The Institutional Memory of Trade Flows: Russia as a Natural Experiment

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Abstract

This paper uses a multilateral resistance gravity model to examine the historical legacy of trading institutions utilizing the impact of membership in the ex-Soviet Union and Comecon on current day Russia's bilateral trade flows. The use of long-term data from 1998 to 2016 allows for examination of changes in the legacy effects over time. The main finding of the paper is that historical patterns do matter in the determination of current trade flows of Russia. Even though there is a declining trend in volume of trade flows between Russia and former members of the Soviet Union and Comecon, overall historical patterns developed by these institutions remain highly significant 26 years after the collapse of the Soviet Union. We provide the first estimates of the legacy left by past institutions with an "institutional legacy decay" measure.

Key Words: Trade Institutions, Legacy Effects, Russia, Comecon

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1 Introduction

We are living in an unprecedented times for international agreements. The United Kingdom, after three years of negotiation officially left the European Union at the end of January 2020 (Bennett, 2020). Three days after being sworn into office, President Trump pulled the United States out of the Trans-Pacific Partnership. In another executive order, many have called President Trumps decision to not full judges to the Appellate Court of the World Trade Organization as a final step in killing the trade organization (Johnson, 2019). Given the number of trade institutions that are seeing either exit or being disbanded, it is worth asking how long do these trade institutions last.

Institutions have been studied widely in economics for a long time. Yet, it was Acemoglu et al. (2005) that provided a framework and makes a case for why institutions matter. In short, Acemoglu et al. argue that institutions shape and incentivize market actors, this in turn organizes productivity and results in the observed differences in economic growth between countries. Since this paper there has arisen interest in the impact history and institutions have on trade (Mitchener and Weidenmier, 2008; Karnups, 2008; Estevadeordal et al., 2003; Brodzicki and Uminski, 2018) and economic growth (North, 1995; Zukowski, 2004; Campos et al., 2016). In looking specifically at trade, the literature has found strong legacy effects of institutional trading arrangements in virtually all cases that have been studied(Eichengreen and Irwin, 1995; Anderson and Smith, 2007; Stack et al., 2019). However, the ability to confidently determine the extent of trade persistence has been hampered by the question of the endogeneity of the development of trade, customs, and monetary unions.

Empirical studies of free trade agreements, currency unions, or trading blocks traditionally apply a gravity trade model to understanding the impact of these organizations forming on trade between nations or the welfare implications of the formation of these bodies. The channels in which endogineity become an issue for the empirical models is twofold. First, by an *a priori* assumption about formation of these international agree-

ments. As (Barro and Tenreyro, 2007, p. 3) state "The implicit assumption in various empirical studies is that currency unions (or, more generally exchange rate arrangements) are randomly formed among countries" or second, because of reverse causality issues. Specifically Wolf and Ritschl (2011); Baldwin and Jaimovich (2012); Keller and Shiue (2014) give different examples of how the application of national arrangements may either increase trade flows or high trade flows depending on what politically stimulated the formation of these agreements. These issues become even more thorny when trying to take historical factors into account.

Eichengreen and Irwin (1995), the seminal paper which identifed the importance of history in gravity trade models, find strong endogeneity in the formation of the Ottawa Agreement in 1932, the Reichsmark Bloc, and the Ouchy Accords. Similarly, Nitsch and Wolf (2013) find that the development of the Euro followed a trend of increased economic integration. In general, Wolf and Ritschl (2011, p. 310) conclude that "to a large extent such arrangements [currency and trading blocs] are endogenous to the pre-existing pattern of trade." To the extent that Wolf and Ritschl are correct about the development of trading institutions, the issue of historical legacy can be difficult to determine since the formation of the bloc may have resulted from pre-existing comparative advantages that cannot be picked up by the gravity equation methodology.

This paper utilizes Russia's post-Soviet trade flows to address the persistence and endogineity question. We argue that both the development of the Soviet Union and its main trading bloc Comecon were developed independently from any particular trade-related rationale, allowing for a more robust test of institutional persistence in trade flows. We utilize a gravity model with data on 108 countries from 1998 to 2016, and measure the lagged impact of previous membership in the Soviet Union and Comecon on trade volume (imports plus exports) to and from Russia. This 19 year data set is used to develop an estimate of the "decay" of institutional persistence of trade flows. More specifically, we run a Poisson pseudo-maximum likelihood (PPML) gravity model with multilateral resistance controls in three-year panels and for each year, to examine

the change in the impact of the legacy of previous trading institutions over time. We find large and persistent legacy effects on trade between Russia and former Soviet and Comecon countries. Our estimates show greater persistence of the legacy effect than most previous studies of other trading institutions.

2 Background

2.1 History & Trade Flows

Institutional legacy has been found important in the determination of trade flows by several authors. de Ménil and Maurel (1994) analyze the breakup of the Austro-Hungarian in 1919 and find that the "dissolution of the Empire did not result in the immediate reversal of the trade patterns of the former union. Even after their dramatic post-war contraction, trade flows between the successor states remained significantly much larger than would have been predicted by economic, demographic and geographic factors alone" (ibid, p. 564-5). Eichengreen and Irwin (1998) investigate the influence of pre-WWII trade (1928 and 1938) on post-war trade flows. They find strong, but diminishing effects for 1949 and 1954, but no logically consistent effects by 1964. And with specific reference to countries that had once been part of the British Empire, they find that "Former British colonies traded disproportionately more with one another in 1949... because of the effects of history" (ibid, p. 55). But again, this effect disappears by 1954 and 1964. In general, Eichengreen and Irwin persuasively argue that history is fundamental for the determination of trade flows in any gravity approach.

Anderson and Smith (2007) attempt to validate the results of seminal papers on the hysteresis of past trading institutions. They use a panel data set and a lagged trade variable specification from Eichengreen and Irwin (1998) and find strong evidence that historical patterns do matter in the estimation of trade flows in Canadian trade. Using a fixed effects approach to estimate the gravity equation, they show that importer and exporter time fixed effects can capture the effects of history without the use of a lagged

dependent variable approach. Making the case that researchers need to put time and effort into ensuring that the gravity trade model is correctly specified.[1] In thinking about the correct specification of the gravity trade model, the authors argue that accounting for the "border puzzle" is much more empirically important than accounting for hysteresis. The importance of the border puzzle will be discussed more in-depth further down.

As the empirical literature has evolved, the application of history's effect in empirical models has been deployed in a more nuanced way. Instead of simply thinking of history's effects as simply the lag of trade, newer investigations, such as Gowa and Hicks (2013); Brodzicki and Uminski (2018); Stack et al. (2019) seek to specify the gravity trade model with variables that appropriately calibrate the model to take important historical factors that still affect current (and future) trade volumes into account. Gowa and Hicks (2013) look at trade volume and the effects of trade blocs on trade during the intervening years between World War I and World War II. They take into consideration that the trade blocs that were formed Post World War I, had different political aims(all of which shared the goal of trying to curb intense global economic downturn) depending upon which major power formulated them when specifying their gravity model. They find that, contrary to recent literature, none of the great power trading blocs affected trade in positively or negatively.

Brodzicki and Uminski (2018) include variables that account for the historical metropolis of Poland to understand foreign trade persistence and development. Using a PPML gravity model they find that there is evidence of trade flows being a function of the historical partitions and metropolises of Poland. Similarly, Stack et al. (2019) look at global trade flows of sugar and accounts for colonization's part in developing this market. In demonstrating that colonial ties dictate current global sugar trade, they show that the geographical direction those colonial ties originate from can have either positive or negative effects on growth and trade broadly.

[1] Chiţu et al. (2014) show the importance of a history effect in patterns of bilateral financial investment. The authors support the idea of a historical legacy effect, in which patterns of country holdings seven decades ago continue to impact current portfolios.

2.2 The Gravity Model & Border Puzzle

Another key literature involves the "border puzzle": after controlling for distance, regions within countries trade much more with each other than do regions across countries (McCallum, 1995; Anderson and van Wincoop, 2003; Ishise and Matsuo, 2015). In order to fully understand this particular problem in the gravity trade literature, a fuller discussion of the gravity trade model is needed.

The empirical framework[2] for the gravity trade model was introduced in Tinbergen (1962). The gravity trade model uses the metaphor of Newton's Law of Gravity to explain trade flows. Specifically, the theoretical argument states that trade flows between any two locations positively correlated with the combined *GDP* (analogous to size in the Newtonian model), and negatively correlated to distance between the two countries (which mirrors the distance between two physical particle in Newtons law). After it's empirical formulation the gravity trade model quickly became "the most empirically successful" model in economics (Anderson and van Wincoop, 2003, p. 170).

Although successful, the gravity trade model suffered from a lack of theoretical grounding for it's formulation beyond the parallels to Newton's Law, which resulted in biased estimation results. This problem came to ahead in McCallum (1995), where the author estimated the trade flows of the United States and Canada via a gravity trade model. McCallum found that the presence of an international border between the two countries results in 2200% increase in intranational trade for Canadian Providences. The surprising result from McCallum begged the question of why it is that the presence of a border results in dramatic diversion between international trade and intranational trade. This result became known as the border puzzle.

The border puzzle was extremely confounding to researchers, compelling the literature to ask if borders really do produce such dramatic effects and/or if the underlying empirical

[2]Although it is undeniable that the empirical formulation of trade flows, distance, and *GDP* were first purposed by Tinbergen in 1962, there were similar models such as Savage and Deutsch (1960) probabilistic formulation, that were around at the same time. As to who first conceptualized employing the metaphor of Newton's Law to trade flows is a much more debated question. Elmslie (2018) makes a compelling case that Adam Smith in the *Wealth Of Nations* used a gravity trade metal framework.

model of gravity was flawed. Anderson and van Wincoop (2003) solved this puzzle by asserting two claims: (i) the gravity theory is suffering from an omitted variable bias that the authors term as multilateral resistance terms (MRT) (ii) if one takes into account MRTs, then it is possible to construct a theoretically consistent and and free of bias model. What made Anderson and van Wincoop's MRT model innovative, by comparison to simple remoteness variables proposed by others in the literature, is that their variable decomposes trade resistances into their component parts.

Trade resistance, as argued by Anderson and van Wincoop, between any two countries (i and j) can be decomposed into three specific effects: (i) bilateral trade barriers between region i & j, (ii) i's resistance to trade with all regions in the world, and (iii) j's resistance to trade with all regions in the world. The previously proposed remoteness variables, Anderson and van Wincoop argue, only captures distance from bilateral trading partners (effect (i) from above), while the MRT capture all three affects. In applying MRT's understanding to their theoretical model they are able probe and empirically test three implications: (I) trade barriers decrease trade more between large countries than small countries, (II) trade barriers increase trade within small countries more than large countries, and (III) trade barriers raise the ratio of trade within country 1 relative to trade between country 1 and 2 where the smaller country is 1. Mapping this to the United States and Canadian trade results from McCallum (1995), Anderson and van Wincoop show that researchers would observe a border effect (though not nearly as large as previously estimated) given testable implications (II) and (III).

Based on the results of Anderson and van Wincoop, researchers understand that borders pose a more nuanced effect on international trade flows. In thinking about our research question with the lenses of the border puzzle and historical effects on trade, we expect to find that the historical legacy of being a part of the ex-Soviet Union will be stronger than those of being a former member of Comecon, because within country exchange during the Soviet era would have been stronger than any international trade all else equal. The *a priori* prediction will be especially important for Russia and the

other ex-Soviet countries since the Soviet Union pursued economic planning based on autarky until 1956 (Korbonski, 1970). This prediction is supported by the border effects literature.

2.3 Border Effects

The border effects literature seeks to exploit natural experiments of impact that the generation and disbandment of national borders have on trade flows. Border effects have been studied in a wide variety of settings that include, cultural identity (Falck et al., 2012), war (Che et al., 2015), and the reintegration of economies (Felbermayr and Gröschl, 2014; Nitsch and Wolf, 2013). Each study finds evidence of long term persistence. Regarding war, Che et al. (2015) study the impact of the Japanese invasion and 8-year occupation of China on current trade and other bilateral economic relationships. The authors exploit differences in the negative impact of the occupation on regions within China and find that a one-percent decrease in their measure of intensity (civilian casualties) increases imports from China to Japan by 14.7% in 2001. Regarding the elimination of borders, Felbermayr and Gröschl (2014) find that by 1993, the historical border between the Confederate South and the North (the Mason-Dixon Line) reduced trade by 13% to 14%. However, some of this could be the result of endogeneity issues. Additionally, in a study that is similar to ours, Nitsch and Wolf (2013) argue that the reunification of Germany provides a natural experiment regarding the importance of previous borders. Even given the extraordinary resources devoted to ensure a rapid reunification, the authors find that it will take between 33 and 40 years for the impact of the previous border to be statistically eliminated.

Other studies that investigate the effects of history and borders on bilateral trade in terms of the disintegration of states, unions and trading blocs including the Soviet Union are Djankov and Freund (2002a,b); Fidrmuc and Fidrmuc (2003); De Sousa and Lamotte (2007). Djankov and Freund (2002a,b) use a gravity equation to examine trade flows among and between 9 Russian regions and 14 former USSR republics during the period

of 1987-1996. They find that trade flows between Russian regions and former members of the Soviet Union were significantly impacted by past linkages. In the beginning of this period, the regions did not trade more with each other than they did with republics. In contrast, after the collapse of the Soviet Union, during the period 1994 to 1996, it is shown that Russian regions traded significantly more with each other than with former Soviet Union republics and that trade had been reoriented more within Russian regions. The result indicates that Russian regions tend to trade extensively with former members but over time there is an increasing home bias in Russia as well as in the new republics.

Djankov and Freund (2002a,b) find a classic border effect considering trade within and between regions of the Soviet Union. A limitation of their analysis deals with institutional legacy. The short-term data utilized in the studies (only 5 years after the collapse of the Soviet Union) does not allow for a longer term analysis of the hysteretic nature of the impact of past institutional trading arrangements on later trade flows.

Continuing with the investigation of border effects of Eastern Europe, Fidrmuc and Fidrmuc (2003) examine three disintegrated unions - Yugoslavia, Czechoslovakia, and the Soviet Union (represented by Russia, Ukraine and Belarus). To capture different trade relations in gravity equations, they include indicator variables for formal preferential trade areas, common border or language, and successor states of former federations in Europe, with data covering the period 1990 to 1998. The results suggest that the trade effects of former institutions decline rapidly over the 8 years, however, trade relations between former members remain significant to 1998. These results are inconsistent with previously mentioned work that finds strong persistence trade patterns after a political disintegration.

De Sousa and Lamotte (2007) attempt to determine why the legacy effects found by Fidrmuc and Fidrmuc (2003) dissipate quickly relative to other findings. Utilizing controls suggested by (Anderson and van Wincoop, 2003) and a 1993 to 2001 data set that includes all countries created by the political disintegration of the Soviet Union, Czechoslovakia and Yugoslavia, de Sousa and Lamotte find more persistence. The most

persistence was found for the former Yugoslavian states. In 1993 the former Yugoslavian states traded 29 times more with each other than expected while the still traded 23 times more by 2001. The form Czechoslovakia states demonstrated the least persistence. The authors found that the results of Firdmuc and Firdmuc were biased by the limited number of former Soviet, Czechoslovakian and Yugoslavian states covered in their study, more than their lack of multilateral resistance controls.

One major difference between our study and those of Fidrmuc and Fidrmuc (2003) and De Sousa and Lamotte (2007), who also address the hysteresis question using ex-Soviet and ex-Soviet satellite countries, is in the general empirical strategy. We focus on Russia's trade legacy with its ex-Soviet and Comecon member states, while the other studies address legacy by analyzing the effect of begin a member of a formerly larger state in general. Firdmuc and Firdmuc investigate if ex-Soviet, Czechoslovakian, and Yugoslavian states trade more with each other in general than would be predicted by gravity considerations alone. Complicating this question is nature in which goods flowed throughout the USSR and Comecon states. In his overview on trade of ex-soviet and Comecon states Pelzman states "the distortions created by intra-CMEA pricing policy, industrial specialization, and single minded dependence on the Soviet Union as the dominant market, resulted in the formation of industrial structures inappropriate to these economies."(Pelzman, 1991, p. 311)[3] In an earlier article Pelzman also points out that this distortion is not limited to Comecon to USSR trade flows, even trade within USSR between Russia and eastern countries was distorted for strategic reasons.(Pelzman, 1980) Trade was used as a tool of planning for the Soviet Union first and Comecon states second. As such much of the trade moved between the Comecon countries and Russia. Therefore, the trade links would be best established between Russia and these other states rather than between the states in general. Utilizing this theoretical strategy results in substantial differences between our results and those of De Sousa and Lamotte (2007).

The second contribution of this paper is that most of the literature finds that even

[3]Note that CMEA stands for the Council for Mutual Economic Assistance also known as Comecon.

though the trade impact of former institutions dissipate over time, overall trade patterns between former members of various trading and political institutions remain significant for long periods after the dissolution of the institutions. This paper expand on this literature by considering the development and break up of institutions that were developed independently from any trade-related rationale. Endogenous development of institutions provides a natural experiment from which to address the legacy question. Moreover, we add to the literature on the Soviet Union and its satellites by increasing the length of time in the study and using all ex-Soviet states and all Comecon member countries allowing for a comparison of borders effects and the effects of a trading union. This allows for an examination of the institutional legacy of trade flows free of the question of the endogeneity of institutional development and allows us to estimate the half-life of the legacy effect.

Moreover, with the exception of De Sousa and Lamotte (2007), the above studies that focus on the breakup of the Soviet Union were conducted without controlling for multilateral resistance as well as still utilizing a log-log specification of the gravity trade model. Anderson and van Wincoop (2003) show that significant bias is possible in estimates of border effects from traditional gravity models due to omitted variable bias and Silva and Tenreyro (2006) show that not using a PPML specification injects bias into the coefficients of estimators. Our estimates are relatively consistence across regressions with and without controls. Our half-life estimates, with controls, demonstrate somewhat more persistence than the standard gravity model. Given the potential bias created in the standard model, we only report the results that utilize the multilateral resistance terms.

3 The Soviet Union and Comecon as Natural Experiments

Can the Soviet Union and Comecon be considered as natural experiments for tests of the legacy effects of previous trading institutions? We argue in the affirmative since these institutions were founded for non-trade related reasons, and there is no evidence of strong trading relations between Russia and the other countries studied prior to the development of the Soviet Union or Comecon. Thus, from the point of view of the determinants of current trade flows they can be considered exogenous shocks.

3.1 Motivation to the Formation of the Soviet Union

The literature suggests that there were many reasons for the formation of the Soviet Union that began in 1922 with the unification of the Russian, Transcaucasian, Ukrainian, and Byelorussian republics, and by 1940 included 15 sub-national Soviet republics existing until 1991 (see Table 1 for a list of countries). In looking at maps of the former Czarist Russian Empire, one can see that no significant portion of USSR was not part of the Russian Czar regime. One could think of the unification of these nations with the Russian state is as if California broke off from the United States then was readmitted.

A fundamental factor driving the unification was ideology (Sherman, 1994). During the rule of Joseph Stalin, the most widely disseminated book known as "the Short Course" (C.P.S.U., ed, 1939), claims that the main goal of the formation of the USSR was the consolidation of the Soviet power and a victory for the working class. To construct socialism required "welding the Soviet republics closer together in a single federal state". (ibid) This rationale for the development of the Soviet Union is also supported in the work of Sakwa (1999). Furthermore, this ideology followed the idea that the removal of all the political differences and further consolidation of the members into the entirely cohesive Socialist state and society was meant as a strong counter balance to Western capitalism. The foundation of this effort was the elimination of nationalistic sentiments that could

block the full development of worker solidarity. The communist ideology driving national decisions was prevalent well before Joseph Stalin.

In 1921, the Tenth Congress of the Revolutionary Communist Party (Bolsheviks) was held with the charge of determining "The Immediate Tasks of the Party in the National Question". The Commission was led by Vladimir Lenin and the report from the commission was developed by Joseph Stalin (Stalin, 1953). The report gives specificity to the ideology behind the planned development of the Soviet Union. It states, "history tells us that the only way to abolish national inequality, the only way to establish a regime of fraternal co-operation between the laboring masses of the oppressed and non-oppressed nations, is to abolish capitalism and establish the Soviet system." (ibid, 38) Those in power in Soviet Russia believed that the state, if managed properly could be a vehicle to united the working masses. Further, in an effort for the state to manifest unification of the workers, leaders believed it needed to be a transnational mission.

In an interview with the Russian newspaper Pravda, number 261, on November 18, 1922, Stalin made this clear when he stated that, "the union of the Soviet republics in a single union state will undoubtedly create a form of all-round military and economic co-operation that will greatly facilitate the economic progress of the Soviet republics and convert them into a citadel against attacks by international capitalism." (ibid, 141) Thus by welding states together the Soviet government was strengthening the bonds between workers as a complete union of the proletariat via abolishing nationalist ties. "The state union of the individual Soviet republics was considered as the only way of salvation from imperialist bondage and national oppression" (Grosul, 2007, translation from Russian by S. Kuznetcova).

It goes without saying that the past cultural, economic, military, and historic linkages as well as external political reasons also played a role in the formation of the Union of Soviet Socialist Republics, but there is no evidence that direct trade-related rationales existed for the development of the Soviet Union. Trade statistics from the period leading to the Soviet Union back up this claim. From 1899 to 1913, no countries that would

become part of the Union with Russia were listed among the top 18 import or export partners of Russia (Vyacheslav, 2011, 30).[4]

3.2 Formation of Comecon

The Council for Mutual Economic Assistance(CMEA) also referred to as Comecon, was the main trading bloc of the Soviet Union. Comecon was an economic organization that existed from 1949 to 1991 under the leadership of the Soviet Union and comprised the countries of the Eastern Block along with a number of socialist states elsewhere in the world (former members of Comecon are listed in Table 1). The official purpose of Comecon was to coordinate planning, promote country and regional specialization, increase trade among member states (Korbonski, 1970), and "to improve economic and military cooperation" (New York Times, 1988). Increased trade flows was among the motivations for the formation of Comecon, but this was not based on any pre-existing strong or rapidly increasing trade relations.

From 1926 to 1928, for example, Czechoslovakia (which in our listing of countries includes the Slovak Republic and the Czech Republic) accounted for only 4% of Soviet trade. No other Comecon country had large enough trade with the Soviet Union to be listed in the Soviet's own publication of economic statistics (Soviet Union Information Bureau, 1929). Moreover, between 1928 and 1938, Holzman (1976, 1985) reports that overall imports from Eastern Europe to the Soviet Union fell by about half, while exports from the Soviet Union to Eastern Europe fell by about one-quarter. As we move back in time to the period from 1899 to 1913, no Comecon country was a major exporter or importer of Russia. In 1913, for example, Austria-Hungary represented 4.3% of exports and 2.6% of imports with no significant trend from 1899. This was the largest representative of what would partly (as Hungary without Austria) become part of Comecon (Vyacheslav, 2011 and details from footnote 2).

[4]The original tables from 1915 are available as "Overview of Russia's Foreign Trade with European and Asian Borders in 1914," Tables 5 and 6 at `http://istmat.info/node/213`. Translation from Russian by S. Kuznetcova.

The most direct reason for Comecon's development was ideological. Comecon was founded in response to the Marshall Plan "to reinforce the bonds between the Soviet Union and the "people's democracies" of Eastern Europe" Brine (1992). So, it can be considered as the socialist alternative and reply to the formation of the Organization for European Cooperation in Western Europe. After World War II Comecon was seen as an effective instrument to spread communism to the countries of the Eastern European block with the USSR being the dominant member. (ibid.) Therefore, Comecon was formed mainly for reasons unconnected to previously strong or growing ties to trade. Even by 1956, six years after its formation in 1949, there was insignificant intra-Comecon trade (Korbonski, 1970, 957). The literature on the development and operation of Comecon demonstrates that it was a poorly designed and managed trading institution that resulted in little true trade creation and was mostly trade diverting (Zickel, ed, 1989; Pelzman, 1977; Holzman, 1985; Biessen, 1991). Additionally, and most importantly, Comecon was meant mainly as a control devise for the Soviet Union over Comecon members (Pelzman, 1977).

While Comecon had no initial economic advantages motivating its existence, it did succeed in dramatically increasing trade flows between members, creating new trade patterns (Hewett, 1976; Holzman, 1985; Pelzman, 1977). It was, therefore, successful in its efforts to promote trade and specialization through central planning (Biessen, 1991). For example, Hewett (1976), using a gravity approach finds that within Comecon trade was 20-times larger than it was predicted to be without the trading bloc. Additionally, (Zickel, ed, 1989, 601) reports that "in 1960 the Soviet Union sent 56% of its exports to and received 58% of its imports from Comecon members. From that time, the volume of this trade has steadily increased..."

Because both the Soviet Union and the Comecon were constructed for non-trade related reasons, they are good candidates to be considered as natural experiments for the determination of institutional legacy effects in trade flows. Since no evidence exists suggesting that pre-institutional trade flows were greater than would be expected by a

gravity analysis, any lingering effects of these institutions on current trade flows can be attributed to legacy effects with a high degree of confidence.

4 Data

The data set developed in this paper is a panel of Post-USSR Russian imports from and exports to 108 countries for the 19-year period from 1998 to 2016. The choice of the countries for the empirical analysis (listed in the appendix Table 1) is based on the data availability for all variables and for all years.

The variables and data sources used to build the variables are listed in Table 2. The dependent variable is bilateral imports plus exports to and from Russia. To measure the trade flows between Russia and its trading partners, import and export figures were taken from the World Bank's World Tables at market prices in U.S. dollars. The trade data is then converted into constant chained 2005 dollars. Country-pairs are used to reflect the bilateral relationship between Russia and its trading partners. To estimate the volume of trade flows between Russia and its trading partners we use three "groups" of independent variables.

First, to predict bilateral trade flows we use the traditional gravity variables of economic size of the countries and distance the between them. To investigate the influence of an economy's size on trade, GDP measurements at market prices in U.S. dollars are also obtained from the World Bank database. Nominal GDP data is then converted into constant chained 2005 dollars. The distance variable is the distance between Moscow and the capital city of Russia's trading partner measured in kilometers, and was generated using online maps. All standard gravity variables are estimated in terms of natural logarithms. Based on the theoretical foundation of the gravity equation, it is expected that greater distance between trading partners reduces the volume of trade and that countries with higher levels of income tend to trade more with Russia.

Second, to follow the historical patterns of trade between Russia and its trading

partners we include two indicator variables. The first variable indicates if the country was a member of the Soviet Union (1 for former members and 0 otherwise). The second variable defines if the country was a non-Soviet part of a trading block Comecon (1 for former members and 0 otherwise). This variable excludes countries of the Soviet Union to avoid strong collinearity with the USSR indicator variable. Given the discussion in the previous section we expect these varibles to be exogenous. Both the Soviet Union and Comecon were constructed for ideological rather trade-related reasons. The inclusion of these two indicator variables in the gravity model, this enables us to compare two effects of disintegration: the border effect (the absence of borders in the USSR) and the effect of a trading agreement (Comecon membership). The long-term nature of the data also allows us to observe the change in these effects over time.

Another variable often used in this type of study is a measure of linguistic distance (Fidrmuc and Fidrmuc, 2003; Hutchinson, 2005). In our case, however, there is a high correlation between linguistic similarity and the makeup of the ex-Soviet states. Therefore, for completeness, we chose another widely utilized variable in these studies, that of economic/political freedom (e.g. Depken and Sonora, 2005; Sonora, 2014; Wall, 1999). Our measure is the Index of Economic Freedom provided by the Heritage Foundation. This index combines ten measures of economic freedom into a single composite index. Measures of freedom represent various quantitative and qualitative factors in business, labor, monetary, trade, investment, and financial freedoms, as well as legislative factors such as freedom from corruption, fiscal freedom, property rights enforcement, and government spending. The index rates countries on a scale of one to five, where numerical scores correspond respectively to the level of economic freedom of a country represented as repressed; mostly unfree; moderately free; mostly free; and free. Lower index numbers represent lower levels of economic freedom of a country. This index allows for the examination of not only trade freedom of countries but to determine the overall degree of countries' openness for trade flows. While potentially of interest in its own right, for our present purposes, the variable is used as an additional control and is not highlighted.

The results are similar when the variable is excluded from the analysis.

5 Methodology and Empirical Analysis

In order to examine the effects of hysteresis on bilateral trade flows between Russia and its trading partners, a traditional gravity model is employed. As stated earlier, the basic gravity trade model relates trade flows to GDP and distance between trading partners. A well specified gravity trade model takes historical institutions into account, must be altered to include variables that account for hysteresis as well as border effects. In order to achieve this goal we have two different types of model specification(log-linear and PPML) with three functional forms of estimation.

Via the first functional form of a log-linearization, we begin with a panel of total trade volume over all the years of the data set:

$$lnT_{iR,t} = \beta_0 + \beta_1 lnGDP_{i,t} + \beta_2 lnDist_{iR} + \beta_3 USSR \cdot t + \beta_4 Comecon \cdot t + \beta_5 F_{i,t} + \beta_6 CNTG + \beta_7 lnMLR_{exp,t} + \beta_8 lnMLR_{imp,t} + \varepsilon_{iR,t} \quad (1)$$

The dependent variable $T_{i,R}$ is the total volume of trade that combines exports and imports between country i and Russia at each year interval. The standard gravity predictor variables are each i^{th} country's real GDP (GDP_i) and the distance between Moscow and the capital of Russia's trading partner ($Dist_{i,R}$). There are two hysteresis variables which are interacted with a year indicator variable, USSR and the Comecon. The reason for this interacted variable is that the indicator variables of USSR and Comecon are constant over time, but performing cross-sectional analysis reveals the effects of these variables are changing over time. Therefore, the interacted variables allows for the change of the effects over time. The F_i variable is the Index of Economic Freedom of trading partners of Russia. The variable $CNTG$ is also an indicator variable to control for countries that have a contiguous border with Russia. Lastly MLR terms are reduced form multilateral

resistance terms and ε_i is the error term. The purpose of the first regression is to test out the validity of the impact of the hysteresis and robustness of using a gravity specification in this manner. The results are reported on Table 3.

Before moving to the second functional form, it is worth discussing the empirical construction of the MLR terms throughout all the of the estimations. As was discussed in the boarder puzzle section, multilateral resistance (MLR) terms are a theoretical construct, and as such must be generated. The original MLR's described in Anderson and van Wincoop (2003) were a custom non-linear least squares program that generated values of the MLR after repeated simulations until convergence. Luckily the broader literature has developed two easily deployable empirical solutions to construct MLR for researchers. (Yotov et al., 2016)

The first empirical solution is referred to as a "remoteness index," and is what is employed under the both specifications. The remoteness index is a reduced form of the custom built MLRs that Anderson and van Winkoop introduced. These remoteness indexes are output and expenditure weighted averages of bilateral distance. They are constructed via the following two equations:

$$REM\ EXP_{i,t} = \left[\Sigma_j Dist_{ij} / \frac{E_{j,t}}{Y_t}\right] \tag{2}$$

$$REM\ IMP_{j,t} = \left[\Sigma_i Dist_{ij} / \frac{Y_{i,t}}{Y_t}\right] \tag{3}$$

Where $E_{j,t}$ is the value of importer expenditure, obtained by summing up the value of all trade exported by country j in year t. Similarly, $Y_{i,t}$ is the value of exporter output by country i in year t. In equation (2), the variable Y_t is sum of all $E_{j,t}$ in a year then utilizing the max value of that year. Conversely, in equation (3), Y_t represents sum of all $Y_{j,t}$ in a year then utilizing the max value of that year. Throughout all of three of the functional forms under a log-linearization specification.

The second empirical way to obtain MLR terms is via exporter(and importer) paired-time fixed effects variables, where an indicator variable is created for when country i

trades with country j in time t. These fixed effects capture the "special" underlying factors that resulted in these two countries trading in this particular time. The problem with deploying this solution in with our data is that of all trade is to and from Russia, thus creating indicator variables that are multicollinear and will absorb all variation in the data.

The next fucntional form employs a year-by-year panel log-linearized gravity trade model. This specification will allow for a more precise quantification of hysteresis' effects on Russian trade flows year over year. The model takes the form of

$$\begin{aligned} lnT_{iR,t} = \beta_0 + \beta_1 lnGDP_{i,t} + \beta_2 lnDist_{iR} + \beta_3 USSR + \beta_4 Comecon \\ + \beta_5 F_{i,t} + \beta_6 CNTG + \beta_7 lnMLR_{exp,t} + \beta_8 lnMLR_{imp,t} + \varepsilon_{iR,t} \quad (4) \end{aligned}$$

This model is similar to specification (1), with one notable difference, our hysteresis dummies are no longer interacted with time. Under specification (4), a regression is run for each year, as such, interacting the indicator variables with a time variable would not have an econometric impact. The results from this specification can be found on Table 4 in the appendix.

Finally we altered specification (4) and experimented with regressions at multiple year intervals (i.e. 5 year, 4 year, 3 year, etc.). Multiple year interval regressions were performed to overcome a common issue in the gravity trade literature, specifically how to adjust to trade policy changes over the time of the data. If there is dramatic changes to a trade policy from year 1 to year 2, then it will likely generate influential outlier data points depending the total span of the data. A simple solution the policy change issue is to use panel data over multiple year intervals (ibid). Since the regressions are over multiple years the hysteresis dummies are again interacted with a time indicator variable. Reproduced below, in Table 5, are the results from a 3 year interval specification. The results are consistent whether looking at 2, 3, 4, or 5 year intervals. Three years was chosen because it showed the smoothest paths of our variables of interest.

The final model specification is a Poisson pseudo-maximum likelihood (PPML). The reason for the employment of the PPML model specification is that it solves two problems of the gravity trade model. First, the PPML solves the problem of zero values in trade flows, as the log of zero is undefined, using this model specification we can include zero values. Second, the PPML solves a much more pressing issue, heteroskedasticity in trade data. As Silva and Tenreyro (2006) makes clear, when the data is heteroskedstic a log-linearization of the model will result in biased and inconsistent results. This is true irrespective of the application of MLR terms. They demonstrate this result as a function of Jensen's inequality and "the expected value of the logarithm of random variable depends on higher-order moments of its distribution. Therefore if the errors are heteroskedastic, the transformed errors will be generally correlated with the covariates." (p. 653, ibid) Given their findings, Silva and Tenreyro advocate for the use of PPML model specification to solve both the zero tradeflows and heteroskedaticity in trade data.

Following Silva and Tenreyro's advice,[5] we employ a PPML specification over the same panel data, using all three different time functional forms. The first model is parallel to (1) in that it aggregates at all of the year of our data set, taking the functional form of:

$$T_{iR,t} = exp\big[\beta_1 lnGDP_{i,t} + \beta 2 lnDist_{iR} + \beta_3 USSR \cdot t + \beta_4 Comecon \cdot t + \beta_5 F_{i,t} + \beta_6 CNTG + \beta_7 lnMLR_{exp,t} + \beta_8 lnMLR_{imp,t}\big] * \varepsilon_{iR,t} \quad (5)$$

The variables used in (5) are the same as those used in(1), with the noted exception that the dependent variable is now total trade values rather than the log of total trade.

Given our interest in the time-trend effect of the USSR and Comecon varibles, we employed the PPML specification with a year-by-year regression, similar to equation (4),

[5]In addition to the case made in their paper, Xiong and Chen (2014) show that PPML and not other proposed models such as a tobit or Heckman model result in the best possible estimations of the gravity model.

which takes the functional form of:

$$T_{iR,t} = exp\big[\beta_1 lnGDP_{i,t} + \beta_2 lnDist_{iR} + \beta_3 USSR + \beta_4 Comecon + \beta_5 F_{i,t} + \beta_6 CNTG + \beta_7 lnMLR_{exp,t} + \beta_8 lnMLR_{imp,t}\big] * \varepsilon_{iR,t} \quad (6)$$

Lastly, given our worry about picking up "noise" in the year-by-year regressions, we employ a 3 year panel specification similar to equation (4) to understand the time trend of our indicator variables.

6 Results

Table 3 gives the results of the log-lin specification using the entire panel from 1998 to 2016 while Table 6 reports the PPML specification over the same period. Table 4 and Table 7 generates the results for each year from 1998 to 2016 for each given model specification. While Table 5 and 8 display the results from the log-linear and PPML 3-year panel results, respectively.

Begining first with panel of all the years (Tables 3 and 6), we note that the coefficients represent the average impact of each variable on Russia's trade volume. Looking between both models we see that GDP, distance, and contiguous borders all have the expected signs and are statistically significant at the highest levels. Interestingly between the two models economic freedom goes from being positive and significant to negative and insignificant as we move from the log-linear to the PPML specification. The change in sign and significance of economic freedom gives evidence that the log-linear specification is biasing the results. In fact if one looks at both models, we see that the log-linear (Table 3) has coefficients that are consistently larger than those under the PPML model specification (Table 6)giving further evidence that the log-linear models are biasing the coefficients as was predicted by Silva and Tenreyro (2006). Given this evidence, the remaining discussion of the model will be on the PPML specification, the log-linear

specification will be left in for comparison sake.

The indicator variable for USSR and Comecon in the aggregated data are time interacted indicators, meaning that the coefficients need to be interpreted with care as they represent an average effect of the previous institution on trade for 1/19 of the overall panel, given that there are 19 years in the data. The difficulties associated with interpreting an indicator variable that is mostly decreasing over time means that we will comment only on the variables in the year-by-year results. The important take away from this model with regards to our historical institution variables is that they are positive and statistically significant, meaning that it is clear these historical institutions are impacting current day trade flows to and from Russia.

Tables 7 break the data by year and report results from the yearly regressions. Note that the coefficients on GDP are stable and consistent with expectations. The coefficient on our main variables of interest (USSR and Comecon) are also stable and declining over time as expected from the general literature on the legacy effects of trading institutions. However, the coefficients on distance and economic freedom vary widely from year to year indicating a substantial amount of noise in the yearly data. This is common in the trade gravity literature (Yotov et al., 2016). To diminish the impact of these year-to-year variations, a standard practice is to create multi-year panels (ibid). We did multi-year panels with 2, 3, 4, and 5 year periods. The results are consistent across all panels. We chose to report the 3-year panel estimates given that it allows for the use of all years except for 2016 and the coefficients on distance are more stable than with the 2-year panel. In these panels, we utilize a time control that allows for the stacking of the data when utilizing a indicator variable.

Turning to the 3-year panel in Table 8, it shows that Russia trades more with larger countries and less with countries that are geographically further away, as expected. Further contiguous borders is positive and statistically significant, at varying levels, through out all of the 3-year intervals. Interestingly, the economic freedom variable is negative and not statistically different from zero in all the panels. While no evidence of collinearity

problems with the multilateral resistance variables exists, the result should be interpreted with caution since trade freedom makes up part of each county's score on the index.

Our main variables of interest are the indicator variables on the USSR and Comecon. The coefficients demonstrate strong and significant positive effects on Russia's trade with former members of the USSR and Comecon across all specifications and models. To interpret the importance of these variables, we must look to the yearly regressions under the PPML specification. Referring to Table 7, the coefficients on USSR and Comecon respectively for 1998 are 2.263 and 0.843. These coefficients indicate that Russia traded approximately 8.611 times ($e^{\beta} - 1$) more than expectation based on country GDPs and distance from Russia with former Soviet countries and approximately 1.32 times more with ex-Comecon countries than expected.[6]

Looking across the Table 7 from 1998 to 2016, a consistent pattern occurs on the relative magnitude of the legacy impacts of membership in the Soviet Union versus Comecon. The effect is about twice as large for ex-Soviet countries. To help aid in examining the pattern, a plot of the coefficients and confidence intervals of both of the variables can be found in Figure 1. The coefficients have been put into percentage impact upon total trade form. Looking at this figure it is clear that there is a monotonically decreasing to zero patter in both variables though, it is much stronger in the USSR variable. Further, we can see that Comecon is must more impacted by the statistical "noise" that comes from doing a year-by-year specification. Irrespective, it is clear that impact of the institutions are decrease as we away from the initial dissolution of the USSR and Comecon.

Turning to the 3-year panel results (Table 8), we see that our institution indicators are a lot more stable. Specifically, the coefficients on the USSR are still statistical significant at the highest levels and Comecon stays statistically significant for longer. Further in looking at the plot for the coefficients (Figure 2) the pattern of monotonically decreasing is much more evident. It is clear from the 3-year panel that the noise present from

[6]Note that this Comecon estimate is in line with the result found by Hewett (1976) in 1970. He found that membership in Comecon increased trade compared with gravity expectations by 200% in gravity estimates that did not utilize proper controls thus biasing his results.

the previous specifications is smoothed out, showing that institutions decay and trend towards zero as we move forward in time.

The pattern of result on our institutional variables is consistent with existing literature and the estimation of the border effect by Anderson and van Wincoop (2003) and others. Borders significantly impede trade. While intra-Soviet trade statistics are not available, it is reasonable to assume that intra-Soviet regional trade was stronger (controlling for gravity variables) than it would have been for trade between the Soviet Union and Comecon member states(Pelzman, 1980). Given that stronger trade ties would have been created for regions within the Soviet Union, the legacy impact is expected to be stronger.

While the legacy effect is stronger for ex-Soviet states, the persistence of the institutional effects are similar. Utilizing the coefficients in 1998 and 2016 and the 19 year time period, we can estimate a "back of the envelope" figure which describes the "decay" of these historical institutions. We find that the institutional impact of being a member of the ex-Soviet Union to be 18.07 years while the half-life for Comecon member states is 11.31 years. This measure takes into account only the magnitude of the coefficient and the rate of decline. Analyzing the magnitude of the institutional impact over time we find that over the 19 year period the impact of being a former member-state of the Soviet Union resulted in Russia trading with its other member-states, 8.611 times more in 1998 and 1.98 times more in 2016. For ex-Comecon, Russia traded 1.32 times more than expected by trade gravity in 1998 and 0.3 times more by 2016. Of course the exact numbers change depending on the end year selected, but the main pattern is consistent for the institutional decay calculations across years.[7]

The main result from the empirical work is that trade patterns developed during previous institutions impact the volume of trade in a manner that demonstrates strong persistence. Twenty-six years after the collapse of the Soviet Union and Comecon trade flows between former members remain significant because of the historical patterns es-

[7]For example, utilizing the same initial year of 1998, the USSR (Comecon) institutional decay estimates are 16.05 (11.16), 16.56 (9.41) for the years 1998 to 2013 and 1998 to 2014 respectively.

tablished in the past. Our results show substantially longer persistence than is found by De Sousa and Lamotte (2007). By 1998, the beginning year of our study, they find that ex-Soviet states trade about 7.5 times more with each other than expected, while we show that Russia traded about 8.611 times more than expected based on trade gravity. This difference is most likely explained by the difference of our empirical strategy. Sousa and Lamotte ask, how much more are ex-Soviet countries trading with each other. But during the Soviet era, a large share of trade moved thorough Russia. Russia was the trade center of gravity around which the bulk of trade flowed. This is true for the satellite states in Comecon as well. Thus, the expectation is that the legacy effects are larger for trade between Russian and ex-Soviet and ex-Comecon states than between those states in general.

7 Conclusion

This paper examines the effect of historical legacy of previous institutions on the volume of Russia's bilateral trade using the gravity model approach. The effects of historical legacy are represented by the former membership of the Soviet Union and trading agreement Comecon. We reach the following conclusions.

First, the results indicate that we cannot fully understand bilateral trade flows without considering the impact of past institutional trading arrangements. The effects of historical legacy of the Soviet Union and Comecon are still impacting Russia's bilateral trade flows even 26 years after their respective collapse. In other words this finding suggests that former networks persist, overlap new borders and encourage trade between successor states.

Second, consistent with expectations and all other studies of the legacy effects of trading institutions, we find declining trends in trade intensity between Russia and the former members of the USSR and Comecon. These findings are consistent with the results of Fidrmuc and Fidrmuc (2003); De Sousa and Lamotte (2007). Institutional

disintegration does not lead to an immediate trade disintegration.

We also find that the effect of the membership of the Soviet Union is stronger than the effect of Comecon, most likely because of the impacts of borders on trade. The absence of borders in the past between former members of the Soviet Union established strong trade patterns that hold even today. Interestingly, while the trading effect of being a former member of the Soviet Union is much stronger than being a member of Comecon, the effect is dissipating at about the same rate. The legacy half-life for the impact of the previous institution on trade is 18 years for the USSR and 11 years for Comecon.

This paper provides the first estimates of the persistence of the legacy effect on trade flows generated by former trading institutions. We demonstrate this both via our figures of the coefficients and our institutional decay measure. Our institutional decay measure estimates indicate that former trading arrangements cast a long shadow on current trade relations. Much as (Krugman, 1987, 47) described, trade patterns are like rivers; once established, even if by purely institutional arrangements, the path becomes self-reinforcing as the flows dig their path deeper and deeper.

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Appendices

A Tables & Figures

Table 1: List of Countries

Albania**	Denmark	Kazakhstan*	Romania**
Algeria	Dominican Republic	Kenya	Rwanda
Argentina	Ecuador	Korea Rep.	Saudi Arabia
Armenia*	Egypt, Arab Rep.	Kyrgyz Republic*	Senegal
Austria	El Salvador	Lao PDR	Singapore
Azerbaijan*	Estonia*	Latvia*	Slovak Republic**
Bangladesh	Ethiopia	Lebanon	Slovenia
Belarus*	Finland	Lithuania*	Spain
Belgium-Luxembourg	France	Malaysia	Sri Lanka
Belize	Georgia*	Malta	Sweden
Bolivia	Germany	Mexico	Switzerland
Bosnia and Herzegovina	Ghana	Moldova*	Tajikistan*
Brazil	Greece	Mongolia**	Tanzania
Bulgaria**	Guatemala	Morocco	Thailand
Cambodia	Guinea	Nepal	Tunisia
Cameroon	Honduras	Netherlands	Turkey
Canada	Hong Kong, China	New Zealand	Turkmenistan*
Chile	Hungary**	Nicaragua	Uganda
China	Iceland	Nigeria	Ukraine*
Colombia	India	Norway	United Arab Emirates
Congo, Rep.	Indonesia	Oman	United Kingdom
Costa Rica	Iran, Islamic Rep.	Pakistan	United States
Cote d'Ivoire	Ireland	Panama	Uruguay
Croatia	Israel	Peru	Uzbekistan*
Cuba**	Italy	Philippines	Venezuela
Cyprus	Japan	Poland**	Vietnam**
Czech Republic**	Jordan	Portugal	Zambia

Note: * indicates former members of the Soviet Union, ** indicates former members of Comecon

Table 2: Measurement and Data Sources

	Description	Measurement	The Source
$T_{R,i}$	The bilateral trade flows: Exports (X) & Imports (M) between Russia & country i	Chained 2005 thousand dollars	The World Bank
GDP_i	Country i's real GDP	Chained 2005 dollars	The World Bank
$Dist_{R,i}$	The distance between Moscow & the capital city of the trading partner	Kilometers	Online maps
F_i	The Index of Economic Freedom 1–Repressed 2–Mostly unfree 3-Moderately free 4-Mostly free 5-Free	Scale of 1 to 5	The Heritage Foundation
$USSR$	Indicator variable: former members of the Soviet Union. These members are: Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan	1–if former member of the Soviet Union 0-otherwise	
$Comecon$	Indicator variable:former members of Comecon. They are: Albania, Bulgaria, Cuba, Czech Republic, Hungary, Mongolia, Poland, Romania, Slovak Republic, Vietna*	1-if former member of Comecon 0-otherwise	

*Soviet Union countries are excluded from because of the existence of USSR indicator.

Table 3: Log-Lin Panel Covering 1998 to 2016

	All Years
Log of GDP	0.986***
	(0.0153)
USSR Membership	0.166***
	(0.00653)
Comecon Membership	0.101***
	(0.00589)
Log of Distance	-0.995***
	(0.0364)
Economic Freedom Index	0.129***
	(0.0259)
Contiguous Borders	0.733***
	(0.0772)
Exporter Remoteness Index	-0.0404*
	(0.0190)
Importer Remoteness Index	-0.0827***
	(0.0163)
Constant	-3.164***
	(0.658)
Observations	4104
R^2	0.681
Adjusted R^2	0.680

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Log-Lin Results by Year

	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Log of GDP	0.993***	0.967***	1.009***	0.975***	1.041***	1.032***	1.116***	0.981***	1.007***	1.038***	1.055***	1.023***	1.100***	1.074***	1.059***	1.034***	1.010***	1.016***	1.068***
	(0.0624)	(0.0664)	(0.0623)	(0.0615)	(0.0656)	(0.0655)	(0.0906)	(0.0658)	(0.0681)	(0.0639)	(0.0672)	(0.0660)	(0.0724)	(0.0736)	(0.0666)	(0.0627)	(0.0628)	(0.0682)	(0.0717)
USSR Indicator Varible	3.596***	3.125***	3.252***	3.013***	3.098***	3.092***	3.113***	2.734***	2.657***	2.720***	2.602***	2.688***	2.774***	2.373***	2.377***	2.399***	2.185***	2.250***	2.508***
	(0.376)	(0.376)	(0.419)	(0.364)	(0.373)	(0.383)	(0.402)	(0.340)	(0.332)	(0.332)	(0.333)	(0.326)	(0.345)	(0.356)	(0.326)	(0.337)	(0.333)	(0.316)	(0.316)
Comecon Indicator Varible	2.036***	1.701***	1.722***	1.730***	1.791***	1.887***	1.707***	1.544***	1.527***	1.524***	1.586***	1.525***	1.577***	1.339***	1.327***	1.184***	1.146***	1.194***	1.289***
	(0.378)	(0.382)	(0.363)	(0.345)	(0.368)	(0.299)	(0.310)	(0.278)	(0.277)	(0.274)	(0.238)	(0.282)	(0.313)	(0.309)	(0.301)	(0.305)	(0.274)	(0.272)	(0.279)
Log of Distance	-1.058	-1.871	-1.775	-5.062**	35.22	-4.227***	-1.980*	-16.90**	-12.75	-45.12**	-4.798*	-13.43**	-2.815**	-8.643*	-2.190*	-8.683	-3.494	-1.112	-1.642**
	(0.966)	(1.078)	(1.358)	(1.873)	(24.65)	(1.236)	(0.852)	(5.797)	(34.19)	(13.95)	(2.024)	(4.519)	(1.037)	(4.333)	(1.066)	(5.206)	(2.277)	(0.595)	(0.577)
Economic Freedom Index	0.282*	0.146	0.0952	0.221*	0.206	0.272*	0.141	0.340**	0.317**	0.251*	0.189	0.245*	0.161	0.0717	0.146	0.258**	0.241*	0.211*	0.130
	(0.122)	(0.118)	(0.117)	(0.101)	(0.107)	(0.114)	(0.109)	(0.107)	(0.108)	(0.0992)	(0.120)	(0.110)	(0.0970)	(0.127)	(0.116)	(0.0949)	(0.0949)	(0.0936)	(0.0899)
Contiguous Borders	0.253	0.313	0.197	0.344	0.444	0.344	0.248	0.311	0.271	0.130	0.0367	0.116	0.177	0.320	0.262	0.293	0.346	0.280	0.0196
	(0.311)	(0.328)	(0.363)	(0.336)	(0.325)	(0.326)	(0.323)	(0.294)	(0.277)	(0.299)	(0.311)	(0.303)	(0.306)	(0.314)	(0.293)	(0.292)	(0.292)	(0.283)	(0.284)
Exporter Remoteness Index	0.277	1.189	0.919	4.483*	-35.85	3.738**	1.172	16.34**	11.82	44.54**	4.028	12.88**	2.137	7.948	1.413	8.082	2.782	0.383	0.871
	(1.125)	(1.208)	(1.470)	(2.003)	(24.56)	(1.330)	(0.968)	(5.896)	(34.16)	(14.05)	(2.140)	(4.641)	(1.151)	(4.446)	(1.176)	(5.309)	(2.387)	(0.715)	(0.705)
Importer Remoteness Index	0.164	0.883	0.695	3.864*	-36.20	2.962**	0.781	15.60**	11.80	43.84**	3.528	12.18**	1.691	7.458	1.091	7.722	2.503	0.221	0.563
	(0.877)	(0.964)	(1.232)	(1.756)	(24.75)	(1.075)	(0.692)	(5.655)	(34.24)	(13.84)	(1.903)	(4.411)	(0.931)	(4.194)	(0.945)	(5.102)	(2.189)	(0.504)	(0.493)
Constant	-13.32	-32.80	-27.17	-110.9*	940.1	-98.59**	-36.61	-413.9**	-312.4	-1108.5**	-100.3*	-313.9**	-57.67*	-208.1	-38.06	-198.6	-70.42	-15.15	-26.31
	(24.88)	(26.83)	(33.96)	(46.70)	(649.5)	(32.00)	(23.15)	(147.5)	(884.3)	(347.6)	(50.45)	(111.1)	(26.58)	(112.7)	(26.27)	(125.5)	(54.99)	(15.13)	(15.31)
Observations	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
R^2	0.695	0.679	0.720	0.712	0.687	0.706	0.710	0.724	0.715	0.746	0.753	0.738	0.734	0.692	0.728	0.730	0.733	0.742	0.750
Adjusted R^2	0.684	0.667	0.709	0.701	0.675	0.695	0.699	0.713	0.704	0.736	0.743	0.728	0.724	0.680	0.717	0.719	0.723	0.732	0.740

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Log-Lin Three Year Panel Results

	98-00	01-03	04-06	07-09	10-12	13-15
Log of GDP	0.940***	1.004***	1.035***	1.041***	1.078***	1.018***
	(0.0360)	(0.0367)	(0.0436)	(0.0375)	(0.0401)	(0.0370)
USSR Membership	1.130***	0.579***	0.344***	0.239***	0.178***	0.131***
	(0.0993)	(0.0406)	(0.0251)	(0.0175)	(0.0139)	(0.0112)
Comecon Membership	0.608***	0.344***	0.194***	0.138***	0.101***	0.0678***
	(0.0999)	(0.0379)	(0.0206)	(0.0140)	(0.0124)	(0.00957)
Log of Distance	-0.846***	-0.879***	-0.931***	-1.077***	-0.895***	-0.724***
	(0.192)	(0.103)	(0.0866)	(0.154)	(0.101)	(0.0854)
Economic Freedom Index	0.0823	0.223***	0.252***	0.223***	0.126	0.231***
	(0.0703)	(0.0619)	(0.0621)	(0.0630)	(0.0650)	(0.0543)
Contiguous Borders	0.684**	0.452*	0.314	0.113	0.260	0.326
	(0.208)	(0.180)	(0.168)	(0.176)	(0.172)	(0.167)
Exporter Remoteness Index	-0.161	0.0249	-0.0129	0.148	-0.0176	-0.0801
	(0.190)	(0.0568)	(0.0369)	(0.143)	(0.0720)	(0.0508)
Importer Remoteness Index	-0.191	-0.0322	-0.0636*	0.0964	-0.0494	-0.113**
	(0.153)	(0.0507)	(0.0322)	(0.134)	(0.0611)	(0.0429)
Constant	-0.0314	-7.503***	-6.164***	-10.04**	-6.881**	-5.046**
	(4.309)	(1.773)	(1.538)	(3.721)	(2.109)	(1.599)
Observations	648	648	648	648	648	648
R^2	0.666	0.690	0.709	0.734	0.713	0.729
Adjusted R^2	0.662	0.686	0.705	0.731	0.709	0.726

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: PPML Panel Results Covering 1998 to 2016

	All Years
Log of GDP	0.804***
	(0.0164)
USSR Membership	0.0794***
	(0.00567)
Comecon Membership	0.0247***
	(0.00556)
Log of Distance	-0.861***
	(0.0427)
Economic Freedom Index	-0.00106
	(0.0291)
Contiguous Borders	0.595***
	(0.0762)
Exporter Remoteness Index	-0.0279
	(0.0200)
Importer Remoteness Index	-0.0546**
	(0.0172)
Constant	1.199
	(0.685)
Observations	4104
R^2	0.473
Adjusted R^2	

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: PPML Results by Year

	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Log of GDP	0.833***	0.811***	0.785***	0.806***	0.769***	0.751***	0.764***	0.773***	0.817***	0.816***	0.887***	0.874***	0.838***	0.848***	0.834***	0.806***	0.810***	0.810***	0.822***
	(0.0394)	(0.0364)	(0.0551)	(0.0505)	(0.0477)	(0.0715)	(0.0707)	(0.0632)	(0.0628)	(0.0666)	(0.0615)	(0.0543)	(0.0567)	(0.0543)	(0.0581)	(0.0589)	(0.0585)	(0.0555)	(0.0493)
USSR Indicator Varible	2.263***	2.035***	1.923***	1.749***	1.532***	1.309***	1.337***	1.247***	1.202***	1.253***	1.229***	1.187***	1.139***	1.205***	1.151***	1.134***	1.111***	1.137***	1.092***
	(0.285)	(0.295)	(0.352)	(0.309)	(0.319)	(0.321)	(0.316)	(0.324)	(0.323)	(0.322)	(0.323)	(0.296)	(0.324)	(0.297)	(0.322)	(0.318)	(0.325)	(0.319)	(0.301)
Comecon Indicator Varible	0.843***	0.738**	0.752**	0.696**	0.508*	0.366	0.276	0.428	0.405	0.334	0.513*	0.359	0.327	0.375	0.334	0.312	0.214	0.198	0.263
	(0.223)	(0.246)	(0.240)	(0.241)	(0.241)	(0.245)	(0.235)	(0.221)	(0.256)	(0.234)	(0.244)	(0.218)	(0.256)	(0.246)	(0.270)	(0.248)	(0.262)	(0.267)	(0.250)
Log of Distance	-0.897	-0.490	-0.187	-0.914	-12.29	-1.112	-1.133*	-6.226	-3.567	-24.43*	-4.765**	-8.513**	-2.182*	-4.621	-1.965*	-6.049	-3.543	-1.464*	-1.690**
	(0.731)	(0.806)	(1.131)	(1.414)	(21.85)	(0.843)	(0.547)	(4.563)	(29.01)	(11.64)	(1.450)	(2.987)	(0.923)	(3.109)	(0.865)	(4.698)	(2.269)	(0.584)	(0.542)
Economic Freedom Index	-0.00481	0.0556	0.0164	-0.0240	0.00974	-0.0489	-0.0397	0.0535	-0.0307	-0.0469	-0.112	-0.106	-0.0216	-0.0504	0.00503	0.0493	0.0599	0.000167	-0.0593
	(0.0749)	(0.0944)	(0.0991)	(0.0808)	(0.0848)	(0.106)	(0.116)	(0.136)	(0.0904)	(0.102)	(0.0987)	(0.0807)	(0.0902)	(0.0831)	(0.100)	(0.0878)	(0.0913)	(0.0869)	(0.0779)
Contiguous Borders	0.182	0.267	0.245	0.304	0.373	0.390	0.337	0.286	0.248	0.311	0.220	0.242	0.468	0.517*	0.481*	0.538*	0.566*	0.593**	0.528*
	(0.224)	(0.260)	(0.284)	(0.258)	(0.258)	(0.250)	(0.234)	(0.245)	(0.234)	(0.227)	(0.227)	(0.206)	(0.263)	(0.214)	(0.232)	(0.239)	(0.240)	(0.222)	(0.209)
Exporter Remoteness Index	0.0517	-0.447	-0.802	0.00838	11.32	0.200	0.197	5.390	2.552	23.70*	4.019**	7.749*	1.457	3.900	1.261	5.382	2.919	0.937	1.143
	(0.848)	(0.929)	(1.239)	(1.509)	(21.76)	(0.930)	(0.640)	(4.666)	(28.96)	(11.74)	(1.554)	(3.062)	(1.033)	(3.206)	(0.953)	(4.788)	(2.344)	(0.655)	(0.641)
Importer Remoteness Index	0.0149	-0.404	-0.734	-0.0404	11.37	0.122	0.105	5.122	2.513	23.33*	3.547*	7.334*	1.158	3.660	0.994	5.151	2.653	0.635	0.777
	(0.661)	(0.741)	(1.041)	(1.324)	(21.93)	(0.753)	(0.458)	(4.479)	(29.03)	(11.57)	(1.385)	(2.911)	(0.838)	(3.027)	(0.768)	(4.604)	(2.152)	(0.463)	(0.448)
Constant	-2.712	9.344	19.43	-0.137	-298.4	-2.821	-2.642	-132.9	-64.53	-585.7*	-94.58*	-185.4*	-34.09	-99.49	-28.62	-127.6	-68.00	-21.39	-26.43
	(19.11)	(21.15)	(29.22)	(35.49)	(575.8)	(22.77)	(15.91)	(116.6)	(750.0)	(290.7)	(36.87)	(73.23)	(24.33)	(81.39)	(21.36)	(113.0)	(53.59)	(13.65)	(14.23)
Observations	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
R^2	0.791	0.795	0.763	0.772	0.710	0.714	0.681	0.637	0.612	0.559	0.614	0.627	0.517	0.592	0.515	0.536	0.523	0.568	0.683
Adjusted R^2																			

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: PPML Three Year Panel Results

	98-00	01-03	04-06	07-09	10-12	13-15
Log of GDP	0.735***	0.765***	0.785***	0.864***	0.844***	0.804***
	(0.0315)	(0.0355)	(0.0382)	(0.0374)	(0.0328)	(0.0356)
USSR Membership	0.554***	0.269***	0.153***	0.108***	0.0837***	0.0632***
	(0.0829)	(0.0345)	(0.0220)	(0.0177)	(0.0131)	(0.0117)
Comecon Membership	0.175*	0.0874**	0.0493**	0.0339*	0.0250*	0.0120
	(0.0701)	(0.0273)	(0.0172)	(0.0142)	(0.0110)	(0.00990)
Log of Distance	-0.988***	-0.955***	-0.994***	-1.017***	-0.868***	-0.737***
	(0.152)	(0.0871)	(0.0908)	(0.159)	(0.106)	(0.101)
Economic Freedom Index	-0.0568	-0.0374	0.0176	-0.0807	-0.0252	0.0362
	(0.0596)	(0.0541)	(0.0640)	(0.0601)	(0.0540)	(0.0548)
Contiguous Borders	0.483***	0.399**	0.313*	0.294	0.495***	0.581***
	(0.135)	(0.147)	(0.146)	(0.156)	(0.147)	(0.155)
Exporter Remoteness Index	0.0776	0.0293	0.00585	0.0294	0.00850	-0.0308
	(0.144)	(0.0386)	(0.0256)	(0.160)	(0.0861)	(0.0527)
Importer Remoteness Index	0.0200	-0.0175	-0.0389	-0.00371	-0.0149	-0.0525
	(0.116)	(0.0344)	(0.0215)	(0.152)	(0.0743)	(0.0421)
Constant	0.316	0.759	1.783	-0.460	-0.645	0.283
	(3.460)	(1.373)	(1.237)	(4.316)	(2.408)	(1.370)
Observations	648	648	648	648	648	648
R^2	0.705	0.717	0.610	0.560	0.531	0.499
Adjusted R^2						

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1: Coefficients & Confidence Intervals for Year-by-Year Panel Regressions

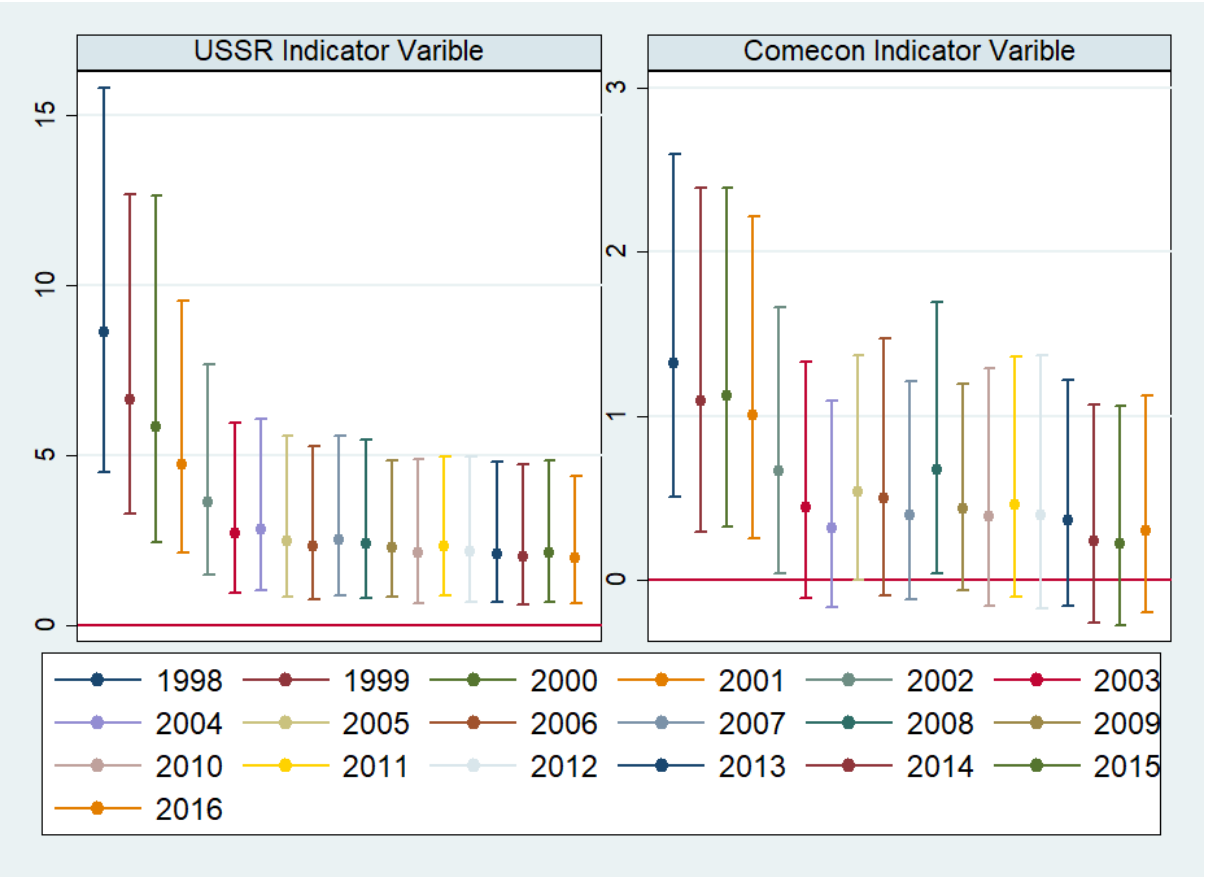

Figure 2: Coefficients & Confidence Intervals for Three-Year Panel Regressions