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Arms Trade and Military Expenditures in Eastern Europe

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Abstract

Four models are developed and tested in this study. The first two models deal with arms trade, and the other two deal with military expenditures. The most important finding of this study is political freedom has a very strong effect on both arms trade and military expenditures in Eastern Europe. The more free a country, the less likely it is to have high levels of arms trade overall, as well as import arms. Also, the higher the level of political freedom, the lower the value and intensity of military expenditures.

All of the models were tested for Eastern Europe a whole as well as for the individual countries of Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania.

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1.0 Introduction

1.1 Question and Significance

The newly elected Bush administration is making international headlines these days by pushing for the development of a national missile-defense system. Such a system, most would agree, is a violation of the 1972 anti-ballistic missile treaty signed between the United States and the Soviet Union. Opponents of the shield argue its development could lead to a new arms race and send military expenditures spiraling out of control.

A recent report entitled "Recent Trends in Military Expenditure" published by the Stockholm International Peach Research Institute (SIPRI) reports that military expenditures are once again increasing after a 10-year period of decline (2001). This increase in military expenditures began in 1999 and continued into 2000. It is important to note this increase is not restricted to certain regions of the world, rather every region has seen an increase in military expenditures since 1999.

Thus far, trade in arms does not seem to be following suit. In a separate report, *Recent Trends in Arms Production*, SIPRI notes that arms trade has been on the decline since 1989 (2001). For example, in 1970, arms imports as a percentage of total imports was 2.1 for all of the Warsaw Pact countries. The percentage of total exports made up of arms exports during that same time was 5.7. In 1994 the percentage of arms imports was down to 0.2 and the export percentage was down to 1.4.

The year 1989 was a very significant one in the international politics and economics. The fall of the Berlin wall and the rapid disintegration of communist governments in Eastern Europe brought about many significant changes in the international community.

Whereas the communist governments generally restricted trade in Eastern Europe to trade amongst communist countries, the new democratic governments pushed for increasingly open trade with all countries. As a result, overall trade volumes in Eastern Europe have been increasing as has the ratio of traded goods to GDP, commonly referred to as openness to trade.

As one can imagine, the collapse of communism in Eastern Europe has sparked a number of questions about the future of global economics and politics. Many have studied the region's emerging trade patterns in areas such as agriculture, manufacturing and services. There has been some research done on the changes in arms trade; however, most of the research was done soon after the fall of the Soviet Union in 1991. This study will explore the changing trade patterns in military expenditures and arms trade that have emerged since the collapse of communism in Eastern Europe.

Two main questions will be addressed in this paper. The first question is "what factors influence arms trade in Eastern Europe?" This question can be broken down into two separate sub-questions. The first being "what variables appear to affect the overall volume of arms traded in Eastern Europe?" The overall volume of arms trade is defined as the total dollar value of arms imports and exports in each of the Eastern European countries.

Realizing that all trade, including arms trade, is a two-way process, the second part of this question

asks, "what factors influence whether a country is a net importer or exporter of arms?" This is essentially defined as the difference between the dollar value of arms imported by these countries from the dollar value of arms exported.

The second question is, "what factors influence military expenditures in Eastern Europe?" This question can also be broken down into two separate parts. The first is "what factors have influenced the overall volume of military expenditures in Eastern Europe over time?" The volume of military expenditures is defined as the total dollar value of military expenditures spent by the governments of the Eastern European countries.

The second part is "what factors influence the intensity of military expenditures in Eastern Europe over time?" The intensity of military expenditures is defined as the ratio of the dollar value of military expenditures to the dollar value of GDP in those same countries.

The answers to these questions are significant for many reasons. Beginning with the second question,

many in the international community consider a reduction in the amount of money spent on military items an important policy goal. Former President Eisenhower once said, "Every rifle being made, every launched naval vessel and every fired missile is after all theft of the people who are hungry and not fed, who are cold and not clothed" (Broek 1998). While not all would agree with this statement, it is at least partially true. A government only has so much in resources to work with; if more of this money is allocated to military expenditures, it only follows that less money is available for other projects that may be of importance including welfare programs, education, and health care programs.

If we can learn what factors are conducive to an increase in the overall volume of military expenditures, we may be able to take measures to lessen or even eliminate the presence of those factors. Directly related to this, if we can learn what factors are conducive to a decline in military expenditures, we may be able to take measures to promote the existence of those factors.

While many may consider a reduction in military expenditures as a step in the right direction, perhaps another equally, if not more, important goal is reducing the emphasis placed on military expenditures within an economy. As GDP increases, it would not be surprising to see all components of GDP to rise also, including military expenditures by the central government. What is also important to analyze is whether the growth in military expenditures is outpacing the growth in GDP. A good way to look at this is to see how the ratio of military expenditures to GDP changes over time.

Looking at what factors influence the volume and intensity of military expenditures may be important; however, a subset of this is arms trade. The volume of arms trade is also an important statistic. It may provide us an idea of what countries are expecting to need, and perhaps use, weapons. Related to this, it is important to note whether a country is a net importer or a net exporter of weapons.

If a country has decided to export weapons this could be a signal that the government of that

particular country does not foresee the need to be using those arms in the near future, either for offensive or defensive purposes, so they are being shipped out of the country. This is assuming, of course, the traded arms were not produced for trade.

Granted, this may not always be the case. Sometimes a net surplus of weapons exports may simply mean that domestic arms production is greater than domestic arms consumption. In the case of Eastern Europe, the production of small arms for trade is on the increase (United Nations 2000).

If a country is also decreasing the total value involved in arms trade, this could also be an indication that governments are expecting a more peaceful future. This could be a positive sign, signaling a more peaceful period in the region. Granted, it could also mean that competition is greater in the weapons industry.

Conversely, if a country begins to import weapons on a larger scale or begins to devote more resources to a higher percentage of arms trade, these could be signals that the government of that country is

expecting to need more arms. This could be, perhaps, in response to a perceived external threat, thus prompting the need for more defense mechanisms, or it could be an indication the government plans to launch its own offensive maneuvers.

Once again, this may not always be an accurate interpretation of the situation. Perhaps domestic production of arms was reduced or even eliminated for some reason; this could be a plausible explanation for an increase in arms imports over arms exports. However, since the volume of domestic arms production in Eastern European countries has changed very little over time, it is more likely that an increase in arms imports may be the signal of a heightening arms race. For example, if a threat is suddenly perceived, a government may not have the time necessary to step-up domestic arms production. Instead, the government may decide to import arms from other countries in order to compete in the arms race.

Predicting whether a country is likely to be a net importer or a net exporter of weapons in the coming years can be a useful tool in determining

whether the near future of a particular region will tend to be more peaceful and stable, or more confrontational and unstable.

1.2 Background

There are a number of reasons why the region of Eastern Europe is an important area to study regarding these issues. First of all, these countries (Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania) were once part of the "Iron Curtain" that was installed by the Soviet Union to help guard against an invasion of the USSR by Western forces. These countries were not actually part of the former USSR, however their economic and political structures were designed to closely mirror those of the Soviet Union.

For example, all of these countries operated under some form of a centrally planned economic system, rather than a free-market based economy. All of the countries in question also were under the influence of a government operating under a communist philosophy of governance. These countries were also once part of a common agreement called the Warsaw

Pact. The Warsaw Pact of 1955 was primarily an agreement meant to protect and strengthen the Communist philosophy, however some military purposes were also served by the pact (Mastny 2001).

Similarities in the economic and political infrastructure of these countries is desirable, as it will help to minimize potential noise in the data. When working with data, an assumption of ceteris paribus, meaning all else being equal, is made. The more similarities there are between the countries from which the data is collected, the more likely the assumption of ceteris paribus is to be true.

Former Iron Curtain countries are also important to study, as they have been more successful in creating stable democratic states and freer economic systems than have their former Soviet counterparts, with the exception of the Baltic states. If these countries are more likely to continue to build upon their newly established political and economic systems, the results of this study will be more relevant than if the states reverted back to their Soviet-style past.

This is because the results of this paper are intended to identify what factors are conducive to a reduction in arms trade and military expenditures; traits which are normally associated with non-Communist regimes, of course the US and France are notable exceptions.

Previously, it has been thought that Eastern Europe was not a desirable region for serious statistical study due in part to the difficulty of obtaining reliable data. This thought has changed in recent years, with the opening of data archives and other valuable research materials to the rest of the academic world (King 2000). Also, records from Eastern Europe tend to be more easily accessible and reliable than data for the former Soviet states.

2.0 Literature Review

2.1 Gravity Model

The empirical framework behind one of the models is the gravity model of trade. The gravity model is used to predict the volume of international trade. The basic structure of the gravity model uses trade volume as the dependent variable and incorporates the

trading partners' GDP, geographic proximity, and general barriers to trade (Bergstrand 1985).

The gravity model has been a part of economic thought for many years now. Tingbergen first applied this model in a 1962 paper, followed by Poyhonen in 1963.

Despite the wide use of the gravity model, some have criticized the model for lack of a strong theoretical foundation. Studies by Anderson (1979) and Bergstrand (1985)have concluded there are no inherent problems with the model and also have provided a microeconomic foundation for the model. A later study by Deardorff (1995) has also strengthened the credibility of the model by showing it is consistent with both the neoclassical and Ricardian traditions.

Since then, many economists have incorporated the gravity models in their studies. One of these economists is Kalirajan (1999). Kalirajan uses data for Australia and its trade partners during the years 1990 through 1994 to analyze trade relationships with countries on the Indian Ocean Rim. Kalirajan uses the gravity model to estimate potential trade and

concludes that those countries with fewer trade restrictions were better able to capitalize on their trade potential.

Wang and Winters (1992)also use the gravity model to predict overall trade in Eastern Europe using data from 1989 to 1992. The authors conclude the increased openness to trade that is emerging in Eastern Europe will not significantly affect trade between Eastern Europe and developing countries, but should significantly increase trade with industrialized countries such as the US.

One economist who does look at the application of the gravity model to Eastern Europe is Nagy (1997). Similar to Wang and Winters, Nagy also use data since the collapse of communism in 1989 through 1995. Nagy concludes the gravity model is indeed a reliable predictor of trade in Eastern Europe.

Summary (1989) also uses the gravity theory to analyze US bilateral trade. Summary runs two separate regressions to see what factors have the greatest effects upon US imports and exports. Summary concludes there are many political factors that influence trade

in addition to the commonly accepted economic factors. Interestingly, one of these political factors is arms transfers. Summary found that arms transfers are highly significant in determining import and export volume in an economy. This study is similar to Summary's in that I also believe that political factors as well as economic ones have an impact upon arms trade and military expenditures.

The encouraging results of the many studies done using the gravity model in predicting overall levels of trade have prompted me to see if the theory can be applied to a specific subset of trade, arms trade. There has been a great deal of research on and use of the gravity model, however there seems to be an absence of research applying the gravity model of trade to specific subsets of trade. More specifically, there does not seem to be any academic literature relating arms trade and the gravity model.

There is a rather large body of literature dealing with issues of arms trade in general, and the economic implications and foundations of it. Some of

the research that has been conducted on the issue of arms trade is summarized in the following section.

2.2 Arms Trade

The recent international debate over the United States' proposed missile defense system has once again brought the issue of arms trade to the forefront of policy debate. Many argue that if such a system is developed by the United States, a new arms race may result.

Of course, the debate over arms trade and its impact is nothing new. Li and Mirmirani (1998) analyze the effects trading military and arms technology has on economic growth. The findings of Li and Mirmirani indicate there is a fairly strong negative correlation between those two variables.

The fact that Li and Mirmirani have found a correlation between economic growth and arms trade implies that arms trade may be something controllable. Therefore, if we can determine what factors influence arms trade, we may be able to manipulate those factors in order to reduce the volume of arms trade in the world.

Mussington (1994) has done a great deal of research on the supply side issues of arms trade, and he also finds that controllable variables do, in fact, influence arms trade. Among Mussington's findings is that government actions, such as taxation, influence arms trade by affecting how much resources are available for the trading of arms.

Harkavy (1994) analyzes three recent historical eras with distinctly different international systems. These periods are the interwar period (between World Wars I and II), the Cold War period, and the post-Cold War period. Harkavy found the post-Cold War period does share many similarities with the interwar period. In both of those eras, Harkavy argues arms trade has become de-politicized and de-nationalized.

Brzoska and Pearson (1994) also note that the United States' current position as the sole remaining military superpower has a definite impact on the arms trade. Taking a supply-side perspective, Brzoska and Pearson note the United States is likely to remain the leading arms supplier, due in part to the political and economic uncertainties that exist in Russia. While

this article was written in 1994, the conclusions are arguably still true today, as economic and political uncertainties are still prevalent in Russia.

Catrina (1994) argues that arms transfers should be the central theme of research on arms in this new era. Catrina argues for a more descriptive approach to analyzing the changing system of arms transfers, as opposed to a more statistical one. Part of his rationale behind this is the lack of reliable statistical information available. While this may have been a valid argument in 1994, vast strides have been made to make reliable data from Eastern Europe more easily obtained.

The arguments made by Harkavy, Brzoska and Pearson, and Catrina lend support to the argument that economic factors may be more influential in arms trade than in the past. Whereas arms trade used to be almost exclusively a political issue, more and more economic factors are being introduced in arms trade models, replacing or complementing political ones.

Many studies have been done on Russia's arms trade, including two studies by Khripunov. The first

study, published in 1994, noted that there would likely be some major changes in the arms trade game in Russia since democracy and capitalism have taken hold.

Khripunov (1999) noted that the Cold War was the primary motivation for Russia to export arms during that time. Now that the Cold War is over, Russia does not have to export weapons in order to protect its national interests. Khripunov also notes that Russian economic policy makers have recently decided to export weapons in order to boost a failing economy.

Khrutsky and Latypov (1997) also look at arms trade in Russia, noting that the future of the Russian defense industry is, at best, uncertain. Berryman looks at the role of the black market in Russia's arms trade game (2000). Very few authors have focused on Eastern Europe's arms trade.

If one is concerned with the military activity in a particular county, region, or in the world overall, it is reasonable to want to be aware not only of issues related to arms trade, but also to a more broad issue: military expenditures. While arms trade has seemed to receive the bulk of academic attention,

there does exist some valuable work on military expenditures.

2.3 Military Expenditures

Broek (1998) and Kempster (1998) have both presented research on the impact of peace movements on military expenditures. Both of these authors, in two separate studies, have concluded that the stronger the peace movement in a country, the lower the military expenditures.

Other economists have examined military expenditures in certain countries. Thomas Scheetz (1996) analyzed 1969-1995 data from Guatemala and concluded that military expenditures have a negative effect on GDP growth. One of the reasons Scheetz believes this relationship holds is that military expenditures in Guatemala monopolized scarce resources which were unavailable for use in productive economic sectors.

Sezgin (1998) analyzes military expenditures in Turkey during the years 1956 through 1994. In the case of Turkey, Sezgin concludes that military expenditures are conducive to economic growth; and the major

determinants of military expenditures are GDP, civil strife, and the military expenditures of rival Greece.

In addition to individual sets of authors, there are also international organizations that specialize in the analysis of military expenditures. One of these organizations is the Ottawa Symposium. The theme of this symposium was "Military Expenditure in Developing Countries: Security and Development." Four different regions of the world were discussed in this symposium: South Asia, Southern Africa, Central America, and the Horn of Africa. There was no work presented on Eastern Europe or the Newly Independent States (NIS). One of the purposes of this study is to help fill this noticeable lack of research on military expenditures in Eastern Europe.

In sum, previous research has shown that both political and economic factors influence arms trade and military expenditures. Very little research has been done on arms trade and military expenditures Eastern Europe exclusively, a fact this paper intends to help change.

3.0 Empirical Models and Data

3.1 Model A

The first model will be developed in order to predict the overall volume of arms trade in Eastern Europe and will be referred to as Model A. The volume of arms trade is defined as the total dollar value of arms imports and exports in the region. The data for exports were obtained from two sources: the U.S. State Department's *publication World Military Expenditures and Arms Transfers (WMEAT)*, and various issues of the *CIA World Factbook*.

A gravity-like model will be the operational theory on which this model is based. In most cases, the gravity model is used to explain the exports of one country to another and is a function of each country's economic and geo-political traits. Due to data limitations, I have modified the theory from its conventional use to analyze broad trade patterns to a more refined use in analyzing arms trade.

Model A will be defined as:

$$TTRADE=\beta_0+\beta_1 LNGDP+\beta_2 LNOPEN+\beta_3 LNPFI+\beta_4 LNMILES+\mu$$

The dependent variable for this model is the total trade in arms in Eastern Europe (TTRADE). Model A has four explanatory variables: GDP, distance from Moscow prior to the collapse of the USSR or from Brussels after the collapse (MILES) openness to trade (OPEN) and a political freedom index (PFI). Where possible, logs of the above variables were used and are indicated by an "LN" in front of each variable name. The models were also estimated including dummy variables for time, such as DUM70 for the year 1970, DUM71 for 1971, etc. However, the dummy variables were not included in the country-specific regressions.

The estimations for Eastern Europe as a whole are presented in addition to the estimations for all six countries included in the study. For Eastern Europe, the number of observations is 164. There are seven different countries that are included in the data, with the years ranging from 1970-1997. More recent data was not available for arms trade.

In sum, Model A is not a true gravity model, as it does not use the trade between two countries as the dependent variable, but rather the total arms trade of

the entire region. However, I have incorporated some of the explanatory variables normally associated with the gravity model into model A. Both nominal GDP of the trading countries and geographic distances are explanatory variables that can be found in traditional gravity models and model A.

Upon analysis of the data, I expect to find a positive correlation between the level of arms trade and GDP. In other words, I expect the volume of arms trade will increase as GDP increases. Many of the previously mentioned studies have found a positive correlation between the volume of trade between countries and their GDPs. I do not expect this relationship to hold up for arms trade, at least not in Eastern Europe. As was mentioned in the SIPRI article, arms trade has been on the decline since the late 1980s, while GDPs have been on the rise.

The data for each country's GDP was also obtained from various issues of *WMEAT* and the *CIA World Factbook*. The data was from various years and needed to be adjusted for inflation. This was accomplished using the GDP deflator provided on www.dismal.com.

The gravity model hypothesizes the closer the economic centers of countries are to one another, the higher the volume of trade will be between those countries. For Model A, this will be modified to account for the distances between centers of military power. During the existence of the USSR, the distance between each country's capital and Moscow will be factored into the model. After the dissolution of the USSR, distance from Moscow will be replaced with distance from Brussels, signifying a shift in influence from the USSR to NATO.

Based on the rationale behind the Warsaw Pact, I expect to find a positive correlation between the volume of arms trade and distance. The Warsaw Pact was intended primarily to promote the communist philosophy, however a secondary purpose was military in nature (Mastny 2001). Military strategy would dictate that the strongest, most reinforced areas should be in place around the target one most wants to preserve. Therefore, those countries closer to Moscow would likely be more heavily armed than those further away. It is important to note, however, that not all

of the members of the Warsaw Pact followed Moscow's military directives with the same level of obedience. Romania especially did not follow these directives (Bacon 2001).

I expect the positive correlation to hold true when distance from Brussels is substituted for distance from Moscow. True, Brussels would want to have more concentrated arms nearby rather than afar, but since Belgium is not the primary weapons trade partner of Eastern European countries, I do not expect the relationship to be quite as strong.

A third explanatory variable included in model A is openness to trade. For the purposes of this study, openness to trade is defined as the dollar value of exports plus imports as a percentage of GDP. Most of these values were obtained from the Penn World Tables, however more recent data (1993-1999) was calculated by myself using data provided in *Nations in Transit 1999-2000: Civil Society, Democracy and Markets in East Central Europe and the Newly Independent States.*

Openness to trade is an important variable because it may be an indicator of how incorporated a

country is in the growing global economic and political systems. The more integrated a country is, the more leverage the international community has to encourage or discourage certain behaviors by that country. For example, if a country is highly incorporated in the international system, it is more likely to submit to arms reductions treaties in order to maintain favorable standing in the economic community. In other words, there may be a negative correlation between arms trade and openness to trade.

On the other hand, a positive correlation between openness and arms trade is possible. Part of the reasoning behind this is the arms trading partners of Eastern Europe tend to be more industrialized countries rather than developing countries, and that is the situation where Wang and Winters (1991) found a positive correlation between openness and total trade. If a country is more open to trade, it is rational to expect the volume of trade to increase (Kalirajan 1999).

Wall (1999) looks at the various trade barriers the United States has erected against various

countries in the rest of the world including import policies, administrative barriers, government procurement, intellectual property and other barriers to trade. Wall looks at these barriers both collectively and separately to see what effects those barriers have on US imports and exports. He concludes that barriers to trade do indeed decrease the overall level of trade.

A final explanatory variable included in model A is political freedom. Research by both Kempster (1998) and Broek (1998) support the claim that the peace movement affects military expenditures and arms trade. The peace movement is likely to be stronger in countries with greater political freedom, as more repressive countries are more likely to squash peace movements. The values for political freedom are taken from an index published in *Nations in Transit 1999-2000.* The values range from one, which represents the highest level of political rights and civil liberties, to seven, which represents the lowest possible level. The data used in the regression will be the index

values for all of the countries analyzed over all of the years in question.

One of the many questions I intend to answer with this study is how communist-style regimes influence arms trade and military expenditures. I have introduced political freedom as a proxy for Communism in all of the models developed in this study. Some of the countries involved in this study, such as Romania, still tend to have a rather sizeable post-communist influence, while others, like Poland, do not.

Whether there is a positive or negative correlation between political freedom and openness to trade remains to be seen. It is possible that the more repressive a regime, the higher the level of arms trade and military expenditures, as in the cases of China and the former Soviet Union. On the other hand, countries such as Great Britain and the United States are arguably quite free, but still have comparatively high levels of arms trade and military expenditures. Also, the studies by Broek (1998) and Kempster (1998) support the hypothesis that more political freedom will lead to less military expenditures.

3.2 Model B

Model B is similar to model A in that it looks at an aspect of arms trade. Whereas model A is developed to predict the overall level of arms trade in Eastern Europe, model B is developed to predict whether or not the region will be a net importer or a net exporter of arms. The data for this dependent variable were obtained from various *WMEAT* publications and from the *CIA World Factbook*.

Model B is specified as follows:

$$BOT=\beta_0+\beta_1 GDPGR+\beta_2 LNOPEN+\beta_3 LNPFI+\mu$$

The dependent variable in this model is the balance of arms trade (BOT) as defined by arms exports minus arms imports. There are three independent variables, the growth rate of real GDP (GDPGR), openness to trade (OPEN) and political freedom (PFI). β_0 is the constant term and μ is the error term.

The first explanatory variable used in model B is the growth rate of GDP. Li and Mirmirani (1998) analyze the effects trading military and arms technology has on economic growth. The findings of Mirmirani and Li indicate there is a correlation

between those two variables. I have incorporated the growth rate of GDP in model B due in part to the findings of Li and Mirmirani.

I expect to find a positive correlation between an arms trade surplus, meaning that exports exceed imports, and economic growth. Once an economy begins to grow, policy makers are likely to want to sustain that growth. One of the ways that GDP can increase is if exports are greater than imports, or even if a trade deficit begins to shrink. An exception to this general rule is the United States. Exporting weapons can help sustain economic growth. Therefore, I expect to find a positive correlation between the growth rate of GDP and an arms trade surplus.

Not everyone subscribes to this hypothesis. Khripunov (1999) notes that the Russian economic policy makers have recently decided to export weapons in order to boost a failing economy. However, Russia is not Eastern Europe. For the most part, Eastern Europe has enjoyed much more prosperous times than Russia and the former Soviet states. Also, this may be

a temporary action by Russia in desperate times, however we cannot be sure.

Khripunov himself noted this is a temporary phenomenon and that Russia's primary motivation for being a net exporter of weapons (to protect and spread Soviet style communism) has disappeared. Governments who operated countries under this ideology tended to squelch free trade and political freedoms.
As the need for arms declines in the region, countries are faced with a surplus of weapons for which Eastern European leaders may not see a need.

With this in mind, I expect to see countries become net exporters of as economies begin to grow, as markets begin to open, and as political freedoms begin to blossom. Therefore I have included openness to trade and political freedom as explanatory variables in model B.

3.3 Model C

The dependent variable in model C is the total dollar value of military expenditures in Eastern Europe. These values were once again obtained using

the *WMEAT* publications as well as *the CIA World Factbook*. Model C is specified as:

$$ME=\beta_0+\beta_1GDPGR+\beta_2LNOPEN+\beta_3LNPFI+\beta_4LNNATO+\mu$$

where β_0 is the constant term and μ is the error term. The dependent variable in this model is total military expenditures (LNME). Three of the explanatory variables have been used in previous models: growth rate of real GDP (GDPGR), political freedom (PFI) and openness to trade (OPEN). A fourth variable is introduced in this model, affiliation with NATO (NATO). Once again, the model was tested both with and without dummy variables for time when estimated for Eastern Europe as a whole.

For the most part, the same variables that influence arms trade should also have an influence on military expenditures. Military expenditures is defined by NATO as capital expenditures on:

(a) The armed forces, including peacekeeping forces;

(b) Defense ministries and other government agencies engaged in defense projects;

(c) Paramilitary forces, when trained and equipped for military operations;

(d) Military space activities

Civil defense, veterans' benefits, demobilization, conversion and weapons destruction are not included in the figures (SIPRI 2001, "Sources…). This definition of military expenditures is used in compiling the data in both the WMEAT and SIPRI publications.

Investment in arms is one aspect of military expenditures, albeit a more specialized subset. Therefore many of the same economic and political variables that have been found to be important factors in the arms trade will also be important with regard to military expenditures as a whole. As a result, many of the same variables will be incorporated into the models of arms trade and military expenditures that I have devised and tested in this study.

The growth rate of real GDP will be included as an explanatory variable. The 1997 Ottawa Symposium on Military Expenditures and Growth presented evidence supporting theories that claim military expenditures

and development are indeed correlated. If these variables are related in areas of the world such as South Asia, Central America and Africa, it is reasonable to see if the relationships also apply in Eastern Europe.

Political freedom will also be included as an explanatory variable in model C. The primary purpose of the Iron Curtain was to act as a shield against Western socio-political penetration into the Soviet sphere of influence [specifically the North Atlantic Treaty Organization (NATO)]. With this in mind, it is rational to expect these countries would need to have a higher level of military expenditures and arms in order to serve the purpose of defending the Soviet Union and the overall communist philosophy.

As communism and the USSR decline, so do the odds that Western forces will attempt to invade. With this understood, there is less need for the Eastern European countries to be armed; therefore, military expenditures should decline during this time. These hypotheses are based, in part, on the findings of Khripunov (1994, 1999).

As was mentioned earlier, openness to trade can also be used as a proxy for communist influence, therefore I have again incorporated openness to trade as an explanatory variable. I expect to find a negative relationship between military expenditures and openness to trade.

In order more fully capture the impact of communism on military expenditures, I have included a variable for affiliation with NATO in both models C and D. As membership or partnership with NATO increases among Eastern European countries, the value and intensity of military expenditures should increase. Eastern European countries join NATO, there is less of a threat of military aggression against these countries so there is less of a need for an arms stockpile, however NATO does stipulate that members increase their military expenditures to a certain level. Partners do not necessarily have to increase the levels as much as full-fledged members (www.nato.org). Should any of these countries become a victim of external aggression, other members of NATO are obliged to come to the assistance of the

victimized country. As a result, there is little incentive to increase military expenditures beyond the levels dictated by NATO.

3.4 Model D

Model D is very similar to model C, except the dependent variable is a measure of the intensity of military expenditures. In other words, it is the ratio -of the dollar value of military expenditures to GDP. Once again the data come from *WMEAT* publications and the *CIA World Factbook*. Model D is specified as:

$$INTENSE=\beta_0+\beta_1 GDPGR+\beta_2 LNOPEN+\beta_3 LNPFI+\mu$$

The dependent variable is intensity of military expenditures (INTENSE), measured as military expenditures as a proportion of GDP, and the other variables are the same as before: growth rate of GDP (GDPGR), log of openness to trade (LNOPEN), and the log of political freedom (LNPFI). Again, β_0 is the constant term and μ is the error term.

While the sheer volume of resources spent on military expenditures is an important figure to look at when studying the military situation of a country, it is also important to take into consideration the

intensity of military expenditures. For example, country A may have a significantly higher level of military expenditures than country B, but if country A also has a significantly higher GDP than country B, perhaps the two aren't all that dissimilar in relationship to each other's expenditures. The intensity variable is useful in comparing countries and regions of the world.

The explanatory variables for model D will be the same as in model C, using the same hypotheses. Once again those variables are the growth rate of real GDP, political freedom, openness to trade, and affiliation with NATO.

4.0 Empirical Results

All of the models were estimated using ordinary least squares regression analysis. The models were tested for the region as a whole, as well as for each of the selected countries to see if any patterns found hold up. For the regional regressions, the models were tested using dummy variables to control for the passing of time on the data.

The statistics provided on Table 1 are only for the region as a whole, and not for the individual countries.

Table 1: Descriptive Statistics

	MEAN	MINIMUM	MAXIMUM	STD DEVIATION
REGIONAL				
TTRADE	299.39	10.00	9487.00	1027.03
BOT	-34.40	-1422.10	8692.80	223.49
ME	8189.10	332.00	20000.00	1708.23
INTENSE	5.77	1.80	15.70	0.94
GDP	134297.90	348142.00	17550.00	1203.11
GDPGR	-0.47	-17.5	10.6	5.79
PFI	2.49	1	7	1.34
OPEN	74.64	29.79	310.70	89.50
MILES	813.89	448	1107	60.14
NATO	1.05	0	2	0.54

4.1 Model A

Table 2: Model A: Dependent Variable TTRADE

	Region**	Region***	Bulgaria	Czechs.	E. Germ.	Hungary	Poland	Romania
LNGDP	0.78*	0.84*	1.87*	0.74*	0.66	0.99*	1.23	0.78*
	(3.49)	(5.95)	(1.37)	(3.50)	(0.04)	(4.21)	(1.27)	(1.42)
LNOPEN	0.18	0.87*	1.05*	0.38	0.43	0.32	0.68	0.05
	(0.58)	(4.34)	(1.60)	(0.88)	(0.78)	(0.68)	(0.33)	(0.00)
LNPFI	0.71*	1.30*	-0.05	0.27	0.31	0.89	-0.02	-0.18
	(2.13)	(7.43)	(-0.04)	0.54	(0.68)	(0.53)	(-0.34)	(-0.67)
LNMILES	0.41	-1.13*	38.5	1.54*	25.60*	13.90*	17.90*	41.3*
	(0.7)	(-2.82)	(1.2)	(1.86)	(1.62)	(1.41)	(-1.32)	(2.1)
C	-7.24*	-7.96*	-288*	-14.3*	-5.41*	-23.70*	-16.90*	-65.9*
	(-1.47)	(-1.48)	(-1.32)	(-2.63)	(-1.57)	(-1.69)	(-3.41)	(-2.27)
Adj. R2	0.65	0.62	0.63	0.77	0.56	0.64	0.82	0.72

t-statistics are presented in parenthesis

* denotes significance at the 0.80 level or better

** regional results with dummies

***results without dummies

Table 2 presents the numerical regression results for model A. The model was tested for the region as a whole with and without the dummy variables. None of the dummy variables tested were statistically significant, therefore the discussion of model A that follows is based off of regression results where the dummy variables were omitted.

The estimated model for the Eastern European region as a whole appears to be fairly solid. An adjusted R^2 value is often used as a measure of "goodness of fit." The model has an adjusted R^2 of 0.62, which implies the variance in the independent variables account for about 62% of the variance in the dependent variable. As for the individual countries, all of them had adjusted R^2 values indicating they explain over half the variance in total arms trade. East Germany's estimated model had the lowest R^2 value, 0.56, while Poland has the highest, 0.82.

Adjusted R^2 values alone are not enough to determine the significance of an estimated model. It is important to look at the F statistic as well. To accept this model with a 95% confidence level, the

estimated F statistic for the regional model must be greater than the critical F statistic of 3.48. The actual F statistic for the regional model is 52.7. For the individual country models, the critical value is 4.18, and all of the country models have F statistics that exceed this value.

Both the adjusted R^2 values and the F statistics for the estimates of model A are encouraging. However, sometimes data similar to the data used in these models suffer from a problem of serial correlation, meaning the error terms are related. A way to judge if serial correlation is a problem is to look at the Durbin-Watson (DW) statistic. For the regionally estimated model, the DW statistic would need to be greater than 1.76 in order to reject serial correlation as a problem with 95% confidence. The actual DW statistic is 1.99. For the country-specific estimates, the DW statistics would also need to be above 1.76 for the same degree of confidence. East Germany's estimated model is the only one where serial correlation can be rejected, however in all of the other country-specific models, the DW

statistics are all greater than 1.08, which puts them into the "inconclusive" range.

Turning now to the individual independent variables, it is important first to look at the t-statistics to determine which, if any, of the independent variables are statistically significant. For variables to be considered statistically significant at the 95% confidence level in the regional model, they must have a t-statistic greater than 1.96. A t-statistic greater than 1.28 would be an indication of significance at the 80% confidence level. The critical t-statistics for the country-specific estimates are 2.04 and 1.31 for 95% and 80% confidence levels, respectively.

When model A is estimated for the region as a whole, all of the estimated coefficients are statistically significant at the 95% level of confidence. However, this is not the case when model A is estimated for individual countries.

The coefficients on GDP and distance are the two which seem to be the most significant in individual countries. The coefficients on GDP are significant at

the 95% confidence level for Czechoslovakia and Hungary, and at the 80% level for Bulgaria and Romania. The results of all of the regressions suggest there is a positive relationship between total arms trade and GDP. However this correlation is not significant in East Germany or Poland. The magnitude of the estimated coefficients also varies between the region and the individual countries. The results suggest as GDP increases, so will the level of arms trade, at least for the region as a whole and for a few of the individual countries.

The same is true for openness to trade. All of the regression results suggest a positive correlation between total arms trade and openness. The coefficients are most significant for the region as a whole, but are significant at the 80% level in Bulgaria. For the region as a whole, and for Bulgaria, the regression results suggest that as openness increases, so does total arms trade. This is to be expected, as arms trade is one component of total trade. If a country or region is more open to trade and increase imports and exports, it is rational to

expect that most sectors of trade would increase as well. The important thing to note is the coefficient is 0.87, which indicates while increased openness to trade may lead to an increase arms trade, the impact is not that great.

Political freedom is only significant for Eastern Europe as a whole, however the estimated coefficient has the highest t-statistic of all of the estimated coefficients in the model. At first glance, it appears there is a positive correlation between arms trade and political freedom, which is contrary to my expectations. In fact, there really is a negative relationship between these variables, as the values for PFI range from 7 (least free) to 1 (most free), so the higher the value, the less free. Once again, however, it is important to note the relationship is only significant for Eastern Europe as a whole.

Finally, the results of the regression suggest a positive correlation between distance and arms trade for the individual countries, all of the country coefficients are significant at the 80% level. Surprisingly, though, the results of the regional

regression suggest a negative correlation between distance and arms trade. A possible explanation for these results is that the more removed the region is from the military power at the time, the less arms trade that region will have. However, the countries that are closer to the military center would need less arms trade, as they can rely on the close proximity to the power center for military protection.

The coefficient for distance is actually the variable's elasticity. The coefficients are quite large which suggests that arms trade is very sensitive to distance.

While model A seems to provide a fairly significant model for determining the overall size of arms trade for the region as a whole, the following model will help to determine what factors predict if a country or region will be a net exporter or importer of arms.

4.2 Model B

Once again, the model was tested with and without dummy variables for time using regional data. The dummy variables do change the results of the

regressions. The results presented on Table 3 do not include the coefficients for the dummy variables, however those coefficients are available in the appendix. The following discussion is based on the regression results where the dummy variables were omitted, as they were not statistically significant.

Table 3: Model B: Dependent Variable BOT

	Region**	Region***	Bulgaria	Czechs.	E. Germ.	Hungary	Poland	Romania
GDPGR	-49.00*	49.10*	15.10	-30.20*	21.00*	-42.30*	-33.10	19.20
	(-2.68)	(3.39)	(0.81)	(-1.60)	(1.34)	(-2.41)	(-1.17)	(0.99)
LNOPEN	-4.66*	-4.22*	-17.60	18.80	-23.40	11.60	13.50	-17.30
	(-2.47)	(-2.15)	(-0.05)	(0.79)	(-0.12)	(0.95)	(0.84)	(0.05)
LNPFI	110.10*	43.40*	-431.00*	456.00	-304.00*	-321.00*	227.00*	58.60
	(2.29)	(1.30)	(-1.35)	(3.95)	(-2.51)	(-1.71)	(1.46)	(0.71)
C	255.10	149.20	524.00	962.00*	947.00	121.00	875.00	367.00
	(0.88)	(0.65)	(0.29)	(1.00)	(0.75)	(0.67)	(0.58)	(0.98)
Adj. R2	0.59	0.56	0.63	0.54	0.57	0.54	0.67	0.55

t-statistics are presented in parenthesis
* denotes significance at the 0.80 level or better
** regional results with dummies
***results without dummies

When applied to the region as a whole, model B has an adjusted R^2 value of 0.56, meaning that roughly 56% of the variance in the balance of arms trade can be explained by the model. In order for the model to be statistically significant at the 95% confidence level, the F statistic would need to be greater than 2.68. The estimated F statistic for the model as applied to Eastern Europe as a whole is 4.2. Finally,

the regional model has a DW statistic of 1.49, which indicates serial correlation may be a problem. For the individual countries, the models statistics are also rather promising, with all having significant t-statistics and adjusted R^2 values greater than 0.5. Also, the DW statistic for the individual countries are better than that of the region as a whole, suggesting serial correlation is not a problem when model B is estimated for the countries.

Turning now the individual estimated coefficients, for the region as a whole, GDP growth and openness to trade are significant at the 95% confidence level, political freedom is significant at the 75% confidence level. For the individual countries, only political freedom is statistically significant at the 80% confidence level or better in the majority of the countries. Openness to trade is not significant in any of the individual country estimates.

The results of the model suggest there is a positive correlation between the growth of GDP and being a net exporter of arms in the cases of Eastern

Europe as a whole, and in East Germany. However, when model B is applied to Czechoslovakia (which is the combination of data from the Czech Republic and Slovakia after the split) and Hungary, the regression results indicate a fairly large negative relationship between the balance of arms trade and GDP growth. It appears that GDP growth may affect arms trade differently in different cases.

The same situation occurs when the coefficients for political freedom are estimated. In all countries except Romania, the estimated coefficients are significant at the 80% level or better. For the region as a whole, along with Czechoslovakia and Poland, the regression results indicate a positive relationship between arms trade flow and political freedom, suggesting the more freedom, the larger the surplus of arms trade. The opposite result was estimated in the cases of Bulgaria, East Germany and Poland. These results suggest there may be other variables that interact with GDP growth and political freedom to affect the flow of arms trade.

Finally, openness to trade is only significant in the region as a whole. The estimated coefficient is (-4.22) which suggests the more open Eastern Europe is to trade, the more likely it is to be a net importer of arms.

While models of arms trade do help us gain insight into the military sector of the region and individual countries, they by no means present the whole picture. It is important also to look at models of military expenditures, both in volume and intensity. Two models of military expenditures are presented next.

4.3 Model C

As was the case in the two previous models, model C was tested both with and without dummy variables for time when estimated for Eastern Europe as a whole. Once again, the estimated coefficients for these dummy variables were not shown to be statistically significant. Table 4 shows the differences in the estimated coefficients for the explanatory variables, but does not provide the coefficients for the dummy variables. These coefficients along with their

corresponding t-statistics are provided in the appendix.

Table 3: Model C: Dependent Variable ME

	Region**	Region***	Bulgaria	Czechs.	E. Germ.	Hungary	Poland	Romania
GDPGR	-0.02*	-0.02*	-0.02*	-0.03	-0.24*	-0.07*	-0.05*	-0.04*
	(-2.21)	(-2.21)	(-1.69)	(-1.15)	(1.44)	(-1.74)	(-1.55)	(-1.31)
LNOPEN	-0.86*	-0.86*	-0.13	-0.24	-0.05*	-0.75	-0.33	-0.66
	(-8.65)	(-1.7)	(-0.37)	(-1.08)	(-2.34)	(-0.98)	(-0.98)	(-1.20)
LNPFI	1.17*	1.17*	1.55*	0.37*	0.98*	2.18*	1.67*	0.95-
	(7.53)	(7.53)	(8.77)	(1.96)	(2.11)	(1.42)	(6.41)	(3.04)
LNNATO	-0.16*	-0.17*	-0.78*	0.41*	-0.08	0.75*	0.38*	-0.64*
	(-2.10)	(-1.25)	(-2.09)	(2.86)	(-0.06)	(3.41)	(2.11)	(1.94)
C	10.40*	10.40*	5.23*	10.35*	6.60*	2.54*	1.47*	11.20*
	23.40	23.40	(3.24)	(6.60)	(8.51)	3.94	(8.54)	(1.34)
Adj. R2	0.95	0.93	0.93	0.97	0.93	0.94	0.95	0.92

t-statistics are presented in parentheses
* denotes significance at the 0.80 level or better
** regional results with dummies
***results without dummies

Model C is obviously quite strong as a model. For all of the cases, the adjusted R^2 values are all greater than 0.9, suggesting the model explains over 90% of the variance in military expenditures. All of the F values are well above the critical value of 3.32 needed for 99% confidence. While the DW statistics indicate there may be some serial correlation in the Bulgarian and Romanian estimates, serial correlation is not a problem in the regional estimates.

Of all the explanatory variables, political freedom is the most significant. For every case, the estimated coefficients on political freedom are significant at the 80% level or better. All of the coefficients are positive, suggesting as political freedom increases, military expenditures will decline. Recall that a high value for PFI indicates a lower level of political freedom.

The coefficients are measurements of elasticity, which is an indication of how sensitive the dependent variable is to fluctuations in the independent variable. Any value greater than one is indicative of a very elastic, or responsive dependent variable. This suggests political freedom has a very large and significant effect on military expenditures in all cases. The only possible exception is the case of Czechoslovakia, where the coefficient is estimated to be 0.37.

The coefficients for GDP growth are significant at the 80% confidence level in all of the countries except Czechoslovakia. It is significant at the 95% level for Eastern Europe as a whole. All of the

coefficients have negative signs, suggesting that as GDP growth increases, military expenditures do indeed fall. However it is important to note that, in most cases, the coefficients are rather small. The largest coefficient estimated is for East Germany, with a value of -0.24.

A new variable, affiliation with NATO was found to be significant at the 95% level in all cases except in the region as a whole and in Hungary. In those two cases, the estimated coefficients were not significant even at the 80% level of confidence. There is a fairly noticeable variation between the magnitudes of the coefficients as well as in their signs. For example, the Bulgarian case has an estimated coefficient of -0.78 whereas the Hungarian coefficient has an estimate of 0.75. These varied results suggest the other 3 explanatory variables likely interact with the NATO variable to affect military expenditures.

Finally, openness to trade is very significant for Eastern Europe as a whole, with a t-statistic of -8.65 and a rather large coefficient of -0.86. However, the only other case where openness to trade

is significant is in East Germany. The estimated coefficient is much smaller in the East German case than in the regional case, though. This suggests that as openness to trade increases in the entire Eastern European region, that military expenditures will decline.

All of the results in model C are in accordance with those hypothesized earlier in this study. The model does appear to be a very useful and significant predictor of military expenditures, especially when applied to Eastern Europe as a whole. While the volume of military expenditures is certainly a useful piece of data, it is also important to consider the intensity of military expenditures. In other words, how much of GDP is made up of military expenditures. A final model developed in this study deals with the intensity of military expenditures.

4.4 Model D

Recall this final model has the intensity of military expenditures, as defined by military expenditures as a percentage of GDP, as the dependent variable. The three explanatory variables are growth

rate of real GDP, political freedom, and openness to trade. Once again, the model was estimated for the region both with and without dummy variables to account for time. The estimated coefficients on the dummy variables themselves were not statistically significant and are available in the appendix.

Table 5: Model D: Dependent Variable INTENSE

	Region**	Region***	Bulgaria	Czechs.	E. Germ.	Hungary	Poland	Romania
GDPGR	-0.02*	-0.20*	0.00	-0.03*	-0.02	-0.03	0.00	-0.02
	(-3.03)	(-3.03)	(-0.81)	(-2.37)	(-0.52)	(-1.20)	(-0.55)	(-0.55)
LNOPEN	0.00	0.00	0.35	0.00*	1.10	0.74	10.30	0.37
	(-0.10)	(0.00)	(1.11)	(1.34)	(0.70)	(0.64)	(0.44)	(1.20)
LNPFI	0.78*	0.78*	1.07*	0.02	0.64*	0.868	0.97*	0.75*
	(13.90)	(14.00)	(4.17)	(0.30)	(1.60)	(3.21)	(1.58)	(1.70)
C	0.45*	0.45*	-942.00	-0.27	-36.00	34.30	-521.00	-115.00
	(1.51)	(1.52)	(0.00)	(-0.09)	(0.01)	0.23	(0.37)	(0.61)
Adj. R2	.054	0.53	0.96	0.80	0.79	0.84	0.67	0.88

t-statistics are presented in parentheses
* denotes significance at the 0.80 level or better
** regional results with dummies
***results without dummies

Once again, the F statistics for all cases are larger than the critical values. The adjusted R^2 values are also above 0.5 in all cases. Finally, the DW statistics indicate that serial correlation is not a problem in any of the cases.

The estimated coefficient for political freedom appears to be the most statistically significant of

The four models that were developed and estimated in this study do provide some valuable insight into what affects the military situations in Eastern Europe. All of the models estimated seem to be more applicable to the region of Eastern Europe as a whole than to the individual countries. This suggests that military affairs, such as arms trade issues and military expenditure issues, tend to be affected more by regional matters than by country-specific ones. With the increasing regionalism that is emerging throughout the globe, this suggestion is not surprising. The final section of this study will review the major conclusions reached from this study as well as policy implications and suggestions for further study.

5.0 Conclusions

5.1 Findings

The most important finding of this study is the importance of political freedom. In all four models, and increase in political freedom was shown to be associated with a desired trait, i.e. less trade in arms, lower military expenditures, etc.

all the explanatory variables. It is significant at the 80% confidence level in all cases except for the Czech case. All of the estimated coefficients are at least 0.64 and are all positive. These results suggest that as political freedom increases, the intensity of military expenditures will decline. The larger coefficients indicate the relationship is an elastic one.

GDP growth is the next most significant of the variables. It is significant at the 95% confidence level when estimated for the region as well as for Czechoslovakia. The coefficients are negative, and rather small, suggesting that as GDP growth increases, the intensity of military expenditures will decline, but not a great deal.

Finally, openness to trade is only significant at the 80% level in the case of Czechoslovakia, however the estimated coefficient is effectively zero. This suggests that openness to trade does not have any statistically significant effect upon the intensity of military expenditures.

Openness to trade does also seem to be associated with a desired trait of lower military expenditures in Eastern Europe. Other significant indicators of lower military expenditures are more political freedoms, positive GDP growth, and a relationship with NATO.

5.2 Policy Implications

As was mentioned in the beginning of this study, there are many people who believe the world is on the brink of another arms race coupled with dangerously high levels of military spending. While many would agree with my assertion that the bi-polar balance of power that existed during the Cold-War era was a far more stable international system than the unbalanced, multi-polar world we live in currently.

If a new arms trade were to begin, it is highly unlikely the world would once again divide itself into a neatly bipolar international system. At the very least, the new arms race would likely trigger a tri-polar system with the US, Russia, and China all competing for superiority. A multi-polar system is inherently unstable, and the instability is more worrisome when arms stockpiles are on the rise.

Therefore it is critical to take steps to inhibit the emergence of another international arms race.

Military expenditures are once again on the rise. The Regan administration ushered in an era of astronomically high military expenditures that some claim had a serious, negative impact upon the economy of the United States as well as the global economy. While military expenditures are certainly necessary and beneficial, it is important to be able to keep them in check to avoid running unhealthy budget deficits.

5.3. Suggestions for Future Studies

The weakest model in this study is model D. The only significant variable in model D is political freedom. More studies need to be done to find out what other variables influence the intensity of military expenditures.

Further research also needs to be done on the role played by NATO with regard to military expenditures. Recall that the estimated coefficients for NATO in the model of military expenditures took on both negative and positive values. It would be

interesting to further divide the NATO variable into the two strategic regions that NATO is developing in Eastern Europe. A similar tiered system was also present in the Warsaw Pact. It would be very interesting to divide the data into these tiers and see what results are generated.

Like the NATO coefficients, the estimated coefficient for political freedom with regard to the direction of arms trade also took on both negative and positive values. More study needs to be done to determine under what circumstances do these coefficients take on negative and positive values.

All of the models discussed throughout this study are more applicable to Eastern Europe as a whole, as opposed to the individual countries that constitute Eastern Europe for the purpose of this study. The strongest of these four models is model C. It would be interesting to see if the highly significant results estimated for this model in the case of Eastern Europe would also be generated for other regions of the world.

Appendix: Estimated Coefficients for Dummy Variables

	Model A	Model B	Model C	Model D
DUM70	-0.16 (-0.19)	-502 (-0.06)	0.1 (0.41)	-0.12 (-0.08)
DUM71	-0.14 (-0.26)	-513 (-0.12)	0.09 (0.37)	-0.05 (-0.31)
DUM72	-0.46 (-0.1)	-730 (-0.19)	0.09 (0.36)	0.08 (0.45)
DUM73	0.08 (0.46)	-1148 (-0.28)	0.10) (0.36)	0.06 (0.33)
DUM74	-0.03 (-0.06)	-1023 (-0.25)	0.11 (0.39)	-0.12 (0.63)
DUM75	-0.03 (-0.06)	-935 (-0.22)	0.12 (0.38)	-0.12 (-0.63)
DUM76	-0.26 (-0.57)	1014 (-0.2)	0.12 (0.37)	0.15 (0.08)
DUM77	-0.37 (-0.78)	-895 (-0.22)	0.12 (0.37)	-0.18 (-0.09)
DUM78	-0.34 (-0.74)	-791 (-0.19)	0.13 (0.37)	-0.23 (-0.11)
DUM79	-0.6 (-0.13)	-860 (-0.21)	0.13 (0.37)	-0.27 (-0.14)
DUM80	-.045 (-0.09)	-743 (-0.18)	0.13 (0.37)	-0.26 (-0.13)
DUM81	-0.3 (-0.06)	-561 (-0.14)	0.14 (0.39)	-0.23 (-0.12)
DUM82	0.13 (0.6)	1338 (0.33)	0.14 (0.4)	-0.18 (-0.09)
DUM83	-0.17 (-0.61)	-467 (-0.12)	0.15 (0.44)	-0.13 (-0.63)
DUM 84	-0.14 (-0.3)	-253 (-0.62)	0.15 (0.44)	-0.18 (0.09)
DUM85	0.4 (0.87)	-566 (-0.14)	0.16 (0.49)	-0.04 (-0.24)
DUM86	0.58 (1.2)	-936 (-0.23)	0.17 (0.49)	0.29 (0.15)
DUM87	0.18 (0.38)	-589 (-0.15)	0.17 (0.53)	0.27 (0.14)
DUM88	0 (0.01)	-714 (-0.18)	0.17 (0.55)	0.23 (0.12)
DUM89	-0.55 (-1.18)	-718* (-1.69)	0.18 (0.56)	0.4 (0.19)

Appendix Continued

DUM90	0.23 (0.49)	1183 (-0.25)	0.14 (0.40)	0.59 (0.25)
DUM91	-0.16 (-0.24)	-613 (-0.13)	0.10 (0.30)	-0.03 (-0.16)
DUM92	-0.18 (0.37)	-446 (-0.01)	0.06 (0.18)	-0.03 (-0.16)
DUM93	-0.14 (-0.27)	-503 (-1.15)	0.00 (0.06)	-0.13 (-0.60)
DUM94	0.2 (0.4)	-17.7 (-0.04)	0.03 (0.11)	-0.29 (-1.38)
DUM95	-0.13 (-0.29)	-6.87 (-0.00)	0.42 (0.15)	-0.20 (-0.10)
DUM96	-0.03 (-0.07)	-96 (-0.23)	0.36 (0.15)	-0.33 (-0.16)
DUM97			0.05 (0.24)	-0.38 (0.18)
DUM98			0.22 (0.14)	-0.40 (-0.19)

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