Potential Impact of Brexit on Fruits and Vegetables Purchases in Scotland

Abstract

At the start of 2021, the economics observatory suggested that the British pound was 15 per cent weaker relative to the Euro than it was on the eve of the Brexit referendum. The goal of the present study is to assess the implications of an unfavourable Brexit deal that has the potential to depreciate the British pound by making fruits and vegetables imported from the EU relatively more expensive than the pre-Brexit era in Scotland. Demand for fourteen kinds of fruits and vegetables purchased in Scotland was estimated using monthly time series data constructed from a consumer panel collated by Kantar Worldpanel from 2006 to 2020. Using short-run elasticities calculated from the demand model we simulated the implications of a 10 per cent price increase for fruit and vegetable resulting from changes to trade tariffs with the EU or movements in exchange rates. The results tend to suggest that a major share of the vegetables purchased in leading retail shops in Scotland are either produced in the UK or the rest of the world. For fruits, a major share of fruits especially tropical fruits and grapes bought are sourced from the rest of the world. The depreciation of the British pound relative to the Euro has negative implications for demand for all kinds of fruits and vegetables. The impact of the price increases is highest for fruits and vegetables of the EU origin. This could result in as high as 63 per cent reduction in net total purchases for seed vegetables and as low as 2 per cent reduction in purchases for edible plant stem vegetables. The fall in purchases could potentially affect Scottish government's goal to increase fruits and vegetable consumption by 400 grams per person per day.

Keywords: Brexit, Trade tariffs, EASI demand, Fruits and Vegetables, Scotland

1. Introduction

Fruits and vegetables intake is considerably lower in Scotland than the rest of the UK (Piacentini et al., 1995). Also, Scotland is among the countries with high mortality rate from Coronary Heart Diseases (CHD) and certain cancers (British Heart Foundation, 2022; World Health Organization (WHO), 1990). In 2014, 65% of adults aged 16 and over were overweight, including 28% who were obese. In the same year, there were 276,430 people diagnosed with diabetes in Scotland recorded on local diabetes registers (Scottish Government, 2015). Recent studies have shown that these diseases can be prevented or minimised through alterations in smoking, physical activity and dietary change (Gey, 1986).

Dietary modification has long been one of the major considerations for CVD prevention. High consumption of fruit and vegetable has been identified as important in the prevention of cardiovascular diseases and certain cancers (Aune et al., 2017). This is due to the high content of bioactive compounds contained in these food groups i.e., dietary fibre, vitamin C, carotenoids and components such as glucosinolates, folic acid and (iso)flavonoids (Steinmetz

& Potter, 1996; van't Veer et al., 2000). Current Scottish dietary guidelines recommend the consumption of five portions or 400 grams of fruits and vegetables per day (Anderson, Marshall, et al., 1994), however, this continues to remain low. A lot of reasons including climate, available and poor quality and cost has been cited for the poor consumption of fruits and vegetables in Scotland (Anderson et al., 1994)

Piacentini et al., (1995) has shown that different factors affect the food choice i.e., consumption of fruits and vegetables. Among them are factors relating to the food itself, the individual and the environment. These factors are either enabling or constraining to the individual. Pollard et al., (2022) grouped these factors into sensory appeal, familiarity and habit, social interactions, cost, availability, time constraints, personal ideology, media and advertising and health.

Economic, social and cultural factors also affect the consumption of fruit and vegetables in the UK (Piacentini et al., 1995). From the economic point of view, the consumption of fruits and vegetables is higher among home owners, high income households, and high social classes (Anderson, Lean, et al., 1994). A study by Conklin et al. (2015) among EPIC Norfolk cohort suggest that consumption of fruits and vegetables is lower among lower social class, less educated households, and households having difficulty paying bills.

Current and future trade agreement between the UK and trading partners has implication for domestic food consumption (Barons & Aspinall, 2020; Hubbard et al., 2018; Seferidi et al., 2019; Strong & Wells, 2020). The reason is that the UK imports more than half of its domestic consumption of fruits and vegetables. For instance, it imported 84% of fruits and 43% of vegetables consumed in 2017. Therefore, unfavourable trade agreements could harm food choice and population health especially demand for fruits and vegetables (Schram et al., 2018; Seferidi et al., 2019).

On June 23, 2016 the United Kingdom voted to exit the European Union, by majority of 52-48 per cent. The impact on food and agricultural sector is expected to be extensive. For instance, a no deal Brexit could increase food prices by 22.5 per cent and the number of households facing food security in the UK (Barons & Aspinall, 2020). Korus & Celebi, (2019) showed that the Brexit news had an impact on the British pound exchange rates. For instance, at the start of 2021, the economics observatory suggested that the British pound was 15 per cent weaker relative to the Euro than it was on the eve of the Brexit referendum. Moreover, a no deal trade agreements between the EU and the UK is expected to impose tariffs between 0.4 – 9.1 per cent on imported fruits and vegetables (Paraskevi & Cuevas, 2020). Revoredo-Giha & Costa-Font (2018) used the depreciation of the British pound to assess the implication for the demand for fruits in the Scotland based on origin. They concluded that demand for fruits is sensitive to price changes arising from the depreciation of the British pound. However, a major limitation of the study was that it was limited to fruits purchases, excluding vegetables. (Paraskevi & Cuevas, 2020)'s study was based on HMRC data and did not consider how the price increase will affect demand.

The present study builds on the work by Revoredo-Giha & Costa-Font (2018) and Paraskevi & Cuevas (2020) by extending the analysis to include eight types vegetables bought in Scotland from major retail stores. In principle, we analyse the demand for fruits and vegetables in

Scotland considering their geographical origin. This allows us to model the extent to which domestic demand is sensitive to price variations in fruits and vegetables from different geographical origins and implications for demand.

Vegetables were grouped under Leafy green, Cruciferous, Marrow, Root, Edible plant stem, Allium, Seeds, and Fruits. Similarly, fruits were grouped under Pome/drupes, Bananas, Citrus, Grapes, Soft fruits, and Tropical fruits (see Appendix A for more details). Three geographical origins were considered for the analysis: UK, EU, and others or the rest of the world. A three stage time series demand modelling was used to estimate elasticities of geographical origin for the different types of fruits and vegetables.

The remainder of the paper is structured as follows: first, we present the empirical section, which briefly presents the data used in the statistical analysis, followed by the methodology used; third, the results are presented and discussed. Finally, conclusion is presented.

2. Methods

Consumers purchase data

The data is monthly Kantar Worldpanel data for Scotland covering the period 2013 through to 2020. The dataset also consists of household food purchases as well as demographic information such as income levels.

A three stage demand approach was used estimate the demand for fruits and vegetables based on their origin. First, purchases made by households were categorized into two broad aggregates: Fruit and vegetables, and other groceries. In the second stage, fruits and vegetables were disaggregated into 13 main groups, namely 1) Leafy green, 2) Cruciferous, 3) Marrow, 4) Root, 5) Edible plant stem, 6) Allium, 7) Seeds, and 8) Fruits, 9) Pome/drupes, 10) Bananas, 11) Citrus, 12) Grapes, 13) Soft fruits, and 14) Tropical fruits. In the third stage, the 14 fruits and vegetable groups were further disaggregated into geographical origin (importing country). For our analyses, three main origins were considered i.e., UK, EU, and rest of the world[1].

Table 1 shows the summary of the data used for estimating the demand model. The first stage shows that approximately 8 per cent of total household expenditure is spent on fruits and vegetables by Scottish consumers. In the second stage, this expenditure is distributed among the 14 different types of fruits and vegetables. The highest amount of expenditure (16 per cent) is spent on root vegetables, this is followed by Pomes/drupes (14 per cent), Fruits vegetables (11 per cent) and soft fruits (11 per cent). The type of fruits and vegetables with the lowest expenditure shares is Edible stem vegetables. In the third stage, fruits and vegetables were further divided into their country of origin or where they are imported from into the UK. Products for which the majority of purchase are from the UK are leafy green vegetables (52

[1] UK refers to products of the following origins: British, Channel Islands, England, England/Wales, Home Produced, Northern Ireland, Scottish. EU refer to products of the following origins: Belgium, Canary Isles, Cyprus, Eire, France, Greek, Holland, Ireland, Italy, Other Europe, and Spain. And Others/Rest of the world refers to products of the following origins: Brazil, Cameroon, Canadian, Chile, Egypt, Israeli, Moroccan, New Zealand, Not Stated, Other Country/Not Stated, South African, Turkish, U.S.A., West Indies, Surinam, Brazilian/Argentinian, Costa Rican, and Australian.

per cent), Cruciferous vegetables (51 per cent), Marrow vegetables (41 per cent), Root vegetables (76 per cent). Those for which major purchase share come from EU is fruit vegetables (46 per cent). The remaining products have their largest purchase shares from the rest of the world.

Paste Table 1 here

Estimation of demand elasticities

The demand system estimation is based on the Exact Affine Stone Index (EASI) model (Lewbel & Pendakur, 2009). Following Molina, (1994), we assumed weak separability of preferences which is a necessary and sufficient condition for our three stage budgeting process. In the first stage, consumers decide how much to spend on fruits and vegetables. Secondly, they decide how much of this income to spend on the 14 different types of fruits and vegetables determined by their prices and total expenditure from the first stage. Next consumers select among the 14 fruit and vegetable types from the second stage considering their origin.

We estimated a time series version of the Linear Approximate EASI (LA/EASI) demand model. The estimated long-run static EASI model in the second stage was specified as:

$$w_t = \sum_{r=0}^{5} b_r y_t^r + \mathrm{A}p_t + \mathrm{C}z + u_{jt} \quad (1)$$

where w_t is the vector of budget shares for each food group at time *t*, *p* is a vector of log prices of each food group, and *z* is a vector of demographic characteristics replaced by time trend and monthly dummies to capture seasonal effects on food consumption.

And y_t[2] is the real expenditure derived by

$$y_t = ln(x_t/cpi) \quad (2)$$

The variable x_t is a vector of nominal expenditure and cpi is the monthly consumer price index of food purchases in Scotland. Parameters to be recovered are matrices and vectors of b, A, and C.

The system of N equations of the form in Equation 1 satisfies adding-up and homogeneity restriction if

$$1_n' = 1, \quad 1_n' b_r = 0, \quad \forall r = 0 \quad (3.1)$$

and

$$1_n' A = 0 \quad (3.2)$$

Where symmetry of the Slutsky matrix is ensured by the symmetry of the nxn matrix A.

The static model implicitly assumes that there is no difference between consumers' short-run and long-run behavior. However, Klonaris & Hallam (2003) suggest that this is inappropriate

[2]The polynomial of y_t was constrained to 1 to make the already complex model easier to estimate.

where there is habit persistence, imperfect information, incorrect expectations, adjustment costs, and misinterpreted real price changes often prevent consumers from adjusting their prices and expenditures instantaneously. In addition, the static demand model does not pay attention to the statistical properties of the data as well as the dynamic specification arising from the data (Li et al., 2016). Moreover, the static demand model does not produce accurate short-run forecast (Chambers & Ben Nowman, 1997). This makes it necessary to augment the long run equilibrium relationship with short-run adjustment mechanism.

To circumvent the limitations of the static or long run demand model, Deaton & Muellbauer, (1980) proposed including lag of the budget shares as explanatory variables. Molina (1994) used this approach to estimate food demand model in Spain. Mazzocchi (2003) performed empirical appraisal of the AIDS that allows for time-varying coefficients (TVC/AIDS) and the simple dynamic AIDS model with time trend, seasonal dummies and lag of the budget shares as explanatory variables. The author concluded that TVC/AIDS did not outperform the dynamic AIDS model, apart from improved short run forecast.

Error correct LA/EASI demand system

Because time series data was used to estimate the demand model, it is appropriate to investigate the time series properties of the data. This will inform the type of dynamic version of the EASI demand model to specify. In addition, testing for the properties of the series is necessary in order to assess whether the long-run relationships are economically meaningful or spurious. First, the budget shares, total expenditure and the prices were tested for unit root. Following literature, an Augmented Dickey-Fuller was performed. Second, the system is tested for cointegration. All variables were found to be stationary after first difference and integrated of order one I(1). The next step is to estimate an error correction Linear Approximate EASI demand system. The lag of the dependent variable was incorporated into the final model in order to capture habit formation. The implication is that current consumption is influenced by past consumption.

The formulated dynamic EASI model is similar to Karagiannis et al. (2000), Li et al. (2004), Nzuma and Sarker (2010) and Rathnayaka et al., (2019):

$$w_t = \alpha_i + \sum_{r=0}^{5} b_r \Delta y_t^r + \mathrm{A}.\Delta p_t + \sum_{s=1}^{12} C z_t + D.\Delta w_{t-1} + E.u_{t-1} + \varepsilon_t \qquad (4)$$

where Δ is the difference operator, $t-1$ represent lags of the variables and u_{t-1} is a vector if estimated residuals from the long run static EASI demand model (1). In equation (4) it is the error correction term that measures the adjustment of the decision errors made in the previous period. z_t captures seasonality in the data. Parameters to be recovered are matrices and vectors of b, A, C, D, E, and α.

Given that y is a function of the budget shares, we have endogeneity. Lewbel and Pendakur proposed the use of non-linear GMM or an iterated linear approximation for the estimation of the parameters (Lewbel & Pendakur, 2009). We estimated another Stone deflated real expenditure where budget shares, w_t has been replaced with their sample average $\overline{w}_t$ leading to: $\tilde{y}_t = ln\,(x_t) - p_t'\overline{w}_t$ to instrument for food group expenditure (x_t). Similar to Reaños and Wölfing (2018), we adopted an iterated three stage technique to estimate the final $n-1$ model.

Price and expenditure elasticities

Given that we estimated a multi-stage demand model, the elasticities computed from the demand systems is conditional on the budgeting level. Unconditional elasticities are more relevant since they better measure the detail reaction of the consumption of the food groups on economics variables such as taxes and subsidies. The unconditional elasticities are estimated from their conditional counterpart using the method applied by Bouamra-Mechemache et al. (2008):

The conditional Hicksian price elasticity of demand for good *i* and *j* belonging to commodities *r* can be defined as:

$$\varepsilon = \overline{w}^{-1}(B) + \Omega\overline{w} - I$$

where ε is an *n x n* matrix of compensated demand elasticities, $\overline{w}$ is an identity matrix where the ones have been replaced by the group mean budget shares, Ω is an *n x n* matrix of ones and I is an identity matrix.

The vector of expenditure elasticities $\boldsymbol{\vartheta}$ were subsequently derived by

$$\vartheta = (\overline{w})^{-1}(\mathrm{I} + Ap')^{-1}A + 1_n \qquad (10)$$

where ϑ is the *J X 1* vector of estimated expenditure elasticities, *b* is the expenditure semi-elasticity coefficients which is $\sum_{r=0}^{5} b_r y^r$ [3], *p* is a vector of mean prices and 1_j is a $J \times 1$ vector of ones.

The matrix of conditional Marshallian elasticities, *e*, were derived from the Slutsky equation given by

$$e = \varepsilon - \overline{w}\vartheta$$

To estimate the unconditional elasticities, we used the equation derived by Bouamra-Mechemache et al., (2008) who followed the method suggested by Carpentier and Guyomard, (2001).

For the three-stage budget allocation, denoting *i* and *j* two commodities belonging, respectively, to sub-groups of commodities r and s that belong, respectively, to the groups *a* and *b*, unconditional Marshallian price elasticities at the third stage are defined as:

$$e_{ij} = \delta_{rs} \times e_{(a)(r)ij} + w_{(b)(s)j} \times \left[\frac{\delta_{rs}}{E_{(b)(s)j}} + e_{(r)(s)}\right] \times E_{(a)(r)(i)} \times E_{(a)(r)(j)} + w_{(b)(s)j} \times w_{(b)s} \times E_{(a)r}$$
$$\times E_{(a)(r)i} \times E_{(b)(s)j} - 1 + w_{(b)(s)j} \times w_{(b)s} \times \left[\frac{\delta_{ab}}{E_{(b)(s)j} \times E_{(b)s}} + e_{(a)(b)}\right] \times E_{(a)(r)i} \times E_{(a)r}$$
$$\times E_{(b)(s)j} \times E_{(b)s} \times w_{(b)(s)j} \times w_{(b)s} \times w_b \times E_{(a)(r)i} \times E_{(a)r} \times E_a \times (E_{(b)(s)j} \times E_{(b)s} - 1)$$

The unconditional expenditure elasticity for good *i* that belongs to the sub-group *r* that belongs to group *a*, is given by

[3] To simplify the model, which is already complicated by its time series nature, r was restricted to 1 since this does not change the expenditure elasticity significantly. Moreover, our interest is not in deriving Engel curves for the various foods.

$$E_i = E_{(a)(r)i} \; x \; E_{(a)r} \; x \; E_{(a)}$$

Finally, the Hicksian price elasticities were estimated using

$$e_{ij} = \delta_{rs} \text{ x } e_{(a)(r)ij} + w_{(b)(s)j} \text{ x } e_{(r)(s)} \; x \; E_{(a)(r)i} \; x \; E_{(a)(r)j} + w_{(b)(s)j} \; x \; w_{(b)s} \; x \; e_{(a)(b)} \; x \quad E_{(a)r} \text{ x } E_{(a)(r)j} \text{ x } E_{(b)s}$$

where δ_{rs} is a dummy equal to 1 if $r = s$ and 0 else,
$e_{(a)(r)ij}$ is the conditional price elasticity of good I with respect to good j
$w_{(b)(s)j}$ the budget share of good j in commodity group s,
$E_{(b)(s)j}$ is the conditional expenditure elasticity of good j (conditional *w.r.t.* expenditure of group s)
$e_{(r)(s)}$ is the conditional price elasticity of sub-group r with respect to sub-group s,
$E_{(a)(r)(i)}$ is the conditional expenditure elasticity of good i (conditional *w.r.t.* expenditures of group r),
$w_{(b)s}$ is the budget share of sub-group s in group b,
$E_{(a)r}$ is the conditional expenditure elasticity of sub-group r (conditional *w.r.t.* expenditures of group a),
$E_{(b)s}$ is the conditional expenditure elasticity of sub-group s (conditional *w.r.t.* expenditures of group b),
w_b is the budget share of group b,
E_a is the expenditure elasticity of group a.

Simulations

A considerable amount of fruit and vegetable consumed in Scotland is imported from the EU. This means that changes in the cost of imports due to trade tariffs and exchange rate fluctuation could potentially affect the price that consumers pay for fruit and vegetable. If the UK leaves the EU without striking a free trade deal, then tariffs will be imposed on EU imports into Scotland. This is because the UK is unable to discriminate between trading partners by imposing zero tariffs on EU imports (Pre-Brexit). It could only achieve this by extending tariff-free access to all WTO members. Since it is not economically sound to offer zero tariffs to all WTO members, a no free trade with EU (post-Brexit) will increase the prices of fruits and vegetable in Scotland unless importers are willing to absorb the price increase. In addition, imported fruits and vegetables are paid for in foreign currency. This means that when the foreign currency become expensive relative to the British pound, more British pound will be required to purchase the same amount of fruit and vegetable. To analyze the impact of both the trade tariff and exchange depreciation on fruit and vegetable demand in Scotland, the following were performed: 1) analyze the market shares or purchase shares of fruits and vegetables bought in major retail stores in Scotland from 2006 to 2020; 2) estimate the demand elasticities for fruits and vegetables based on their geographical origin; and 3) simulate the implications of a 10 per cent[4] depreciation of the British pound on fruits and vegetables demand in Scotland.

[4] This figure is low; currently, the UK imposes tariff rates between 0 and 30 per cent on EU imports. Also, the British pound depreciated by 3 per cent between 2020 and 2021.

3. Results and discussion

Test for stationarity and cointegration

An ADF test was conducted to determine the presence of unit root in the long-run static LA/EASI demand system (1)[5]. The results shows that the null hypothesis of non-stationarity cannot be rejected at the 5 per cent significant level for most of the series. Each series was first-differenced and test again for unit root. The alternative hypothesis of stationarity was accepted at 1 per cent significant level for all series indicating that the series are non-stationary, integrated of order one (I(1)). In the second step, a cointegration test was performed to determine whether the budget shares are jointly determined by real food expenditure and prices. According to Engle and Granger (1987), a linear combination of non-stationary series maybe stationary if they have a long-term relationship. The ADF and Philip-Perron test was applied to the residuals from (1) for the test. The null hypothesis of no cointegration was rejected for all n equations suggesting that shocks to expenditure and prices are reflected in the budget shares.

Price and expenditure elasticities

Table 2 presents the short run Marshallian and expenditure elasticities for fruit and vegetable aggregates, and other groceries. All calculated own price elasticities were significant at the 1 per cent level. Fruit and vegetables purchases in Scotland are price inelastic suggesting that Scottish consumer are not very responsive to price changes – lower impact on government's agenda to increase their consumption. In addition, they are expenditure inelastic indicating that consumers consider them as necessities and hence are irresponsive to changes real expenditure. As expected, there is a significant complementary relationship between fruit and vegetable aggregate and other groceries bought by consumers. This means that a fall in the price of fruits and vegetables will increase purchases of other groceries and vice versa.

Paste Table 2 here

Table 3 shows the short-run Marshallian price and expenditure elasticities for the 14 types of fruits and vegetables. All own price elasticities are price inelastic except for seed vegetables, grapes, and tropical fruits. This suggest that buyers are more responsive to price changes in these products. For instance, a 1 per cent increase in price will reduce demand for seed vegetables by 1.76 per cent. Bananas are the least responsive to price changes probably because their easiness to eat and requiring not further preparation before consumption. Cesar and Wojciech (2013) also found a similar results for Scotland. There exist 79 complementary relationships and 103 substitutionary relationships between the different types of fruits and vegetables. For instance, leafy greens are a substitute for all kinds of fruits and vegetables except Cruciferous, Marrow, Root, Pome/drupes, and Bananas. Pomes/drupes are complements to all fruit and vegetable types except Allium, Seeds, Fruits vegetables, Citrus, Grapes, and Soft fruits. All expenditure elasticities are significant at the 1 per cent level. All

[5] Results are show on Appendix B

except Marrow, Edible plant stem, Soft fruits, Tropical fruits are expenditure inelastic. This means that buyers consider these products as normal goods and are not very responsive to changes in real expenditure. Hence price increases for these products will have minimal effect on the governments campaign to increase fruits and vegetables consumption.

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Table 4 presents the third stage short run Marshallian price and expenditure elasticities by fruit and vegetable type and geographical origin. First, own price elasticity for leafy green vegetables, marrows, root vegetables, edible plant stems of UK origin were found to be the most price inelastic. This result indicate that Scottish buyers are less responsive to price changes for those products of UK origin. This confirms the findings of Arnoult et al. (2008) that showed that consumers have preference for locally produced food. However, any government policy that lowers the prices of those vegetables of UK origin will have less impact on consumption as consumers are not responsive to price changes.

Second, fruit vegetables of UK origin were found to be own price elastic whilst those from the EU and the rest of the world were price inelastic. This means that Scottish buyers respond more to price changes for fruit vegetables from UK origin more than those from outside the UK. The implication is that a significant increase in price due to an unfavourable Brexit deal would have minimal impact on the purchases of this group of vegetable, having less impact on government's goal to increase fruits and vegetables consumption.

Third, edible stem vegetables from the rest of the world were found to be price elastic whilst those of the UK and EU origins were price inelastic. From the Brexit perspective, an unfavourable Brexit deal that causes edible stem vegetables from the EU to be more expensive than pre-Brexit times will have little impact on edible stem vegetable consumption in Scotland. However, any UK trade policy that results in increases in the price of edible stem from the rest of the world will have significant effect on purchases in Scotland.

Tropical fruits and citrus of EU origins were found to be price elastic. This means that an unfavourable trade policy that increases the prices of these product could lead to a significant reduction in purchases dwindling the five-a-day campaign. Similarly, Grapes and soft fruits from the UK were more price elastic than those from outside the UK. In summary, products of EU origins that are elastic or have a high price elasticity could potentially reduce demand if government trade agreement results in higher prices.

Finally, all expenditure elasticities were significant at the 5 per cent level. Tropical fruits, soft fruits, and marrows were all expenditure elastic irrespective of their origin. UK's fruit vegetables, seed vegetables, grapes and soft fruits were found to be expenditure elastic whilst those sourced from outside the UK were expenditure inelastic. Lastly, tropical fruits and seed vegetables from the EU were found to be expenditure elastic but inelastic for those from the UK and the rest of the world.

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Impact of price rise due GB pound depreciation on fruits and vegetables purchases

This section presents the results for a 10 per cent price increase for fruits and vegetables sold in Scotland due to depreciation of the GB pound relative to the EURO or GB-EU trade policy that imposes tax tariffs on fruits and vegetable imported from the EU, holding prices for fruit and vegetables produced in the UK and the rest of the world constant. The impact is reported in terms of percentage changes in quantity demanded considering their cross-price elasticities.

The simulation exercise shows that demand for leafy greens of EU origin is expected to fall by 9 per cent whilst those from the UK and the rest of the world will increase by 2 and 4 per cent, respectively; a net short of 3 per cent. Purchases for cruciferous vegetables is expected to decline for those of UK and EU origin but increase for those imported from the rest of the world, resulting a net reduction of 10 per cent. Demand for marrows of EU origin is expected to decline by 9 per cent but increase by 1 and 2 per cent for the UK and the rest of the world, respectively; net total reduction of about 6 per cent. Also, demand for root vegetables from the EU is expected to decline by 13 per cent whilst those of the UK and from the rest of the world will increase by 3 and 1 per cent, respectively. Edible plant stem is expected by reduce 7 per cent for those of EU origin but increase by 2 and 3 per cent for the UK and rest of the world respectively, respectively; a net increase of 1 per cent. UK and EU allium are expected to reduce by 0.6 and 8 per cent, respectively, whilst those from the rest of the world would increase marginally by 0.1 per cent; net reduction of 8 per cent. Demand for all seed vegetables is expected to reduce irrespective of the origin; equivalent to 62 per cent total reduction. Fruit vegetables are expected to decline by 0.06 and 10 per cent for those of UK and EU origin but increase by 0.9 per cent for those imported from the rest of the world.

Paste Figure 1 here

Demand for drupes/pomes is expected to decline by 0.2, 11, and 2, per cent for the UK, EU, and the rest of the world, respectively; net total reduction of 13 per cent. Demand for banana from EU origin is expected to fall by 10 per cent but increase by 3 per cent for imports from the rest world. However, this does not make up for the shortfall leading to a net fall of 7 per cent. Net total demand for citrus, grapes and soft fruits are expected to increase by 2, 6, 4 per cent, respectively. Demand for tropical fruits would fall irrespective of the origin; total net fall is about 17 per cent.

Conclusion

At the start of 2021, economics observatory suggested that the British pound was 15 per cent weaker relative to the Euro than it was on the eve of the referendum. The present study assesses the implications of price rise due to the depreciation of the British pound on fruits and vegetable purchases in Scotland. The aim was to show that depreciation of the British pound could have negative consequences for the five-a-day campaign and/or purchases of fruits and vegetables in Scotland.

Our analyses were primarily based on fruits and vegetables from three main origins: UK, EU and the rest of the world. Demand for fourteen fruits and vegetables i.e., leafy green, cruciferous, marrow, root vegetables, edible plant stem, allium, seed vegetables, fruit

vegetables, pome/drupes, bananas, citrus, grapes, soft fruits, and tropical fruits was estimated using monthly time series data constructed from consumer panel by Kantar Worldpanel from 2006 – 2020.

Our results tend to suggest that major share of the vegetables consumed/purchased in leading retail shops in Scotland are either produced in the UK or the rest of the world. Leafy greens, cruciferous, marrow, root vegetables and allium are mainly sourced from the UK. A major share of fruity vegetables bought in major retail shops are from the EU whilst edible seed stem and seed vegetable are from the rest of the world. Major share of fruits especially tropical fruits, and grapes bought in Scotland are sourced from the rest of the world.

Edible plant stem vegetables and tropical fruits are the most responsive to expenditure changes. They followed by soft fruits and marrow vegetables. Own price elasticities for all types of fruits and vegetables were less than one except for tropical fruits, grapes, and seed vegetables.

The simulation shows the importance of prise rise due to depreciation of the British pound relative to the Euro/imposition of trade tariffs by the EU on fruits and vegetables imported into Scotland. In general, the net demand for all categories of fruits and vegetables will be negative, indicating that an unfavourable Brexit deal could potentially reduce the purchases of fruits and vegetables. The impact of the price rise is higher for fruits and vegetables of the EU origin. This could be as high as 63 per cent reduction in purchases for seed vegetables or as low as 2.2 per cent reduction in purchases for edible plant stems.

In summary, we have shown that an unfavourable Brexit trade deal resulting in 10 per cent increase in the prices of all fruits and vegetables imported from the EU and purchased in Scotland could potentially reduce their overall fruit and vegetable consumption. This phenomenon could have a negative implication for the government's agenda to increase fruits and vegetables to 400 grams per capita per day.

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Table 1 Data description

	Origin	Shares	Prices	Total Average Expenditure
Stage 1				
Fruits and vegetables		0.08	1.53	61519815
Other Groceries		0.92	1.51	725485523
Stage 2				
Leafy green		0.04	1.98	2671785.6
Cruciferous		0.03	1.47	1877670
Marrow		0.02	1.62	1344639.5
Root		0.16	0.77	9462433.3
Edible plant stem		0.01	2.55	671371.6
Allium		0.08	1.70	5011542
Seeds		0.02	3.70	1257756.3
Fruits		0.11	2.76	6863192.1
Pome/drupes		0.14	6.48	8739457.3
Bananas		0.09	0.88	5365888.2
Citrus		0.07	1.81	4429748.5
Grapes		0.08	2.74	4706867.4
Soft fruits		0.11	5.47	6827406.3
Tropical fruits		0.04	1.31	2290057.1

Table 1 Data description cont'd

	Origin	Shares	Prices	Total Average Expenditure
Stage 3				
Leafy green	UK	0.52	1.91	1388958.36
	EU	0.18	2.42	488875.47
	Others	0.3	1.98	793952.18
Cruciferous	UK	0.51	1.32	957651.36
	EU	0.12	1.84	230205.08
	Others	0.37	1.65	689813.56
Marrow	UK	0.41	1.64	550360.92
	EU	0.24	1.81	319365.37
	Others	0.35	1.51	474913.72
Root	UK	0.76	0.75	7179641.29
	EU	0.05	0.92	490043.79
	Others	0.19	0.85	1792747.92
Edible plant stem	UK	0.34	2.17	225868.37
	EU	0.23	1.45	156295.09
	Others	0.43	6.01	289208.13
Allium	UK	0.4	1.8	2023376.91
	EU	0.2	2.02	1015430.52
	Others	0.39	1.52	1972734.57
Seeds	UK	0.13	2.85	169522.58
	EU	0.06	2.56	70105.8
	Others	0.81	4.04	1018127.62
Fruits	UK	0.2	3.36	1370181.79
	EU	0.46	2.82	3145634.31
	Others	0.34	2.51	2347375.9
Pome/drupes	UK	0.13	1.73	1143883.06
	EU	0.38	1.72	3321073.19
	Others	0.49	1.98	4274500.75
Bananas	EU	0.23	0.98	1260037.67
	Others	0.77	0.86	4105850.33
Citrus	EU	0.37	1.82	1626149.42
	Others	0.63	1.82	2803598.58
Grapes	UK	0.02	3.38	102606.5
	EU	0.23	2.71	1072699.7
	Others	0.75	2.85	3531560.9
Soft fruits	UK	0.33	6.53	2246343.56
	EU	0.29	5.04	1947658.89
	Others	0.39	5.28	2633403.55
Tropical fruits	EU	0.14	1.3	328840.51
	Others	0.86	1.33	1961216.49

Table 2 Short run Marshallian and expenditure elasticities for fruit and vegetable aggregate and other groceries

	Fruits and vegetable	Other groceries	Expenditure
Fruits and vegetable	-0.557	-0.0377	0.893
	(0.044)	(0.044)	(0.087)
Other groceries	-0.336	-1.045	1.009
	(0.004)	(0.004)	(0.007)

Table 3 Marshallian price and expenditure elasticities for fruits and vegetables purchased in Scotland

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Expenditure
Leafy green (1)	-0.155	-0.028	-0.024	-0.001	0.006	0.015	0.031	0.011	-0.140	-0.025	0.004	0.040	0.004	0.003	0.853
	(0.025)	(0.033)	(0.04)	(0.011)	(0.051)	(0.02)	(0.038)	(0.016)	(0.013)	(0.019)	(0.023)	(0.018)	(0.016)	(0.048)	(0.063)
Cruciferous (2)	-0.020	-0.833	-0.046	0.031	-0.142	0.072	0.002	0.034	-0.021	-0.064	0.099	0.062	-0.010	-0.122	0.866
	(0.024)	(0.076)	(0.08)	(0.02)	(0.098)	(0.032)	(0.074)	(0.03)	(0.021)	(0.044)	(0.045)	(0.029)	(0.024)	(0.092)	(0.051)
Marrow (3)	-0.012	-0.031	-0.598	0.032	0.016	-0.013	0.063	0.025	-0.005	-0.017	-0.065	0.022	0.022	-0.145	1.088
	(0.02)	(0.056)	(0.116)	(0.017)	(0.104)	(0.039)	(0.061)	(0.03)	(0.014)	(0.041)	(0.039)	(0.025)	(0.019)	(0.1)	(0.15)
Root (4)	-0.006	0.156	0.228	-0.534	-0.043	-0.064	-0.057	0.063	-0.018	-0.015	0.046	0.113	-0.049	-0.006	0.708
	(0.038)	(0.098)	(0.12)	(0.043)	(0.133)	(0.043)	(0.111)	(0.045)	(0.035)	(0.062)	(0.075)	(0.061)	(0.064)	(0.125)	(0.039)
Edible plant stem (5)	0.002	-0.049	0.008	-0.003	-0.365	-0.016	0.001	0.002	-0.009	-0.027	0.009	0.008	-0.004	0.060	1.101
	(0.013)	(0.035)	(0.052)	(0.009)	(0.107)	(0.026)	(0.034)	(0.022)	(0.008)	(0.024)	(0.023)	(0.013)	(0.011)	(0.061)	(0.149)
Allium (6)	0.027	0.190	-0.050	-0.033	-0.123	-0.541	-0.055	-0.089	0.033	-0.045	0.088	0.073	0.010	0.117	0.721
	(0.038)	(0.083)	(0.148)	(0.023)	(0.193)	(0.096)	(0.116)	(0.055)	(0.023)	(0.07)	(0.06)	(0.036)	(0.038)	(0.162)	(0.047)
Seeds (7)	0.014	0.001	0.059	-0.007	0.002	-0.013	-1.764	-0.008	0.002	0.048	0.096	0.032	0.039	0.182	0.95
	(0.017)	(0.048)	(0.057)	(0.014)	(0.063)	(0.029)	(0.14)	(0.025)	(0.015)	(0.036)	(0.045)	(0.026)	(0.022)	(0.069)	(0.119)
Fruits (8)	0.028	0.120	0.129	0.046	0.019	-0.119	-0.043	-0.599	0.009	-0.074	-0.080	0.090	0.068	-0.111	0.913
	(0.04)	(0.106)	(0.154)	(0.032)	(0.222)	(0.075)	(0.137)	(0.083)	(0.027)	(0.087)	(0.087)	(0.056)	(0.045)	(0.173)	(0.099)
Pome/drupes (9)	-0.452	-0.094	-0.034	-0.014	-0.116	0.058	0.016	0.011	-0.452	-0.034	0.051	0.127	0.022	-0.163	0.882
	(0.042)	(0.094)	(0.09)	(0.031)	(0.106)	(0.04)	(0.108)	(0.035)	(0.043)	(0.052)	(0.067)	(0.059)	(0.051)	(0.108)	(0.062)
Bananas (10)	-0.051	-0.181	-0.073	-0.008	-0.219	-0.047	0.212	-0.059	-0.021	-0.094	-0.131	0.102	-0.025	-0.368	0.872
	(0.039)	(0.125)	(0.166)	(0.035)	(0.2)	(0.075)	(0.157)	(0.069)	(0.033)	(0.125)	(0.097)	(0.055)	(0.045)	(0.217)	(0.044)
Citrus (11)	0.007	0.231	-0.218	0.023	0.062	0.079	0.344	-0.052	0.027	-0.106	-0.835	0.076	0.073	-0.149	0.969
	(0.038)	(0.105)	(0.128)	(0.035)	(0.154)	(0.053)	(0.163)	(0.056)	(0.035)	(0.079)	(0.117)	(0.07)	(0.054)	(0.151)	(0.084)
Grapes (12)	0.070	0.151	0.077	0.056	0.054	0.069	0.120	0.061	0.068	0.088	0.080	-1.433	0.038	0.182	0.872
	(0.031)	(0.069)	(0.087)	(0.029)	(0.09)	(0.033)	(0.097)	(0.038)	(0.032)	(0.047)	(0.073)	(0.09)	(0.062)	(0.092)	(0.088)
Soft fruits (13)	0.012	-0.031	0.108	-0.030	-0.041	0.016	0.206	0.066	0.018	-0.028	0.108	0.055	-0.894	0.068	1.096
	(0.037)	(0.081)	(0.092)	(0.043)	(0.107)	(0.052)	(0.116)	(0.041)	(0.038)	(0.054)	(0.079)	(0.087)	(0.128)	(0.111)	(0.203)
Tropical fruits (14)	0.003	-0.143	-0.244	0.000	0.204	0.054	0.331	-0.035	-0.041	-0.152	-0.075	0.089	0.024	-1.661	1.281
	(0.04)	(0.107)	(0.168)	(0.029)	(0.206)	(0.072)	(0.128)	(0.057)	(0.028)	(0.09)	(0.076)	(0.044)	(0.038)	(0.312)	(0.154)

*** standard errors are in the brackets

Table 4 Unconditional Marshallian price and expenditure elasticities for fruits and vegetables by origin

Marshallian	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Leafy green UK (1)	-0.423	0.275	0.302	-0.016	-0.013	-0.014	-0.015	-0.016	-0.017	0.001	0.001	0.001	0.000	0.000	-0.001	0.011	0.008	0.007	0.015	0.056	0.011
	(0.137)	(0.151)	(0.221)	(0.019)	(0.015)	(0.016)	(0.011)	(0.035)	(0.031)	(0.005)	(0.006)	(0.006)	(0.025)	(0.018)	(0.045)	(0.011)	(0.012)	(0.009)	(0.044)	(0.018)	(0.016)
Leafy green EU (2)	0.097	-0.886	0.286	-0.005	-0.004	-0.005	-0.005	-0.005	-0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.002	0.005	0.019	0.004
	(0.053)	(0.105)	(0.068)	(0.01)	(0.008)	(0.008)	(0.006)	(0.017)	(0.016)	(0.003)	(0.003)	(0.003)	(0.013)	(0.009)	(0.023)	(0.006)	(0.006)	(0.004)	(0.023)	(0.009)	(0.008)
Leafy green Others (3)	0.173	0.464	-0.757	-0.010	-0.008	-0.008	-0.009	-0.010	-0.010	0.001	0.001	0.001	0.000	0.000	0.000	0.007	0.005	0.004	0.010	0.035	0.007
	(0.129)	(0.115)	(0.226)	(0.009)	(0.007)	(0.007)	(0.005)	(0.016)	(0.014)	(0.002)	(0.003)	(0.003)	(0.012)	(0.009)	(0.022)	(0.005)	(0.005)	(0.004)	(0.019)	(0.008)	(0.007)
Cruciferous UK (4)	-0.011	-0.010	-0.012	-1.075	-0.076	0.259	-0.026	-0.028	-0.029	0.019	0.021	0.018	-0.055	-0.043	-0.124	0.052	0.040	0.031	0.000	0.001	0.000
	(0.013)	(0.02)	(0.01)	(0.124)	(0.207)	(0.093)	(0.022)	(0.067)	(0.06)	(0.01)	(0.011)	(0.012)	(0.043)	(0.034)	(0.082)	(0.02)	(0.021)	(0.017)	(0.089)	(0.037)	(0.033)
Cruciferous EU (5)	-0.002	-0.002	-0.002	-0.018	-1.225	0.189	-0.005	-0.006	-0.006	0.004	0.004	0.004	-0.011	-0.008	-0.024	0.010	0.008	0.006	0.000	0.000	0.000
	(0.002)	(0.004)	(0.002)	(0.05)	(0.151)	(0.038)	(0.004)	(0.012)	(0.011)	(0.002)	(0.002)	(0.002)	(0.009)	(0.007)	(0.017)	(0.004)	(0.004)	(0.003)	(0.017)	(0.007)	(0.006)
Cruciferous Others (6)	-0.007	-0.006	-0.007	0.186	0.566	-0.568	-0.016	-0.017	-0.018	0.011	0.013	0.011	-0.033	-0.026	-0.075	0.032	0.024	0.019	0.000	0.000	0.000
	(0.008)	(0.012)	(0.006)	(0.067)	(0.117)	(0.095)	(0.013)	(0.039)	(0.035)	(0.006)	(0.007)	(0.007)	(0.026)	(0.021)	(0.049)	(0.012)	(0.013)	(0.01)	(0.053)	(0.022)	(0.019)
Marrow UK (7)	-0.003	-0.003	-0.004	-0.012	-0.010	-0.010	-0.560	0.104	-0.076	0.014	0.016	0.013	0.004	0.003	0.009	-0.004	-0.003	-0.003	0.027	0.098	0.020
	(0.004)	(0.006)	(0.003)	(0.012)	(0.009)	(0.01)	(0.143)	(0.157)	(0.11)	(0.004)	(0.005)	(0.004)	(0.014)	(0.01)	(0.028)	(0.008)	(0.009)	(0.007)	(0.027)	(0.011)	(0.01)
Marrow EU (8)	-0.002	-0.002	-0.002	-0.008	-0.006	-0.006	0.061	-0.940	0.156	0.009	0.010	0.008	0.003	0.002	0.006	-0.003	-0.002	-0.002	0.017	0.061	0.012
	(0.007)	(0.01)	(0.005)	(0.021)	(0.016)	(0.017)	(0.094)	(0.194)	(0.081)	(0.006)	(0.008)	(0.007)	(0.026)	(0.019)	(0.052)	(0.015)	(0.015)	(0.012)	(0.05)	(0.019)	(0.018)
Marrow Others (9)	-0.003	-0.003	-0.004	-0.012	-0.009	-0.010	-0.066	0.233	-1.053	0.013	0.015	0.013	0.004	0.003	0.009	-0.004	-0.003	-0.003	0.026	0.095	0.019
	(0.009)	(0.013)	(0.007)	(0.028)	(0.021)	(0.023)	(0.096)	(0.121)	(0.11)	(0.008)	(0.011)	(0.009)	(0.034)	(0.024)	(0.068)	(0.02)	(0.02)	(0.016)	(0.066)	(0.026)	(0.024)
Root UK (10)	-0.013	-0.013	-0.014	0.118	0.096	0.099	0.135	0.144	0.151	-0.637	0.515	0.278	-0.043	-0.033	-0.097	-0.062	-0.047	-0.037	-0.064	-0.232	-0.047
	(0.028)	(0.043)	(0.022)	(0.075)	(0.06)	(0.062)	(0.049)	(0.139)	(0.125)	(0.045)	(0.177)	(0.074)	(0.07)	(0.051)	(0.137)	(0.039)	(0.04)	(0.03)	(0.18)	(0.074)	(0.065)
Root EU (11)	-0.001	-0.001	-0.001	0.009	0.007	0.008	0.011	0.011	0.012	0.035	-1.311	0.052	-0.003	-0.003	-0.007	-0.005	-0.004	-0.003	-0.005	-0.018	-0.004
	(0.002)	(0.003)	(0.001)	(0.005)	(0.004)	(0.005)	(0.004)	(0.01)	(0.009)	(0.012)	(0.122)	(0.035)	(0.005)	(0.003)	(0.009)	(0.003)	(0.003)	(0.002)	(0.012)	(0.005)	(0.004)
Root Others (12)	-0.003	-0.003	-0.004	0.029	0.023	0.024	0.033	0.035	0.037	0.069	0.191	-0.962	-0.011	-0.008	-0.024	-0.015	-0.011	-0.009	-0.016	-0.057	-0.012
	(0.008)	(0.013)	(0.007)	(0.022)	(0.017)	(0.018)	(0.014)	(0.041)	(0.036)	(0.018)	(0.129)	(0.062)	(0.02)	(0.015)	(0.04)	(0.012)	(0.012)	(0.009)	(0.053)	(0.022)	(0.019)
Edible plant stem UK (13)	0.001	0.001	0.001	-0.012	-0.010	-0.010	0.002	0.002	0.002	0.000	0.000	0.000	-0.175	0.239	-0.184	-0.004	-0.003	-0.002	0.000	0.002	0.000
	(0.004)	(0.005)	(0.003)	(0.01)	(0.008)	(0.008)	(0.006)	(0.019)	(0.016)	(0.002)	(0.002)	(0.002)	(0.134)	(0.143)	(0.065)	(0.007)	(0.007)	(0.006)	(0.02)	(0.008)	(0.007)
Edible plant stem EU (14)	0.000	0.000	0.000	-0.006	-0.005	-0.005	0.001	0.001	0.001	0.000	0.000	0.000	0.165	-0.714	0.154	-0.002	-0.002	-0.001	0.000	0.001	0.000
	(0.002)	(0.003)	(0.002)	(0.005)	(0.004)	(0.004)	(0.003)	(0.009)	(0.008)	(0.001)	(0.001)	(0.001)	(0.098)	(0.118)	(0.049)	(0.004)	(0.004)	(0.003)	(0.01)	(0.004)	(0.004)
Edible plant stem Others (15)	0.002	0.002	0.002	-0.034	-0.027	-0.028	0.005	0.006	0.006	0.000	0.000	0.000	-0.235	0.285	-1.337	-0.011	-0.009	-0.007	0.002	0.006	0.001
	(0.009)	(0.013)	(0.007)	(0.024)	(0.02)	(0.02)	(0.015)	(0.048)	(0.042)	(0.005)	(0.005)	(0.006)	(0.086)	(0.089)	(0.112)	(0.017)	(0.018)	(0.014)	(0.051)	(0.02)	(0.019)
Allium UK (16)	0.011	0.011	0.012	0.103	0.083	0.086	-0.033	-0.035	-0.037	-0.016	-0.018	-0.016	-0.049	-0.038	-0.110	-0.987	0.058	0.283	-0.035	-0.128	-0.026
	(0.016)	(0.023)	(0.013)	(0.041)	(0.037)	(0.036)	(0.033)	(0.098)	(0.086)	(0.011)	(0.012)	(0.013)	(0.065)	(0.049)	(0.125)	(0.099)	(0.099)	(0.096)	(0.114)	(0.044)	(0.042)
Allium EU (17)	0.004	0.004	0.004	0.039	0.031	0.032	-0.013	-0.014	-0.014	-0.006	-0.007	-0.006	-0.019	-0.015	-0.042	0.029	-0.705	0.067	-0.014	-0.050	-0.010
	(0.008)	(0.012)	(0.007)	(0.022)	(0.019)	(0.018)	(0.017)	(0.051)	(0.045)	(0.006)	(0.006)	(0.007)	(0.034)	(0.025)	(0.064)	(0.05)	(0.069)	(0.057)	(0.058)	(0.023)	(0.021)
Allium Others (18)	0.006	0.005	0.006	0.059	0.048	0.049	-0.020	-0.022	-0.023	-0.010	-0.012	-0.010	-0.029	-0.023	-0.066	0.275	0.131	-0.698	-0.021	-0.078	-0.016
	(0.012)	(0.018)	(0.01)	(0.035)	(0.028)	(0.028)	(0.026)	(0.077)	(0.068)	(0.008)	(0.008)	(0.01)	(0.051)	(0.038)	(0.096)	(0.094)	(0.111)	(0.127)	(0.086)	(0.034)	(0.032)
Seeds UK (19)	0.002	0.002	0.002	0.000	0.000	0.000	0.008	0.008	0.009	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.002	-0.002	-0.001	-1.149	-0.668	-0.076
	(0.005)	(0.007)	(0.004)	(0.015)	(0.012)	(0.012)	(0.008)	(0.027)	(0.024)	(0.004)	(0.004)	(0.005)	(0.015)	(0.011)	(0.03)	(0.009)	(0.009)	(0.007)	(0.299)	(0.377)	(0.061)
Seeds EU (20)	0.004	0.003	0.004	0.001	0.001	0.001	0.012	0.013	0.013	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.003	-0.002	-0.002	-0.276	-4.022	-0.150
	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.001)	(0.001)	(0.001)	(0.158)	(0.665)	(0.029)
Seeds Others (21)	0.009	0.009	0.010	0.001	0.001	0.001	0.034	0.036	0.038	-0.003	-0.004	-0.003	0.000	0.000	0.000	-0.009	-0.007	-0.005	-0.457	-2.182	-0.995
	(0.011)	(0.016)	(0.009)	(0.034)	(0.026)	(0.028)	(0.018)	(0.059)	(0.052)	(0.008)	(0.008)	(0.01)	(0.033)	(0.024)	(0.066)	(0.02)	(0.021)	(0.016)	(0.365)	(0.367)	(0.093)

** Standard errors are in the brackets

Table 4 Unconditional Marshallian price and expenditure elasticities for fruits and vegetables by origin (cont'd)

	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Expenditure
Leafy green UK (1)	0.007	0.005	0.004	-0.052	-0.074	-0.075	-0.042	-0.004	0.000	0.000	0.237	0.014	0.015826959	-0.002	-0.002	-0.001	-0.009	-0.006	0.841
	(0.012)	(0.003)	(0.013)	(0.008)	(0.009)	(0.01)	(0.021)	(0.008)	(0.018)	(0.011)	(0.035)	(0.013)	(0.009)	(0.018)	(0.012)	(0.019)	(0.039)	(0.023)	(0.066)
Leafy green EU (2)	0.002	0.002	0.001	-0.018	-0.025	-0.025	-0.014	-0.001	0.000	0.000	0.080	0.005	0.005320113	-0.001	-0.001	0.000	-0.003	-0.002	0.805
	(0.006)	(0.002)	(0.007)	(0.005)	(0.004)	(0.005)	(0.011)	(0.004)	(0.01)	(0.006)	(0.019)	(0.007)	(0.005)	(0.007)	(0.005)	(0.008)	(0.02)	(0.012)	(0.078)
Leafy green Others (3)	0.005	0.003	0.002	-0.032	-0.046	-0.046	-0.026	-0.003	0.000	0.000	0.146	0.009	0.009791933	-0.001	-0.001	-0.001	-0.005	-0.003	0.905
	(0.006)	(0.001)	(0.006)	(0.005)	(0.005)	(0.006)	(0.009)	(0.004)	(0.008)	(0.005)	(0.016)	(0.006)	(0.004)	(0.009)	(0.006)	(0.011)	(0.018)	(0.01)	(0.09)
Cruciferous UK (4)	0.027	0.018	0.013	-0.008	-0.012	-0.012	-0.113	-0.012	0.055	0.054	0.401	0.024	0.026777968	-0.010	-0.008	-0.006	-0.105	-0.068	0.943
	(0.025)	(0.007)	(0.028)	(0.008)	(0.011)	(0.013)	(0.05)	(0.021)	(0.032)	(0.02)	(0.059)	(0.02)	(0.014)	(0.018)	(0.012)	(0.022)	(0.084)	(0.048)	(0.064)
Cruciferous EU (5)	0.005	0.003	0.003	-0.002	-0.002	-0.002	-0.022	-0.002	0.011	0.010	0.077	0.005	0.005174151	-0.002	-0.002	-0.001	-0.021	-0.013	0.764
	(0.005)	(0.001)	(0.006)	(0.001)	(0.002)	(0.002)	(0.01)	(0.004)	(0.006)	(0.004)	(0.012)	(0.004)	(0.003)	(0.003)	(0.002)	(0.004)	(0.016)	(0.009)	(0.049)
Cruciferous Others (6)	0.016	0.011	0.008	-0.005	-0.007	-0.007	-0.069	-0.007	0.033	0.033	0.241	0.015	0.016113041	-0.006	-0.005	-0.004	-0.064	-0.041	0.793
	(0.015)	(0.004)	(0.017)	(0.005)	(0.007)	(0.008)	(0.029)	(0.012)	(0.019)	(0.012)	(0.036)	(0.012)	(0.008)	(0.01)	(0.007)	(0.012)	(0.049)	(0.029)	(0.052)
Marrow UK (7)	0.016	0.010	0.008	-0.001	-0.001	-0.001	-0.019	-0.002	-0.025	-0.025	0.111	0.007	0.007425441	0.011	0.008	0.006	-0.082	-0.053	1.028
	(0.008)	(0.002)	(0.009)	(0.002)	(0.003)	(0.003)	(0.015)	(0.006)	(0.01)	(0.006)	(0.015)	(0.006)	(0.004)	(0.004)	(0.003)	(0.005)	(0.03)	(0.017)	(0.097)
Marrow EU (8)	0.010	0.006	0.005	0.000	-0.001	-0.001	-0.011	-0.001	-0.015	-0.015	0.069	0.004	0.004616529	0.007	0.005	0.004	-0.051	-0.033	1.097
	(0.016)	(0.004)	(0.017)	(0.004)	(0.005)	(0.005)	(0.028)	(0.011)	(0.017)	(0.011)	(0.027)	(0.01)	(0.007)	(0.007)	(0.005)	(0.008)	(0.054)	(0.032)	(0.22)
Marrow Others (9)	0.015	0.010	0.008	-0.001	-0.001	-0.001	-0.018	-0.002	-0.024	-0.024	0.108	0.007	0.00722522	0.011	0.008	0.006	-0.079	-0.051	1.151
	(0.021)	(0.005)	(0.022)	(0.006)	(0.006)	(0.007)	(0.037)	(0.015)	(0.023)	(0.014)	(0.036)	(0.014)	(0.009)	(0.009)	(0.006)	(0.011)	(0.072)	(0.042)	(0.194)
Root UK (10)	0.051	0.033	0.025	-0.018	-0.026	-0.026	-0.071	-0.007	0.016	0.016	0.875	0.053	0.058480849	-0.089	-0.066	-0.052	-0.083	-0.053	0.706
	(0.056)	(0.021)	(0.061)	(0.018)	(0.026)	(0.029)	(0.141)	(0.051)	(0.078)	(0.05)	(0.192)	(0.066)	(0.044)	(0.079)	(0.052)	(0.093)	(0.149)	(0.083)	(0.043)
Root EU (11)	0.004	0.003	0.002	-0.001	-0.002	-0.002	-0.005	-0.001	0.001	0.001	0.069	0.004	0.004588984	-0.007	-0.005	-0.004	-0.006	-0.004	0.801
	(0.005)	(0.001)	(0.005)	(0.001)	(0.002)	(0.002)	(0.01)	(0.004)	(0.008)	(0.005)	(0.013)	(0.004)	(0.003)	(0.005)	(0.004)	(0.006)	(0.012)	(0.006)	(0.05)
Root Others (12)	0.012	0.008	0.006	-0.004	-0.006	-0.006	-0.017	-0.002	0.004	0.004	0.213	0.013	0.014243495	-0.022	-0.016	-0.013	-0.020	-0.013	0.690
	(0.016)	(0.006)	(0.018)	(0.005)	(0.008)	(0.009)	(0.041)	(0.015)	(0.022)	(0.014)	(0.056)	(0.02)	(0.013)	(0.024)	(0.016)	(0.028)	(0.044)	(0.025)	(0.047)
Edible plant stem UK (13)	0.001	0.001	0.000	-0.001	-0.002	-0.002	-0.018	-0.002	0.002	0.002	0.023	0.001	0.001541046	-0.001	-0.001	-0.001	0.019	0.012	0.739
	(0.008)	(0.002)	(0.008)	(0.002)	(0.002)	(0.002)	(0.011)	(0.005)	(0.008)	(0.005)	(0.012)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.027)	(0.016)	(0.143)
Edible plant stem EU (14)	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.010	-0.001	0.001	0.001	0.012	0.001	0.000796904	-0.001	-0.001	0.000	0.010	0.006	0.574
	(0.004)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)	(0.005)	(0.002)	(0.004)	(0.002)	(0.007)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.013)	(0.008)	(0.124)
Edible plant stem Others (15)	0.003	0.002	0.002	-0.003	-0.005	-0.005	-0.052	-0.005	0.007	0.007	0.071	0.004	0.004763481	-0.003	-0.002	-0.002	0.055	0.036	1.668
	(0.019)	(0.005)	(0.02)	(0.004)	(0.005)	(0.005)	(0.026)	(0.012)	(0.019)	(0.012)	(0.03)	(0.01)	(0.007)	(0.007)	(0.005)	(0.009)	(0.066)	(0.038)	(0.175)
Allium UK (16)	-0.074	-0.049	-0.036	0.010	0.014	0.014	-0.082	-0.008	0.040	0.039	0.402	0.024	0.02687218	-0.006	-0.005	-0.004	0.061	0.039	0.911
	(0.038)	(0.011)	(0.04)	(0.009)	(0.01)	(0.012)	(0.057)	(0.024)	(0.036)	(0.022)	(0.056)	(0.021)	(0.014)	(0.025)	(0.017)	(0.031)	(0.131)	(0.072)	(0.055)
Allium EU (17)	-0.028	-0.019	-0.014	0.004	0.005	0.005	-0.032	-0.003	0.015	0.015	0.149	0.009	0.00996621	-0.003	-0.002	-0.002	0.022	0.014	0.688
	(0.02)	(0.006)	(0.021)	(0.004)	(0.005)	(0.006)	(0.03)	(0.012)	(0.018)	(0.011)	(0.029)	(0.011)	(0.007)	(0.013)	(0.009)	(0.016)	(0.066)	(0.037)	(0.055)
Allium Others (18)	-0.044	-0.029	-0.022	0.005	0.007	0.007	-0.050	-0.005	0.022	0.022	0.223	0.014	0.014928526	-0.005	-0.004	-0.003	0.033	0.022	0.543
	(0.029)	(0.008)	(0.03)	(0.006)	(0.008)	(0.009)	(0.043)	(0.018)	(0.027)	(0.017)	(0.043)	(0.016)	(0.011)	(0.019)	(0.013)	(0.024)	(0.101)	(0.056)	(0.048)
Seeds UK (19)	-0.002	-0.001	-0.001	0.000	0.000	0.000	0.023	0.002	0.014	0.014	0.055	0.003	0.003694158	0.007	0.005	0.004	0.036	0.024	1.014
	(0.01)	(0.003)	(0.011)	(0.003)	(0.004)	(0.005)	(0.02)	(0.008)	(0.023)	(0.013)	(0.031)	(0.011)	(0.007)	(0.008)	(0.006)	(0.009)	(0.035)	(0.02)	(0.24)
Seeds EU (20)	-0.002	-0.001	-0.001	0.001	0.001	0.001	0.035	0.004	0.021	0.021	0.086	0.005	0.005736218	0.011	0.008	0.006	0.056	0.036	3.700
	(0.002)	(0)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.004)	(0.003)	(0.007)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.006)	(0.003)	(0.178)
Seeds Others (21)	-0.007	-0.005	-0.004	0.001	0.002	0.002	0.100	0.010	0.061	0.061	0.242	0.015	0.016191634	0.030	0.022	0.018	0.162	0.104	0.750
	(0.023)	(0.006)	(0.024)	(0.007)	(0.01)	(0.011)	(0.044)	(0.018)	(0.044)	(0.024)	(0.067)	(0.023)	(0.015)	(0.017)	(0.012)	(0.019)	(0.079)	(0.043)	(0.088)

*** Standard errors are in the brackets

Table 4 Unconditional Marshallian price and expenditure elasticities for fruits and vegetables by origin (cont'd)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Fruits UK (22)	0.010	0.010	0.011	0.041	0.033	0.034	0.034	0.036	0.038	0.017	0.020	0.017	0.002	0.001	0.004	-0.041	-0.031	-0.024	-0.014	-0.050	-0.010
	(0.011)	(0.017)	(0.009)	(0.035)	(0.032)	(0.03)	(0.021)	(0.069)	(0.061)	(0.01)	(0.016)	(0.012)	(0.047)	(0.034)	(0.09)	(0.025)	(0.025)	(0.019)	(0.086)	(0.034)	(0.031)
Fruits EU (23)	0.014	0.014	0.015	0.060	0.049	0.051	0.049	0.053	0.055	0.025	0.029	0.025	0.001	0.001	0.003	-0.063	-0.047	-0.037	-0.022	-0.080	-0.016
	(0.007)	(0.01)	(0.005)	(0.026)	(0.019)	(0.021)	(0.013)	(0.039)	(0.034)	(0.012)	(0.012)	(0.013)	(0.031)	(0.021)	(0.058)	(0.015)	(0.015)	(0.012)	(0.051)	(0.021)	(0.018)
Fruits Others (24)	0.007	0.007	0.008	0.033	0.027	0.028	0.027	0.029	0.030	0.014	0.015	0.013	0.000	0.000	0.001	-0.036	-0.027	-0.021	-0.013	-0.048	-0.010
	(0.021)	(0.031)	(0.016)	(0.068)	(0.063)	(0.058)	(0.039)	(0.128)	(0.113)	(0.019)	(0.031)	(0.024)	(0.084)	(0.062)	(0.162)	(0.044)	(0.046)	(0.034)	(0.155)	(0.061)	(0.056)
Pome/drupes UK (25)	-0.042	-0.041	-0.046	-0.010	-0.008	-0.008	-0.005	-0.006	-0.006	-0.001	-0.001	-0.001	-0.009	-0.007	-0.020	0.008	0.006	0.005	0.001	0.002	0.000
	(0.007)	(0.011)	(0.007)	(0.009)	(0.007)	(0.008)	(0.006)	(0.02)	(0.018)	(0.003)	(0.003)	(0.004)	(0.01)	(0.008)	(0.018)	(0.005)	(0.005)	(0.004)	(0.023)	(0.009)	(0.008)
Pome/drupes EU (26)	-0.174	-0.167	-0.188	-0.039	-0.032	-0.033	-0.020	-0.021	-0.022	-0.001	-0.002	-0.001	-0.036	-0.028	-0.082	0.034	0.026	0.020	0.004	0.016	0.003
	(0.021)	(0.029)	(0.021)	(0.039)	(0.029)	(0.032)	(0.02)	(0.06)	(0.054)	(0.011)	(0.012)	(0.014)	(0.036)	(0.027)	(0.061)	(0.018)	(0.018)	(0.013)	(0.092)	(0.037)	(0.034)
Pome/drupes Others (27)	-0.227	-0.217	-0.244	-0.051	-0.042	-0.043	-0.026	-0.027	-0.029	-0.002	-0.002	-0.002	-0.047	-0.036	-0.106	0.044	0.033	0.026	0.006	0.021	0.004
	(0.031)	(0.042)	(0.031)	(0.058)	(0.044)	(0.048)	(0.03)	(0.089)	(0.079)	(0.017)	(0.018)	(0.02)	(0.055)	(0.041)	(0.094)	(0.027)	(0.027)	(0.02)	(0.137)	(0.054)	(0.05)
Bananas EU (28)	-0.034	-0.032	-0.036	-0.144	-0.117	-0.121	-0.057	-0.061	-0.064	0.002	0.002	0.002	-0.114	-0.089	-0.258	-0.036	-0.027	-0.021	0.170	0.620	0.126
	(0.019)	(0.028)	(0.014)	(0.065)	(0.051)	(0.053)	(0.038)	(0.119)	(0.106)	(0.025)	(0.026)	(0.028)	(0.062)	(0.044)	(0.121)	(0.036)	(0.037)	(0.028)	(0.153)	(0.059)	(0.056)
Bananas Others (29)	-0.015	-0.015	-0.016	-0.053	-0.043	-0.044	-0.024	-0.025	-0.027	-0.003	-0.003	-0.003	-0.042	-0.032	-0.094	-0.016	-0.012	-0.010	0.052	0.189	0.038
	(0.025)	(0.037)	(0.019)	(0.088)	(0.067)	(0.071)	(0.053)	(0.16)	(0.143)	(0.029)	(0.037)	(0.036)	(0.09)	(0.066)	(0.175)	(0.05)	(0.051)	(0.038)	(0.207)	(0.082)	(0.076)
Citrus EU (30)	0.004	0.004	0.005	0.095	0.077	0.080	-0.078	-0.083	-0.087	0.011	0.013	0.011	0.014	0.011	0.031	0.041	0.031	0.024	0.136	0.497	0.101
	(0.021)	(0.031)	(0.017)	(0.054)	(0.04)	(0.044)	(0.029)	(0.091)	(0.08)	(0.017)	(0.025)	(0.02)	(0.055)	(0.04)	(0.108)	(0.029)	(0.03)	(0.022)	(0.204)	(0.099)	(0.071)
Citrus Others (31)	0.007	0.007	0.008	0.161	0.131	0.136	-0.133	-0.142	-0.149	0.019	0.022	0.019	0.024	0.018	0.053	0.069	0.052	0.041	0.232	0.847	0.172
	(0.021)	(0.032)	(0.018)	(0.057)	(0.043)	(0.046)	(0.031)	(0.097)	(0.085)	(0.019)	(0.027)	(0.022)	(0.06)	(0.043)	(0.115)	(0.031)	(0.032)	(0.024)	(0.198)	(0.101)	(0.068)
Grapes UK (32)	0.019	0.018	0.020	0.043	0.035	0.036	0.017	0.018	0.019	0.017	0.019	0.016	0.008	0.006	0.018	0.025	0.019	0.015	0.033	0.121	0.025
	(0.002)	(0.003)	(0.002)	(0.005)	(0.005)	(0.005)	(0.003)	(0.008)	(0.007)	(0.002)	(0.002)	(0.003)	(0.005)	(0.004)	(0.009)	(0.003)	(0.003)	(0.002)	(0.017)	(0.008)	(0.006)
Grapes EU (33)	0.011	0.010	0.012	0.026	0.021	0.022	0.010	0.010	0.011	0.010	0.011	0.009	0.004	0.003	0.010	0.015	0.011	0.009	0.020	0.072	0.015
	(0.009)	(0.013)	(0.007)	(0.022)	(0.018)	(0.019)	(0.011)	(0.034)	(0.03)	(0.009)	(0.008)	(0.01)	(0.019)	(0.015)	(0.037)	(0.011)	(0.011)	(0.008)	(0.067)	(0.031)	(0.024)
Grapes Others (34)	0.040	0.038	0.043	0.096	0.077	0.080	0.035	0.038	0.040	0.035	0.040	0.034	0.016	0.012	0.035	0.054	0.041	0.032	0.072	0.263	0.053
	(0.02)	(0.031)	(0.016)	(0.049)	(0.041)	(0.042)	(0.024)	(0.076)	(0.068)	(0.02)	(0.019)	(0.023)	(0.041)	(0.033)	(0.081)	(0.025)	(0.025)	(0.019)	(0.147)	(0.069)	(0.053)
Soft fruits UK (35)	0.011	0.011	0.012	-0.008	-0.006	-0.006	0.045	0.048	0.050	-0.005	-0.005	-0.005	-0.011	-0.009	-0.026	0.019	0.014	0.011	0.099	0.363	0.074
	(0.013)	(0.018)	(0.011)	(0.037)	(0.036)	(0.028)	(0.015)	(0.047)	(0.041)	(0.015)	(0.019)	(0.018)	(0.026)	(0.019)	(0.05)	(0.023)	(0.023)	(0.019)	(0.093)	(0.044)	(0.032)
Soft fruits EU (36)	0.007	0.006	0.007	-0.005	-0.004	-0.005	0.028	0.030	0.031	-0.003	-0.004	-0.003	-0.008	-0.006	-0.017	0.011	0.009	0.007	0.063	0.229	0.046
	(0.008)	(0.01)	(0.006)	(0.023)	(0.022)	(0.018)	(0.009)	(0.027)	(0.024)	(0.009)	(0.011)	(0.011)	(0.015)	(0.011)	(0.029)	(0.015)	(0.014)	(0.012)	(0.057)	(0.027)	(0.02)
Soft fruits Others (37)	0.007	0.006	0.007	-0.006	-0.005	-0.005	0.030	0.032	0.033	-0.004	-0.005	-0.004	-0.009	-0.007	-0.020	0.012	0.009	0.007	0.067	0.245	0.050
	(0.018)	(0.025)	(0.016)	(0.051)	(0.053)	(0.041)	(0.021)	(0.065)	(0.058)	(0.021)	(0.027)	(0.025)	(0.036)	(0.027)	(0.07)	(0.033)	(0.031)	(0.024)	(0.124)	(0.059)	(0.044)
Tropical fruits EU (38)	0.003	0.002	0.003	-0.030	-0.024	-0.025	-0.046	-0.050	-0.052	0.002	0.002	0.002	0.029	0.023	0.065	0.017	0.013	0.010	0.075	0.272	0.055
	(0.009)	(0.012)	(0.007)	(0.026)	(0.02)	(0.021)	(0.017)	(0.056)	(0.049)	(0.006)	(0.006)	(0.007)	(0.038)	(0.027)	(0.073)	(0.02)	(0.02)	(0.016)	(0.07)	(0.03)	(0.026)
Tropical fruits Others (39)	0.009	0.009	0.010	-0.116	-0.094	-0.098	-0.180	-0.192	-0.202	0.007	0.008	0.007	0.111	0.086	0.251	0.063	0.048	0.038	0.286	1.046	0.212
	(0.03)	(0.043)	(0.023)	(0.093)	(0.071)	(0.076)	(0.061)	(0.193)	(0.171)	(0.021)	(0.021)	(0.025)	(0.133)	(0.094)	(0.252)	(0.066)	(0.067)	(0.052)	(0.229)	(0.098)	(0.083)

*** Standard errors are in the brackets

Table 4 Unconditional Marshallian price and expenditure elasticities for fruits and vegetables by origin (cont'd)

	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Expenditure
Fruits UK (22)	-1.239	0.084	0.090	0.003	0.004	0.004	-0.065	-0.007	-0.024	-0.024	0.328	0.020	0.021	0.022	0.016	0.013	-0.059	-0.038	1.362
	(0.074)	(0.054)	(0.083)	(0.005)	(0.008)	(0.009)	(0.055)	(0.022)	(0.034)	(0.02)	(0.057)	(0.02)	(0.014)	(0.02)	(0.014)	(0.022)	(0.091)	(0.052)	(0.151)
Fruits EU (23)	0.192	-0.860	0.251	0.003	0.005	0.005	-0.102	-0.010	-0.038	-0.038	0.482	0.029	0.032	0.032	0.023	0.019	-0.092	-0.060	0.897
	(0.127)	(0.281)	(0.341)	(0.003)	(0.005)	(0.005)	(0.032)	(0.013)	(0.024)	(0.014)	(0.035)	(0.013)	(0.008)	(0.022)	(0.015)	(0.024)	(0.059)	(0.034)	(0.088)
Fruits Others (24)	0.152	0.187	-0.756	0.001	0.002	0.002	-0.059	-0.006	-0.022	-0.022	0.262	0.016	0.017	0.017	0.012	0.010	-0.053	-0.034	0.672
	(0.138)	(0.254)	(0.397)	(0.01)	(0.014)	(0.016)	(0.103)	(0.04)	(0.062)	(0.038)	(0.104)	(0.037)	(0.025)	(0.04)	(0.027)	(0.046)	(0.166)	(0.095)	(0.178)
Pome/drupes UK (25)	0.001	0.000	0.000	-0.671	0.059	0.045	-0.011	-0.001	0.004	0.004	0.137	0.008	0.009	0.000	0.000	0.000	-0.029	-0.019	0.638
	(0.006)	(0.002)	(0.007)	(0.202)	(0.058)	(0.065)	(0.011)	(0.004)	(0.009)	(0.006)	(0.02)	(0.007)	(0.005)	(0.012)	(0.008)	(0.014)	(0.017)	(0.01)	(0.064)
Pome/drupes EU (26)	0.005	0.003	0.002	0.172	-0.754	0.177	-0.041	-0.004	0.017	0.017	0.587	0.036	0.039	0.001	0.001	0.000	-0.117	-0.075	0.913
	(0.021)	(0.007)	(0.023)	(0.172)	(0.077)	(0.062)	(0.042)	(0.018)	(0.036)	(0.022)	(0.085)	(0.03)	(0.021)	(0.034)	(0.024)	(0.037)	(0.069)	(0.041)	(0.056)
Pome/drupes Others (27)	0.007	0.004	0.003	0.172	0.227	-0.810	-0.053	-0.005	0.023	0.023	0.764	0.046	0.051	0.001	0.001	0.001	-0.152	-0.098	0.923
	(0.033)	(0.01)	(0.035)	(0.243)	(0.079)	(0.119)	(0.064)	(0.027)	(0.052)	(0.032)	(0.128)	(0.045)	(0.031)	(0.054)	(0.038)	(0.059)	(0.104)	(0.061)	(0.064)
Bananas EU (28)	-0.063	-0.042	-0.031	-0.009	-0.013	-0.014	-0.727	0.135	-0.099	-0.098	0.928	0.056	0.062	-0.033	-0.024	-0.019	-0.421	-0.272	2.785
	(0.051)	(0.013)	(0.055)	(0.012)	(0.015)	(0.018)	(0.566)	(0.145)	(0.059)	(0.037)	(0.1)	(0.033)	(0.023)	(0.035)	(0.023)	(0.041)	(0.163)	(0.095)	(0.206)
Bananas Others (29)	-0.028	-0.018	-0.014	-0.006	-0.009	-0.009	0.427	-0.321	-0.038	-0.037	0.261	0.016	0.017	-0.018	-0.013	-0.010	-0.149	-0.096	0.285
	(0.065)	(0.017)	(0.069)	(0.015)	(0.022)	(0.025)	(0.463)	(0.184)	(0.086)	(0.055)	(0.133)	(0.046)	(0.031)	(0.049)	(0.033)	(0.055)	(0.195)	(0.112)	(0.066)
Citrus EU (30)	-0.027	-0.018	-0.014	0.008	0.011	0.012	-0.121	-0.012	-1.047	0.120	0.344	0.021	0.023	0.032	0.024	0.019	-0.089	-0.057	0.976
	(0.041)	(0.013)	(0.045)	(0.013)	(0.017)	(0.019)	(0.074)	(0.034)	(0.166)	(0.078)	(0.17)	(0.049)	(0.03)	(0.036)	(0.024)	(0.042)	(0.12)	(0.07)	(0.116)
Citrus Others (31)	-0.047	-0.031	-0.023	0.014	0.020	0.020	-0.206	-0.021	0.206	-0.832	0.587	0.036	0.039	0.055	0.040	0.032	-0.151	-0.098	0.965
	(0.043)	(0.014)	(0.047)	(0.013)	(0.018)	(0.02)	(0.08)	(0.037)	(0.133)	(0.104)	(0.189)	(0.054)	(0.032)	(0.038)	(0.025)	(0.045)	(0.126)	(0.073)	(0.072)
Grapes UK (32)	0.024	0.016	0.012	0.013	0.019	0.019	0.075	0.008	0.021	0.020	-9.259	-0.172	-0.162	0.011	0.008	0.006	0.060	0.039	10.170
	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)	(0.003)	(0.007)	(0.003)	(0.007)	(0.005)	(0.71)	(0.057)	(0.013)	(0.005)	(0.003)	(0.006)	(0.012)	(0.007)	(0.571)
Grapes EU (33)	0.014	0.009	0.007	0.008	0.011	0.011	0.044	0.005	0.012	0.012	-1.813	-0.933	0.028	0.005	0.004	0.003	0.036	0.023	0.616
	(0.016)	(0.004)	(0.018)	(0.006)	(0.009)	(0.01)	(0.026)	(0.011)	(0.033)	(0.021)	(0.674)	(0.229)	(0.043)	(0.02)	(0.013)	(0.024)	(0.047)	(0.026)	(0.161)
Grapes Others (34)	0.051	0.033	0.025	0.028	0.040	0.041	0.161	0.017	0.043	0.043	-5.632	0.093	-0.824	0.019	0.014	0.011	0.131	0.084	0.680
	(0.036)	(0.01)	(0.039)	(0.014)	(0.02)	(0.023)	(0.061)	(0.025)	(0.061)	(0.039)	(0.756)	(0.142)	(0.114)	(0.047)	(0.03)	(0.055)	(0.102)	(0.058)	(0.077)
Soft fruits UK (35)	0.051	0.033	0.025	0.010	0.014	0.014	-0.019	-0.002	0.051	0.050	0.349	0.021	0.023	-1.494	0.081	0.220	0.034	0.022	1.431
	(0.02)	(0.008)	(0.022)	(0.01)	(0.013)	(0.015)	(0.038)	(0.015)	(0.046)	(0.029)	(0.129)	(0.04)	(0.027)	(0.136)	(0.133)	(0.122)	(0.057)	(0.033)	(0.193)
Soft fruits EU (36)	0.031	0.021	0.016	0.006	0.008	0.009	-0.014	-0.001	0.032	0.032	0.216	0.013	0.014	0.069	-0.825	-0.085	0.020	0.013	1.054
	(0.012)	(0.005)	(0.013)	(0.005)	(0.007)	(0.008)	(0.021)	(0.008)	(0.028)	(0.016)	(0.067)	(0.021)	(0.014)	(0.117)	(0.202)	(0.101)	(0.032)	(0.019)	(0.173)
Soft fruits Others (37)	0.033	0.022	0.016	0.006	0.009	0.009	-0.017	-0.002	0.034	0.033	0.227	0.014	0.015	0.256	-0.116	-0.815	0.021	0.013	0.841
	(0.027)	(0.01)	(0.031)	(0.013)	(0.018)	(0.02)	(0.052)	(0.021)	(0.061)	(0.038)	(0.172)	(0.054)	(0.037)	(0.142)	(0.136)	(0.174)	(0.078)	(0.045)	(0.213)
Tropical fruits EU (38)	-0.008	-0.005	-0.004	-0.005	-0.007	-0.007	-0.094	-0.010	-0.014	-0.014	0.234	0.014	0.015	0.008	0.006	0.005	-1.252	-0.190	1.839
	(0.02)	(0.006)	(0.022)	(0.004)	(0.006)	(0.007)	(0.039)	(0.014)	(0.023)	(0.014)	(0.042)	(0.014)	(0.009)	(0.009)	(0.006)	(0.01)	(0.245)	(0.067)	(0.298)
Tropical fruits Others (39)	-0.033	-0.022	-0.016	-0.019	-0.027	-0.028	-0.364	-0.037	-0.055	-0.054	0.894	0.054	0.059	0.029	0.022	0.017	-1.132	-1.382	1.187
	(0.071)	(0.02)	(0.076)	(0.014)	(0.02)	(0.024)	(0.133)	(0.049)	(0.08)	(0.049)	(0.147)	(0.049)	(0.032)	(0.029)	(0.019)	(0.034)	(0.401)	(0.232)	(0.132)

*** Standard errors are in the brackets

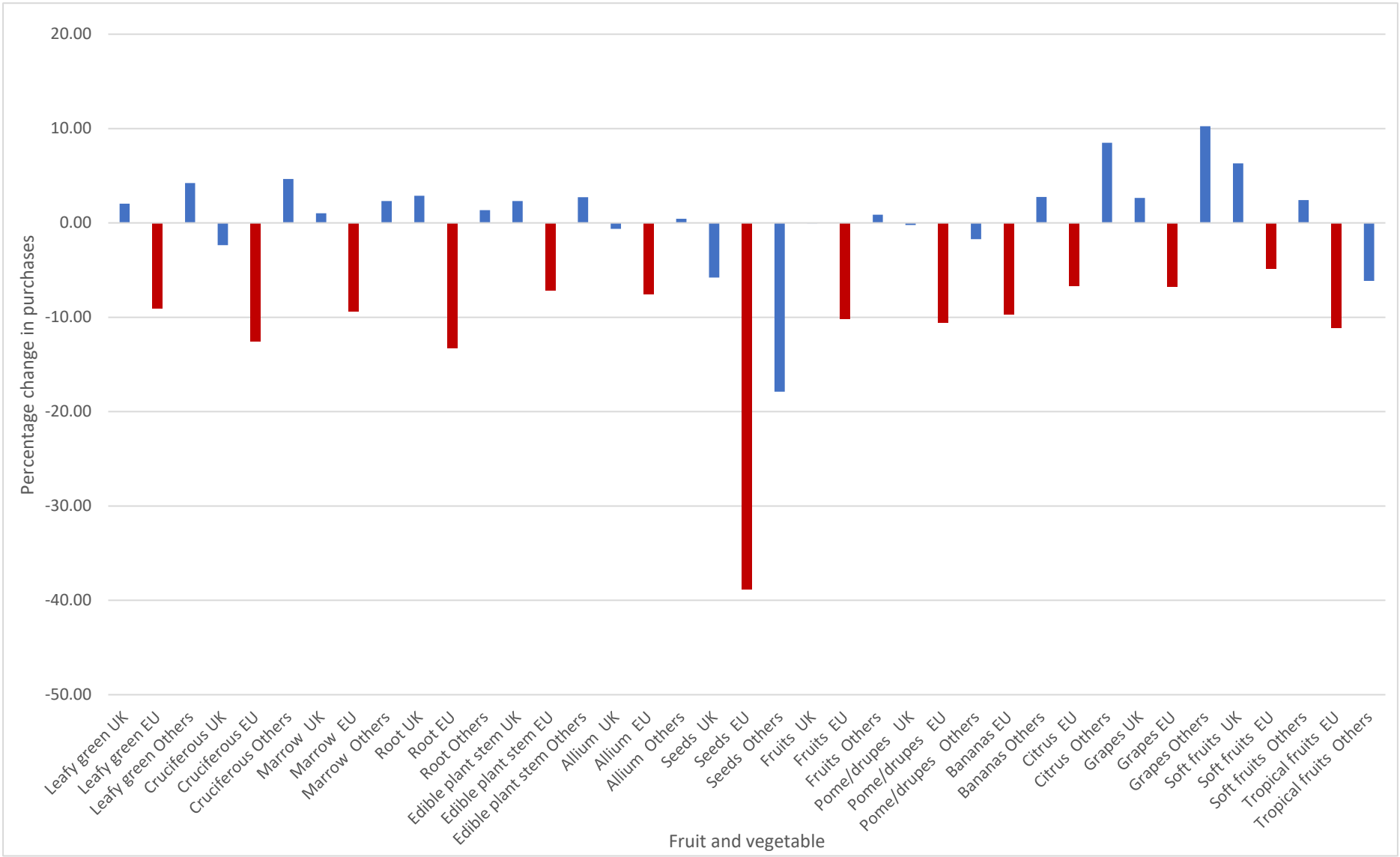

Figure 1 impact of price rise due to depreciation on the UK pound on fruits and vegetables purchases

Append A. Description of fruits and vegetables by category

Vegetables	Fruits
Leafy greens	**Tropical fruits**
Basil	Avocado
Cabbage	Coconut
Chicory	Dates
Chinese Leaves	Figs
Coriander	Lychees
Endive	Mango
Herb Selection	Melons
Kale	Other Tropical Fruit
Kalettes	Passion Fruit
Lettuce	Paw-Paws
Marjoram	Pineapples
Mint	Pomegranates
Mixed Pack	Star Fruit
Oregano	**Soft fruits**
Other Herbs	Berries+Currants
Other Vegetables	Kiwi Berries
Pak Choi	Kiwi Fruit
Parsley-Curly	Other Soft Fruit
Parsley-Flat Leaf	Persimmon Fruit
Rosemary	Physalis
Sage	Pineberries
Spinach	Sharon Fruit
Spring Greens	**Citrus fruits**
Tarragon	Easy Peelers
Thyme	Kumquats
Alliums vegetables	Lemon
Chives	Lemon+Lime
Fennel	Lime
Garlic	Orange
Leeks	Ugli Fruit
Mushroom	**Banana**
Onions	Banana
Spring Onions	**Grapes fruits**
Cruciferous vegetables	Grape-Black
Broccoli	Grapefruit
Brussel Sprouts	Grape-Mixed Pack
Cauliflower	Grape-Red
Mustard	Grape-White
Other Brassicas	
Radish	
Watercress	
Edible plant stems	
Asparagus	
Bean Sprouts	
Celery	

Dill
Lemongrass
Rhubarb
Fruit vegetables
Artichokes
Aubergines
Chillies
Okra
Peppers
Tomato
Marrows vegetables
Courgettes
Cucumber
Marrow
Pumpkin
Squash
Pome/Drupes
Apricot
Cherries
Cooking Apples
Dessert Apples
Nectarines
Peaches
Pears
Plums
Roots vegetables
Baking Potatoes
Beetroot
Carrots
Celeriac
Ginger
New Potatoes
Old Potatoes
Other Root Crops
Parsnips
Swedes
Sweet Potatoes
Turnips
Seeds vegetables
Beans
Fenugreek
Peas
Sweetcorn

Appendix B.1: Augmented Dickey-Fuller Test results

	First-difference		Level	
Prices	**Test statistics**	**P-value**	**Test statistics**	**P-value**
Leafy green UK	-7.47	<0.01	5.21	<0.01
Leafy green EU	-6.92	<0.01	2.71	0.28
Leafy green Others	-7.14	<0.01	2.21	0.49
Cruciferous UK	-7.52	<0.01	4.17	<0.01
Cruciferous EU	-6.85	<0.01	3.19	0.09
Cruciferous Others	-7.92	<0.01	3.11	0.11
Marrow UK	-7.48	<0.01	3.09	0.12
Marrow EU	-6.95	<0.01	2.98	0.17
Marrow Others	-7.67	<0.01	3.09	0.12
Root UK	-7.43	<0.01	2.62	0.32
Root EU	-7.75	<0.01	3.57	0.04
Root Others	-8.37	<0.01	2.53	0.35
Edible plant stem UK	-8.18	<0.01	5.57	<0.01
Edible plant stem EU	-8.85	<0.01	2.48	0.37
Edible plant stem Others	-7.95	<0.01	2.35	0.43
Allium UK	-6.90	<0.01	2.54	0.35
Allium EU	-6.67	<0.01	2.49	0.37
Allium Others	-7.20	<0.01	4.56	<0.01
Seeds UK	-8.52	<0.01	4.04	<0.01
Seeds EU	-7.39	<0.01	5.04	<0.01
Seeds Others	-8.24	<0.01	7.50	<0.01
Fruits UK	-7.07	<0.01	1.79	0.67
Fruits EU	-7.42	<0.01	3.11	0.11
Fruits Others	-7.39	<0.01	2.62	0.32
Pome/drupes UK	-8.14	<0.01	6.47	<0.01
Pome/drupes EU	-8.28	<0.01	3.80	0.02
Pome/drupes Others	-9.27	<0.01	3.47	0.05
Bananas EU	-8.88	<0.01	10.27	<0.01
Bananas Others	-7.62	<0.01	2.72	<0.01
Citrus EU	-8.44	<0.01	3.78	0.02
Citrus Others	-7.96	<0.01	4.01	<0.01
Grapes UK	-13.22	<0.01	4.32	<0.01
Grapes EU	-7.46	<0.01	2.43	<0.01
Grapes Others	-7.71	<0.01	2.32	0.44
Soft fruits UK	-8.42	<0.01	8.62	<0.01
Soft fruits EU	-7.28	<0.01	3.95	0.01
Soft fruits Others	-7.63	<0.01	5.01	<0.01
Tropical fruits EU	-7.84	<0.01	4.27	<0.01
Tropical fruits Others	-8.32	<0.01	6.74	<0.02

Appendix B.2 Augmented Dickey-Fuller Test

	First-difference		Level	
Total expenditure	**Test statistics**	**P-value**	**Test statistics**	**P-value**
Leafy green UK	8.05	<0.01	8.63	<0.01
Cruciferous UK	10.05	<0.01	8.58	<0.01
Marrow UK	7.30	<0.01	6.23	<0.01
Root UK	7.82	<0.01	4.30	<0.01
Edible plant stem UK	8.18	<0.01	8.82	<0.01
Allium UK	7.28	<0.01	4.27	<0.01
Seeds UK	7.93	<0.01	6.81	<0.01
Fruits UK	9.25	<0.01	7.41	<0.01
Pome/drupes UK	7.20	<0.01	8.47	<0.01
Bananas EU	7.47	<0.01	5.49	<0.01
Citrus EU	10.28	<0.01	10.35	<0.01
Grapes UK	8.07	<0.01	5.61	<0.01
Soft fruits UK	9.52	<0.01	8.82	<0.01
Tropical fruits EU	7.76	<0.01	4.77	<0.01

Appendix B.3 Augmented Dickey-Fuller Test

	First-difference		Level	
Shares	Test statistics	P-value	Test statistics	P-value
Leafy green UK	8.03	<0.01	4.22	<0.01
Leafy green EU	8.08	<0.01	2.70	0.28
Leafy green Others	8.25	<0.01	1.63	0.73
Cruciferous UK	6.82	<0.01	3.28	0.08
Cruciferous EU	7.68	<0.01	2.34	0.43
Cruciferous Others	6.49	<0.01	3.80	0.02
Marrow UK	7.70	<0.01	3.39	0.06
Marrow EU	6.59	<0.01	2.59	0.33
Marrow Others	7.54	<0.01	4.31	<0.01
Root UK	8.23	<0.01	3.76	0.02
Root EU	7.48	<0.01	4.20	<0.01
Root Others	8.20	<0.01	4.83	<0.01
Edible plant stem UK	9.56	<0.01	3.32	0.07
Edible plant stem EU	7.73	<0.01	5.41	<0.01
Edible plant stem Others	9.63	<0.01	2.70	0.28
Allium UK	6.59	<0.01	1.42	0.82
Allium EU	6.29	<0.01	2.59	0.33
Allium Others	6.27	<0.01	2.03	0.57
Seeds UK	8.25	<0.01	8.90	<0.01
Seeds EU	8.94	<0.01	5.76	<0.01
Seeds Others	8.41	<0.01	7.67	<0.01
Fruits UK	7.65	<0.01	3.42	0.05
Fruits EU	7.14	<0.01	2.05	0.55
Fruits Others	6.82	<0.01	0.94	0.95
Pome/drupes UK	8.03	<0.01	7.46	<0.01
Pome/drupes EU	8.09	<0.01	4.48	<0.01
Pome/drupes Others	8.18	<0.01	4.61	<0.01
Bananas EU	9.25	<0.01	4.95	<0.01
Bananas Others	9.25	<0.01	4.95	<0.01
Citrus EU	8.04	<0.01	4.85	<0.01
Citrus Others	8.04	<0.01	4.85	<0.01
Grapes UK	11.10	<0.01	3.64	0.03
Grapes EU	6.95	<0.01	1.90	0.62
Grapes Others	8.26	<0.01	2.06	0.55
Soft fruits UK	9.48	<0.01	8.89	<0.01
Soft fruits EU	7.49	<0.01	5.75	<0.01
Soft fruits Others	8.54	<0.01	6.15	<0.01
Tropical fruits EU	6.36	<0.01	2.69	0.29
Tropical fruits Others	6.36	<0.01	2.69	0.29

Appendix B.4 Cointegration test

	Augmented Dickey-Fuler Test		Philip-perron test	
Shares	Test statistics	P-value	Test statistics	P-value
Leafy green UK	5.62	<0.01	5.92	<0.01
Leafy green EU	6.39	<0.01	8.51	<0.01
Leafy green Others	5.38	<0.01	6.16	<0.01
Cruciferous UK	5.89	<0.01	5.84	<0.01
Cruciferous EU	4.95	<0.01	4.63	<0.01
Cruciferous Others	9.06	<0.01	9.35	<0.01
Marrow UK	5.18	<0.01	5.95	<0.01
Marrow EU	4.79	<0.01	6.55	<0.01
Marrow Others	6.29	<0.01	7.14	<0.01
Root UK	6.71	<0.01	8.15	<0.01
Root EU	6.49	<0.01	8.39	<0.01
Root Others	5.65	<0.01	6.83	<0.01
Edible plant stem UK	6.21	<0.01	8.47	<0.01
Edible plant stem EU	6.43	<0.01	8.83	<0.01
Edible plant stem Others	6.22	<0.01	9.29	<0.01
Allium UK	4.55	<0.01	4.92	<0.01
Allium EU	4.57	<0.01	5.28	<0.01
Allium Others	3.94	<0.01	4.73	<0.01
Seeds UK	5.20	<0.01	7.64	<0.01
Seeds EU	5.16	<0.01	11.72	<0.01
Seeds Others	4.02	<0.01	8.59	<0.01
Fruits UK	4.52	<0.01	7.76	<0.01
Fruits EU	5.10	<0.01	5.80	<0.01
Fruits Others	4.77	<0.01	6.18	<0.01
Pome/drupes UK	7.15	<0.01	6.89	<0.01
Pome/drupes EU	4.72	<0.01	7.43	<0.01
Pome/drupes Others	6.43	<0.01	6.71	<0.01
Bananas EU	4.36	<0.01	10.05	<0.01
Bananas Others	4.36	<0.01	10.05	<0.01
Citrus EU	4.64	<0.01	6.70	<0.01
Citrus Others	4.64	<0.01	6.70	<0.01
Grapes UK	8.10	<0.01	10.73	<0.01
Grapes EU	3.83	<0.05	3.71	<0.05
Grapes Others	3.97	<0.05	4.66	<0.01
Soft fruits UK	7.10	<0.01	5.66	<0.01
Soft fruits EU	5.61	<0.01	5.60	<0.01
Soft fruits Others	4.62	<0.01	6.79	<0.01
Tropical fruits EU	3.31	<0.1	3.80	<0.05
Tropical fruits Others	3.31	<0.1	3.80	<0.05