ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis [**IBEB**]

Obesity in GCC Middle Eastern Countries: A panel study on the impact of economic deregulation of the fast-food industry on body mass index

Name student: **Pranaav Ganesh**

Student ID number: **473528**

Supervisor: **W.Q.Toh**

Second assessor: **Lisa Voois**

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Thank you all,
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Abstract

Over the past decade, obesity rates in the Middle East, particularly in Gulf Cooperation Council (GCC) countries have substantially increased. The average BMI of the population in this region is edging closer to 30 kg/m^2 which is progressing towards a major health crisis. This research paper is a panel study across 6 GCC countries which analyses how deregulation of the fast-food industry has led to an increase in the average BMI of the population. The main aim of the study is to find the impact of fast food consumption on the Average BMI of countries in this region. Empirical analysis is conducted using Fixed Effects Regression and Instrument Variables Regression with country fixed effects. The analysis shows that fast food consumption, measured through market size has a significant impact on Average BMI. The results also found that factors such as urbanization, foreign direct investment, HDI and Average Income impacted consumption levels.

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1. Introduction

Obesity has become a global epidemic with the World Health Organisation (WHO) estimating that each year at least 2.8 million people die from chronic diseases due to being obese or overweight. A person with a Body Mass Index (BMI) over 30 is considered Obese. The percentage of the world population that is obese is now greater than the percentage of the world population that is malnourished, which has put tremendous pressure on public healthcare systems (WHO, 2020).

Obesity is an issue that many western developed countries face, however rapid globalisation has exported this problem and led to an escalation in the number of persons obese in Asian developing countries. A paper by (Pingali, 2007) finds that a change in Eastern diets is accompanied by an increase in the consumption of western fast food. The growth of fast-food giants such as Burger King, KFC and McDonalds in Asia is a visible indicator of rapid change in diets and how domestic foodservice restaurants are replicating the same food products and operational procedures.

Fast food restaurants offer consumers a cheap, accessible and desirable product which has led to its increased consumption. George Ritzer, in his book Explorations in the Sociology of Consumption, explains that fast food restaurants provide an illusion of efficiency along with the entertainment part of dining (Ritzer, 2001).

A study by (Periera et al, 2005) published in The Lancet analyses the link between fast food consumption, weight gain and insulin resistance. Amongst all participants, they found a direct association between fast-food frequency and 15-year changes in bodyweight. This association was stronger particularly in less physically active participants, where a change in fast-food frequency to three times a week on average led to an increase of 3.8 kg. The frequent intake of Western-style fast food led to a 27 per cent increase in risk of developing type 2 diabetes mellitus and a 56 per cent chance of dying of coronary heart disease (Odegaard, 2015). Another study using interstate highway exits as an instrument variable found that a ten per cent increase in the number of fast-food restaurants increased BMI on average by .33 points (Dunn, 2008).

With developing Asian countries experiencing rapid economic growth, obesity has become a price to pay for the increased demand for Western fast-food products. In particular, the demand for these products in the Middle East has exponentially increased over the decade, accompanied by an obesity crisis in these countries.

A study by The Economist Intelligence Unit reported that disability-adjusted life-years (DALY's) as measured by a high body mass index, rose by 62 per cent across the Middle East (Chipman, 2016).

DALY's refer to the years of life lost due to ill health, disease and early death. The findings from this report are an accurate representation of the rise in the obesity rates in the GCC.

GCC countries have obesity rates close to 30 per cent of their population. 4 out of these countries are ranked as the top 25 countries with the highest obesity rates. *Table 1* derived from the WHO data repository, shows the most recent BMI approximations by the WHO for GCC countries, with Saudi Arabia estimated to have a 35 per cent obesity rate. The Middle East also serves as an interesting case to analyze fast food consumption as consumption is not merely driven by the low-cost of fast food. There are other reasons such as availability, cultural eating habits, use of technology that are discussed in (Musaiger, 2011).

Table 1: Prevalence of overweight amongst adults in GCG countries in 2016

Country	Prevalence of Overweight amongst Adults (BMI>30) (%)
Bahrain	28.7
Kuwait	37.0
Oman	27.0
Qatar	33.9
Saudi Arabia	35.0
United Arab Emirates	29.9

Addressing this issue, the following research question is proposed:

To what extent has the deregulation of the fast-food industry led to an increase in Average BMI in GCC countries?

There is an increase in the number of fast-food chains, particularly North American chains that are expanding to the GCC countries. The ease of doing business in GCC countries and unswerving demand for fast food has led to an increase in expansion of these restaurants. What this research question aims to answer, is the reasons for this growth, and how deregulation of the fast-food industry has played an important role in impacting the health of citizens in these countries.

Obesity in these regions is already causing the rise in hospitalizations related to diabetes, hypertension and heart diseases. It is estimated that obesity could cost the GCC countries $ 68 Billion in output lost and treatment costs by 2022 (Chipman, 2016). This research will help countries to identify factors that are affecting the rise in BMI. Identifying these factors will help governments

to use preventive health measures. Thereby, preventing obesity can reduce the burden on the healthcare system, ease healthcare costs and decrease the DALY's of its citizens. In addition to helping individual countries, this paper is also relevant for GCC countries to reform policies used to combat obesity. On one hand, it is relevant to understand the role fast food plays in shaping the modern middle eastern diet. On the other hand, it emphasizes the need for regulation by the government to solve the issue of obesity in the GCC countries.

The paper is structured as follows. First, the theoretical framework is discussed, highlighting the previous important research papers in the area of the research topic. This section also formulates a hypothesis that sets the base to answer the research question. The paper then proceeds to discuss the data and methodology used. This paper uses secondary data. In this section, the various variables used in the analysis, types of methods used and differences in methodologic approach are discussed. Next, the results of the analysis are discussed in detail. Finally, the last section of the paper deals with the discussion and conclusion. Here, using the results, the main research question will be answered. The limitations and scope of future research are also discussed here.

2. Theoretical framework

With the following research question at hand, this section aims to discuss the main research question in more detail. The research question itself can be broken down into two sub-questions. The first sub-question is related to the causal relationship between fast food consumption and BMI. The second sub-question is related to the impact of deregulation on the fast-food industry in GCC countries. The discussion of important theory and concepts related to these sub-questions are supported by previous research. This is followed by constructing a hypothesis which sets the main base for the paper.

2.1 Causal relationship between Fast food consumption and BMI

Fast food consumption can be measured at an individual level and a population-wide level. It is fundamentally important to understand the relationship at an individual level to establish this relationship at a population-wide level. An increase in fast food consumption leads to an increase in consumption of calories that impacts BMI. (Schroder et.al, 2007) conducted a study to test the association of fast food consumption on dietary intake and BMI amongst adults. Over a year, participants dietary intake and energy consumption were measured. The results showed that fast-food consumption resulted in total higher energy intake. Participants who reported eating fast food more than once a week had a 2.5 MJ/d higher energy intake. These participants also showed a

significantly higher risk of not meeting the minimum dietary requirements and an increase in their BMI.

This research paper aims to study fast-food consumption at a population-wide level, suggesting how the change in total fast food-consumption of a country has affected its Average BMI of the population. Fast food consumption is measured in this paper in terms of fast food market size i.e. the total sales (€) from the fast-food industry. From the figure below, the causal relationship between fast-food market size and BMI is explained through the various causal inferences.

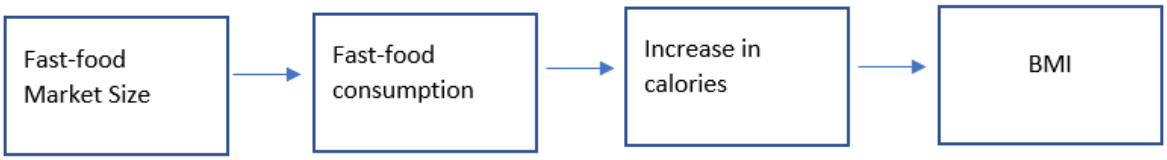

Figure (1): Explanation of the causal relationship between fast-food market size and BMI

The research question analyses the impact of the fast-food industry on Average BMI in GCC countries. It is important to use BMI as it is an accurate predictor of the health of the population. The research question is mainly inspired by (De Vogli et al., 2014) which explores the influence of market deregulation of fast food consumption on BMI. Their paper looks at fast-food consumption being a major determinant of population increases in BMI in 25 high-income OECD countries.

Their findings suggested that a 1 per cent increase in fast food transactions increased BMI by 3.3 per cent in high-income countries. The paper also suggested that market deregulation contributed to the obesity epidemic, by facilitating the greater spread of fast food. A similar research question is proposed in this paper; however, the focus is on GCC countries in Middle East Asia.

The focus of this research paper is concentrated in one region i.e. the Middle East. Using the same region helps to improve the external validity of the results from the analysis as GCC countries have similar socio-economic characteristics. Thus, while retaining the research methods used in (De Vogli et al, 2014), this paper uses unique regional factors that may have an impact on the way fast food consumption and availability affects BMI in the Middle East.

2.2. Deregulation of the fast-food industry in GCC Countries

There is very little research concerning fast-food restaurants in the Middle East. Considering obesity in the Middle East has been a rising problem only in the last decade, there is little research concerning the role of fast-food restaurants in generating this problem. Thus, it is important to

explore economic, social and demographic factors that have contributed to the problem in this region.

Globalisation has imminently led to the rise of the fast-food industry, with fast-food chains operating at a large scale internationally. Free trade and foreign direct investment have led to the deregulation of the fast-food industry in Middle East Asia. In particular, GCC countries have become a very important market due to the large urban population, ease of doing business and economically liberal government policies.

Since the start of the new millennium, foreign direct investment (FDI) has played an important role in the economic growth with a rise in Gross Domestic Product (GDP). Countries in these regions have used the process of privatisation to attract foreign direct investment. The rise in GDP has propelled further FDI, which has led to liberal policies adopted by the government to increase privatisation and the ease of doing business (Iriani, 2007).

(Lawson et al,. 2016) uses fixed effects to find the impact of economic freedom on BMI. Their findings suggest much of the impact of economic freedom on BMI is linked to economic development. There is very little evidence in their paper that economic freedom is associated with slightly higher BMI's, particularly in developing countries. It is also interesting that the findings additionally report that increase in government health spending has no significant impact on reducing obesity levels.

Using previous research and information in GCC Countries, the following hypothesis will be tested in this research paper.

2.3 Hypothesis 1

Hypothesis 1

Increase in fast food consumption has led to an increase in the Average BMI in GCC countries.

The hypothesis tests the relationship between the Fast food Market Size and Average BMI in GCC countries. This hypothesis is tested by analyzing consumer data on the total market size of the fast-food industry across 6 countries in the GCC. The null hypothesis (H_0) states that fast food consumption has a positive effect on the Average BMI. The alternative hypothesis (H_a) states that fast food consumption does not have a positive effect on Average BMI.

3. Data and Methodology

3.1 Data sources

Panel data used for the paper is derived from multiple sources. The data for BMI contains the Average Adult BMI Data which is available for all GCC countries from 2006 to 2016. This data was derived from the *NCD Risk Factor Collaboration*.

Data for the fast-food market size was obtained primarily from two sources. Data for Saudi Arabia and UAE were obtained from *Passport* which is Euromonitor International's market research database. For other countries (Bahrain, Kuwait, Oman and Qatar), data was obtained from *Al-Masah Capital's yearly reports* on food consumption in GCC Countries. The Al-Masah Capital reports were only available from 2012 to 2016.

Data for the main instrument variable used in the paper is obtained from the Wall Street Journal which calculates various factors that affect the economic freedom in a country. Out of these factors, the Index of Economic Freedom (WSJ) was selected.

The dataset used for this paper also contains data related to GDP per capita (adjusted for PPP), Human Development Index, population size, urban population(%) and FDI. The source for this data is mainly from international organizations like the WHO or The World Bank. Data for Average Income and Gini index is obtained from ResourceWatch, an open data visualization platform hosted by the World Resources Institute.

3.2 Specification of variables

Average BMI is the main dependent variable tested in this study. It represents the Average Body Mass Index of the population per year. It is measured in kg/m^2. BMI over 25 is considered Overweight. BMI over 30 kg/m^2 is considered Obese.

Fast food consumption is the main independent variable tested in this paper. It represents the total fast-food market size of a country per year, it is measured in terms of Euros(€). Market size constitutes the total volume of sales generated from products each year. In this case, products refer to the various food and beverage commodities offered by fast-food restaurants.

Population size refers to the total adult population (18-64) residing in each country. *Urban population* is the percentage of the population living in urban areas. Expressed in percentage terms, with 100% meaning the entire population residing in cities. *HDI* or Human Development Index is a composite score ranging from 0 to 100, calculating life expectancy, education and per capita income

used to rank a country's human development. *Gini Index* is the measure of economic inequality on a scale of 0 to 100, with 0 being complete equality and 100 being complete inequality.

GDP per Capita (PPP) and *Average Income* are economic indicators with a difference in derivation. *GDP per Capita (PPP)* is a measure of the market value of goods and services per person within a country per year. *Average Income* is a measure of the mean income of the population per year. *FDI* was measured as the percentage of net FDI inflows as a share of GDP per year. FDI inflows are negative due to disinvestment from capital investors. Expressed in fractional terms, it ranges from -1 to 1.

Finally, the *WSJ Index* is a composite index measuring the level of economic freedom of a country within a given year. On a scale of 0 to 1, with 0 meaning no economic freedom and 100 meaning complete economic freedom. The index ranks countries based on the following 12 factors: Property Rights, Judicial Effectiveness, Government integrity, Tax burden, Government spending, Fiscal Health, Business Freedom, Labour Freedom, Monetary Freedom, Trade Freedom, Investment Freedom and Financial Freedom.

3.3 Descriptive statistics

The descriptive statistics for the various outcome variables are found below in *Table 1*. Note that not all variables have the same amount of observations. This is due to the limited data available for some countries. The dataset is restricted to 38 observations for the analysis as data for the fast-food market size is not available from 2006-2011 for 4 countries (Bahrain, Kuwait, Oman and Qatar). Fast food market size, Average Income and GDP are measured in terms of Euros (€).

Table 2: Descriptive statistics of main variables tested in the regression analysis

Variable	Obs	Mean	Std.Dev.	Min	Max
BMI (overall)	61	27.713	1.527	24.86	29.762
BMI (Male)	61	27.344	1.329	24.896	29.194
BMI (Female)	61	28.495	1.953	24.792	30.661
Population	61	6.02 mln	6.73 mln	0.847 mln	23.2 mln
Fast food market size (€)	38	3310 mln	3040 mln	1760 mln	10400 mln
Urban Population	61	.884	.085	.735	1
HDI	61	.818	.025	.764	.863
FDI	38	.02427	.02354	-.0315	.085
WSJ Index score	61	.675	.045	.606	.77
GDP per capita (PPP) (€)	61	60279.45	25402.77	25655.43	125000

Gini Index	61	.708	.044	.61	.781
Average Income (€)	61	67222.1	24022.44	35602.72	126000

3.4 Descriptive graphs

Supporting the descriptive statistics, the figures below show the trends of the important variables used in the analysis over time. Figure 2 shows the increasing trend in Average BMI over the reported period. Figure 3 shows the logarithmic values of fast-food consumption over the years. Figure 4 shows the changes in HDI. Figure 5 shows the FDI inflows over the years measured as a percentage of GDP. Figure 6 shows the change in the WSJ Index for all 6 countries, also indicating the degree of economic deregulation in a country.

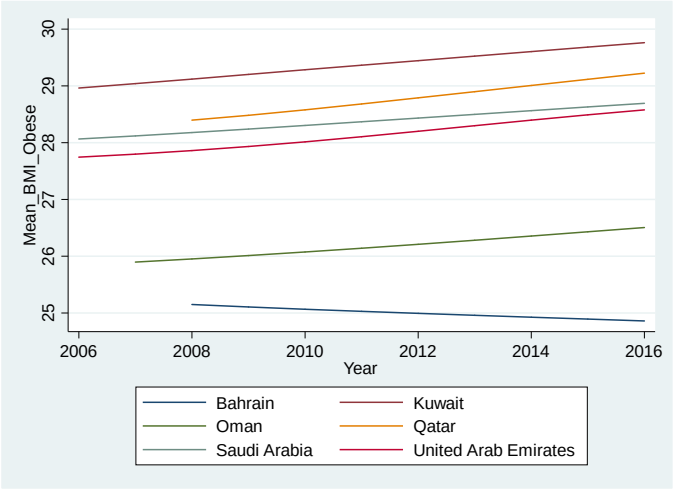

Figure 2: Average BMI from 2006 to 2016 across 6 GCC countries

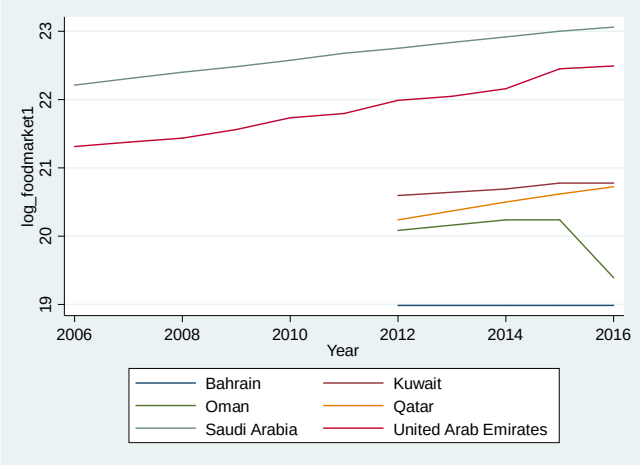

Figure 3: Log of Fast Food Consumption across 6 GCC countries

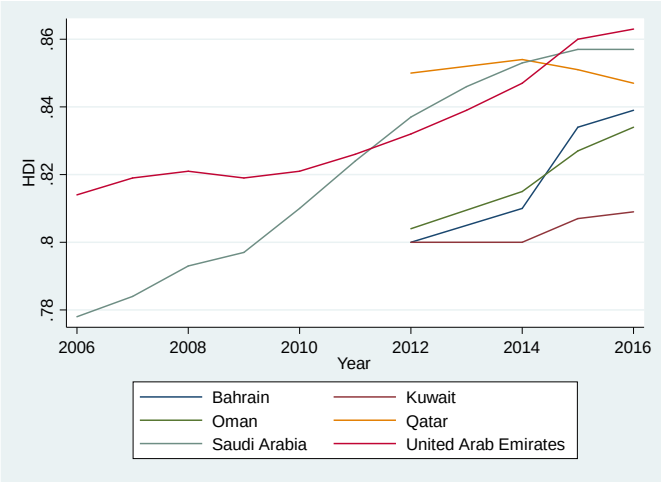

Figure 4:Panel overlay of Human Development Index of GCC countries

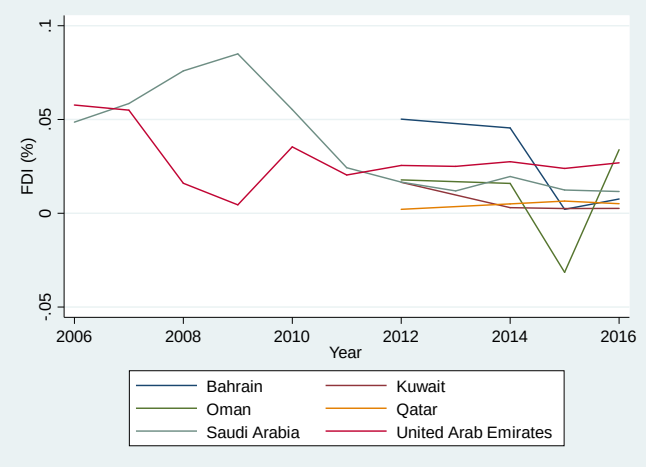

Figure 5: FDI Inflows as a share of GDP(%) across 6 GCC countries

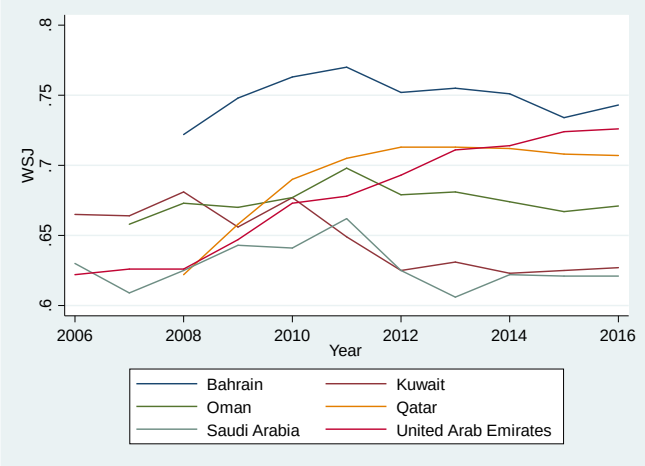

Figure : Instrument (WSJ Index) from 2006 to 2016 across 6 GCC countries

3.5 Methods used for analysis

This paper will use an empirical approach as the aim is to analyse secondary data. The empirical approaches used are econometric analysis of panel data of GCC countries from 2006 to 2016. The analysis will be done using STATA. Three empirical methods are used throughout the analysis. These are Ordinary Least Squares (OLS) regression, Fixed Effects Regression and Instrument Variables Regression (with country fixed effects).

3.6 Baseline OLS and Fixed Effects regression

The first part of the analysis uses Pooled OLS regression and Fixed Effects regression to analyze panel data. To choose between Fixed effects and Random Effects, a Hausman test will be run in the Results section with the null hypothesis being that Random effects is the preferred model. The alternative hypothesis is that Fixed effects is the preferred model. Hence the first section runs a baseline OLS regression on the data which is compared with the results from the fixed effects regression.

With the available data, the main strategy is to find the impact of fast food consumption on BMI. A wide variety of control variables will be used to predict the exogenous variation derived from fast food consumption. For both the OLS regression and Fixed Effects regression models, the coefficient of fast food consumption is monitored with the addition and removal of various control variables. Fixed effects helps in removing much of the endogeneity concerns faced with while performing OLS. All time-invariant variables that may impact the dependent variable are captured in the Fixed Effects Model. The regression equations for OLS and Fixed Effects regression are formed the following way:

OLS Regression

$$\mathbf{Y_i = \beta_0 + \beta_1 X_1 + e_i} \quad (1)$$

$$\mathbf{Y_i = \beta_0 + \beta_1 X_1 + \beta_n X_{n+} e_i} \quad (2)$$

Fixed Effects Regression

$$\mathbf{Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + v_{it+} u_{it}} \quad (3)$$

$$\mathbf{Y_{it} = \beta_0 + \beta_1 X_{it} + \ldots + \beta_n X_{it} + \alpha_{i+} v_{it+} u_{it}} \quad (4)$$

Where *i* is the country and *t* is the year. Y_{it} is the dependent variable, denoting Average BMI. β_0 is the constant term used in the regressions. β_1 is the regression coefficient of the log of fast-food consumption. β_2 is the coefficient for the log of the total population in the country. β_3 is the

coefficient for the log of Average Income. β_4 is the coefficient for HDI. B_5 is the coefficient for FDI. B_6 is the coefficient for the log of GDP per capita (PPP). B_7 is the coefficient for the Urban population. B_7 is the coefficient for the Gini index. e_i is the error term from the OLS Regression. α_i is the country fixed effects which captures the time-invariant characteristics. v_{it} is the error term occurring from country-specific heterogeneity. u_{it} is the measurement error from fixed effects.

Since the sample size is restricted, only a limited number of variables will be included in each tested model. The aim is to find how additional control variables impact the coefficient of the main independent variable that is tested in the analysis. All the above coefficients will be tested to arrive at the best possible model. The final regression models shown in the results will be the most important and relevant models to accompany the main research question. Certain independent variables are logarithmically transformed to ensure normal distribution.

3.7 Instrument Variables with country fixed effects

The next part of the analysis is concerned using instrument variables as an analysis tool. Instrument variables is a beneficial analysis method as it helps with the time-varying omitted variable bias that still may have existed when using a fixed-effects model. Country fixed effects (α_i) are included to capture time-invariant country characteristics that may be related to BMI. A two-stage least squares regression will be used with the Index of Economic freedom score (WSJ) as an instrument variable. For WSJ to be a strong instrument, it should satisfy three assumptions.

Firstly, there should be a strong first stage i.e. WSJ should have a strong causal effect on the variable of interest. This can be verified if the F-Statistic is greater than 10. Secondly, WSJ should be uncorrelated with the error term (independence assumption). This assumption cannot be formally tested, however, if WSJ is uncorrelated with any observable characteristics, we can falsify this assumption. Finally, WSJ should not have a direct effect on the outcome variable (BMI). This assumption cannot be formally tested. By fulfilling these assumptions, using it as the main analysis method to answer the research question is imperative. The following equations can be used in the IV Regression analysis.

Instrument Variables

$$T_{it} = \delta + \gamma_1 Z_{it} + \beta_2 X_{it} + \ldots + \beta_n X_{it} + \alpha_i + v_{it} \quad \textbf{(1st stage)}$$

$$Y_{it} = \theta + \tau_1 Z_{it} + \beta_2 X_{it} + \ldots + \beta_n X_{it} + \alpha_i + \eta_{it} \quad \textbf{(reduced form)}$$

$$Y_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 X_{it} \ldots + \beta_n X_{it} + \alpha_i + u_{it} \quad \textbf{(2nd stage)}$$

$$Y_{it} = \beta_0 + \beta_1(\delta + \gamma_1 Z_{it} + \beta_2 X_{it} + \ldots + \beta_n X_{it} + \alpha_i + v_{it}) + \beta_2 X_{it} \ldots + \beta_n X_{it} + \alpha_i + u_{it} \quad \textbf{(expanded)}$$

Where *i* is the country and *t* is the year. T denotes the variable of interest i.e. Log of Fast food consumption. δ, θ and β_0 are the constant terms for the respective equations. Z refers to the instrument (WSJ Index) that is used in the IV regression. Country fixed effects (α_i) are included to capture time-invariant country characteristics that may be related to BMI.

Once again, the coefficients that are tested in this section are the same that are tested in the previous section. The emphasis is on the model explaining the causal effect of fast food consumption the best way possible. Hence, no attention would be paid to the R^2 of the model, as the analysis is not concerned with the best fitting model. Rather, the F-statistic, value of coefficients and reducing the error term as much as possible will be the main focus in finding the causal impact.

4. Results

The results section is divided into two sets. The first section is concerned with OLS Regression and Fixed Effects Regression. The second section is concerned with Instrument Variable regression analysis, using the Index of Economic Freedom as an instrument to calculate the causal effect of fast food consumption on BMI.

4.1 Set A

A Hausman test was used to decide between choosing Fixed or Random Effects as the preferred method. The results from table 3 show that p- value is lesser than 0.05. Hence, we can reject the null hypothesis that random effects is the preferred model and accept the alternative hypothesis that fixed effects is the preferred model.

Table 3: Results from Hausman test

	Coef.
Chi-square test value	25.595
P-value	0.0001

Several models were tested in the analysis. The main aim of this comparison is to find the causal effect of fast food consumption on the Average BMI of the Population. Additionally, we test for factors that have been previously mentioned in similar research papers. The most important and appropriate models are shown in *Table 4.*

For Pooled OLS Regression, Log of fast food consumption in Model (1) and Model (2) had a significant impact on Average BMI. In these models, on average a 1 percentage point increase in Log Fast food increased Average BMI by 0.5-0.6 kg/m^2.

The inclusion of FDI in model (3) resulted in Log Fast food being insignificant. This is the model with the lowest F-Statistic. The change in urban population was a significant factor in all regressions. HDI remained significant only in Model (2). Population size was only significant in Model (3) when the Gini Index was removed from the model. Gini Index was found significant in models (1) and (2). Controlling for all other explanatory variables, an increase in one point in the Gini Index increased Average BMI by 0.116 kg/m^2. From pooling the data, it can be said that income inequality leads to an increase in BMI. However, since this OLS model does not account for country fixed effects there is omitted variable bias that cannot be accounted for.

The results from the FE models (4) and (5) show that Fast food consumption has a significant effect on the explanatory variable Average BMI. Both models tested Population size, change in urban population and Log Income. Model (4) included HDI whereas Model(5) included FDI. On average, a

1% increase in fast food consumption increases BMI by 0.234 kg/m^2. HDI was significant in all models that did not include FDI. Model (4) found that on average, a point increase in the HDI score decreased Average BMI 0.0253 kg/m^2 controlling for the other variables. This meant that lesser developed countries faced a higher risk of an increase in average BMI.

Average Income, Urban Population and Population size were found to have a significant impact on BMI. In both OLS and FE, Average Income proved to be a better economic indicator than GDP per capita. GDP per capita was insignificant in all models and did not explain the variation in BMI. Since income is directly linked to fast-food consumption and GDP per capita is not, the variation in fast food consumption is better explain through Average Income.

FDI Inflows were also tested in various regression models in the analysis. Considering FDI is a substantial result of deregulation, its coefficient had a weak relationship with the log of fast food consumption and BMI. FDI was significant in all our models, at a 95% confidence interval level. These results are somewhat in line (De Vogli et al, 2014) where the relationship of FDI and the explanatory variable was weakened. The coefficients of FDI in the FE models were more accurate and explained the variation better than the OLS models. Gini index was found to be insignificant in all FE models. This implies that at a country level, income inequality has no significant role in determining how fast food impacts BMI.

Since Fixed effects removes time-invariant unobservable characteristics through taking first differences, it explains the causal effect of Fast food consumption better than OLS regression. Time invariant characteristics such as education, weather, etc are captured in the FE models. The difference in the models is a result of including country-specific fixed effects while analyzing data. Variables such as Income and Population size that are country-specific are significant in FE compared to Pooled OLS regression where it is insignificant. Model (5) provides the best estimate with the highest F-statistic of 121.6.

Table 4: Comparison of OLS and Fixed Effects regression of Fast Food consumption on Average BMI

	(1)	(2)	(3)	(4)	(5)
Average BMI	OLS	OLS	OLS	FE	FE

Log Fastfood	0.517*	0.600*	0.189	0.234***	0.235***
	(0.012)	(0.012)	(0.487)	(0.000)	(0.000)
Log Income	0.466	0.359	2.003***	1.158***	0.862***
	(0.257)	(0.410)	(0.001)	(0.000)	(0.000)
Urban population	0.119***	0.122***	0.0889***	0.05828**	0.0380*
	(0.000)	(0.000)	(0.001)	(0.006)	(0.044)
Log population	0.307	0.217	0.800*	1.484***	1.322***
	(0.233)	(0.443)	(0.025)	(0.000)	(0.000)
Gini Index	0.116***	0.116***			
	(0.000)	(0.000)			
HDI		-0.0204		-0.0253*	
		(0.456)		(0.024)	
FDI			-0.0765*		0.0183**
			(0.043)		(0.001)
cons	-11.61***	-9.397*	-18.16***	-15.87*	-10.48*
	(0.000)	(0.026)	(0.000)	(0.013)	(0.013)
N	38	38	38	38	38
F	126.3	103.9	66.62	98.66	121.6
df_m	5	6	5	10	10
df_r	32	31	32	27	27

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

4.2 Set B

Another applicable test for this dataset is instrumental variable (IV) regression. Considering there still might exist time-invariant unobservable characteristics that may explain the variation in BMI, IV Regression with country fixed effects was conducted on the sample. Before proceeding with the IV regression analysis, it is important to test the strength of the instrument used, along with the other assumptions made previously.

Testing the first assumption, the relationship between Fast food consumption and WSJ is presented in (*Table 5)*. The results from the test show that WSJ has a direct positive effect on Fast food. The F-stat is greater than 10 which also is an effective indicator that the WSJ index is a strong instrument. To test reverse causality, a regression was run with the terms interchanged using lags. The results found that there was no reverse causality (*not visible*).

Table 5: Direct relationship between Fast food consumption and the instrument (WSJ)

	(1)	(2)	(3)
Log Fastfood			

WSJ	0.0879**	0.0771*	0.0563**
	(0.004)	(0.044)	(0.001)
WSJ t-1	-0.088	-0.133	
	(0.724)	(0.597)	
WSJ t+1		1.434	
		(0.489)	
Log Income			1.632
			(0.042)
Urban Population			-0.145**
			(0.018)
Log population			2.275**
			(0.011)
HDI			.0223
			(0.569)
FDI			-.0245
			(0.261)
_cons	16.04***	16.52***	-24.97
	(0.000)	(0.000)	(0.191)
N	38	37	38
F	9.820	4.762	17.05
df_m	7	8	11
df_r	30	28	26

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

The independence assumption is tested, to find whether WSJ Index is correlated with any other variables that affect Average *BMI*. This assumption cannot be completely verified, since the error term is unobserved. The assumption however is checked informally by seeing if WSJ is correlated with the observable variables. It was found that WSJ was uncorrelated with all observable characteristics except population size (not shown in results). Hence, it is highly unlikely that it is correlated with unobservable variables. We can falsify this assumption; however, it cannot be completely proven as there might exist a certain degree of endogeneity.

Since the third assumption cannot be formally tested, the only evidence is from previous research papers testing the relationship. As found previously, greater economic freedom is not linked to a direct increase in BMI (Lawson et al., 2016). Their research finds that economic freedom is linked to rapid development, a consequence of which BMI's are on the rise. Thus, Economic freedom may not directly affect the Average BMI. They also find that included country fixed effects siphons the relationship between economic freedom and BMI.

From the results in *table 7,* on average, for a 1 per cent increase in fast food consumption, BMI increases by 0.269 kg/m^2 (Model 4). Fast-food consumption has a significant effect on the Average BMI of GCC Countries. For IV2SLS, two models are estimated. Model (4) runs the regression including HDI, excluding FDI. Model (5) runs the regression including FDI and excluding FDI.

Similar to the FE Regression in Set A, including both HDI and FDI together in the regression models do not explain the variation in fast food consumption. It is quite likely that countries with higher foreign direct investment have higher levels of HDI. (Lenhert et al., 2013) ran a panel study on the mediating effect of inward FDI inflows on the HDI Index. Their results found 23 per cent of the total effect of FDI on HDI being mediated. Nevertheless, HDI and FDI are important to include as explanatory variables in this study and explained the variation in fast food consumption.

Finally, since the methods of this paper were similar to (De Vogli et al., 2014), it is appropriate to compare the findings of this paper with their results. In their models, on average a 1 per cent increase in fast food transactions increases BMI by 0.03-0.04 kg/m2. The results from the regression in this paper, show that that number is almost ten times higher in the Gulf Countries. Due to the selected sample, the size of the coefficients is much larger. FDI And Openness to trade were significant and did not have a great impact on BMI in their paper. A similar result was gathered in this paper as FDI was significant in many of the models, however, its weak relationship did not help in explaining the increase in fast food consumption.

Table 6: Comparison of OLS, FE and IV2SLS regressions

Average BMI	(1) OLS	(2) FE	(3) IV2SLS	(4) IV2SLS
Log Fastfood	0.407	0.234***	0.269**	0.209*
	(0.209)	(0.000)	(0.008)	(0.017)
Log Income	1.470*	1.158***	1.083***	0.917***
	(0.012)	(0.000)	(0.001)	(0.000)
Urban Population	0.113***	0.0583**	0.0632**	0.0344
	(0.000)	(0.006)	(0.006)	(0.098)
Log Population	0.571	1.484***	1.362**	1.413***
	(0.152)	(0.000)	(0.002)	(0.000)
HDI	-0.0167	-0.0253*	-0.0253*	
	(0.666)	(0.024)	(0.017)	
FDI				0.0183***
				(0.000)
_cons	-14.24*	-15.87*	-14.32*	-11.63*
	(0.016)	(0.013)	(0.043)	(0.023)
N	38	38	38	38
F	58.09	98.66		
df_m	5	10	11	11
df_r	32	27		

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

4.3 Revisiting Hypothesis 1

To recapitulate the first hypothesis stated that an increase in fast food consumption led to an increase in the average BMI. In all Fixed Effects and IV models, Log of fast food consumption has significantly impacted Average BMI. From the results in Set (A) and Set (B), it can be realised that on average an increase in 1 per cent in fast food consumption leads to an increase in BMI of around 0.2-0.3 kg/m^2. Inferring from *table 4* and *table 6*, the variation of the change in fast food consumption can be explained due to the change in other independent variables such as population, income, urbanisation, human development and foreign investment. Thus, there is enough evidence to not reject the null hypothesis that fast food consumption has a positive impact on the average BMI.

5 Discussion and Conclusion

5.1 Discussion

The main research question this paper aimed to answer was: *To what extent has the deregulation of the fast-food industry led to an increase in the Average BMI in GCC countries?* After the discussion of previous research and conducting empirical analysis, it can be concluded that deregulation has contributed to the Increase in Average BMI brought about by the consumption of fast food.

The main discussion from the analysis of the data pertains to the obvious result that fast food is impacting the health of the citizens of these countries at an alarming rate. There is clearly a strong link in trends between fast food consumption and the Average BMI, as found by the analysis. What is concerning is the rate at which consumption patterns have grown over years. The analysis itself, is reflective of the rising obesity rates in the Middle East, as we see that Average BMI's are close to 30 kg/m^2 or even above in countries like Kuwait. Comparing that to the global average of BMI which is 24.75 kg/m^2, there is a serious cause for concern that is developing in this region.

This paper has played a role in explaining this problem, with findings suggesting that deregulation, urbanization and increase in income have played a significant role in the increase of fast food consumption. It is relevant to see the role economic growth, development and foreign investment has played easing the restrictions of doing business in this region. This region has been significantly impacted by the inflow of FDI which has led to an increase in the Average GDP of these countries. Capital inflows have not only led to the rise of fast food restaurants but have also increased the Average Income, which in turn has accelerated this problem.

The ease of doing business in this region is propelling the entry of new fast food chains, which is giving consumers more options. With a fast food restaurant around every corner, the convenience of ordering in or take ways has also dramatically increased in this region. Fast food has taken over local

foods, with not only the big chains competing, but also local fast food chains that are increasing in number. Franchising is also interconnected with the concept of fast food, with fast food chains opening new franchises in multiple locations in these countries (Balkhy, 2017).

Comparing the Middle East with other regions witnessing tremendous growth in fast-food consumption, several unique factors are multiplying the impact on the Average BMI in the Middle East. The change in lifestyle in these countries has played a role along with the consumption of fast food. The lack of physical exercise is one major contributor to the problem, as are there is not enough awareness about the benefits of exercise to the human body. This is also due to the high temperatures in the region, which makes it difficult to engage in physical activity. Finally, an increase in ownership of cars and use of technology are factors that are enabling people to become less active, which is further escalating the problem (Savodnik, 2012).

5.2 Limitations and suggestions for further research

There were many limitations faced while conducting research. The main limitation was the sample size of the dataset. Due to the lack of data and previous research in the Middle East, data availability proved to be a big issue in this research. The second limitation, related to the first limitation, was the limited use of controls to test fast-food consumption. Due to the small sample, only relevant control variables were tested in the regressions. Controls such as openness to trade, physical inactivity, etc could not be tested in this research.

There were limitations faced with the methods and approaches used to analyse the data. For the fixed effects models, there could still be time-variant unobserved variables that could not be controlled for. The main limitation of Instrument variables is that we are not certain that the second and third assumption of the method can be truly satisfied. There could be a correlation between the instrument and the error term. In our analysis, the second assumption was falsified as the instrument was uncorrelated with the observable variables. There could also a correlation between the instrument and the main dependent variable. Our analysis was not able to prove that there does not exist any correlation.

Finally, previous literature has suggested that having a small sample size while performing IV regressions could lead to a large standard error if the instrument is weak. Considering that the sample size was small, the OLS and FE estimates could be more accurate than the IV estimates. Thus, the suggestion for future research would be to retain the IV and FE methods, but to use a large sample size, preferably more than 100 observations. For similar research papers, testing the

relationship between FDI Inflows and the change in fast food outlets could also be beneficial to explain the growth in fast chains due to deregulation.

5.3 Conclusion

In conclusion, the results of this research paper could be useful to understand the magnitude and role fast food consumption in the Middle East. It can be particularly useful for governments in regulating the increase in fast food consumption. The obesity epidemic is becoming an increasingly dangerous, and one of the key action's government can take is to increase the awareness and prevention of Obesity. This paper serves as a reminder that there is much action needed to be taken in this region, to have a significant impact on the population.

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