose, replacing ARRIV, given like in specification (3) with POS and NEG variables (as in Shin et al., 2014):

$$\Delta FOODIMP_i =$$

$$\alpha + \sum_{i=1}^{n1} \beta\, \Delta FOODIMP_{t-1} + \sum_{i=1}^{n2} \delta_i^{+}\, \Delta POS_{t-1} + \sum_{i=1}^{n2} \delta_i^{-}\, \Delta NEG_{t-1} + \cdots$$

$$\ldots + \gamma_0 ARRIV_{t-1} + \rho_1^{+} POS_{t-1} + \rho_1^{-} NEG_{t-1} \qquad (5)$$

A newly-formed model given by specification (5), because of its uniqueness, is referred to as nonlinear autoregressive distributed lag (NARDL model). That unrestricted specification provides a bounds based test statistic and, with it, we are checking for the existence of a stable long-run association among variables of interest. So, if the ARDL bounds test fails to deliver relevant statistical evidence regarding cointegration, we will transit towards NARDL modelling.

Asymmetric causality analysis

The unrestricted specification of the NARDL error correction model in eq. (5) allows for the possibility of short-run asymmetry, which reflects two restrictions; the validity of these restrictions was tested by employing the standard Wald tests (Shin et al., 2014). The first refers to events which take place during an increase of tourist arrivals, which causes a rise in food imports: the Wald test will show $\sum \delta_i^+ \neq 0$ if the tourism arrivals are going in the opposite declining direction, meaning the force of this will have an impact on the food import path, and $\sum \delta_i^- \neq 0$ should be detected.

For long-term causality evidence in our bivariate case, we use normalised long-run estimates and a long-run specification to generate the error term. We then replace the linear combination of lagged level variables with *ECMt-1*. Regarding the significance of the same term, we will be able to establish the direction of the long-run causality. The long-run asymmetric model in this case will take the following form:

$FOODIMP_i$=a+ $bPOS_i$+cNEG_i, where $\hat{b} = \frac{\widehat{\rho_i^+}}{-\rho_i}$ and $\hat{c} = \frac{\widehat{\rho_i^-}}{-\rho_i}$.

Data

In our study, the import is proxied by the value of various food products, which flow from abroad into Croatia: the bovine meat (*bov*), the fish (*fish*), the dairy (*dai*), the meat (*mea*), the sugar (*sug*), the vegetables, fruit, nuts (*vegfn*), the vegetable oils and fats (*vegof*), and total food products in the general sense: the food (*food*). These variables are sourced from CHELEM - International Trade (GTAP sectoral classification), with the assistance of DB-NOMICS data provider (2020), retrieved from http://www.db.nomics.world.

The international tourism arrivals (*arriv*) variable is employed as a crude measure of orientation towards tourism spending on food, and has been used as a substitute (alternative term) for tourism consumption in this study, directed to the above-mentioned food items. This data is collected from the Statistical Yearbook of the Republic of Croatia, and the period considered is that spanning 1969-2018 (SGJ). The data used is the principal annual time series in the analysis for the Croatia food dependency related to tourism. Furthermore, a dummy variable is included to account for the exact timing of the dissolution of the former Yugoslav federation of 1991. We felt that this institutional structural change in the former Yugoslav federation's past was an important event, which affected trade that proceeded following those years. We assign a value of 1 for the period before 1991 and zero for the period thereafter. All the variables used in this paper come in their natural log form.

Results and discussions

We start with an examination of the integration properties of the variables by applying the Augmented Dickey and Fuller (1979) (ADF), as well as the DF-GLS test invented by Elliott, Rothenberg, and Stock (1992). In the presence of I(2) or higher variables, the computed statistics provided by Pesaran et al. (2001) and Narayan (2005) are not valid (Ang, 2007).

Using the conventional specifications for each variable in each of the tests, the results presented in Table 1 report that there is no I(2) or higher indicated feature in the same variables. All the included variables in the examination are found to be I(1) at a level and I(0) at first differences.

Table 1. Unit Root Test ADF & DF-GLS

		Augmented Dickey–Fuller Test	**DF-GLS**
Levels	*arri*	-0.171 (2)	0.341 (1)
First diff.		-3.709(1)***	-3.547(1)**
Levels	*food*	1.936(1)	1.881 (1)
First diff.		-3.010(3)	-5.047(1)***
Levels	*bov*	0.654 (1)	0.925 (1)
First diff.		-5.526(0)***	-5.301(1)***
Levels	*fish*	1.513 (4)	0.826 (2)
First diff.		-4.224 (2)***	-7.112(2)***
Levels	*dai*	2.175(3)	1.797(2)
First diff.		-7.729(0)***	-6.139(1)***
Levels	*mea*	1.438(3)	1.275(2)
First diff.		-6.137(2)***	-7.797(1)***
Levels	*sug*	-2.212(1)	-1.131 (1)
First diff.		-5.342(2)***	-6.479(1)***
Levels	*vegfn*	1.155 (3)	0.875(1)
First diff.		-4.877(2)***	5.927(1)***
Levels	*veofof*	-0.992 (1)	-0.525(1)
First diff.		-6.316 (0)***	-5.448(1)***

Source: author's research

Notes: All the regressions include a linear trend in the levels, and include an intercept in the first differences; secondly, the numbers in parentheses are the optimal lag orders and are selected based on Schwarz Bayesian; thirdly, *, ** and *** denote the 10%, 5% and 1% levels of significance, respectively.

We attempt to set up the best of the models (in *Tables 2-6* below) and fix an optimal lag, which is crucial. With an initial lag of 6, the automated model selection, according to minimal SBC (Pesaran and Shin, 1999), calculates the optimal lag length. They recorded evidenced cointegration between variables in various bivariate cases included dummy variable because. Hence, the variable's empirical F value surpasses critical values related to the bounds test (given in *Table 3*).

Table 2-6 also shows the estimated symmetric and asymmetric models that have passed several diagnostic tests, which indicate no evidence of serial correlation and heteroscedasticity, nor deviation from normal distribution.

Before the causality evaluation, which will require the running of eight bivariate equations for various food import variables (driven by tourist arrivals), we first check whether or not the variables of prime interest, i.e. each of the food variables and *arriv*, have any cointegration relationship.

In the first step of applying the bounds test, we specify the optimal lag length of the UECM version, i.e. eq. (1), and check the long-run level equilibrium relationship. The results are given in *Table 2* for both cases (III and V).

Table 2. Result of the cointegration test using ARDL approach and Granger causality

	International tourist arrivals causing import (arrivals → import)							
Dependent variable	Case	p and q orders	F-Test	ECMt-1	Wald test	LM-test	HET	JB-test
fish	III	4,4	5.879**	-0.879***	0.772	0.405	0.637	0.603
	V	4,4	5.065	-0.543***	0.567	0.502	0.229	0.711
dai	III	3,4	1.027	-0.840**	1.358	0.308	0.034	0.675
	V	3,4	5.937*	-0.849***	1.238	0.257	0.138	0.628
mea	III	4,4	4.470*	-0.947***	2.695*	0.004	0.313	0.438
	V	4,4	4.508	-0.831***	2.543*	0.117	0.623	0.025
sug	III	4,4	4.760**	-0.847***	4.486***	0.238	0.113	0.047
	V	4,4	6.191**	-0.934***	3.898**	0.597	0.017	0.000
vegfn	III	2,1	5.335**	-0.341***	4.082***	0.261	0.884	0.587
	V	2,1	5.715**	-0.315***	3.789**	0.186	0.772	0.485

Source: author's research

Notes:

- The critical values are derived from Tables CI (V) and CI (III) (see *Table 3* below). LM is the Lagrange multiplier test for serial correlation with a $x2$ distribution, with only one degree of freedom; J-B is the Jarque–Bera test for normality, HET is the White test for heteroscedasticity with a $x2$ distribution, with only one degree of freedom; asterisks *, ** and *** denote statistical significance, respectively, at the 1%, 5% and 10% levels. Italic and bold labels for the variables indicate bounds testing repeats, according to case III.

- Long-run Granger causality is conducted using the t-statistics of α coefficient, which stands before the ETCt-1 term, the latter of which measures how fast the deviations from the long-run equilibrium die out following changes in each variable, according to eq. (2).

- Short-run Granger causality is conducted using Wald statistics, testing $H0$: $\sigma = 0$ that stands as a coefficient before the *arriv* variable for all p lags, according to eq. (2). The figure in italics captures the arriv input as a dependent variable, F-stat. (objective is to inspect reverse causality).

Table 3. Critical Values for the (N)ARDL Modelling Approach Related to the Bounds Test

	Case V		**Case III**	
	I(0)	I(1)	I(0)	I(1)
10% critical value	5.78	6.54	4.38	5.35
5% critical value	6.985	7.86	5.247	6.303
1% critical value	9.895	10.965	7.337	8.643

Source: Pesaran et al. (2001); case V and case III are related to ‘unrestricted intercept, unrestricted trend’, ‘unrestricted intercept, no trend’, and ARDL regression, respectively.

The ARDL bounds test results show that there is no equilibrium relationship between the selected variables of food import (meant in the general sense) and tourist arrivals in the following cases: *food, bov, and vegof*. Conversely, in other variables the null of no cointegration is rejected (*fis, dai, meat, sug, veg*). Those last cases with cointegration evidence are indicated in *Table 2* by a significant F-test.

Even in the relaxed case of unrestricted intercept and no trend equation frame (case 5) produced by the F-test, we do not reach a decisive conclusion about linear cointegration in some mentioned food import variables. Therefore, we drop those variables in this stage of symmetric Granger causality testing. We hope to provide, later on, deeper insights into the possible asymmetric cointegration by using NARDL modelling.

Let us now consider the first two linear models, which refer to imported food products (reported in *Table 2*). From the Wald test of the additive short-run symmetry condition, we observe no apparent significant short-run effects of change in *arriv* to the import of *fish*, and neither to the import of *dai*. However, the analysis reveals short-run unidirectional Granger causality running from *arriv* to other kinds of food import (*mea*, *sug*, and *vegfn*).

The coefficient estimates for the lagged error correction terms (ECTt-1) range between a low of 31.5% for the *veg* variable and a high of 94.7% for the meat variable, indicating the percentage of adjustment towards a long-run equilibrium that occurs within an annual interval. Meanwhile, the t-statistics of the coefficients of the lagged error correction terms (ECTt-1) indicate the statistical significance of the long-run causal effects. There is long-run unidirectional Granger symmetric causality running from tourist arrivals to various components of food imports. And this, according to *Table 2*, is specifically from international tourist arrivals, which affect the imports of the following food products: *fis*, *dai*, *sug*, and *vegfn*.

As was designed in the theoretical consideration, we search for reversed Granger causality direction – from food imports to tourist arrivals; again we should target one or more food import cases in the corresponding cointegration testing – in our study. Despite the trial, we are able to deliver a plausible F test result only in two cases (see *Table 4*). In these two regressions, when *meat* or *vegof*, respectively are independent variables, slight evidence of a cointegration link between the two variables (F statistics at 10% significantly) is revealed.

To summarise this reverse short-term causality, we can identify one bidirectional, long-run causality, which refers to the meat import (read in *Tables 2* and *4*). Meat import is a consequence, as well as a long-run cause, of tourist arrivals. We also find here evidence that the *vegfn* import cause arrivals along the long-run trajectory path.

Table 4. Result of the cointegration test using ARDL approach and Granger causality (reverse cases)

Import causing international tourist arrivals (import → arrivals)							
	Case	P and q orders	F-Test	ECMt-1	Wald test	LM-test	HET
mea	III	(3,4)	4.984*	-0.351**	1.248	0.099	0.510
	V	(3,4)	4.571	-0.429**	1.345	0.068	0.592
vegfn	III	(3,4)	5.016*	-0.315***	0.856	0.561	0.734
	V	(3,4)	5.065	-0.448***	0.786	0.817	0.655

Source: author's research

Notes: Ibidem

We continue our analysis by selecting the best specification of the NARDL model for each food import product, which drops off from previous analysis within the ARDL model, and thus it is necessary to pick up cointegration F-statistics before proceeding through to an asymmetric causality checking versus arrivals impact.

We compare now obtained F-statistics with the critical values for the NARDL bounds test statistics, which are in the same range as for the ARDL, according to the critical value proposed by Pesaran et al. (2001). For *bovine* meat and *vegof*, the F value is higher than the upper bound of the critical value at the 5% level of significance, but for total food products, it is significant at only 10%. How does the causality result in here stemming from the nonlinear model complement earlier research? We review only three types of food (*food*, *bov*, and *vegof*). From *Table 5*, we recognise that, in the short-term, increases in the *arriv* cause *food*, just the same as *bovine* meat and *vegof*. In all those dependent variables, the $\sum \sigma_i^+ \neq 0$ is supported by a significant Wald test at 5% significance. Regarding the opposite movement of the independent variable set in the NARDL equation, decreases in the *arriv* variable cause in the following short run variables: *food, bov*, and *vegof*, respectively. The $\sum \sigma_i^- \neq 0$ that stands before those coefficients has significant statistics according to the Wald test. Introducing a nonlinear adjustment of the *arriv* into the NARD model has resulted in more cases in which tourism affects food imports, asymmetrically, and in the short run. This evidence can be supplemented by new cognition, which also arises from long-run causality. ECMt-1 carries a significantly negative coefficient in all three food import cases. Thus, in all cases, the null hypothesis regarding the long-run existence of an asymmetric relationship is rejected at the 1% level of significance.

Table 5. Result of the cointegration test using NARDL approach and Granger causality

Dependent variable	Case	p and q orders	F-Test	ECMt-1	Wald test (POS)	Wald test (NEG)	LM-test	HET	JB-test
food	III	2,3	2.367	0.341**	3.787**	4.273**	0.594	0.515	0.000
	V	1,1	3.851*	0.438**	2.312	1.765	0.774	0.779	0.001
bov	III	1,1	7.783**	0.431**	3.312**	4.179**	0.695	0.126	0.063
	V	1,1	7.723**	0.574**	1.987	2.100	0.502	0.247	0.022
veofof	III	1,1	6.797**	0.512**	3.127**	3.673**	0.354	0.648	0.512
	V		7.867**	0.643**	1.756	1.987	0.526	0.647	0.527

Source: author's research

Notes: Ibidem

Once again, our pieces of evidence suggest a bidirectional relationship between aggregate food import and tourist arrivals when considering the NARDL model.

Table 6. Result of the cointegration test using NARDL approach and Granger causality (reverse cases)

Dependent variable	Case	p and q orders	F-Test	ECMt-1	Wald test (POS)	Wald test (NEG)	LM-test	HET	JB-test
food	III	1,1	3.862*	0.476*	3.827**	4.073**	0.755	0.882	0.054
	V	1,1	4.362**	0.534**	2.234	1.987	0.775	0.966	0.098

Source: author's research

Notes: Ibidem

According to the nonlinear model (*Table 6*), we show that if imported food brings about more tourists, viewing separately, regardless – in the short or long run – to the country, that gives rise to a side-effect which touches tourism.

Conclusions

Our understanding of the interrelationships between food import demand and tourism consumption proxied by international tourist arrivals in Croatia, by employing rigorous statistical testing – the unit root, cointegration analysis, bounds testing (Pesaran et al., 2001), and the Granger causality test, as a result of this research, has improved.

In this paper, we first investigate the link between food imports and international tourist arrivals, assuming the relation between these two variables to be linear or the effects of one variable on the other to be symmetric. Results regarding the autoregressive distributed lag (ARDL) model show that there is a distinct unidirectional causal relationship between *arriv* and *mea*, *sug*, and *vegfn* in the short run, while in the long run there exists this relationship for the same previous variables along with *fis* and *dai* too. The reverse causality from *meat* and *vegof*, respectively to *arriv* exists but only in the long run, and there is no reverse causality in the short run.

To justify the fact that the relationship between two occurrences in our focus need not be straightforwardly linear, we take an additional step and separate the declines from increases in food import variables; we then engage in finding asymmetric causality, after carrying out an asymmetric cointegration analysis. The NARDL-based results indicate that, in the short term, increases in the *arriv* cause aggregate food, as well as *bovine* meat and *vegof*. On the other hand, the fall of the *arriv* has a short-run impact on *food*, *bov* and *vegof*, decreasing their import. We also find bidirectional short-term asymmetric causality, where the increase in food imports aggregated causes the *arriv* to jump up. In all those cases, we find also the long-run causality impact.

Our contribution is not quite comparable to that of Fisher (2004) and Fisher et al. (2006). For German aggregate food imports coming after these papers, the focus is on alternate, and perhaps simpler, explanations of food imports dynamics. Authors dealing with this issue from other perspectives conclude that increased food product imports from particular countries (imports of wine, cheese, and processed/preserved vegetables from France and Italy) have been attributed to migration to Germany and Germans' international travel activities to particular places. Normally, in a tourism-based economy such as Croatia, overwhelming food imports is no excuse for the country's present-day state of food dependency, which we reveal in our contribution. Manny factors besides tourism are cumulative causative ingredients of this dependency, namely: the profit-lacking initiative to adopt sufficient primary food production in rural districts; the relative price problems, or unfavourable terms of trade of agriculture products; exchange rate issue; lacking the economies of scale operating on small land parcels; and low comparative advantage in food processing for some goods versus those from abroad. All of the aforementioned are complexities that cause food import, from behind, along with the tourism to growth. The importing of food is, as a matter of fact, an effective short-term policy for improving food insecurity because of a huge inflow of foreign tourists to Croatia. It is not difficult to see how this trend curve – an echo of what is happening in tourism consumption – would be flattened by the build-out of the new reality. It may be that tourism will decrease, taking on a more sustainable number of arrivals generally, because of the detachment from mass tourism in the future. Alternatively, by improving some of the aforementioned factors that cause a hinderance, a more diversified and productive food production supply in the country may be possible. We hope that our study contributions will sharpen the diagnosis of how tourism has affected food imports in Croatia.

Acknowledgments

"The Faculty of Economics and Tourism "Dr. Mijo Mirkovic," Juraj Dobrila University of Pula, Croatia, supported the scientific project TOURISM DEVELOPMENT AND DESTINATION IMPACTS, which resulted in this study. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the author(s) and do not necessarily reflect the views of the Faculty of Economics and Tourism "Dr. Mijo Mirković" Pula."

Conflict of interests

The authors declare no conflict of interest.

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