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IMPLICATION OF DEMAND AND SUPPLY THEORY FOR GOVERNMENT POLICY IN UZBEKISTAN

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Abstract

This study examines the implications of demand and supply theory for government policy in Uzbekistan, with a focus on tax policy design and its socioeconomic consequences. The research uses theoretical as well as empirical studies from existing literature, exploring the impact of personal income tax, cigarette taxes, and carbon tax. It uses empirical data from household surveys conducted in Uzbekistan, estimating the elasticity of demand for beef, rice, and high-quality flour. The empirical study has reported inelastic, as well as elastic, demand for beef, rice, and high-quality flour, respectively. The paper concludes that elasticity has significant impacts on reaction patterns of people in terms of changes in price or income. Therefore, while framing taxation or price policies, governments must take these elasticity measures seriously.

Keywords: Tax policy, demand and supply theory, income elasticity, price elasticity, consumption

Introduction

The ways of reaching to the market equilibrium is one of the most frequently discussed topics in economics. The theory of "invisible hand" that assumes the unobservable market force to equalize automatically the demand and supply of goods in the market was introduced by Adam Smith (1776) in his book.

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However, fiscal or monetary policies will be carried out if the government is not satisfied with the market outcome. Governments should predict correctly the consequences of the implemented policies. Elasticity, which measures the sensitivity of the targeted indicator, is helpful while imposing any tax, price floor or cap, and other policies. In this report, I will provide some examples for tax policy and its consequences and conduct an empirical analysis of demand elasticity.

Literature review

An appropriate design of tax policy is useful for both recovery from the economic crisis and maintenance for growth. Main dilemma is that for short-term growth necessary change should be done on demand, whereas for a long-term stable growth increase in supply is required. The reduction in some taxes enhances the economic situation, while reducing certain types of taxes appear to slow down the economy (Arnold at al, 2011). Below three types of taxes – personal income tax, cigarette consumption tax and carbon tax – and their effects will be discussed.

Measuring the percentage change in taxable income against one percent marginal tax rates change is known as elasticity of taxable income (Giertz, 2009).

Taxable income is a main source of public deficit reduction that raises money in the form of tax revenues. However, income-generating opportunity will be lost if the government fails to calculate potential expenditures incurred by a tax increase. According to Robson (2005) individuals' reduced joy and their economic worse-off are not only consequences of high personal income taxes; they trigger remarkable disincentives, too. He states high elasticity rate for top-income individuals, whereas elasticity of those on lower incomes was relatively small. Robson brings evidence from the study by Lindsey (1987, sited in Robson, 2005) in which computed elasticity ranged from 1.05 to 2.75. Additionally, research conducted by Gruber and Saez (2002) indicates elasticity of 0.4 for taxable income in US; responsiveness of higher-income earners were greater (0.57) underlining a considerable economic cost per dollar of income raised for the most profitable taxpayers. Robson also argues that distorted

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economic incentives due to a high marginal tax rate further creates a significant deadweight loss. Therefore, governments can generate larger revenue by reducing marginal tax rate than the gain they can earn by putting higher tax. Because, indirect costs arose by extra tax can be greater than collected revenue. Governments impose custom and exercise taxes for two reasons: to get equity benefits and to protect public health. Evidence from the New Zealand provides a justification approved by the Ministry of Health that tobacco taxes reduced tobacco consumption in the population and collected some revenue (Wilson and Thomson, 2005). They used a time series data for the years 1988-1998 and their estimated overall price elasticity of demand ranged from 5% to 8% net decrease in demand to a 10% price rise. Yet, Farrelly at al. (2012) argue that although a price rise reduces daily consumption and smoking prevalence, at the same time raising cigarette excise tax will increases its regressivity; more of the tobacco burden will be passed to poorer smokers. They advise that along with a tax increase some additional programs, which is targeted to assist poor smokers to quit, should be implemented to the life. Furthermore, Sullivan and Dutkowsky (2012) in their state-level research stated a considerable tax incidence that buyers not only pay whole tax burden but also have to spend extra money because of the higher price increase than the amount of tax. According to empirical evidence they found, when the rate of the state cigarette tax rises by 1 US dollar, prices alter by approximately 1.10 US dollars. In short, cigarette consumption tax is effective tool to reduce health effect of cigarette and to generate income for government; however, state should care of poorer smokers since those taxes are over shifted onto consumers.

Carbon taxes are distinct from other consumption or exercise taxes due to the purpose of their implementation. Although, a number of exercise and sales taxes on fossil fuel consumption are present, main intention of those taxes are not reducing environmental externalities. Rivers and Schaufele (2012) took the case of carbon tax on gasoline for the investigation of environmental taxation. They compared a five-cent price increase of gasoline in the market and the same monetary increase in the carbon tax; the short-run reduction in the gasoline consumption measured in liters was 2.2% and 10.6%, respectively. Relying on the results, they claim that carbon dioxide taxes are more productive in reducing

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gasoline usage than tax-exclusive price rises. Additionally, the growth in prices of energy sources, electricity, home-heating fuels and other sources consuming fuel is also caused by carbon tax rise (Marron and Morris, 2016). Assuming that a levy on carbon tax is fifteen US dollars, calculations of Belsie (2018) indicates extra 325 US dollar expense of energy consumption for one-fifth of low-income families a year, which is one third of the fee paid by one-fifth of top-income groups. Comparing their average yearly earning, tax burden for poor families is four times higher. Thus, revenues generated by such a tax should be employed to minimize income or consumption taxes, finance public goods or decrease the budget deficit (Williams, 2016). This strategy lowers repressiveness of the tax allowing lower-income households to take a slightly higher burden than households at the bottom of the income distribution.

Methodology

Data provided is a survey, Living Standards Measurement, by World Bank that contains data from Uzbekistan for 2006. Due to the random missing observations, regression obtained using Stata 14 entails 1067 observations. The amount of observations is still large enough to proceed with data estimations.
Several new dummy variables have been changed or created to make the survey suit to the Stata format and to get rid of possible skewness of the variables. Since some variables may not have normal shape- to exemplify, wages and expenditures are usually skewed to the right –log form of them have been generated.
In the data, Uzbeks, females, and residents of cities amount about 81%, 22%, and 48% of observations, respectively. More than 77% of respondents are married and observations are equally divided to three regions. The number of children in a family is categorized into three corresponding to their age. (Table 1)

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Table 1. Details of the variables

Variable	Obs	Mean	Std. Dev.	Min	Max
wbeef	2,265	.0975576	.059071	.0059969	.4840336
wrice	2,569	.0515673	.033576	.0038393	.3576751
wflourhg	1,349	.1069704	.1216221	.0015604	.7358894
lnconsaggm~h	2,946	11.87815	.6068071	10.03368	14.09356
lnbeef_pu	2,265	7.649324	.2360915	4.60417	8.160519
lnrice_pu	2,569	6.192513	.1749796	3.911022	7.313221
lnflourhp_pu	1,349	5.831017	.2391509	4.198705	6.39693
uzbek	2,946	.8068568	.3948314	0	1
age	2,946	49.34827	14.28807	17	101
lnhsize	2,946	1.526014	.5215837	0	2.890372
tashkent	2,946	.3251867	.4685241	0	1
andijan	2,946	.3380855	.4731381	0	1
marit	2,946	.7752885	.417463	0	1
urban	2,946	.4755601	.4994871	0	1
female	2,946	.2219959	.415659	0	1
child0_4	2,946	.3740665	.6345402	0	4
child5_10	2,946	.6513917	.8189146	0	4
child11_16	2,946	.7471147	.9039811	0	5

Working Leser model is employed to perform demand function analysis using ordinary least squares (OLS). Taniguchi and Chern (2000) discussed Working Leser model, original version of which was presented by Working (1943) and Leser (1963), and derived supply and demand elasticity formulas. Moreover, Al-Habashneh and Al-Majali (2014) used modified form of Working Leser model and calculated the income elasticity of demand. The model measures the share of any type of food in a linear function, which is expressed as:

$$W_i=\alpha_o+\alpha_i \ln m_i+\sum\beta_j \ln p_j+\sum\gamma_k \ln H_k+ u_i$$

w_i- ratio of food i's price to total food expenditure,

m_i- income(monthly total expenditure is generated from total consumption aggregate yearly and taken as a proxy),

p_j- the price of the other food j included in the model.

H_k – the vector of other variables representing household characteristics. In the model there are 11 of them:

female- dummy variable (1=female, 0=male);

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uzbek- dummy (1=uzbek, 0=other nations);
tashkent and andijan- dummies expressing regions (Kashkadarya in the reference group);
lnage- log form of age;
lnhhsize- log of household size;
marit- dummy (1=married, 0=single, divorced, widowed);
urban- dummy (1=urban, 0=rural);
child0_4- number of children aged under 4;
child5_10- number of children between 5 and 10;
child11_16- number of children aged from 11 to 16.

Results

Extended version of the model is utilized to test each food in the research. Price of low-grade flour is excluded form regressions, because it reduces significantly number of observations and makes other variables insignificant. Below, OLS results for 3 types of food, namely beef, rice and flour with high-grade, is given:

Table 2. OLS results for 3 types of food, namely beef, rice and flour with high-grade

Variable	wbeef	wrice	wflourhg
lnconsaggm~h	-.00527844	-.01427615***	-.04605844***
lnbeef_pu	.04842063***	.00399545	.00128174
lnrice_pu	.00740761	.03303359***	.02650664*
lnflourhp_pu	.00006982	-.01209814*	-.11668603***
uzbek	.00234703	.00788671***	-.00077086
age	.00049702***	.00016383*	.00017376
lnhsize	.00237989	.00970591***	.0333126***
tashkent	.0128108	.00709663*	-.04294447***
andijan	.00163359	.01841896***	-.02143522**
marit	.00891673	.00335439	-.00103234
urban	.01754933**	-.00694982**	-.06887048***
female	-.00178994	.00083098	.00336414
child11_16	-.00527743*	-.00010898	.00280307
child5_10	-.00399529	2.026e-06	-.00032336
child0_4	-.00402887	-.00036634	-.00071337
_cons	-.2961235**	.02051169	1.1803928***
N	1067	1067	1067
r2	.1267958	.28701899	.56423997
r2_a	.11433332	.27684323	.55802075

legend: * p<.05; ** p<.01; *** p<.001

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Several variables are insignificant in all models, while some of them significant in certain models.

Holding all other things constant, Uzbeks have a higher share of rice in the expenditure (on average 0.8%) than other nations included in the model. On average, people spend more on beef and rice as they get older. Household size positively effects to the consumption of rice and flour high-grade.

Residents of Tashkent and Andijan consumes more rice (0.7% and 1.8%) and less flour high-grade (4.2% and 2.1%) than people living in Kashkadarya.

Ceterious paribus, discrepancy in share of beef, rice, and flour high-grade in the expenditure of people living in urban and rural areas is on average 1.8%, 0.7%, and 6.9%, respectively.

If the number of children aged from 11 to 16 increases by one, share of beef rises on average by 0.5%.

Calculation of elasticity estimators

Derived formulas (taken from papers mentioned above) for elasticity:

Own (i=j) and cross (i≠j) price elasticity of demand: $e_{ij} = -\delta_{ij}+(\beta_{ij}/w_i)$, where δ is 1 and zero for own and cross price elasticity, respectively;

Income elasticity of demand: $e_i=1+(\beta_i/w_i)$.

Elasticity is calculated for all prices and income, although some of them do not confirm the hypothesis.

Table 3. Results of income elasticity

Beef	**Calculation**	**Answer**
Own price elasticity	-1+(0.0484206/0.0975576)	-0.5037
Cross price elasticity(rice)	0.00740761/0.0975576	0.0759
Cross price elasticity(flour)	0.00006982 /0.0975576	0.0007
Income elasticity	1+(-0.00527844/0.0975576)	0.9459
Rice		
Own price elasticity	-1+(0.03303359/0.0515673)	-0.3594
Cross price elasticity(beef)	0.00399545/0.0515673	0.0775
Cross price elasticity(flour)	-0.01209814/0.0515673	-0.2346
Income elasticity	1+(-0.01427615/0.0515673)	0.7232
Flour with high-grade		
Own price elasticity	-1+(-0.11668603/0.1069704)	-2.0908
Cross price elasticity(beef)	0.00128174 /0.1069704	0.01198
Cross price elasticity(rice)	0.02650664/0.1069704	0.2478
Income elasticity	1+(-0.04605844/0.1069704)	0.5694

Own price elasticity

Having inverse relationship, own price elasticity assesses percentage change in demand, when price is raised by 1 per cent. In the regressions, demand for beef and rice is inelastic, meanwhile demand for high-grade flour is elastic. It means that demand for beef and rice drops by 0.5037% and 0.3594% respectively for a percent change in their prices and demand for high-grade flour's changes approximately twice as much as price change.

Cross price elasticity

Substitute goods replace one another. The results show that beef and rice are substitutes. One present price increase in rice or beef leads approximately 0.8% increase in the demand of the other.

The closer cross price elasticity to zero, the more independent the products are. Beef and high-grade flour can be considered as substitutes, but their relationship is very weak.

Complementary goods are usually consumed together, so they fill each other. If one goods price rises, demand for its complementary goods will decrease. Therefore, the sign of cross price elasticity for complementary commodities is negative.

Complementary effect can be one-sided. In over case, rice and high-grade flour is representing both substitute and complementary food. When flour's price increase, more rice will be demanded. However, an increase in the price of rice results consumers to switch to consuming flour.

Income elasticity

In all cases, income elasticity is less than one since β_i's are negative. Negative β_i's define the commodity to be necessity, while positive ones show that the food is luxury (Al-Habashneh and Al-Majali, 2014). Thus, under Working Leser, as people get richer the food becomes less luxury and people switch to more expensive food.

The theory, marginal propensity to consume (MPC) measures by how much consumption changes as a response to a change in income. When income increases the share of necessity decreases and the share of luxury grows.

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Although demand will increase for these three types of food, their share will decrease. Because consumers do not spend equally proportional to the price change, they will spend more of their money on more luxury food.

Conclusion

The report has discussed the importance of elasticity in both government policy and market equilibrium. Considering the analysis of literature review, government should be careful to increase taxes, even though their direct benefits are explicit. Otherwise, the economy may suffer from disincentives in labor supply (as a response for higher marginal income tax), welfare losses or an increase in disparity. In the second part, empirical results show food preferences of Uzbekistan residents as price of food or income changes. People are much more sensitive for the price change of flour with high-grade compared to beef and rice. Moreover, they are not perfect substitute for one another. Finally, income increases demand a little but the share of these products in total expenditure reduces.

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Appendix

Appendix 1

Correlation

	wbeef	wrice	wflourhg	lncons~h	lnbeef~u	lnrice~u	lnf~p_pu	uzbek	age	lnhsize	tashkent	andijan	marit	urban	female	child~16	child~10	child0_4
wbeef	1.0000																	
wrice	0.0154	1.0000																
wflourhg	-0.1678	0.3328	1.0000															
lnconsaggm~h	0.0356	-0.2762	-0.3666	1.0000														
lnbeef_pu	0.2421	-0.0445	-0.1398	0.0823	1.0000													
lnrice_pu	0.0205	0.1514	-0.0140	0.1449	0.0305	1.0000												
lnflourhp_pu	0.1765	-0.3249	-0.6425	0.3114	0.1724	0.0489	1.0000											
uzbek	-0.0741	0.2287	0.2182	0.0506	-0.0469	-0.0086	-0.2611	1.0000										
age	0.1127	0.0675	0.0303	-0.0245	-0.0040	-0.0214	-0.0291	-0.0864	1.0000									
lnhsize	-0.1142	0.2038	0.2913	0.2771	-0.1151	0.0025	-0.2784	0.4367	0.0598	1.0000								
tashkent	0.2280	-0.3654	-0.6361	0.3261	0.2163	-0.0448	0.7018	-0.3313	0.0225	-0.3251	1.0000							
andijan	-0.1348	0.4247	0.4139	-0.3647	-0.1296	0.0550	-0.4481	0.2525	0.0214	0.1793	-0.6848	1.0000						
marit	-0.0257	0.0737	0.0951	0.1324	-0.0706	-0.0064	-0.1159	0.1817	-0.3194	0.3298	-0.1428	0.0640	1.0000					
urban	0.2224	-0.3135	-0.6295	0.2362	0.1138	0.0565	0.6169	-0.2064	0.0382	-0.2815	0.6787	-0.4830	-0.1527	1.0000				
female	0.0385	-0.1130	-0.1442	-0.0869	0.0832	-0.0090	0.1901	-0.2508	0.2165	-0.3502	0.2051	-0.1374	-0.7498	0.1877	1.0000			
child11_16	-0.1144	0.1091	0.1859	0.0600	-0.0519	0.0031	-0.1753	0.2003	-0.0547	0.4052	-0.1939	0.1285	0.1055	-0.1613	-0.1232	1.0000		
child5_10	-0.1112	0.1107	0.1653	0.0170	-0.0843	0.0149	-0.1743	0.2114	-0.1121	0.4004	-0.2101	0.1179	0.1081	-0.1323	-0.1275	0.0516	1.0000	
child0_4	-0.0607	0.0452	0.0769	0.1384	-0.0296	0.0365	-0.0528	0.1492	-0.0502	0.3621	-0.1104	0.0207	0.1056	-0.1027	-0.1126	-0.1712	0.1423	1.0000

Appendix 2

Regression for beef

Source	SS	df	MS			
				Number of obs	=	1,067
				F(15, 1051)	=	10.17
Model	.470522044	15	.031368136	Prob > F	=	0.0000
Residual	3.24034262	1,051	.003083104	R-squared	=	0.1268
				Adj R-squared	=	0.1143
Total	3.71086466	1,066	.003481111	Root MSE	=	.05553

wbeef	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnconsaggmonth	-.0052784	.0037781	-1.40	0.163	-.012692	.0021351
lnbeef_pu	.0484206	.0069209	7.00	0.000	.0348403	.062001
lnrice_pu	.0074076	.0094485	0.78	0.433	-.0111324	.0259476
lnflourhp_pu	.0000698	.0108774	0.01	0.995	-.021274	.0214137
uzbek	.002347	.0045047	0.52	0.602	-.0064921	.0111862
age	.000497	.0001375	3.61	0.000	.0002272	.0007668
lnhsize	.0023799	.0055173	0.43	0.666	-.0084463	.0132061
tashkent	.0128108	.0065306	1.96	0.050	-3.75e-06	.0256254
andijan	.0016336	.0053013	0.31	0.758	-.0087688	.0120359
marit	.0089167	.0061594	1.45	0.148	-.0031694	.0210028
urban	.0175493	.0053738	3.27	0.001	.0070047	.028094
female	-.0017899	.005886	-0.30	0.761	-.0133396	.0097597
child11_16	-.0052774	.0023767	-2.22	0.027	-.009941	-.0006139
child5_10	-.0039953	.0025344	-1.58	0.115	-.0089684	.0009778
child0_4	-.0040289	.0032853	-1.23	0.220	-.0104753	.0024175
_cons	-.2961235	.0965325	-3.07	0.002	-.4855418	-.1067052

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Appendix 3

Regression for rice

Source	SS	df	MS			
				Number of obs	=	1,067
				F(15, 1051)	=	28.21
Model	.32227687	15	.021485125	Prob > F	=	0.0000
Residual	.800564778	1,051	.000761717	R-squared	=	0.2870
				Adj R-squared	=	0.2768
Total	1.12284165	1,066	.001053322	Root MSE	=	.0276

wrice	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnconsaggmonth	-.0142762	.0018779	-7.60	0.000	-.0179611	-.0105912
lnbeef_pu	.0039955	.00344	1.16	0.246	-.0027547	.0107456
lnrice_pu	.0330336	.0046964	7.03	0.000	.0238182	.0422489
lnflourhp_pu	-.0120981	.0054066	-2.24	0.025	-.0227072	-.0014891
uzbek	.0078867	.0022391	3.52	0.000	.0034932	.0122802
age	.0001638	.0000683	2.40	0.017	.0000297	.0002979
lnhsize	.0097059	.0027424	3.54	0.000	.0043247	.0150871
tashkent	.0070966	.0032461	2.19	0.029	.0007271	.0134661
andijan	.018419	.002635	6.99	0.000	.0132484	.0235895
marit	.0033544	.0030615	1.10	0.273	-.002653	.0093618
urban	-.0069498	.0026711	-2.60	0.009	-.0121911	-.0017086
female	.000831	.0029257	0.28	0.776	-.0049098	.0065718
child11_16	-.000109	.0011813	-0.09	0.927	-.002427	.002209
child5_10	2.03e-06	.0012597	0.00	0.999	-.0024699	.0024739
child0_4	-.0003663	.0016329	-0.22	0.823	-.0035705	.0028379
_cons	.0205117	.0479818	0.43	0.669	-.0736393	.1146627

Appendix 4

Regression for high-grade flour

Source	SS	df	MS			
				Number of obs	=	1,067
				F(15, 1051)	=	90.73
Model	7.13446879	15	.475631253	Prob > F	=	0.0000
Residual	5.50991872	1,051	.005242549	R-squared	=	0.5642
				Adj R-squared	=	0.5580
Total	12.6443875	1,066	.011861527	Root MSE	=	.07241

wflourhg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnconsaggmonth	-.0460584	.0049267	-9.35	0.000	-.0557257	-.0363912
lnbeef_pu	.0012817	.0090248	0.14	0.887	-.016427	.0189905
lnrice_pu	.0265066	.0123208	2.15	0.032	.0023305	.0506828
lnflourhp_pu	-.116686	.0141841	-8.23	0.000	-.1445184	-.0888537
uzbek	-.0007709	.0058741	-0.13	0.896	-.0122971	.0107554
age	.0001738	.0001793	0.97	0.333	-.0001781	.0005256
lnhsize	.0333126	.0071946	4.63	0.000	.0191952	.04743
tashkent	-.0429445	.0085159	-5.04	0.000	-.0596546	-.0262343
andijan	-.0214352	.0069129	-3.10	0.002	-.0349999	-.0078706
marit	-.0010323	.0080318	-0.13	0.898	-.0167926	.0147279
urban	-.0688705	.0070074	-9.83	0.000	-.0826207	-.0551203
female	.0033641	.0076753	0.44	0.661	-.0116966	.0184249
child11_16	.0028031	.0030992	0.90	0.366	-.0032782	.0088843
child5_10	-.0003234	.0033049	-0.10	0.922	-.0068083	.0061616
child0_4	-.0007134	.004284	-0.17	0.868	-.0091195	.0076927
_cons	1.180393	.1258782	9.38	0.000	.9333916	1.427394