How Media Opinion Influences Imports in the US

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Abstract: *Does public opinion influence US imports? Do countries with a good reputation export more to the US? And vice versa? Based on an extended trade gravity model, this paper employs news data from the GDELT database and US monthly import data to create an indicator of the influence of public opinion to examine the effects of US domestic public opinion on imports. Our research findings suggest that: (i) US public opinion influences US imports. Specifically, (ii) when public opinion turned negative during 2013-2017, it exerted a significantly negative effect on US imports; when public opinion was favorable during 2008-2012, it exerted an insignificantly positive effect on US imports. (iii) According to the pulse response function and variance decomposition, negative public opinion exerted a more significant and more lasting effect on US imports compared with positive public opinion. (iv) It can be discovered after further decomposing such effects on product categories that significant product heterogeneity exists in the public opinion effects on US imports: Complex and differentiated products are more influenced by negative public opinion while homogeneous and intermediate products are more influenced by positive public opinion.*

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1. Introduction

Soft power, especially the power to sway public opinion, is a key aspect of international economic and political competition in today's world. In recent years, some countries have attempted to influence public opinion as a new non-tariff barrier for trade protectionism. The sub-prime mortgage crisis that erupted in 2008 dealt a heavy blow to the US economy. The domestic economic downturn and rising unemployment rate topped public concerns, giving rise to protectionist sentiments. US trade protectionists often blamed trade for domestic employment woes, attributing the loss of US manufacturing jobs to external factors such as imports and service outsourcing (Acemoglu, 2016; Autor, 2013). Change in US public opinion is reflected in US press coverage about major trading partners.

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[1] Sentiment index refers to the sentiment expressed in an article. Based on the natural language processing technology, this index assigns value to the tone of an article when mentioning a certain event. The range of value is from -100 (extremely negative) to +100 (extremely positive). Common values are in the range between -5 and 5.

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During the period from 2008 to 2012 , the US press coverage sentiment index for various countries was above +5.[1] This value dived below +2 in 2013-2014 and below -1 in 2015-2017. The downward trend is still continuing. Negative US press coverage about the same countries increased steadily. Coincidentally, growth in total US trade deficits slowed. In 2008, US trade deficits totaled 88.197 billion US dollars. By 2016, this amount dropped to 79.775 billion US dollars. In 2017, US trade deficits rose again to reach 86.233 billion US dollars, but still stayed below the 2008 level. We suspect that a close correlation exists between public opinion and US imports that curbed US trade deficit growth.

Hence, this paper investigates how US public opinion about major trading partners influences US imports.

2. Literature Review and Research Hypotheses

Based on the US media environment and theories on public communication and consumer attitudes, this paper puts forth three hypotheses for explorative research on the effects of public opinion on US imports.

2.1 Effects of Public Opinion on US Imports

According to consumption psychologist Daniel Carson's consumption attitude theory, perception and emotional experience comprise the bulk of consumer attitude and influence consumer decision and behavior (Ajzen, 1991). As a key source of perception and emotional experience, public opinion has an important influence on consumers' daily life (Mccombs and Reynolds, 2002). Studies suggest that public opinion affects the audiences' emotional experience of a particular thing, including their preference and emotional reaction to the object or event (Bounie, 2005; Stimson, 1991; Gonzales-Bailon *et al*., 2012). Studies on the relationship between public opinion and value perception found that public opinion influences consumers' perception of the product's value. With asymmetrical access to information, the press in one country tends to exaggerate negative news about other countries, and trade-related negative news about product quality and company reputation in other countries constitutes an implicit trade barrier that inflicts serious harm on the exporting country (Ren, 2013). Such a negative public opinion will lock a country's product quality reputation at a certain level, and such a value perception will stay for a long time (Tang and Li, 2011; Rajul and Lawrence, 2013; Cage and Rouzet, 2015). Hence, we put forth the following hypothesis:

Hypothesis 1: Change in the public opinion environment has a significant effect on US imports.

2.2 Influence of Positive and Negative Public Opinion

While positive public opinion elicits positive consumer attitudes, negative public opinion leads to resistance and resentment (Herr and Kardes, 1991). Normally, negative public opinion is the key factor in consumers' purchase decisions and sways consumer decisions more than positive public opinion does (Lee and Thadani, 2009). According to Kroloff and George (1988), the influence of negative public opinion is fourfold that of positive public opinion. Positive public opinion about a country is beneficial to its international image and fosters a more favorable environment for its tourism, trade, labor market, and political relations (Anholt, 2011). For a multinational firm, public opinion plays a vital role in shaping its international image, and positive international public opinion helps boost the firm's overseas sales, brand reputation, and customer loyalty (Till and Nowak, 2000; Brown and Dacin, 1997). Negative press coverage will give rise to negative opinions among the US public about relevant countries and firms (Kiousis and Wu, 2015). Hence, we put forth the following hypothesis:

Hypothesis 2: Positive and negative public opinion will exert different effects on US imports.

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2.3 Time Distance: the Influence of Public Opinion

Existing studies consider that the influence of public opinion will diminish and ultimately vanish over time. Yet with different emotional shocks to the public, positive and negative public opinions are remembered for different durations of time. Normally, negative reports attract more consumer attention and create greater emotional shocks to the audience, and negative impressions are harder to forget (Susan, 1980). Unfavorable opinions may cause a company to lose its market, and the impact on exports is extensive and lasting (Xu and Xu, 2008). Hence, the following hypothesis is proposed:

Hypothesis 3: Based on time distance, positive and negative opinions influence US imports for different durations of time.

3. Typified Facts of Public Opinion

3.1 Definition and Classification of Public Opinion

Public opinion can be understood as social perception and opinion about a specific matter. While some public opinions are formed spontaneously, others are created by the mainstream media. Public opinion is formed through unconscious communication and exists as a critical force. On the contrary, media opinion is manipulated by "agenda-setting" resulting from interaction among various interest groups and compound forces. With changing forms of media, the monopoly of news media has led to a transition of public opinion[2] from a critical force to media opinion[3] as a manipulative force that wields a huge - and sometimes hidden - influence in people's daily life (Guo, 2010).

3.2 US Press Coverage about Other Countries

In this paper, all public opinion data is presented in the form of media opinion based on the world's largest open database of political events: the Global Database of Events, Language and Tone (GDELT)[4], which marks metadata for every news report including detailed information such as subject matter, place, personal name, and type of event. As its biggest advantage, the GDELT database marks the "sentiment index" for each news article with natural language processing technology, i.e. the average tone ("AvgTone") of the press coverage. This index is derived from the average score of articles when mentioning the event ranging from -100 (extremely negative) to +100 (extremely positive); common values range between -5 and 5.

As can be seen from Table 1, the US press has been the most critical of countries that sequentially are China, Russia, Israel, Canada, the UK, Mexico, and Japan. In terms of the number of public opinion reports, there has been a steady increase in the news reports about 30 countries, and China is ranked first in terms of the number of reports. Over the past decade, there has been a sharp decline in the AvgTone of US media about these countries, which dropped from +5.48 in 2008 to -1.22 in 2017. From 2015 to 2017, the AvgTone's value remained negative, i.e. negative press coverage prevailed. Public opinion in this stage is defined as "critical". Russia was the most criticized country then in the US media[5], and China came third.

3.3 Trend in US Public Opinion

As can be seen from Figure 1, there has been a steady increase in the US in the media coverage of

[2] The main public opinion function of critical force is to separate political rights from social power.

[3] The display and manipulation of public opinion find expression in the balance and conflict of interests among state's public authorities, social organizations, and the general public.

[4] GDELT data source: https://www.gdeltproject.org/data.html.

[5] In this paper, criticism is defined as disapproval and attacks expressed in words or remarks. Public opinion in the third stage is defined as criticism since the AvgTone of news articles is below zero, i.e. the US press coverage on most countries was negative during this period.

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Table 1: US News Coverage about Major Trade Partners

Stage	Stage I: 2008-2012		Stage II: 2013-2014		Stage III: 2015-2017	
Country	Annual average number of news articles	Average tone	Annual average number of news articles	Average tone	Annual average number of news articles	Average tone
China	14,914	5.65	28,220	2.37	32,444	-1.23
Russia	8,623	5.41	23,865	2.14	34,462	-2.65
Israel	11,912	5.75	21,607	2.66	23,481	-1.84
Canada	9,461	5.5	16,474	2.42	25,599	-0.93
UK	6,890	5.6	14,314	2.56	18,761	-1.22
France	5,508	5.63	10,934	2.71	19,633	-1.24
Japan	6,622	5.52	11,840	2.51	17,416	-0.96
Mexico	6,893	4.79	10,415	2.23	18,422	-2.09
Australia	6,405	5.51	9,636	2.58	13,527	-0.79
Germany	4,543	5.54	8,978	2.5	13,696	-1.22
Spain	13,959	5.35	5,308	2.56	7,487	-1.21
Italy	3,284	5.44	6,117	2.58	9,197	-0.69
Ireland	2,362	5.75	5,698	2.48	6,695	-0.56
The Philippines	2,147	5.46	5,844	2.53	6,653	-1.44
Vietnam	1,434	5.6	3,945	2.74	7,258	-1.15
India	1,672	5.3	3,334	2.55	4,478	-0.61
Saudi Arabia	1,144	5.79	3,090	2.48	4,838	-2.53
Switzerland	1,566	5.76	2,798	2.64	3,678	-0.62
Brazil	1,991	4.99	2,806	2.4	3,205	-1.1
South Korea	1,214	5.44	2,717	2.28	3,390	-0.96
The Netherlands	1,507	5.27	2,429	2.32	3,361	-0.78
Malaysia	742	5.78	4,047	2.37	2,112	-1.55
Belgium	1,161	5.09	1,981	2.37	3,205	-1.7
Indonesia	1,781	5.4	1,970	2.29	2,307	-1.84
Columbia	1,740	5.34	1,338	2.76	2,030	-1.45
Thailand	968	5.27	1,618	2.38	1,768	-1.27
Sweden	631	5.67	1,224	2.85	1,595	-0.79
Singapore	588	5.88	1,001	2.59	1,771	-0.01
Austria	441	5.5	787	2.66	1,181	-0.98
Average	4,210	5.48	7,391	2.5	10,126	-1.22

Source: Calculated with Excel sheet based on original data from GDELT database.

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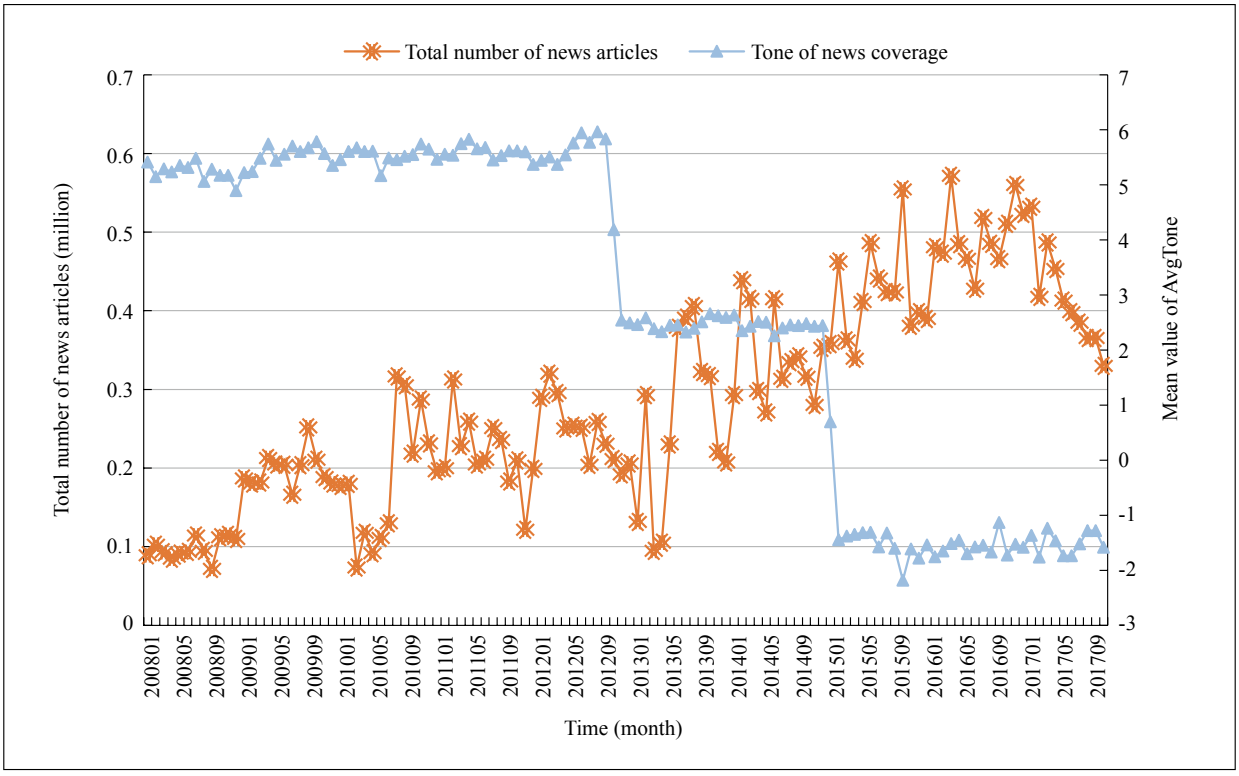

Figure 1: Change in US Domestic Media Opinion

Source: GDELT database

major US trading partners, but the AvgTone value has been decreasing over the years, which decrease can be divided into three stages. In Stage I (2008-2012), the mean value of the AvgTone stayed at a fairly high level of above +5. In Stage II (2013-2014), the AvgTone sharply decreased to around +2 amid an increase in negative coverage. In Stage III (2015-2017), this index fell to about -1. Overall, the AvgTone was reduced sharply by 6.7 points in just a decade as public opinion turned from favorable to unfavorable.

4. Model Specification and Data Explanation

4.1 Creation of an Econometric Model

Using the gravity model, this paper examines how public opinion influenced US imports. Tinbergen (1962) and Poyhonen (1963) trade gravity model, which involves trade promotion and trade barriers, is extended by introducing such variables as two-way trade cost, exchange rate and trade openness. Our model is specified as follows:

$$\ln import_{it}=\alpha_0+\alpha_1 lnpop+X'_{it}\tau+\lambda_i+u_t+\xi_{it} \quad (1)$$

In the above model, i is the country that exports to the US, t is the year, α_0 is the constant term, and λ_i, u_t, ξ_{it} denote the individual effect on country, time effect and residual term, respectively. Variable $\ln import_{it}$ denotes the logarithm of US imports from country i at time t. Public opinion (*pop*) as the key variable denotes various public opinion information released in the US about country i at time t, which

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includes the gathering of all positive and negative public opinions of various sectors and categories. α_1 is the correlation coefficient of the public opinion variable for estimating the relationship between public opinion and US imports.

Vector X'_{it} is a group of covariants, including the primary explanatory variables in the gravity model: US GDP (ln*GDPa*), GDP of US trading partners (ln*GDP*) and two-way trade cost (ln*cost*), which is used to replace the two-way distance variable that does not change with time. Based on the original gravity model, we include other explanatory variables such as exchange rate (ln*rate*) and the exporting country's trade openness (ln*openness*) to extend the original gravity model.

4.2 Data Sources and Explanations

The US's 30 major import sourcing countries are selected for data. To avoid sample selection bias, we select sample countries sequentially from developed countries, moderately developed countries, developing countries and less developed countries.[6] Our 30 sample countries including China, Japan and Mexico have accounted for more than 90% of US total imports over the years. The duration of our study includes 120 months from 2008 to 2017, which allows us to examine how US media opinion influenced US imports. Aside from media opinion, other variables include GDP, the exchange rate data from the World Bank's World Development Indicators (WDI) database, and US two-way trade monthly data from the U.S. Census Bureau Foreign Trade Statistics.[7] To eliminate the impact of outliers, we winsorized continuous variables at 1% and 99% percentiles. The definitions and creation methods of key variables employed in the econometric methods are as follows:

(i) Public opinion index (*pop*). In this paper, we created a new index for measuring the influence of public opinion, which employs the product of monthly average tone and total monthly number of media reports. On both dimensions, the influence of public opinion is synthesized by a multiplicative model:

Public opinion index (*pop*)= Monthly average tone of public opinion (*AvgTone*)*Total monthly media reports (*num*)[8].

(ii) Negative news index (*bni*) and the total number of mentions (*Atotal*). Referencing Carlos D. Ramirez *et al*. (2009), we create the negative news index (*bni*) measured by the ratio of the total number of negative news reports to the total number of monthly news reports (*num*). The ratio is between -1 and 1. A higher ratio means a larger number of negative news reports, and vice versa. The total number of mentions (*Atotal*) is from the GDELT database and can be used to evaluate the importance of an event: A more widely discussed event is more likely to have great significance. This field will be updated over time to reflect the follow-up coverage of an event.

(iii) Other variables: Two-way trade cost (*cost*) is calculated referencing Qian and Liang (2008) equation for two-way trade cost; trade dependence (*openness*) is calculated referencing Xu (2003).

See Table 2 for the definitions of the explanatory variables, theoretically forecasted impact on dependent variables (expected sign) and explanations.

4.3 Statistical Description of Variables

Table 2 is variable definitions and statistical descriptions. In the interest of statistical deduction, we have conducted logarithmic transformation for all variables. As can be seen from the table, the average value of the public opinion variable (ln*pop*) is 2.051 and the standard error is 0.613, which is the largest

[6] Sample countries are selected based on criteria from the *Overall Level of World Modernization 2014*. Developed countries include Sweden, Singapore, the Netherlands, Japan, Switzerland, Belgium, and others; moderately developed countries include Spain, Italy, Saudi Arabia, Russia, and others; developing countries include China, Colombia, Mexico and others; less developed countries include India and the Laos.

[7] Website of the U.S. Census Bureau Foreign Trade Statistics:www.census.gov/foreign-trade

[8] Equation for calculating actual media influence: lnpop=ln(5+poz)+ln(pom). Since the tone of media opinion can be negative or positive, we have added 2 to all the media tone indexes before taking logarithms.

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Table 2: Variable Definitions and Statistical Descriptions

Variable	Symbol	Definition	Mean	Standard error	Min.	Max.	Sample size
Key explanatory variables							
Media opinion	ln*pop*	As an implicit trade barrier, media opinion has a certain influence on US trade volume. Specifically, positive media information exerts a positive effect on consumer attitudes while negative media information feeds repulsion and aversion.	2.051	0.613	-4.104	3.836	3480
Import volume	ln*Import*	US import volume	3.436	0.448	2.628	4.683	3480
Consumer goods	ln*Import_xf*	Import of consumer goods	8.168	1.761	12.065	1.624	300
Capital goods	ln*Import_zb*	Import of capital goods	8.436	1.808	12.441	2.532	300
Intermediate goods	ln*Import_md*	Import of intermediate goods	9.84	1.082	12.66	7.634	300
Primary goods	ln*Import_cj*	The import of primary goods	8.343	1.332	11.987	5.427	300
Industrial finished goods	ln*Import_gy*	Import of industrial finished goods	10.053	1.276	13.154	6.289	300
Control variables							
Country GDP (million USD)	ln*GDP*	Reflects a country's export supply capacity. Higher value suggests greater two-way trade flows. Hence, the coefficient of this term is expected to be positive.	4.889	0.487	3.847	6.569	3480
US GDP (million USD)	ln*GDPa*	US economist and statistician Kuznets (S Kuznets) found that as national income (GDP) reduces, total imports as a share of national income will rise. Hence, we assume that US GDP is negatively correlated with total US imports.	6.139	0.0433	6.077	6.218	3480
Two-way trade cost	ln*cost*	In this paper, two-way trade cost refers to all costs for acquiring the product except for production cost, including costs of transportation, policy barrier, information cost and sales cost. It is negatively correlated with US imports.	-0.326	0.079	-0.616	-0.108	3480
Exchange rate (direct quotation method)	ln*rate*	US dollar appreciation is adverse for US exports and conducive to US imports. The coefficient of this term, therefore, should be positive.	1.951	0.219	0.782	2.108	3480
Trade dependence of exporting country	ln*openness*	Normally, the more dependent on trade and exporting country it is, the higher the level of its exports will become.	-0.241	0.276	-0.819	0.557	3480
Average monthly media tone	ln*AvgTone*	In different stages, the US media may cover a country in a positive or negative way. The average tone is calculated with the following equation: ln*AvgTone*=ln(5+*AvgTone*)	0.855	0.217	-1.495	1.123	3480
Total monthly number of media reports	ln*num*	The larger the number of media reports in the month, the greater audience attention is attracted to such media opinion, and the more consumer behavior is influenced.	2.447	0.536	0.699	3.81	3480
Percentage of negative reports in the US	Ln*bni*	As instrumental variable 1	0.067	0.094	0	0.301	3480
Total number of mentions	ln*Atotal*	As instrumental variable 2	3.314	0.657	1.255	5.185	3480

Source: Calculated with Stata.

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among all variables. This indicates great variation in the US media coverage on major trading nations. The mean value of the total monthly media reports (ln*num*) is 2.447, and the standard error is 0.536, which means that the number of US news reports on different countries varies considerably. The monthly average tone of US media reports (ln*AvgTone*) is 2.447 with a standard error of 0.885, which is much smaller than the total monthly number of media reports (ln*num*). In creating the public opinion variable, change in the total number of monthly media reports exerts the primary effect on the public opinion variable.

5. Econometric Regression Results and Explanations

5.1 Public Opinion's Effect on US Imports

This section examines how US public opinion influenced US imports, i.e. to test whether hypothesis 1 and hypothesis 2 hold true. First, we should determine whether US public opinion influences US imports, i.e. whether significant economic significance exists in the relationship between public opinion and international trade (verify hypothesis 1). Next, public opinion is divided into positive opinion and negative opinion to verify their separate effects on US imports (verify hypothesis 2).

5.1.1 Benchmark regression analysis

Based on the trade gravity model, we employ OLS method to test the relationship between US imports and US domestic public opinion (ln*pop*). In Column (1) of Table 3, we control for three variables, including the exporting country's GDP, the importing country's GDP and two-way distance. Since distance does not change over time, we replace two-way distance with two-way trade cost (*cost*). Compared with two-way distance, two-way trade cost may better reflect two-way trade growth. To avoid spurious regression arising from the time trend term, we also control for the time fixed effect. Given the economic differences among countries, we further control for the country fixed effect. As can be seen from Column (1) of Table 3, the coefficient of public opinion is significantly negative, reflecting a reverse relationship between US public opinion index and US imports, i.e. a rise in public opinion index will induce a reduction in US imports. Given that US imports are also influenced by a multitude of other factors, we further include control variables such as exchange rate (*rate*) and trade openness (*openness*). Compared with Column (1), the pubic opinion coefficient in Column (2) is slightly smaller, but the result still reflects a significantly negative impact of public opinion on US imports.

We adopt a fixed-effect panel regression model in Columns (3) through (6). To address the endogeneity problem that may exist in the international gravity model, we control for the fixed effect of country group and the fixed effect of time to overcome the potential problem of missing variables and the impact of variables on trade flow that is related to two-way trade but does not change with time (Egger and Pfaffermayr, 2003). In Columns (3) through (6) in Table 3, we carry out the test with current-phase public opinion, one-phase-lag public opinion, two-phase-lag public opinion and three-phase-lag public opinion. Results show that public opinion had a limited impact on US imports. With one phase lag, however, public opinion's adverse impact on US imports started to appear. With the increase of lag phase, the impact also increases. That is to say, public opinion's impact on US trade import is subject to a lag time, which becomes more significant in a later phase than in an earlier phase.

5.1.2 Analysis of media opinion influence during different periods of time

Grouped regression is conducted for different periods of time with results shown in Table 4. In the sample group of positive public opinion (Columns (1)-(4)), public opinion's impact on US import is insignificant. In the sample group of negative public opinion, public opinion's impact on US import with one-phase lag becomes significant. With more lag phases, the significance gradually increases

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Table 3: Benchmark Estimation of Public Opinion's Trade Effect

Explained variable: US imports	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE	(6) FE
GDP of other countries	0.339***	0.298***	0.166***	0.166***	0.167***	0.162***
	(14.08)	(12.87)	(6.52)	(6.47)	(6.40)	(6.16)
US GDP	-0.504***	-0.831***	-1.698***	-1.704***	-1.652***	-1.626***
	(-11.89)	(-19.17)	(-6.15)	(-6.05)	(-5.82)	(-5.69)
Two-way trade cost	-1.204***	-0.264**	0.0743	0.0589	0.0516	0.0367
	(-12.11)	(-2.53)	(0.71)	(0.55)	(0.48)	(0.34)
Exchange rate		0.448***	0.460***	0.464***	0.466***	0.465***
		(9.60)	(10.03)	(10.07)	(10.07)	(10.03)
Trade dependence		0.523***	0.396***	0.402***	0.407***	0.409***
		(18.57)	(13.57)	(13.50)	(13.48)	(13.36)
Public opinion	-0.0205***	-0.0138**	-0.00688			
	(-3.51)	(-2.49)	(-1.17)			
L. Public opinion				-0.0105*		
				(-1.77)		
L2. Public opinion					-0.0129**	
					(-2.18)	
L3. Public opinion						-0.0197***
						(-3.36)
Constant term	4.547***	6.289***	12.38***	12.41***	12.10***	11.97***
	(13.50)	(19.10)	(7.17)	(7.05)	(6.82)	(6.71)
Fixed effect of year	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	No	No	Yes	Yes	Yes	Yes
Sample size	3,480	3,480	3,480	3,451	3,422	3,393
R^2	0.227	0.313	0.350	0.352	0.354	0.357

Notes: Columns (1) and (2) are clustered at the country level; numbers in parentheses are robust standard errors; *p<0.10, **p<0.05 and ***p<0.01; L1, L2 and L3 denote one-phase lag, two-phase lag and three-phase lag, respectively.

with the coefficient. Compared with the test result of total samples, however, the coefficient of samples dominated by negative public opinion is slightly larger. For instance, the coefficient is -0.011vs-0.015 with one-phase lag, -0.013vs-0.017 with two-phase lag, and -0.020vs-0.029 with three-phase lag. As can be learned from the above analysis, Hypothesis 2 holds true. Negative and positive media opinion influence US import in different ways. While negative opinion effectively curbed US imports, positive opinion exerted an insignificant effect on US imports.

5.1.3 Robustness analysis

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Table 4: Public Opinion's Effect on US Imports during Different Periods of Time

	2008~2012 (Positive opinion)				2013~2017 (Negative opinion)			
Explained variable: US imports	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE	(8) FE
Public opinion	0.00220				-0.00574			
	(0.30)				(-0.71)			
L. Public opinion		0.000713				-0.0147*		
		(0.10)				(-1.82)		
L2. Public opinion			-0.00291				-0.0166**	
			(-0.38)				(-2.11)	
L3. Public opinion				-0.00453				-0.0291***
				(-0.60)				(-3.74)
Constant term	12.18***	12.08***	12.10***	12.27***	9.291***	9.666***	9.403***	8.700***
	(6.79)	(6.49)	(6.40)	(6.39)	(3.86)	(4.01)	(3.93)	(3.65)
Fixed effect of year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	1,740	1,711	1,682	1,653	1,740	1,740	1,740	1,740
R^2	0.471	0.477	0.484	0.490	0.028	0.030	0.031	0.036

Notes: Numbers in parentheses are robust standard errors; *p<0.10, **p<0.05 and ***p<0.01 denote significance level; L1, L2 and L3 denote one-phase, two-phase and three-phase lags, respectively.

While the above analysis has verified Hypothesis 1 and Hypothesis 2, the following problems may still exist: first, missing key explanatory variables; second, reverse causality. An increase in US imports from a certain country will also influence US public opinion about the country (Pierce and Schott, 2014). All the above problems may cause endogeneity in the public opinion variable. Referencing Ramirez and Rong (2012), we use "share of negative opinion" and "total mentions of the event" as the instrumental variable of public opinion. The above indicators have high correlation coefficients with the public opinion index, i.e. 0.8 and 0.3. Without directly influencing US imports as the explained variable, these indicators meet the exogenous condition as an instrumental variable. We use these two instrumental variables on the basis of the fixed-effect panel regression, i.e. "*bni*" and "*Atotal*" serve as instrumental variables of public opinion "*pop*", and the estimation results are shown in Columns (1) through (4) of Table 5. Results suggest a significant increase in the absolute value of public opinion's coefficient and a significant effect of public opinion on US imports in the current phase. That is to say, both OLS and FE models have underestimated the negative impact of public opinion on US imports. To determine the necessity of instrumental variable, we conduct an endogeneity test on public opinion (lnpop) as a variable suspected of endogeneity. As can be learned from Table 5, the test results reject the null hypothesis that the variable is an exogenous variable, making it necessary for us to perform a robustness test by means of instrumental variable regression. In addition, we employ Kleibergen-Paap rk LM statistic for an econometric test of whether unincluded instrumental variables are correlated with endogenous variables, and the test results reject the null hypothesis of "insufficient instrumental variable identification". As shown in the above statistic, our use of an instrumental variable is reasonable, and the

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Table 5: Robustness Test

	FE-IV	FE-IV	FE-IV	FE-IV	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explained variable	US imports	US imports	US imports	US imports	US trade deficit	US trade deficit	US trade deficit	US trade deficit
Public opinion	-0.0363***				-0.0207***			
	(-3.21)				(-2.88)			
L. Public opinion		-0.0337***				-0.0296***		
		(-2.94)				(-4.10)		
L2. Public opinion			-0.0301***				-0.0280***	
			(-2.58)				(-3.88)	
L3. Public opinion				-0.0256**				-0.0338***
				(-2.17)				(-4.75)
Constant term	6.721***	6.813***	6.974***	7.047***	6.948***	8.197***	7.565***	6.498***
	(20.70)	(20.77)	(21.10)	(21.12)	(3.31)	(3.83)	(3.51)	(3.00)
Fixed effect of year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	3,480	3,451	3,422	3,393	3,480	3,451	3,422	3,393
R^2					0.036	0.038	0.038	0.041
F					11.48	11.96	11.85	12.65

Notes: Numbers in parentheses are robust standard errors; *p<0.10, **p<0.05 and ***p<0.01 denote significance level; L1, L2 and L3 denote one-phase, two-phase and three-phase lags, respectively. The statistic of endogeneity test in Columns (1) through (4) is 42.13 and the P value is 9.7e-11, i.e. the null hypothesis that the "variable is an exogenous variable" is significantly rejected, indicating the necessity to perform a robustness analysis with IV. In addition, Cragg-Donald Wald F statistic is 634.10, and the 10% critical value of Stock-Yogo weak identification test is 29.18, which significantly rejects the null hypothesis of "weak instrumental variable." P-value of Sargan test is 0.129. These test results indicate the instrumental variable's effectiveness.

regression results are reliable.

Lastly, we re-test the influence of public opinion by replacing the explained variable. With US two-way trade deficits with other countries as the proxy variable for US imports, we re-estimate the regression model in Columns (3) - (6) of Table 1 (see Columns (5) - (8) in Table 5). According to the estimation results, the coefficients of the public opinion variable in the current phase and with phase lags are significantly negative. Compared with the regression results with US imports as the dependent variable, the absolute value of the coefficient is somewhat smaller, but the level of significance remains constant. There is no substantive change in other variables, which verifies the robustness of estimation results.

In summary, we only consider the missing variables of the US import model, the endogeneity of public opinion, and the replacement of explanatory variables in Table 5. All the results suggest that public opinion is negatively correlated with US imports and trade deficits, i.e., an increase in negative US public opinion about certain countries may effectively reduce US imports from such countries and cut US trade deficits.

5.2 Lasting Effect of Public Opinion's Influence

In this section, we separately verify Hypothesis 3: the lasting effect and duration of the impact of

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public opinion on US imports after having verified Hypothesis1 and Hypothesis 2. We create a panel vector autoregression model and employ the pulse response function and the forecast variance to decompose the duration of the effects of public opinion, including positive public opinion and negative public opinion, on US imports.

5.2.1 Pulse response function

In this paper, the pulse response function is mainly intended to test the impact on US imports when one unit of public opinion shock is entered into the US import model. Figure 2 provides the IRF charts for public opinion (A1), positive opinion (A2) and negative opinion (A3) with a 95% confidence interval (the middle line segment in the chart is the point estimate of the IRF, and the grey shadow area is the upper and lower boundaries of the 95% confidence interval). The horizontal axis denotes the number of lag phases (months).

The response of US imports to public opinion shock. For each unit of increase in public opinion shock, there will be a negative response in US imports in the same period, as shown in A1, Figure 2. The response reaches its maximum with two-phase lag before gradually diminishing and converging at 0 after 14 phases of lag. Obviously, each unit of public opinion shock swiftly exerts an adverse impact on US imports, and the impact lasts for a rather long period of time.

The response of US imports to predominantly negative public opinion is shown in A2, Figure 2. The impact of each unit of negative opinion on US imports is similar to the shock of the total sample of

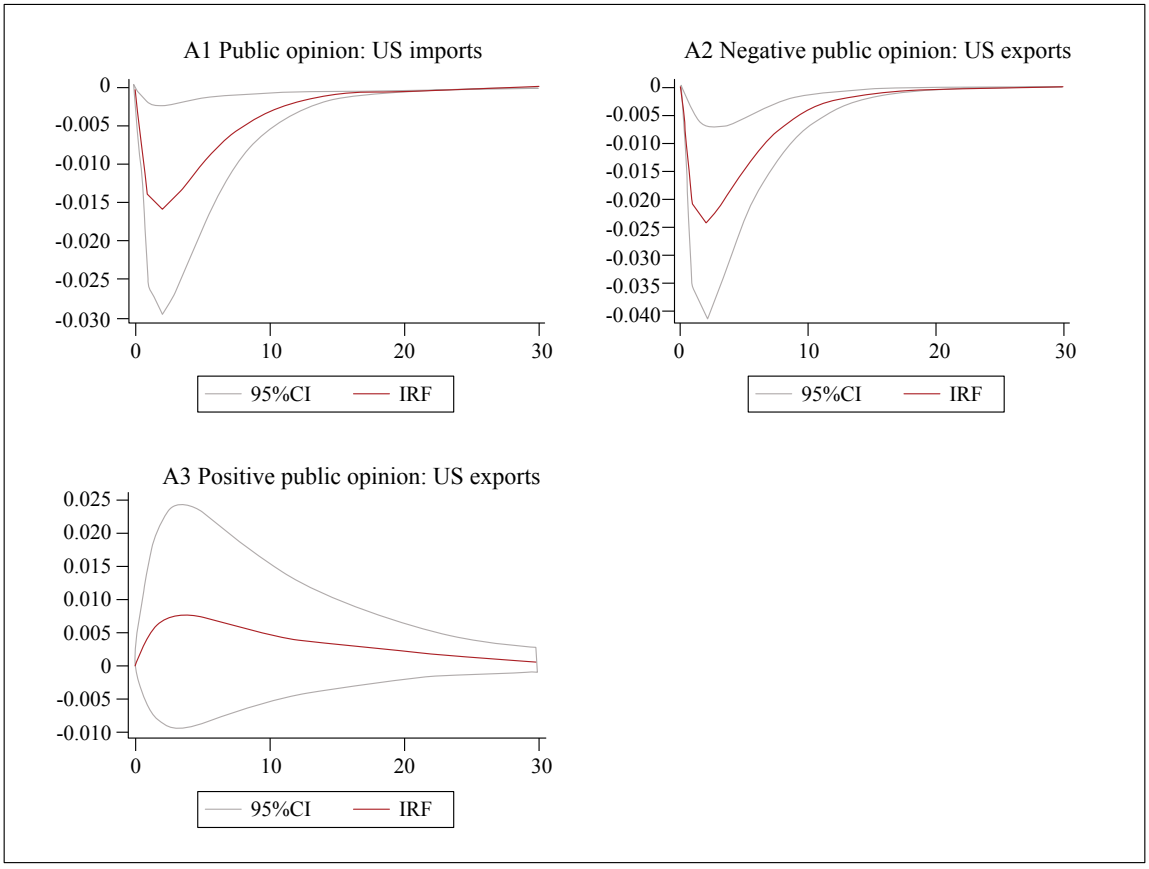

Figure 2: Pulse Response Analysis

Source: Calculated according to the pulse response function with Stata.

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Table 6: Results of Variance Decomposition

Step	Total-sample public opinion	Positive public opinion	Negative public opinion
2	0.0018	0.0002	0.0047
10	0.0062	0.0010	0.0245
20	0.0063	0.0011	0.0249

Source: Calculated according to variance decomposition in Stata's computation.

public opinion to US imports. The response of US imports to positive public opinion is shown in A3, Figure 2. The impact of each unit of positive public opinion on US imports is insignificant.

In summary, there is a negative response of US imports with each unit of negative public opinion shock, and the impact is insignificant for each unit of positive public opinion shock. Hence, the proposition of Hypothesis 3 holds true. Positive and negative public opinions influenced US imports for different durations of time. Negative public opinion had a swifter and more lasting impact on US imports than positive public opinion.

5.2.2 Variance decomposition

This paper employs the variance of panel data to explain the extent to which public opinion contributed to change in US imports. As shown in Table 6, the forecast variance of US imports primarily stems from negative public opinion, and only a small portion is attributable to positive public opinion. When ln*import* is foecast two months forward, 0.0047% of the forecast variance derives from negative public opinion, and only 0.002% is from positive public opinion. For a ten-month forecast, 0.0245% of the forecast error stems from negative public opinion, and only 0.001% is from positive public opinion. For a 20-month forecast, the forecast errors have limited differences with October, i.e., 0.249% and 0.0011%. Comparatively, negative public opinion has the greatest impact on ln*import* in the long run.

6. Heterogeneity Analysis

This paper tests the heterogeneous effects of US public opinion, including positive and negative public opinion, on US imports. In this section, our main goal is to compare the effects of public opinion on US imports of various types of goods in parallel. Hence, the results based on annual and monthly data should be consistent. Given the lack of product-level monthly data availability, this section employs annual data to conduct a test.

During time periods such as Panel A, when positive public opinion prevailed, among consumer, capital and intermediate goods listed by Broad Economic Categories (BEC), only intermediate goods were significantly influenced by positive public opinion. Among the two types of products listed by the Standard International Trade Classification (SITC), only primary products were significantly influenced, indicating that intermediate goods and primary products as inputs were more likely to be influenced by positive public opinion.

During time periods such as Panel B, when negative public opinion dominated, capital and consumer goods listed by BEC classification and industrial finished goods listed by SITC classification were significantly influenced by negative public opinion. Negative public opinion is found to have exerted the most significant adverse impact on consumer goods, which is consistent with Lee and Thadan (2009) findings. Negative public opinion holds sway in consumers' decisions to buy. Consumers of an importing country more or less rely on domestic information when making a purchase decision and

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Table 7: Product-Specific Effects

	(1)	(2)	(3)	(4)	(5)
	Capital goods	Consumer goods	Intermediate goods	Primary products	Industrial finished goods
Pannel A: 2008-2012 (Positive public opinion dominates)					
Public opinion	0.235	1.134	3.918**	0.611***	0.930
	(3.411)	(3.228)	(1.477)	(0.159)	(1.961)
Pannel B: 2013-2017(Negative public opinion dominates)					
Public opinion	-0.361**	-0.310***	0.243	-0.153	-0.179**
	(0.130)	(0.082)	(0.245)	(0.384)	(0.062)

Notes: Numbers in parentheses are robust standard errors; *p<0.10, **p<0.05 and ***p<0.01 denote significance level; L1, L2 and L3 denote one-phase, two-phase and three-phase lags, respectively. This table employs annual data and classifies international trade commodities into capital, consumer and intermediate goods by BEC criteria and primary goods and industrial finished goods by SITC criteria. Product-level data is from UN Comtrade database.

demonstrate relatively stable country preferences. Hence, negative public opinion plays a bigger role than positive public opinion in swaying consumer decisions. However, the coefficient of capital goods is greater than the coefficient of consumer goods probably because capital investments are made more cautiously and thus are more sensitive to negative information.

In summary, there is a great deal of product heterogeneity in the impact of US public opinion on imports. Complex and differentiated products are more influenced by negative public opinion. Homogeneous products and intermediate goods are more influenced by positive public opinion.

7. Conclusions

Based on the news data from the GDELT news database, this paper creates a public opinion index by quantifying public opinion data with respect to key source countries of US imports over 2008-2017, and then employs an extended gravity model to examine the effect of US public opinion on US imports. We have addressed the endogeneity problem of the public opinion variable as the key explanatory variable through the fixed-effect model, the instrumental variable method and the fixed-effect model with the replaced explained variable, and the test results provide a robust revelation of the correlation between public opinion and US imports.

(1) From 2008 to 2017, US public opinion was correlated with US imports.

(2) When positive public opinion prevailed from 2008 to 2012, the positive effect on US imports was insignificant, but when negative public opinion prevailed from 2013 to 2017, the negative impact on US imports was highly significant. Hence, the correlation revealed by the total samples is reasonable.

(3) As revealed by the pulse response function and variance decomposition, negative public opinion exerted a swifter and more lasting impact on US imports.

(4) As can be discovered from the further decomposition of the influence of public opinion to specific product categories, there is a great deal of product heterogeneity in the effect of public opinion on US imports. Complex and differentiated products are more influenced by negative public opinion. Homogeneous products and intermediate goods are more influenced by positive public opinion.

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