

The demand for ornamental plants in Poland after its integration into the EU: a quantitative approach

Dawid Olewnicki^{1*}, Lilianna Jabłońska¹, Hanna Dudek²

¹Warsaw University of Life Sciences, Section of Horticultural Economics, 02-776 Warsaw, Poland

²Warsaw University of Life Sciences, Department of Econometrics and Statistics, 02-776 Warsaw, Poland

*Correspondence author: dawid_olewnicki@sggw.pl

Abstract

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The importance of ornamental plants in human life is increasing along with the growth of industrialisation and urbanisation as well as the enrichment of societies. The consumption of these plants is increasing and accompanied by the systematic development of their production worldwide. In Poland, after political transformation and upon entering the path of economic development after 1990, there was also an increase in demand for ornamental plants. In light of further development of the floriculture sector, it is important to identify the changes in the level of demand for such floricultural products in Poland in the long term.

Central Statistical Office (CSO) data was applied so that the dynamics of both spending on gardening products for the home and garden (2006-2013), including floriculture products (2013-2015) and the disposable income of Polish households could thus be analysed. Later on, the dependence of these expenditures upon income was studied with linear and power functions. The analyses demonstrated that a high and strong income level determined the demand for such gardening products, including ornamental plants. Demand is unmet, and ornamental plants belong to the luxury goods sector, even within the group of people with a very high income (elasticity factor > 1).

Keywords: ornamental plants; demand; expenditure; income

List of abbreviations: CSO – Central Statistical Office of Poland, GNP – Gross National Product, PLN – Polish Zloty New (Polish currency since 1994), USDA – United States Department of Agriculture

Introduction

People have lived alongside ornamental plants for centuries. These, being primarily a source of aesthetic experience, make daily life more pleasant and express love, respect, gratitude or tribute. They embellish either religious or secular ceremonies (Jabłońska, 2009; Janes, 2011; Mazar, 2015), and are given to other people on various occasions (Yue & Hall, 2010; Palma et al., 2011; Lai & Huang, 2013; Jabłońska et al., 2013a).

Yet, along with increasing industrialisation and urbanisation, their significance is increasing and extending the scope of their function. More and more emphasis is put on the en-

vironmental function, including the preservation of biodiversity (Mohamad et al., 2013; Idilfitria et al., 2014; Clarke & Jenerette, 2015) or phytoremediation (Dzierzanowski & Gawroński, 2011; Varun et al., 2011; Hazrat et al., 2013), of the plants impact on human physical and mental health (well-being), and thus on the therapeutic function and improvement of work efficiency (Lewis, 1995; Lohr et al., 1996; Larsen et al., 1998; Rappe & Linden, 2004; Chang & Chen, 2005; Maller et al., 2005; Stigsdotter, 2005; Velarde et al., 2007; Bringslimark et al., 2007; Thomsen et al., 2011; Jun et al., 2013; Barnicl & Midden, 2013; Trau et al., 2016), as well as direct economic benefits, such as an increase in the value of real estate, a reduction in heating and air condition-

ing costs (Hall et al., 2006; Hall & Dickson, 2011; Hall & Hodges, 2011).

All of the above results in an increasing demand for ornamental plants (Wijnands, 2005; Van Uffelen & De Groot, 2005; Russia Flowers Expo, 2012; Yana, 2012; Sudhagar & Phil, 2013). In the US, spending on household floriculture products between 2000-2003, increased from USD 34.2 to USD 46.1 (Abate & Peterson, 2005), in the UK the consumption of cut flowers increased twofold in 2000-2005 (Reid & Jiang, 2005), in Italy spending on cut flowers and potted plants increased between 2005-2008 by 15.1% with an increase in the number of buyers by 23% (Schimmenti et al., 2010), in the Czech Republic an average annual increase in expenditure on flowers in 1994-2010 was at deflated (fixed) prices CZK 22/person (Halova, 2015). The continuous growth in global floriculture is a response to growing demand. According to IAHP, the area of cut flowers and pot plant cultivation increased from 201000 ha between 1994-1998 to 360000 ha between 1995-2003 (Jabłońska, 2007) and then up to 416000 ha between 2008-2012 (Jabłońska, 2016). The area of nursery stocks has also grown, e.g. between 1990-2012 it grew 3.2 times in the Netherlands, in Belgium 3 times, over twice in Germany, in France 1.2 times, and in the USA by 4% between 2000-2011 (by 7000 ha) (Jabłońska, 2007, 2016).

Many authors have emphasized, that the growth in consumption of ornamental plants is directly related to the level of economic development. Higher expenditure on ornamental plants is seen in countries with a higher GDP *per capita*. According to Hanks (2015), the highest levels of both GDP and expenditure on floriculture products per person, was in the period 2011-2012 and was recorded in Norway (51500 Euro and 283 Euro, respectively). Similar levels of both volumes were found in Sweden and Denmark, Austria, Germany and the Netherlands, much lower values were seen in England, Japan, Italy and Spain. The lowest expenditure by far was seen in the Czech Republic (respectively 19400 thousand Euro and 32 Euro). Since the socialist economy in Poland was transformed into a free market economy, a growing interest in ornamental plants has also been observed along with Poland's economic development. Fragmentary research shows that spending on cut flowers and potted flowers in Warsaw, per rose head increased from 23 individual roses bought in 2003 (Jabłońska & Zyntek, 2005) to 29-31 pieces purchased in 2011 (Jabłońska et al., 2013b).

In the first decade of the 21st century, spending on cut flowers was even greater than in the USA (Reid & Jiang, 2005). At the same time, the area of floriculture continued to grow in Poland. In the period 1995-2012, the field/area of cut flower cultivation and potted flowers/plants

increased 1.9 times, and nurseries 2.2 times (Jabłońska, 2016). However, recent years have seen a slowdown in the growth rate of the areas cultivated (Jabłońska & Olewnicki, 2016), which would suggest a gradual saturation of the market. With foresight of further development of the sector, it seems to be important to examine the demand for floricultural products in Poland. We also need to consider the extent of its dependence upon the income of the population. Understanding the long-term trend of change and its impact on income and on demand will thus support producers and other entities related to the floricultural sector especially when making short and long-term decisions. The following hypotheses have been put forward: 1) there is a strong dependence between spending on floriculture products and upon income; 2) expenses on floricultural products increase with the growth of income; 3) floricultural products belong to the luxury goods sector in Polish society and the demand is unmet; 4) in lower income groups, a stronger response to growth in income should be anticipated. The assumptions made in the hypotheses have resulted from the fact that ornamental plants are not basic goods, non-essential items, are not a basic necessity for families such as food. These are discretionary goods (Gineo & Omamo, 1990; Giraponthong & Ward, 2003) and most people may consider their acquisition a luxury (Jin et al., 2013)

Not much researches have been conducted concerning the subject of demand for ornamental plants, whether in Poland or the rest of the world. Even less researches have been done on the changes in the level of demand in the long run. Very little researches consider its dependence on the level of the society's wealth, which would allow us to assess the further development of the market. Most of the analyses presented in literature, have dealt with demand and the preferences of consumers in relation to individual groups of ornamental plants or individual species. Whereas some analyses has looked at the impact on purchasing decisions of economic and non-economic factors, in order to support producers in their marketing activities and production planning.

An extensive study of consumer behaviour with regard to cut flowers as well as flowering and green plants was conducted by Van Tilburg (1984). He studied spending on flowers for the home and/or intended as gifts within the group of occasional and regular buyers. In the latter group he looked at: the habitual and non-habitual buyers, depending, inter alia, on social class, the region of the country, the size of agglomeration, the size of the household, the age of the hostess, the garden, advertising and prices. He showed, among other things, that these expenditures depended significantly on social class, while spending on gifts was more diverse than home expenses. The influence of the region, place of

residence and the age of a housekeeper was also meaningful, while the influence of the price was irrelevant.

Gineo (1988), studies were based on the results of previous studies available in literature, whereby he analysed the factors determining the demand for plants intended for landscaping. These factors were: age, education, income, house construction, and product attributes (quality, price, choice, colour, low requirements for care, cultivation in containers) and their usefulness. He demonstrated, *inter alia*, that the demand for this group of nursery plants and garden services grows along with the increase in the percentage of people aged between 35-44, the level of education and income, and the development of family housing. At the same time, he stressed that the precise quantification of these relations are crucial for planning and marketing.

In turn, Abdelmagid et al. (1996) studied the preferences of garden centre customers as regards annual flowering plants. He analysed the impact of price, income and demographic factors (owning a house, employment status, marital status, type and size of plants) on the purchase of 7 species. His research has showed a close increasing correlation between number of purchases the age of the customer, which was also higher in the case of women accompanied by men rather than women buying alone. Consumers were also sensitive to the price level of a given species, while cross-elasticity was also statistically insignificant i.e. the plants researched were never complementary of each other nor was there a substitute. Statistically customer income had little or insignificant impact on the purchases of annual plants, with 3 species considered to be common goods.

Consumer preferences were also studied by Girapunthong and Ward (2003), who analysed the impact of price and income on the share of the market of fresh cut flowers, flowering potted plants and artificial /dry flowers within the total expenses of these 3 groups. They demonstrated that the impact of income was meaningful in groups of people who had either a low or high income. In the first group, their share of spending on fresh cut flowers grew along with their increasing income. Whereas, spending on potted and artificial plants decreased. In the affluent group, their share of spending on cut flowers had a decreasing tendency, while in the other two groups there was an increasing tendency. However, in the medium-income group, income had an infinitesimal impact on the above shares of goods. In addition, people with a higher income, although buying less frequently, spent more on ornamental plants than did the less wealthy group. Also the level of total expenses and prices had a significant impact on the expenditure of the three groups of flowers. Together with the increase in spending on flowers in general, spending on cut flowers increased faster than on potted and

artificial plants, i.e. the share of fresh cut flowers grew, and potted and artificial flowers decreased, and vice versa. The demand for cut flowers was also much more responsive to price change.

In turn, the purpose of research by Huang and Yeh (2009) was to assess consumer value of floriculture products within consumer groups with different choices for purchase. It was shown that consumer values of flowers differed depending on their purchase choice, but generally the most recognised by consumers were (in descending order): taking care of others, expressing emotions, sensory feelings perceived through the senses (hedonic sensors).

Palma and Ward (2010) studied household demand in the USA for: fresh cut flowers, flowering potted plants, dry/artificial flowers and outdoor flowers. Research involved the breakdown of the demand of market penetration and buying frequency, to show which factors affect non-purchasers to become buyers, and which buyers would buy more. It was demonstrated that the majority of transactions resulted from the entry of new buyers into the market rather than the repetition of purchases by existing customers. Moreover, although the results differed depending on the type of flowers and the region, market penetration and the frequency of purchases were highly determined by: age and gender, followed by purchase targets, calendar occasions as well as the region, whereas the lowest impact was recorded in the case of household income.

The frequency of purchases of ornamental plants was also the subject of research conducted by Palma et al. (2011). They studied the impact of floristic product attributes (including ecological products, care requirements, vivid colour), and demographic and seasonal factors on the number of transactions per month. It was found that the two main factors affecting the frequency of purchases were consumer habits (including the purchase goal – for themselves or as a gift) and seasonality. In addition, lower frequency was characterised by people with higher education, elderly and with a higher income. People with the lowest income had 0.6 transactions per month more and it was a statistically significant relationship. With other income groups, the dependence was not as statistically significant, with a negative impact in the groups with the highest income (by 0.02 less transactions).

Factors influencing the selection of individual traditional and special cut flowers were the subject of Yue and Hall's research (2010). They proved that the choice of the species depended on who was its recipient, on calendar and non-calendar 'occasion's, gender, age and education. Income also had an impact. Consumers with a lower income were more likely to buy carnations and roses, and less willing to buy bulbs. In turn, those with a higher income were more probable to buy orchids and other tropical plants.

The aim of the study of Schimmenti et al. (2010, 2013) was to present the profile of consumers buying cut flowers and potted plants' in the regions of Southern Italy and other Italian regions, respectively. They studied the participation of the population buying each of two groups of plants, the frequency of purchases, motives for purchase (for themselves, or as a gift) and not purchasing, average expenditure, place of purchase, reasons for the purchase. The 2013 article also showed the impact of socio-demographic characteristics on the decision to purchase, showing a significant impact of age and gender, and the non-relevance of the area of the country and education. It was also demonstrated that only 3.08% of the respondents preferred products with an ecological certificate.

Consumer behaviour connected with the floricultural market in Warsaw, including preferences for cut flowers and potted plants, species, colour and other attributes of products, as well as motives and shopping opportunities depending on age, gender, education and income, were examined by Jabłońska et al. (2013a). The research demonstrates that demand is an occasional demand, though the percentage of occasional buyers or when acting on impulse, increased along with the income and level of education, and the purchasing behaviour studied was determined mainly by gender, with the minimum impact of other factors.

On the other hand, Khachatryan and Choi (2013) examined American consumer preferences in terms of plant types (annual, perennial, deciduous plants, etc.), species and market type (outlet) as well as factors of their choice, and the level of expenditure on flowers and their determinants. It was shown that with the increase of income and education, the number of non-buyers decreased, while the amount of planned expenses increased. The choice of plants was determined mainly by: quality, followed by price and color; the outlet choice by the selection of plants and price, and then followed by quality. These studies also demonstrated that the information provided on the benefits of plants (health and well-being, environmental and economic) would not significantly affect the purchase of more plants in the future.

Choi and Khachatryan (2013) studied an important economic issue for retailers in the formation of pricing strategy: the impact of retail prices, of 16 ornamental plants, (annual, perennial and deciduous potted) on the demand for them, along with the amount of demand which may have an effect on price changes. It was found that the demand for plants is characterised by a high elasticity of own price (> 1) and the highest demand being for potted plants, lower for perennials and the lowest for annual plants. In turn, cross-price elasticity has shown that plants are more substitutable among themselves in the same group than between plants of different groups. It was also demonstrated that the elasticity of

spending on ornamental potted plants was generally higher than expenditure on annuals or perennials.

Jin et al. (2013) studied the impact of household income, age, sex, race and duration of living in a given place, on expenditure on 6 groups of nursery plants and 3 gardening services. It was shown that all these factors had a significant impact on purchasing decisions. It was interesting to analyse two types of profitable elasticity – based on conditionally adjusted coefficients (in the group of people already buying, which explained how many customers decided to buy or not) and unconditionally adjusted the coefficient (this applies to all households, which explains how many new customers can be attracted through increased income). The level of the coefficients calculated indicates that all of the products tested were common goods, with elasticity of expenditure being different, depending on the product. Generally, it was higher for gardening services (Inc.Elast. > 1) than for plants (Inc.Elast. < 1).

“To buy or not to buy” ornamental plants was itself the subject of studies by Atik et al. (2013). These resulted in findings concerning the gender of a family member of the buyer, the number of family members of the buyer, whether they owned a house or a balcony as well as pets. All these factors had significant statistical influence on whether the respondents were buying ornamental plants or not. The influence of education and income was not statistically significant.

Rihn et al. (2015, 2016) studied the impact of ecological production methods and the origin of the product on the probability of buying indoor foliage and fruit producing plants, to show the feasibility of promoting these two attributes to stimulate demand. It was examined whether consumers preferred plants from conventional or organic farming sources, or from domestic, local or imported production. In addition, the impact on the demand of socio-economic factors, prices and volatile organic compounds (VOC) were studied. The research shows that organic production, domestic or state origin of crops and VOC have a positive impact on the probability of shopping, while price has a negative impact. There is no impact based on age, size of household, education or income on demand.

There are relatively fewer publications, which present studies focusing on long-term changes in demand for ornamental plants and its determinants on the macro scale, as a support for producers in forecasting sales. Nonetheless, such afore mentioned research, was carried out by Gineo and Ommo (1990). They used Engel's law to determine the impact of household expenditure on ornamental plants and garden products in 5 US sub-regions (2 agricultural and 3 urbanized) of factors such as: household income, number of newly built single-family homes, age, and education. They showed that primarily income and house construction influenced spending

in the short-term, however in the long run it was income, age and education that had an influence. There were also differences between agricultural and urbanised regions.

In Poland, spending on ornamental plants in the period 1971-1979 was examined by Jabłońska (1987), using the CSO's data on household budgets. She demonstrated that spending in Warsaw increased within the period studied threefold and increased along with growth in household income as well as education. According to these studies, ornamental plants belonged to the luxury goods sector, with the rate of elasticity in income dropping from 1.57 to 1.51 as income increased. However, in the group of people with the highest income, flowers were not a luxury item anymore, because the coefficient fell to 0.62 in 1979. Among people with the lowest income, the demand was very elastic (elasticity coefficient 3.12 and 2.54).

In turn, Johnson and Jensen (1992), using USDA data from 1966-1988, proved a high, positive dependence of plant sales on GNP, and also, though weaker, on the expenses of house owners on repairs and supplements. The multivariate regression analysis showed that with the GNP increase by 1%, the real value of plant sales increased by 1.21%.

The influence of economic factors on production and consumption of floricultural products in the Czech Republic was investigated by Halova (2015). In the section on demand, she analysed the dependence of spending on floricultural products upon disposable income in the period 1994-2010, using official statistical data. She stated that this was a statistically meaningful relationship, and an increase in the income of Czech families by 1% caused an increase in spending of 0.77%. Thanks to the determination of income elasticity coefficients for 10 income groups, it showed that the higher the income, the weaker the reaction of consumers to its change.

Material and Methods

The aim of the research was to determine changes in the demand for ornamental plants in Poland and the impact of the population's income upon them. The research covers the years 2006-2015. Due to the huge variety of products included in the group of ornamental plants, analyses of demand cannot, as in the case of other agricultural products, be carried out in quantification terms. It is impossible to express completely the purchase of one cut flower, a bouquet of cut flowers with greenery, a floral arrangement in a basket, a potted plant or a shrub for planting in the garden. Thus, the study analysed the demand in terms of value, as total spending on floriculture products. Published and unpublished CSO's household budget survey data was used, which was conducted with a representa-

tive method that gives the opportunity to generalise the results obtained for all households in the country. Because the expenditure is aggregated by the Central Statistical Office with expenditure for home and garden products other than plants, such as pots, seeds, flower bulbs, fertilizers, mowers, etc., these aggregated values were used in these analyses. They are referred to as "gardening products for home and garden". The same type of aggregated data was also analysed by Gineo and Omamo (1990). In CSO bases connected with 2013-2015, it was possible to extract expenses on ornamental plants from the total sum. Thus, for the last three years, spending on ornamental plants alone, their dependence on income and share in total expenses on gardening products for home and garden as well as total expenditure, was analysed. The study focuses on a household unit, but expenses and income cover 1 person and refer to 1 month.

The analyses include three stages. The first one examines the dynamics of changes on the level of spending on gardening products for the home and garden as well as the level of disposable income in total for the whole population and in groups with different income levels. Taking into account: income, the CSO's apportioned data was used which is divided into 5 quintile groups and was thus applied (groups with the equal number of people, where group I accounts for 20% of people with the lowest income, and group V – 20% of people with the highest income). To determine the direction and dynamics of change, the trend model was used, which is a function of the time variable, applying a linear function for expressing changes in absolute values (in PLN) and exponential function for expressing the average annual relative change (in %). Both functions were well matched to the empirical function, as evidence is reflected in the high values of the R^2 coefficient. The dynamics were determined for nominal values and adjusted by price indices of goods and services (adjusted by the inflation rate), expressing them as fixed prices, as of 2006.

The second part of the analysis focused on examining the dependence of spending on gardening products for home and garden, on disposable income. The various functional forms of the model can be used to describe the dependence of expenses on income. In the reference literature it is pointed out that functions (among others) are applied to describe the course of Engel curves (Ohidul-Haque, 2005):

- Linear $y = a + bx$
- Power (*double log*) $\log y = a + b \log x$
- Exponential function
with an inverse (*log inverse*) $\log y = a + \frac{b}{x}$

where: y – expenditure on particular goods in PLN per person, x – income in PLN per person.

Separate models have been estimated for each year from the period of 2006-2015. Data on average expenditure and income values in quintile groups were used here. The determination coefficient set on the basis of the following formula, was used to assess the goodness of fit:

$$R^2 = 1 - \frac{\sum_{i=1}^n e_i^2}{\sum_{i=1}^n (y_i - \bar{y})^2},$$

where: y_i – expenditure on given goods in PLN per person in the i^{th} quintile group, $i = 1, 2, \dots, n$, $n = 5$, $e_i = y_i - \bar{y}$ – the rest of the model, i.e. the difference between the actual expenditure on particular goods in PLN per person in the i^{th} quintile group and spending determined on the basis of the model.

It was found that the best fit was characterised by the power models $y = a \cdot x^b$, followed by the linear models. By far the worst fit to the empirical data was characterised by the exponential model with the inverse, therefore the presentation of its results was omitted. The aggregate results regarding model estimates are presented in Table 3. In power models, the estimated b is the income elasticity of expenditures and indicates how much expenses will increase in percentage in the situation of an increase in income by 1%. In linear models, the b ratio means, how much expenses will increase

in PLN with an increase in income of 1 PLN. The results of these models were determined on the basis of real data, i.e. adjusted by the inflation rate.

The linear model also allows us how to determine the elasticity for different income levels. The values of this elasticity are presented in Table 4. The formula below was applied:

$$E_x f = \frac{f'(x)x}{f(x)},$$

which for a linear model takes the following form: $E_x = \frac{bx}{a + bx}$.

In the third part, as in the case of spending on gardening products dedicated for the home and garden, an econometric analysis of the dependence upon income was carried out in reference to expenditure on ornamental plants and the share of this expenditure within total household expenses. The results of the estimates are included in Table 5 and Table 6, respectively.

Results and Discussion

Monthly expenses on gardening products for the home and garden, of the average Pole, have increased by PLN 1.90

Table 1. The level and change in monthly income and spending on gardening products dedicated for the home and garden for the average Pole between 2006-2015

Specification	Value in PLN ¹ per person		The average annual change			
	2006	2015	PLN	R ²	%	R ²
Face value						
Income	834.68	1386.16	56.93	0.9089	5.12	0.8717
Expenditure	2.08	3.98	0.19	0.9518	6.33	0.9263
Real value (deflated)						
Income	834.68	1203.45	33.1	0.8163	3.28	0.7961
Expenditure	2.08	3.52	0.13	0.8835	4.70	0.8793

Source: own calculations

Table 2. Changes in spending on gardening products for home and garden as well as in disposable income in individual quintile groups in the period 2006-2015

Quintile group	Expenses in PLN per person			Average annual change				The share of expenses in income	
	2006	2015		Expenses ¹		Income ¹		2006	2015
		Nominal	Real	%	R ²	%	R ²		
I	0.49	1.28	1.17	7.85	0.9076	2.75	0.6665	0.18	0.30
II	0.78	2.01	1.84	6.76	0.7410	3.76	0.8755	0.16	0.24
III	1.50	3.10	2.77	5.19	0.7919	3.80	0.9084	0.22	0.27
IV	2.41	4.41	3.88	4.91	0.9014	3.59	0.9127	0.25	0.28
V	5.23	9.13	7.99	3.65	0.8375	3.11	0.8694	0.30	0.33

Source: own calculations

¹determined on the basis of real values (deflated)

in face value in the period 2006-2015, and by PLN 1.44 in fixed prices (Table 1). On average, each year these grew by 6.33% and 4.70%, respectively. Thus the dynamics were faster than the increase in disposable income, which grew on average by 5.12% on face value and by 3.28% in real value (deflated). As a result of a faster increase in spending on gardening products, their share in income increased from 0.25% to 0.29% within 10 years. It is a relatively low share. For example, in households in North Carolina, US, in 2009, this expenditure represented 1.20% of income (Jin et al., 2013).

The analyses clearly demonstrate that the higher the income group, the higher the level of spending on garden products was (Table 2). Greater spending was also involved in income. This is a phenomenon known in the theory of economics. As Gineo emphasized (1988), along with the in-

crease in income, its part recognized as discretionary, which can be dedicated for the purchase of less important (for everyday life) items, luxuries also increase. This has been noticed in the floriculture market by a number of researchers including Gineo and Omamo (1990), Girapunthong and Ward (2003), Khachatryan and Choi (2013), Choi and Khachatryan (2013). At the same time, there is a visible decrease in differences in the level of expenditure in Poland. In 2006, the expenses of people with the highest income were 10.67 times higher than of people with the lowest income, and in 2015 – this was 6.83 times. This was due to the fact that the highest growth rate of spending on gardening products was recorded in the group of people with the lowest income, and along with the shift to a higher income group, the dynamics of growth in expenditure was decreasing. In the quin-

Table 3. Results of the estimation of power and linear models describing the dependence of expenditure on gardening articles upon income

Year	Power model			Linear model ¹		
	a	b	R ²	a	b	R ²
2006	-8.2853***	1.3272***	0.9950	-0.6938**	0.0033***	0.9909
2007	-3.5537***	1.3107***	0.9981	-0.8509**	0.0035***	0.9881
2008	-3.4067***	1.2640***	0.9989	-0.7438**	0.0033***	0.9938
2009	-3.5220***	1.3019***	0.9995	-0.8498**	0.0034***	0.9946
2010	-3.4412***	1.2634***	0.9985	-0.8359**	0.0032***	0.9936
2011	-3.4990***	1.2914***	0.9975	-0.9762**	0.0035***	0.9926
2012	-3.3501***	1.2374***	0.9985	-1.0010*	0.0034***	0.9880
2013	-3.0842***	1.1505***	0.9930	-0.7478*	0.0031***	0.9871
2014	-3.1101***	1.1696***	0.9958	-0.8632*	0.0034***	0.9892
2015	-2.8608***	1.0966***	0.9968	-0.7531**	0.0034***	0.9883

Source: own calculations/research; *** means significance at the level 0.01, ** at the level 0.05, * at the level 0.10.

Table 4. Income elasticity upon spending on gardening products in quintile groups

Year	Quintile group I	Quintile group II	Quintile group III	Quintile group IV	Quintile group V
2006	4.1834	1.7151	1.4309	1.2810	1.1349
2007	4.4682	1.7689	1.4667	1.3082	1.1436
2008	2.7358	1.5295	1.3415	1.2329	1.1149
2009	3.0249	1.5623	1.3572	1.2419	1.1199
2010	2.7658	1.5598	1.3570	1.2420	1.1171
2011	3.3148	1.5831	1.3704	1.2508	1.1222
2012	3.5194	1.6056	1.3770	1.2543	1.1234
2013	2.4402	1.4295	1.2770	1.1919	1.0957
2014	2.4268	1.4361	1.2818	1.1950	1.1012
2015	1.9327	1.3387	1.2266	1.1608	1.0847

Source: own calculations

¹determined for real values, expenses and income are expressed in PLN per person;
Polish Zloty New. According to average quotations of the National Bank of Poland (NBP):
2006 – 1 PLN = 0.26 Euro
2015 – 1 PLN = 0.24 Euro

tile group marked as I, spending grew annually by 7.85% on average, and in the group V by 3.65%. At the same time, the dynamics of growth in income within individual groups fluctuated only within the limits of 2.75%-3.80%. Hence, the increase recorded in the share of expenditure on gardening products of disposable income was greatest in the groups with a lower income. In group I it increased from 0.18% to 0.30%, while in group V it increased from 0.30% to 0.33%. Therefore, the gradual saturation of demand among more affluent people can be assumed.

For the proper prediction of the demands of the florist market, apart from learning about the direction and dynam-

ics of change in spending on gardening products, it is important to quantify the response of expenditure connected with changes in income. As can be seen from the figures in Table 3, within the whole of the period analysed, the rate of income elasticity upon expenditure was greater than 1, i.e. an increase in income in a given year by 1% caused an increase in spending on gardening articles by more than 1%. At the same time, a gradual decrease in the elasticity coefficient within 10 years is visible from around 1.3 at the beginning of the period to 1.1 at the end. However, demand was still elastic, and garden articles were considered luxury goods. In absolute terms, the increase in expenses in individual years

Table 5. Characteristics of change in expenditure on ornamental plants, expenditure and its dependence upon income in the period 2013-2015

Specification	Population in total	Quintile group				
		I	II	III	IV	V
The average annual change ¹						
Expenditure						
%	9.95	12.46	17.48	14.68	7.97	7.74
R ²	0.9906	0.9378	0.9784	0.9963	0.8515	0.9604
Income						
%	3.73	6.62	5.18	4.61	4.11	2.19
R ²	0.9936	0.9988	0.9984	0.9999	0.9967	0.8745
Results of the estimation of models describing the dependence of expenditure upon ornamental plants based on income						
	Power model			Linear model ^{1,2}		
Year	a	b	R ²	a	b	R ²
2013	-7.1600***	1.1064***	0.9783	-0.4519	0.0021***	0.9869
2014	-7.4353***	1.1553***	0.9838	-0.5829*	0.0023***	0.9875
2015	-6.8524***	1.0826***	0.9866	-0.4412	0.0023***	0.9913
Results of the estimation of models describing the dependence of the share of expenditures on ornamental plants in total household expenditure on income						
	Power model			Linear model ³		
Year	a	b	R ²	a	b	R ²
2013	-1.7336***	0.4233***	0.9564	0.1034***	0.0660***	0.9570
2014	-1.6592***	0.4608***	0.9664	0.1083***	0.0751***	0.9527
2015	-1.5666***	0.3937***	0.9923	0.1352***	0.0669***	0.9754

Source: own calculations; ***means significance at the level 0.01, **at the level of 0.05, *at the level of 0.10

Table 6. Income elasticity of expenditure on ornamental plants in quintile groups

Year	Quintile group I	Quintile group II	Quintile group III	Quintile group IV	Quintile group V
2013	2.1500	1.3742	1.2447	1.1709	1.0860
2014	2.3857	1.4285	1.2774	1.1922	1.0999
2015	1.7228	1.2820	1.1914	1.1369	1.0728

Source: own calculations

¹determined for real values;

²expenses and income are expressed in PLN per person;

³share expressed in %, income in thousands of PLN

caused by an increase in income of PLN 1000 ranged from PLN 3.1 (2013) to PLN 3.5 (2007).

A significant impact of income upon spending on gardening articles, including ornamental plants, has been demonstrated by a number of other studies. Their authors emphasized the high elasticity of demand, although in general the factors of income on ornamental plant expenditure in the populations studied were below 1. According to Gineo and Omamo (1990) this coefficient for agricultural regions in the US amounted to 0.94 and in urbanized regions to 0.75. Furthermore, according to Jin et al. (2013) in North Carolina this was about 0.9, and according to Halova (2015) in the Czech Republic this was 0.77. When considering these results/findings, it should be stated that in Poland the demand for ornamental plants is characterised by highly “elastic”/flexible consumers who clearly react by increasing their purchases alongside an increase in income of 1%. This is positive news for producers, as with economic development and the increasing affluence of Polish society, the demand for gardening products will clearly continue to rise. The significant influence of GDP levels on ornamental plant expenditure in the 1980’s in the USA (coefficient of elasticity 1.21) was demonstrated by Johanson and Jensen (1992).

The analysis of coefficients considering the elasticity of income upon spending on gardening products for different income levels shows that the demand for these items in Poland is elastic regardless of the level of income (Table 4). These were luxury goods across all income groups. The highest elasticity of the whole period analysed was characterized by expenses in the group of households with the lowest income per person. In subsequent groups, with a higher level of income, expenditure elasticity decreased. In these groups, the level of income allows satisfaction in demand for gardening products to a greater extent hence their response to further income growth will be lower. This phenomenon was also recorded by Halova (2015), but the results of her research show that the elasticity in income of household demand in the Czech Republic, for each income level was lower than in Poland. In 2010, the elasticity coefficient > 1 was only in the first six income groups, decreasing from 2.038 to 1.012, and in the next four groups it was < 1 decreasing from 0.935 to 0.603. In the group of most affluent people, income had a negligible impact upon expenditure on ornamental plants. In Poland, the income effect was significant in each income group, although in all groups there was a decline in the value of elasticity coefficients in subsequent years, with the largest changes taking place in the first group. Here, the elasticity coefficient decreased from 4.18 to 1.93. The smallest changes were recorded in: group V, where the rate decreased from 1.13 to 1.08. The latter allows us to conclude

that Polish society will continue to show a high demand for gardening products dedicated for the garden and home, for several years to come.

As far as ornamental plants are concerned, data from the last three years indicates that spending in Poland amounts to about 68% of the total spending on gardening products for the garden and home, which allows us to state that the above-mentioned behaviour can also refer to spending on ornamental plants. This is confirmed by analyses of the latter. The increase in spending on ornamental plants in the period 2013-2015 was clearly faster than income was. To tally up: where prices were constant from 2013, expenditure grew by 9.95% annually with an increase in income of 3.73% (Table 5). Faster growth of expenditure in comparison to income, applies to each quintile group, while the growth rate of both variables decreased along with the increase in the level of income. Moreover, income elasticity coefficients in each of the three years were > 1 , which means that ornamental plants belong to the “luxury goods” sector and the demand for them is elastic. At the same time, the share of expenditure on ornamental plants per total household expenses also increased. An increase in revenue of 1% was accompanied by an increase in the percentage share by 0.39-0.46%. Moreover, the increase in spending on ornamental plants along with the increase in income resulted from higher amounts paid for one-off purchases, and not from an increase in their frequency, as according to the research of Girapunthong and Word (2003), Palma and Word (2010) and Palma et al., (2011), the number of transactions decreases along with an increase in income.

Demand for ornamental plants in Poland was elastic regardless of their level of income, while this elasticity decreased as the groups with higher incomes were referred to (Table 6). In the first quintile group (I), the elasticity coefficients of demand, for ornamental plants oscillated around 2.0, while in group V they did not exceed 1.1. Thus, along with greater wealth, the reaction strength of spending upon ornamental plants becomes smaller and smaller. It should be noted, however, that in each case the coefficients of income elasticity of spending on ornamental plants was slightly lower than total spending on gardening products for the garden and home. The conclusion is that the increase in wealth results in a higher increases in expenses on garden products, which are not plants, than on the plants themselves. Jin et al., (2013) recorded a similar phenomenon in their research. Determined by them factors of income elasticity of expenditure on plants, flowerpots, chemicals and garden designs, were almost equal to 1, while expenses on outdoor living hardscapes was 1.27, and on landscape services 2.69.

But according to other studies, within the group of ornamental plants, the impact of income on demand varies depending on the type of plants and even the species. Abdelmagid et al., (1996) showed that the income had a negligible impact on expenditure on 7 species of annual plants, with the coefficient of elasticity being positive for 3 species and negative for 4. Yue and Hall (2010) demonstrated that people with lower income purchased traditional cut flowers more often, and those of higher income would buy specialty cut flowers. On the other hand, the research of Choi and Khachatryan (2013) shows that when income that the consumer can spend on ornamental plants rises, the consumer will purchase more ornamental foliage plants than annual plants or perennials. But, as emphasized by Rihn et al. (2015), income did not have a significant impact on the selection of the species of potted plant purchased.

Conclusions

The analyses show that demand for ornamental plants in Poland is growing systematically, but demand is still unmet and is strongly determined by the level of income. The higher the income, the higher the expenses on gardening products dedicated for the garden and home. This demand is characterised by high elasticity. Although the income elasticity coefficient dropped in 10 years from 1.3 to 1.1, consumers still clearly react with an increase in purchases when there is an increase in income of 1%. This phenomenon takes place regardless of the level of income. Even in the group of very affluent people, with the decrease of the elasticity coefficient along with the increase in the income level, it takes the values of > 1 . This is positive information for producers, as income levels will continue to rise over the coming years. This will therefore cause a strong reaction by the consumer, even those with high income levels, thus leading to an increase in the number of purchases of gardening products for the home and garden, including ornamental plants. At the same time, it seems that consumers in a situation where a growth in income increases their spending on non-plant-based products and, to a lesser extent, on ornamental plants. However, further and more detailed studies are necessary to confirm this conclusion. As far as the development of the florist sector and the support of producers in their marketing decisions are concerned, it is also important to undertake further detailed research on the income elasticity of demand for particular types of ornamental plants, even species or varieties. Moreover, the impact of this demand of non-economic factors such as gender, age, and place of residence should also be considered further.

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