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Risk in International Trade

Bachelor thesis

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Sworn Statement

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In Prague on 19th of May Michaela Svobodová

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Abstract

The aim of this thesis is to define and classify international trade risks and provide an overview of key types of international trade operations. Furthermore, it describes the process of risk analysis, including the following decision-making, and outlines the most important tools in risk mitigation. Most importantly it uses a micro-founded gravity model to find a link between political risk indicators and international bilateral trade flows. Results were estimated using OLS and Poisson pseudo-maximum likelihood estimator and multilateral resistance terms were approximated with use of Taylor series and dummies.

Key words: International trade, Risk, Political risk, Gravity model

Abstrakt

Cílem této práce je definovat riziko v mezinárodním obchodu, roztřídit jej do jednotlivých kategorií a poskytnout shrnutí nejdůležitějších operací na mezinárodních trzích. Dále popisuje postup při analýze rizik, včetně následné rozhodovací fáze a nastiňuje nejpodstatnější nástroje využívané ke zmírnění rizik. Především ale užívá gravitačního modelu pro zjištění, zda existuje vztah mezi ukazateli politického rizika a mezinárodním dvoustranným obchodem. K odhadnutí modelu byla užita metoda nejmenších čtverců a metoda Poissonovy pseudo-maximální věrohodnosti. K odhadnutí multilaterální obchodní přirážky byla využita metoda Taylorových řad a metoda užívající formální (dummy) proměnné

Klíčová slova: Mezinárodní obchod, Riziko, Politické riziko, Gravitační model

BACHELOR THESIS PROPOSAL

Proposed Topic:

Risk in international trade

Preliminary scope of work:

Research question and motivation

What are the risks business entities face when undergoing international trade? How do these influence the volume of trade between countries and are there ways to mitigate them?

The focus of this thesis will be mainly on commercial risks (i.e. risks of default of the commercial partner on his obligations, this includes inability or unwillingness to pay or perform, cancellation of the contract, and unfounded refusal to accept the object of the contract) and country risks (i.e. risks due to unstable political and macroeconomic situation, e.g. vis major, change of statutes, etc.). The former will be discussed in a form of theoretical distinction between different kinds of commercial risks and the latter will be addressed in the same way with addition of a gravity model, where country risk will be the key variable in the model.

This topic is very relevant in today's fast-moving and internationally intertwined economy. With trade relations becoming ever so global and lack of regulation at this level, traders face an enormous number an amount of risks. This paper aims to map these risks and also give an overview of ways to mitigate them. This topic is current and very interesting, with new institutions to mitigate risks developing over time.

Contribution

The intended contribution in mainly empirical. The thesis will provide categorization of risks with focus on commercial and country risks and proposals for their mitigation, based on real-life instruments that deal with said risks. The thesis will also include gravity model of trade, showing impact of risks on international trade.

Since there's not much literature giving such specific overview, the results could have practical use for smaller-scaled traders involved in international trade, that are not aware of the risks they're facing.

Methodology

Qualitatively the paper will analyse commercial and country risks and ways to mitigate them. Then it will analyse WTO and Comtrade data to see how country risk influences trade with given country. This will be done by constructing a gravity model of trade, more precisely micro-founded gravity model (Anderson & Wincoop, 2003; Eaton & Kortum, 2002).

This paper will also try to approximate multilateral trade resistance terms through use of dummies (Baldwin & Taglioni, 2007) (through Poisson pseudo-maximum-likelihood estimator (Santos Silva & Tenreyro, 2006)) and Taylor polynomial (Baier & Bergstrand, 2009).

Outline

1. Introduction
2. Overview of most important risks in international trade
3. Ways to mitigate them
4. Relationship between country risk and international trade with that country
5. Conclusion

List of academic literature

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Risk in international trade

1. Introduction

Risk matters. It affects all imaginable aspects of life, including trade. And although it plays a crucial part in domestic trade, on international level it reaches new dimensions. It takes on many forms, from unreliable trading partner to a hurricane and can have a large variety of effects, from losing an inconsequential asset to catastrophic and liquidating results. It is important part of international trade and there will never be a way to fully "get rid of it", that is why it is so crucial to study it and understand it.

This thesis attempts to empirically prove that "Risk matters" is not just an empty statement. Although there are vast number of papers on policy variables using similar methodology to the one employed by this thesis, the lack of papers on influence of country-specific risk (political risk to be precise) on international trade makes this thesis quite beneficial.

The notion that international trade risks influence international trade, more precisely that countries with lower political risk will enjoy more trade than those with higher political risk, all else being equal, is tested by a gravity model. Specifically, it is a micro-founded gravity model of trade (Anderson & Van Wincoop, 2003) where the multilateral resistance terms are approximated through use of dummies (Baldwin & Taglioni, 2007) and Taylor polynomial (Baier & Bergstrand, 2009) and in the term of trade cost a political risk indicator variable is added. The estimation methods used in the thesis are OLS and Poisson pseudo-maximum likelihood estimator (Santos Silva & Tenreyro, 2006).

The estimates obtained by the four regressions (generated by combining each of the two estimation method with each of the multilateral resistance terms approximation methods) were not consistent for the political risk indicator variable. However, the fact that the gravity model provided consistent robust findings for the other variables, coupled with the methodology for assessment of political risk indicators which is based on the subjective analysis of the available information, suggests that the data for political risk indicators are

not reliable, rather than that the intuition about the relationship between trade and political risk is invalid.

The structure of the thesis is as follows. In section two a literature overview is provided, in which a grounding for the subsequent sections is given. It consists of classification of international trade operations (outlining of potential impact areas of international trade risk), definition of the term 'risk' as such, and identification and categorization of different risk types in international trade. This should provide an idea of the scope of impact and sources of risk. Following that will be a synopsis of risk analysis tools and decision-making options expanded by independent section elaborating on topic of risk mitigation tools.

In section three a methodology and data for the micro-founded gravity model will be introduces, with a small part on model's history and rationale attached to it.

Section four will present the results obtained from models specified in part three.

And finally, section five, the last section, will provide a conclusion.

2. Literature review

Literature review will start by delimitation of potential field of impact of international trade risk (i.e. classification of trade operations), then it will continue with definition of the term 'risk' as such, and identification and categorization of different risk types in international trade. After that a synopsis of risk analysis tools available for corporations and entrepreneurs, and their subsequent decision-making options will follow. To make this segment more practically applicable and thus real-life beneficial, an expansion on risk mitigation is included, which consists of short description of key instruments used for risk mitigation, with their advantages and disadvantages outlined.

2.1. Types of international trade operations

International trade is realized through substantial number of individual trade operations. It is crucial to realize, that international trade doesn't consist only of export and import operations, in order to capture the wide impact of risk. Hereunder follows the classification of main types of international trade operations, which is not an exhaustive one, but rather gives a quick overview for the purpose of providing a context for the following sections and subsections of the thesis. The classification follows the classification used by Machková et al. (2014).

2.1.1. Export and import of goods and services

This is the easiest form on entry into a foreign market, consequently taking part in international trade. This type of operation takes on many forms, from direct export and use of export alliances, to brokering, exclusive distribution agreements and many others. (Machková et al., 2014)

2.1.1.1. Direct export

Pure direct exports are usually used for sale of industrial goods, manufacturing equipment and investment units. These goods are distinguished from the others, because to be properly implemented, they require vast number of expert services, which makes direct involvement of the exporter in the foreign market necessary. Although this way the seller assumes all risks associated with international trade, it also gives exporter a total control

over all managerial decisions like price setting, marketing strategies and supervision. (Machková et al., 2014)

2.1.1.2. Export alliances

Small- and middle-sized companies may find it advantageous to join an export alliance. These alliances are formed by companies that operate in the same industry, and whose products are in some way complements to each other. The goal of these associations is to access foreign markets and operate together on these markets. Export alliances help diminish costs, mitigate export risks and overall strengthen the position of its members. (D'Arcy et al., 2000)

2.1.1.3. Intermediate relations

Intermediaries sell goods acquired through purchase contract to other intermediary buyers, or final consumers. The price margin is the intermediary's remuneration for the intermediary. This type of international trade operations is mostly used by corporations and entrepreneurs that have international trade only as a marginal affair. The main advantage consists of lower costs and elimination of international trade risks. The biggest drawback arises if the company decides on different pricing for different markets, and is then faced with parallel imports and unsanctioned exports. That can not only affect the company's price policy enforceability of the company but also its reputation, because the intermediary corporation is unlikely to provide the same level, if any, of the accompanying services. The parallel exports and reexports may be avoided by including the appropriate provisions in the contracts. (Machková et al., 2014)

2.1.1.4. Exclusive distribution contracts

The exclusive distribution agreement is different from a regular distribution agreement in that it guarantees that the supplier won't, in a given territory, supply goods to any other person or entity than the purchaser. This form is convenient, if the supplier wants to participate on the foreign market, but isn't willing to forego all the costs of it, and hopes to limit the risk exposure from participating in international trade. But for this form of participation in international trade to be really effective, in terms of mitigating supplier's risk exposure, he needs to take special care when choosing the distributor, because if the

exclusive distributor doesn't fulfil his duties accordingly, the supplier closed off the option to supply to that market. This can also be dealt with via including suitable provision in the agreement. (D'Arcy, 2000)

2.1.1.5. Commercial agency

The core of commercial agency activities lies in conducting activities to promote contracting. The main difference from distribution contracts is that the agent doesn't purchase the goods before selling them to the third party, instead it just serves as an intermediary who acts in name and on account of the principal (seller). If the commercial agency is exclusive, the seller may face the same kind of problems, as when he partakes in exclusive distribution agreement. Furthermore, this form doesn't limit his exposure to international trade risk, although it can in some cases help to limit it, if the agent undertakes to guarantee that the buyer will fulfil his obligations towards the seller. (Machková et al., 2014)

2.1.1.6. Transaction-management contract (mandatary contract)

The transaction management contracts are similar to the commercial agency agreements, however they are used to procure a specific outcome stipulated by the mandatary. This type of agreement can be, at least in Czech republic, concluded only between two entrepreneurs. (Machková et al., 2014)

2.1.2. Forms of presence of a company on foreign markets not demanding on capital investments

This category includes forms that are not part of classical import and export and don't strain financial resources of the company. These can be divided into two groups. First one enables a company to offer/ use its goods and services on a foreign market without classic export operations. This group includes licensing, franchising or a management contracts. The second group involves a cooperation on an international level, either in production, where it takes a form of outward processing or production cooperation, or in the field of research and development research, as work order or R&D cooperation. (Machková, 2014)

2.1.2.1. Licenses

A company can enter into foreign market by selling rights to an invention, design or utility models, or use of company's trade mark. In order to be able to provide a license, the goods

intended for export need to be patent-harmless, i.e. they cannot distort third-party's patent rights in that country. It is also advisable that the exporter seeks patent protection for these goods, if it's available to him, in order to protect the licensed goods. Even so, providing a license proves risky in terms of keeping the affiliated trade secrets secret, so once again, caution has to be exercised when choosing the licensee. (Carr, 2010)

2.1.2.2. Franchising

Many of the large commercial chains operating in multiple countries use franchising to do so. Franchising is a contractual bond between partners, where the franchisor provides its label, know-how and the right to use franchisor's object of business, and the franchisee undertakes to comply with licensor's business policy and pay franchisor remuneration for the know-how, and all other useful rights and guidance provided by the franchisor. Convenience of franchising lies in lowering the costs and the business risk. The overall bankruptcy rate is also lower among franchisees than it is among independent entrepreneurs, and return on investment is higher. (Machková et al., 2014)

2.1.2.3. Management contract

The management contract is, in many ways, similar to franchising. However, the object differs, for management contract the object is the managerial skills of top managers. The contract is used mainly by companies in developed countries. If the manager is competent, that can have direct implication for risk in a form of implementing the appropriate risk-management, and thus lowering all kinds of risks faced by the company. (Machková et al., 2014)

2.1.2.4. Outward processing

The essence of outward processing operation is processing of raw materials or semi-finished products into higher-level of finality. The reason for undertaking the additional risk of outward processing, is lowering costs or seeking the suitable expertise, that cannot easily be found within the given country. (Carr, 2010)

2.1.2.5. International production cooperation

The production process may be divided into steps, of which some may take place abroad, at facilities owned by other producers. This makes use of the fact that countries have different factor endowment and pricing. (Machková et al., 2014)

2.1.3. Capital entries of a company to a foreign market

This category contains trans-border flows of financial capital. This can take a form of either foreign direct investment (FDI), or a portfolio investment. Investments vary in respect to the amount of capital needed from extensive, e.g. for mergers and acquisitions or establishment of new companies, to less extensive, for subsidiary companies and branch offices etc. (Machková et al. 2014)

2.2. Definition and classification of risks

2.2.1. Definition of risk

There is not one single widely agreed upon definition of risk at the moment, so hereunder will be introduced a few different definitions, that best fit the following classification of risk. Then their common features will be deduced.

Vose (2008) defines risk as a random event, that may possibly occur ,and if it did occur, would have a negative impact on the goals of organization.

Vaughan (2001) opts for a similar, but a slightly different and clearer definition of risk. According to him, risk is a condition, in which there is a possibility of an adverse deviation from a desired outcome that is expected, or hoped for.

Although there is not a consensus at the moment on the "correct" wording of the definition of risk (Vaughn,4), the underlying idea behind all major and reasonable definitions insinuate that risk is comprised of three components: the negative scenario (which is an undesirable deviation of the goal); its probability of occurrence (the fact, that the occurrence is not certain); and the size of impact if it were to occur (either in a form of a fixes value or a distribution) (Vose, 2008). The fact that the risk has these quite clearly defined component does in no way mean, that we are able to observe, let alone calculate them all, e.g. we might not be able to measure the probability of occurrence of the negative scenario, all we might

know is that there is some. In extreme cases we might not be able to foresee any of the aforementioned components, that is most likely to happen in case that we are unable to presume the very existence of the risk.

To clarify the term risk further, we need to distinguish it from other terms that are on everyday basis used as interchangeable with the term risk, even though they do carry a different meaning. These terms are uncertainty, hazard and peril.

The difference between uncertainty, as it is understood by Vaughan, and risk, is that risk is objective, whereas uncertainty depends on an individual, i.e. is subjective (Vaughan, 2001). The uncertainty has to do with microeconomic theory of different types of utility functions of individuals and the way they view risk, whether they are risk- averse, risk-neutral or risk-seeking.

Risk also shouldn't be confused with peril and hazard. Peril is a cause of a loss that occurs, e.g. fire, trade-partner's bankruptcy etc. Hazard is a condition, that may create or increase the chance of a loss arising from a given peril (Vaughan, 2001).

2.2.2. Classifications of risk

In this section we'll try to distinguish between different types of risks. Within our classification, we'll pay special attention to international trade risks (as opposed to common trade risks). This means, that we'll focus on types of risks that are amplified when the trade is international, or that only exist within international trade. There are many ways to divide risk, so hereunder will be introduced a few crucial ones.

2.2.2.1. Financial and non-financial

Risk can be divided to financial and non-financial. Financial risk is a possibility of financial loss. It involves the relationship between an individual (or an organization) and asset or expectation of income that may be lost or damaged. Financial risk is composed of three elements: (1) individual/organization exposed to loss, (2) asset/income whose dispossession/ destruction will cause financial loss and (3) peril that can cause such loss. Non-financial risk involves possibility of no financial loss, or only incidental possibility of financial consequences, e.g. possibility of harm to company's reputation. (Hill, 2009)

2.2.2.2. Static and dynamic

Another way to divide risks is into static and dynamic. Dynamic risk is a risk resulting from changes in economy. Static risk covers losses that would occur even if there are no changes in economy. The biggest difference between the two from an economist's standpoint is that dynamic risk is less predictable than static. (Hill, 2009)

2.2.2.3. Fundamental and particular

A different possible division of risk is into fundamental and particular risk, each one is different in origin and consequence of losses: fundamental risks (group risks) affect large segments of population, whereas particular risks stem from individual events which influence individuals.

2.2.2.4. Pure and speculative

Yet another way to distinguish between risks is to divide them into pure and speculative. Pure risks are risks, where the only possible outcomes are loss situation and no-loss situation. In speculative (business) risk there is a possibility of an adverse situation, however there is a possibility of a positive outcome as well (e.g. loss or gain due to the movement of exchange rates). (Hill, 2009)

2.2.2.5. Classification by origin

The most useful and most detailer classification, for the purpose of the international trade analysis, differentiates between risk types on the basis of risk's origin, i.e. situation or factor which it stems from. The classification is based on Machková et al. (2014) categorization into following groups:

- commercial risk,
- market risk,
- country risk,
- exchange rate risk,
- transportation risk,
- liability for damages caused by defective product risk.

Commercial risk is a risk that one party will default on its obligations. This risk doesn't involve only the seller and buyer, but other entrepreneurs providing accompanying services

used in trade, such as carriers, insurance companies and so on. Commercial risks are intensified in the international trade, because of the distinct law and economic conditions on the foreign markets, trade practices, cultural differences and less accessible information about the foreign trade partners. The forms of display of commercial risks are withdrawal of the business partner from the contract, non-fulfilment or flawed fulfilment of a contract by supplier, unfounded non-acceptance of goods or other performance by the purchaser, payment unwillingness or inability of the debtor (Polák, 2011).

Market risk is the risk that, as a consequence of changes in market conditions, the company won't achieve the expected result or will suffer a loss. This risk is not a pure risk, since it can bring company a positive result as well. The pure form of this risk can result in change in prices of the product, rise of cost of production or even unmarketability of the product. This risk is especially crucial for suppliers of products with lengthy production or sales cycle, where the reaction period is extensive (Machková et al., 2014).

Country risk is risk specific to international trade and is a risk arising from some specific characteristic of a country, be it natural catastrophes, boycott, political, economic or legal risk (Fritz, 2014). We'll focus on the last three mentioned, which are arguably the most important country risk types.

- Political risk is the likelihood, that political forces will cause drastic changes in country's business environment that adversely affect the profit and other goals of a business enterprise.[1] Extreme cases of such risk can take a form of expropriation, worthlessness of assets due to economic collapse or imposition of bans on trade (e.g. EU sanctions against Russia in 2014). However, the direct form of expropriation is quite uncommon, with the wide range of international trade agreements in force, dedicated to protecting the FDIs, nowadays a 'de facto expropriation' is more frequent. This type of situation results from lack of consistent legislation, poor property law enforcement, and unwillingness on

[1] It is greater in countries experiencing social unrest (expresses in strikes, demonstrations, terrorism and violent conflicts) and disorder or in countries where underlying nature of a society increases the likelihood of social unrest. It is therefore mainly high in countries where there are competing ideologies, low living standards, or other similar indicators like high corruption or low bureaucratic quality (Hill, 2009).

part of government to enforce contracts protect private property rights (Carr, 2010)

- Economic risk is the likelihood, that economic mismanagement will cause drastic changes in a country's business environment that hurt the profit and other goals of a particular business enterprise (visible indicator – inflation rate, level of business and government debt in the country) (Hill, 2009)
    - In practice the biggest problem arising is inflation (value of cash flows from asset placed in such country falls as the country's currency depreciates on the foreign exchange market)
- Legal risk is the likelihood that a trading partner will opportunistically break a contract or expropriate property rights (as a result of weak legal safeguards against the aforementioned), this risk is especially harmful for long term contracts and joint-venture agreements (Hill, 2009)

Currency risk is one of the risks specific to the international trade. It arise from movement of exchange rates, interest rates development, development of inflation, possibility of restriction of transfers to abroad, or restriction of convertibility. By the peril of the risk we can distinguish between exchange-rate risk, inflation risk and interest rate risk (Carr, 2010).

- Exchange-rate risk is the risk associated with movement of exchange rates between currencies, it is a speculative risk. In it's pure form, it can be characterized as a risk that, as a result of development of exchange rates of individual currencies, a party to international trade operation will have to transfer larger value than was previously expected, receives relatively lower value, reduce of assets kept in foreign currency or rise in foreign currency liabilities (Machková et al., 2014).
    - Transaction exposure is the exposure due to conducting the transaction in foreign currency.
    - Translation, or accounting, exposure affects assets held or reported in foreign currency and that in turn has effect on company's consolidated financial statements.

        - Economic exposure stems from unexpected exchange rate fluctuation that can render a company uncompetitive, even if it doesn't operate on international level. This might be a case when imported goods become much cheaper than their domestically produced counterparts, which are no longer able to compete with them.
    - Inflation risk belongs to types of risks that are usually country-specific, although they can transcend borders in some cases. Therefore they influence mostly transactions which have direct involvement on the foreign market in question (Vaughan, 2001), e.g. FDI.
    - Interest rate risk is tied to changes in interest rates and influences mainly financial institutions, but concerns non-financial subjects as well (Machková et al., 2014).

Transportation risk affects only international trade operations involving tangible goods. During transportation it's not uncommon that merchandise is lost or damaged and the loss is suffered by the party that bears the risk at the time of occurrence of the action/ situation that brought about the loss. Who that is is usually stipulated in the contract in terms of delivery provisions (Polák, 2011).

Liability for damage caused by defective product risk is mainly connected to export to developed countries (especially EU and USA), which have extensive legislation protecting consumers, and tend to hold companies liable for any damage to health or property caused by the faulty product (Machková et al., 2014).

2.3. Risk measurement, risk analysis and decision making related to risk

2.3.1. Magnitude of risk

Before continuing any further, we need to define what we mean by the term "magnitude of risk". The magnitude of the risk can be thought of in two dimensions. First one as a degree of risk, which represents the likelihood of occurrence of the negative scenario; i.e. how probable it is that the risk will indeed ensue. Second as a size of risk, this corresponds to the severity of the impact of the risk. These two are not mutually exclusive, on the contrary they are complementary and to relate these two concepts (probability and the size of impact),

which is useful especially when we want to compare risks between themselves, we can use the expected value concept, i.e. multiply the two to get results that are comparable between themselves (Vaughan, 2001).

2.3.2. Risk analysis

Risk analysis should be a crucial part of every management activities in the company, that much is clear, but the extent may vary based on the risk exposure and the potential risk's magnitude. In the following part a simple risk analysis and its tools will be introduced to relate the abstract risk concept to the everyday company's operation.

After deciding its objective where risk is concerned, the corporation should start its risk analysis process by identifying (mapping) the risks that might arise from/during given operations. Formalized identification of risks often proves as the most constructive and informative part of the whole analysis, because it provides an idea of the potential trouble that might be encountered, which in itself is more important than the further scoping of the potential risks. Useful tool in this area are prompt lists that provide categories of types of risks.(Vose, 2008). However, such categorization may prove dangerous, because it separates the risk types and that can in some cases mean, that risk won't fall into any category and may be therefore forgotten, or that each class of risks is treated by different measures although overall a different approach might be more efficient, especially if different personnel is assigned to different risk types (Crouhy et al., 2006). Identification of risks is partially a periodical and partially continuous activity. The continuity can be supported by monitoring systems or early warning systems, which issues a warning when it hits the trigger point.

Second stage consists of measuring the risk, i.e. assessing its quantitative qualities. This requires the quantitative characteristic of the variable with respect to which the risk is determined, and knowledge of its distribution. If the quantification of risk isn't possible, the qualitative verbal assessment should be used instead. (Hnilica & Fotr, 2009)

Quantitative analysis of risk

Calculating the risk means calculating or acquiring information about the magnitude of risk of a business activity, company asset or a company as a whole. The risk is expressed through

quantifiable criteria (variables), which help evaluate the result of the risky activity. Quantifiable criteria can be a probability of non-achievement of a certain level of criterion (e.g. probability of profit from the project not being negative), statistical variability of this criterion (how probable different levels of proximity to expected value are, i.e. variance, standard deviation, and coefficient of variation) and value at risk (quantile of the loss distribution). Assessing these characteristics may prove difficult because it requires knowledge of the risk criterion probability distribution. A tool to do so is a Monte Carlo simulation that shall be mentioned in next section. (Hnilica & Fotr, 2009)

Qualitative analysis of risk

If the risk criterion distribution isn't known, qualitative characterization in form of verbal description is used. This generally takes a form of choosing a proper grade on the scale from very low risk to very high risk. This is done both for the risk probability and the potential impact of the risk. Measuring risk in qualitative manner is fused with its evaluation (Hnilica & Fotr, 2009).

Each risk should be then recorded in a risk register, which along which the description of the risk contains risk drivers (factors that have the potential to influence the probability of the occurrence of the risk), estimate of its probability and potential impact, P-I scores (qualitative assessment of the probability of a risk event and impact it would produce), reduction strategies and the action window in which to implement them and other items. P-I scores can be then used to rank the identified risks, which can help keep the attention on the crucial ones (Vose, 2008).

2.3.3. Measuring the size of risk

2.3.3.1. What-if analysis

One of the simplest ways to measure risk is using "what-if" scenarios. In this type of model, each variable has best-guess estimation which is used to determine model's outcome and then sensitivities are performed to see how much might the real outcome vary. Advantage of this type of analysis is that it's easily done, but disadvantage is that it doesn't result in a numerical expression of the risk (Vose, 2008).

The what-if analysis is in a sense extension to the sensitivity analysis, where it allows for measuring of impact of changes of multiple risk factors at a time. Each such combination then creates one scenario, which could arise in the future. The choice of factors and their possible changes falls to the person responsible for carrying out the analysis and therefore proficiency in the matter of risk is essential (Hnilica & Fotr, 2009).

2.3.3.2. Scenarios analysis

Generally scenarios represent some image or description of future with multiple elements and their mutual relations, given specified assumptions. Scenarios do not help form prognosis of future, rather they help give a structuralized overview of potential development and connections between different factors. These scenarios take on two forms- qualitative and quantitative.

Qualitative scenarios help capture longer term visions, usually in form of verbal description. The most essential task of the quantitative scenarios is to give the person, who has been entrusted with the risk analysis, the scope of the potential impact, and list of factors that influence it and that therefore should be taken into account when dealing with the given risk (Hnilica & Fotr, 2009). Another term for qualitative scenarios is influence diagrams. Although the mathematics and data behind this model are difficult to reach, the visualization makes them ideal for managerial purposes (Vose, 2008).

Quantitative scenarios represent mutually consistent combinations of numerical values of crucial risk factors. These types of scenarios are commonly used for decision making concerning the risk-encumbered activity. An imperative tool in quantitative scenario analysis are event trees (Hnilica & Fotr, 2009). Event trees show sequence of events with assigned probabilities of occurrence and their subsequent impacts. The visualization in form of nodes and arcs that form the diagram in combination with the event probabilities make them intuitive and easy to use, which in turn makes them quite popular in practice. On the beginning of the tree is a node which contains the first event. From this node to the right there are arcs signifying different possible outcomes which are then again denoted in nodes and each arch has assigned probability. This goes on until the final column of nodes which signify the final outcomes of the branch. All probabilities assigned to the given arrow, are

conditional on previous step. It is also possible to add decision possibilities after the final outcome boxes, turning the event tree into a decision tree. [2](Vose, 2008)

2.3.3.3. Discrete event simulation

Discrete event simulation models evolution of a system (customarily stochastic) over time. The risk manager first defines equations for each element, interaction with other elements and boundaries of potential change. The simulation then maps the system changes in small time increments, recording the results as it goes (Vaughan, 2001).

2.3.3.4. Monte Carlo analysis

The Monte Carlo method is not a single method of risk measurement, but rather it denotes all approaches to risk measurement involving simulation of an explicit parametric model for risk-factor changes. Depending on whether the model adopted is dynamic time series model for risk factor changes or a static distributional model is the method conditional or unconditional (McNeil et al., 2005). The Monte Carlo analysis is used in cases, where there is more than one risk factor influencing the object of risk analysis and therefore scenarios analysis cannot be used. The conductor of the analysis must first choose the model, assess the crucial risk factors, determine the probability distribution of these risk factors (discretely distributed risk factors – tables, continuously distributed risk factors – type of distribution and parameters)[3] and determine the statistical dependence of risk factors[4]. Following that, the simulation has to be run. It consists of generating a number of possible values of risk factors from their distribution, i.e. scenarios and calculates the model of the risk analysis object. After the appropriate number of simulations has been run, the results are reported in graphic and numeric form. Although Monte Carlo simulation is widely recognized as valid and its results are thus likely to be accepted, it is important to bear in mind that the model

[2] Another similar approach with one crucial difference are fault trees, which don't start from the beginning of the timeline, but from the end (or rather possible end) – a negative outcome and then works its way back identifying its possible causes.

[3] this can be done though approximation by using historical data of risk factor changes, if these are not available, then expert knowledge may be used to substitute it

[4] the dependence may be between two risk factors – pair dependence, or dependence of one risk factor on the time period – time dependence

is only as good as is the model builder, since building a model is very subjective and requires lot of discretion on the model builder's part (Vose, 2008).

2.3.4. Assessment of importance of risk

There are two ways to assess importance of a given risk, sensitivity analysis and expert evaluation. Each will be introduced in their proper subsection.

2.3.4.1. Sensitivity analysis

Sensitivity analysis may be used in case that risks are quantifiable, where it's possible to model dependency of financial criteria on risk factors and other variables. This analysis goes to show how changes in factors (e.g. increasing production), influence given criterion. The basic form of the analysis is the one-factor analysis which studies impact of isolated change of one risk factor on a chosen criterion, while other factors stay fixed. From this we get pessimistic, optimistic and most probable scenario and their deviation from the expected (most probable) value. The higher the deviation, the higher the sensitivity of the criterion to the given factor (Hnilica & Fotr, 2009). A big advantage of this approach lies in that it respects the different riskiness level of each factor (Pessimistic scenario for one factor may be that it changes by 10% and for other that it changes by 100%) In practice however the most pessimistic and optimistic scenarios may not be known, so they are replaced by sensitivity test of factor deviated by a fixed percentage from the expected factor and these results are reported instead (Crouhy et al., 2006).

2.3.4.2. Expert evaluation

The tool of expert evaluation, the risk matrix, helps gauge seriousness of unquantifiable and hardly-quantifiable risks. The risks are evaluated by experts with the proper knowledge and expertise on the subject, they estimate both the probability of occurrence of the risk and intensity of the negative outcome. The importance of the risk stems then from its high probability and high impact (Hnilica & Fotr, 2009).

The expert evaluation takes on two forms: qualitative and semi-quantitative evaluation. The former does not assign any numbers to risk, whereas the latter does. The qualitative matrix then helps place risks into their respective categories, based on their magnitude. The semi-quantitative matrix multiplies numerically denoted probability and impact (usually integers

are used) are multiplied together and the result is the importance of the risk, where higher the number, higher the risk (Hnilica & Fotr, 2009).

For the matrix (both qualitative and semi-quantitative) to be efficient and consistent, threshold values have to be determined for risk probability (i.e. determining the risk scale) and for the potential impact of risk (i.e. impact measurement scale). Each of the values should be viewed in a definite time horizon, e.g. one year (Vaughan, 2001).

2.4. Decision making

The last stage consists of making appropriate decisions. Based on these results, the decision maker can take different measures to optimize the company's position. The management options can be divided into following categories (Vose, 2008):

2.4.1. Acceptance

Taking no actions to control either the risk or the exposure to the risk. This is an appropriate reaction when the costs of such control would exceed the risk, i.e. the risks are low-probability and low-impact ones.

2.4.2. Increase

In the event that company is "overprotected" against a certain risk, it might be advisable to reallocate the resources in another way, to cover other risks more. This happens when the funds allocated to management of the risk are disproportionate to the protection granted by the instruments chosen for that purpose.

2.4.3. Obtainment of additional information

If the uncertainty is still too high for the decision-maker to take an action, the correct thing to do might be reduce it by acquiring more information. For that purpose it has to be decided exactly how precise the results should be, in order to know how much information needs to be collected and the method that should be chosen in order for it to be the least-cost method.

2.4.4. Avoidance

When the risk is deemed too high, the project or the method of operation has to be changed or cancelled all together in order not to leave the company too exposed to the risk. If the

plans are changed as the result of risk avoidance, it's prudent to go through the process of risk analysis once again, because it's plausible that with the new plan, new and different risks arise.

2.4.5. Mitigation

When the risk is high, but doesn't reach the level at which it would have to be avoided, it can be dealt with through mitigation. Reduction of risk includes a number of techniques that help reduce the probability of the risk or its impact, or both. Among the methods of risk mitigation are building in redundancy (standby and back-up equipment), perform more inspections and quality tests, provide better personnel training and spread risk. Because of the importance of risk mitigation (reduction), mitigation tools will be discussed in more detail in section 2.5..

2.4.6. Contingency planning

Contingency planning is in place, because there is need to plan for response to when the risk is realized, because optimization of the response can mitigate excessive losses.

2.4.7. Risk reserve creation

With some risks it's prudent to create a sort of "buffer", should they occur. This can take a form of financial reserves, but also non-financial reserves.

2.4.8. Insurance

Insurance belongs to risk reduction, but it's very important in itself, so it deserves to be mentioned separately. In a competitive market place an insurance company would offer insurance at a price little above cost of the risk, so it coheres that insurance will be taken out on risks where the risk is valued higher than its expected value.

2.4.9. Risk transfer

The risk can be dealt with by transferring it from one party to the other, which usually happens through contracts with penalty clause. By the nature of this measure, it's clear that it will be used principally for dealing with commercial risks.

2.5. Mitigation of risks and insurance against them

2.5.1. Universal recommendations

General advices applicable in any type of transaction, not just international, is to gather any relevant materials that may aid in making an informed decision. This includes information about the potential business partner (financial statements, legal form of the partner, reputation), country in which the international trade operation shall take place, as well as any other relevant country (economical and political situation as well as any pertinent and trustworthy predictions of such). After choice of business partner and affected country, it is critical to correctly draft the contract which will create the basis for the future business interaction. There are several standardized provisions that may help mitigate international trade risks (D'Arcy et al., 2000).

2.5.2. Contract clauses

International private law in most countries allows parties to choose law[5] which will be applicable on their contractual relationship and to select procedure which will take effect in case that they get into dispute which cannot be resolved in amicable manner. This does not only mean that they can choose the court that will, in the event that it's needed, carry out the litigation, but they can also choose one of the alternative dispute resolutions, be it mitigation, arbitration or any other form of ADR (Pauknerová & Růžička, 2014).

Parties also have power to influence the individual risk types. Price adjustment clause helps cover either one or both parties against market risks[6], by stipulating some objective criterion based on which the price shall be adjusted. To mitigate the currency risk, the parties can decide on the currency in which they will settle the trade operation, and/or currency clause may be used. Its merit lies in fixing the exchange rate to one decided on by the parties. By including this clause in the contract, the party limits its exposure that is the consequence of exchange rate volatility, however it cannot reap the potential benefits either. If parties decide to conclude the contract without the currency clause, they might decide to hedge

[5] This is of course not without limitations, i.e. overriding mandatory provisions and ordre public §2 and §3 of law no. 91/2012 Sb. International private law

[6] It can cover both parties, because the market risk isn't pure risk.

their position either by means of foreign currency futures (which are similar to the clause) and foreign currency options (which assist to keep the potential benefits and limit the associated risks). Another quite useful tool is the retention of title, which protects the exporter (or contractor in contract for work) by letting him stay the legal owner of the goods, even if they are not in his actual possession anymore, until the full purchase price has been paid. The last part of contract that will be mentioned at the end of this section, are payment terms, which play a crucial role in the enforceability of the terms set out in the contract. (Pauknerová & Růžička, 2014)

2.5.3. Insurance

Insurance is a common tool to hedge against risks. Definition of insurance from an individual point of view by Vaughan (2001) presents it as economic device whereby the individual substitutes a small certain cost (premium) for a large uncertain financial loss that would exist were it not for the insurance. It is quite common to take out insurance against transportation risks, because due to the distance these risks impose greater danger than in intra-national trade, and country risks, because these insurance services are usually subsidized by the state (Machková et al., 2014). Another type of risk where it's prudent and typical to be insure is the liability for damage caused by defective product risk, because damages awarded by courts in developed countries can be ruinous for companies. Conditions at which the insurance will be taken out were explained in the risk analysis section.

2.5.4. Sale of claim

Factoring and forfaiting a financing method where a finance house, or any other third party, agrees to collect debt instead of the seller. The profit of the finance house is the difference between the debt collected (ideally the full amount of seller's claim) and the price that was paid for this claim. For the seller it has the benefit of receiving payment in advance, which can mean reduction of risk associated with non-collection, but only if the contract stipulates that the transaction is on non-recourse basis (i.e. the finance house doesn't have a claim against the seller in case that the buyer doesn't fulfil his obligation to pay) (D'Arcy et al., 2000).

The difference between factoring and forfaiting is in the maturity date of the claim. Factoring is concerned with claims that are short-term, i.e. have maturity within a year, and forfaiting deals with long-term claims, i.e. over one year.

2.5.5. Payment terms

2.5.5.1. Payment terms distinction

Payment terms in international purchase contracts and any other forms of international trade influence the result and success of the international trade operations. Different types formed in international trade as usance. Because of the distance, high cost and overall riskiness of international trade, other means of payment had to be developed, than direct, to protect both seller and buyer (Machková et al., 2014).

Embodied in the payment terms clauses are time, place, mode and currency of payment of purchase or other price (D'Arcy et al., 2000).

Place of settlement is a location where the purchase price is due. It's usually given by specifying a bank to which the price shall be transferred (Machková et al., 2014).

Date of payment is important in consequence of discharge of a contract, mainly in stipulating which action should precede the other (payment or the fulfilment of the contract by the other party) and when a party can withdraw from a contract. The dates of payment are divided into time preceding discharge of the agreement by the other party, i.e. delivery, payment at the time of delivery, or payment after the delivery. (Carr, 2010)

In each of these, the burden of risk of breach of the contract by the party lies within different party. Payment before the delivery due date is convenient for the supplier and risky for the purchaser. In international trade it's far from common to pay the full price before the delivery date, but rather partial advance payments are used to ensure the decrease of risk. (Carr, 2010)

Payment at the time of delivery is used mostly in form of letter of credit and other similar vicarious methods. The intermediaries in the case of international transactions are usually banks or banking instruments. (Carr, 2010)

Payment after the delivery burdens the supplier in terms of risk and financial backing of the transaction. The supplier therefore has to be cautious of the creditworthiness of the international partner (Carr, 2010).

The need to reconcile the conflicting economic interests involved in export transactions forced mercantile custom to develop standardized methods of payment. For the purpose of the reconciliation of interests the interposition of banks is necessary. This usually happen through the means of collection arrangement of payment (or documentary collection -DC as called by Niepmann and Schmidt-Eisenlohr) or under the letter of credit (L/C). One of the differences between the two is from whom bank receives its instructions, whether it's from the seller (in the former case), or the buyer (in the latter case). This substantially decreases the risk of the other party defaulting on its obligations, because the bank is able to use the documents of title as collateral. If the buyer and seller don't feel the need for an interposition of banks, the buyer can transfer the price to the seller on open account, or the seller may send the buyer a documentary bill of exchange (or pay via cash in advance as suggested by other sources) (Francois & Manchin, 2013),(Niepmann & Schmidt-Eisenlohr, 2017).

So it's clear to see that the most used payment methods in international trade are payment on account, cash in advance, documentary collections and letters of credit.

Payment on account and cash in advance are the most straightforward ways to settle a transaction. In the first one, the importer pays upon receipt and in the second one the importer pays before the exporter produces the good. Under these methods one side bears all the risks, as aforementioned, and may wish to mitigate them using instruments provided by banks just for this purpose. The two most common being documentary collection and letter of credit.

2.5.5.2. Empirical analysis of bank instruments usefulness

The above mentioned difference between L/C and DC is not the only one and probably not even the main one. In DC exporter's bank forwards documents (usually proprietary or other similar legal title) to importer's bank, which are handed over to the importer only upon payment. In L/C the importer initiates the transaction and the bank that issued the letter of

credit guarantees that it will pay the thereunder agreed price upon receipt of a proof of a delivery of the good (usually in the form of shipping documents). L/C can also involve a cooperation of banks as DC, where the L/C is confirmed by another bank, usually in the exporter's country, which agrees to pay if the issuing bank defaults. The L/C is more costly than the DC, because banks undergo a more thorough screening and monitoring process to ensure liquidity and creditworthiness of the importer.

Niepmann and Schmidt-Eisenlohr (2017) assigned each of the four payment methods a different expected profit for the exporter and by maximizing this profit, the exporter chooses the appropriate method of payment. The profit function depends on portion of "bad" firms on the target market (i.e. firms that are willing to break their contractual obligations if it suits them) and on how well the contracts are enforceable in the country (i.e. legal country risk as described in section 2.2.2.). By doing the theoretical analysis of these expected profits, Niepmann and Schmidt-Eisenlohr (2017) conclude that destination country risk influences which type of payment method will be chosen. Namely that if there is little risk, the firms are likely to choose open account transaction, but as the risk grows they will switch to DCs and with even higher risk to L/Cs, which are more expensive than DCs, but bring more security to the exporter. However, if the risk grows even further, the cost of L/C, which consists of a fixed component (payment for screening, monitoring and other activities that the bank has to carry out) and a flexible one (payment proportional to risk that the bank is undergoing of importer defaulting on its obligations), becomes too high and exporters won't settle for any other payment method than cash in advance, which they deem to be the only secure option in that case.

These theoretically grounded conclusions are well supported by the swift data on US exports analysis carried out in the empirical part of Niepmann and Schmidt-Eisenlohr's paper (2017). They found statistically significant nonlinear relationship between number of LCs and DCs, and rule of law in the country, as expected. They also found a positive correlation between the size of the transaction and the use of banking products for their securement, with the average size of L/C transactions being about four times higher than the average size of DC transactions, which was roughly triple the size of average of all transactions.

3. Methodology and data for the Gravity model

In this section we first provide a brief motivation for using the gravity model in the way we are using it and share a little bit of the model's history, in order to become more acquainted with the model and with the underlying idea behind it. After that we'll discuss the methodology and data used for our specification of the gravity model.

3.1. Motivation

Risks are, together with benefits (size of an economy and likely economic growth) and costs (corruption, lack of infrastructure, legal costs in the country), part of overall attractiveness of a country as a potential market or investment site for an international business. (Hill – international business, 77-79 & 678-680) With this in mind, it's quite an intuitive notion, that the political risk in a given country influences its volume of trade. More specifically, by adding term for political risk, we hope to provide evidence that the higher the country's risk the lower its volume of trade. We will test this hypothesis with a micro-founded gravity model specified by Anderson- Van Wincoop paper published in 2003 and amended by Baldwin & Taglioni (2007) and Baier & Bergstrand (2009) multilateral resistance terms approximation.

3.2. Brief history of gravity model

First gravity model, built by Tinbergen in 1962, was not theoretically based, but rather just an intuitive notion explaining bilateral trades between countries. Although this was the predominant objection raised by the gravity model opponents, it didn't stop its widespread, mainly because with its high R-squared the data seemed to fit quite nicely. (Shepherd) Anderson in 1979 was probably the first one to provide clear micro-foundation by deriving the gravity model from the CES expenditure function, but he wasn't, by far, the only one. As it turns out, the gravity-like equation is bound to arise from almost any trade theory.

Gravity model got its name because of the uncanny similarity to Newton's law of universal gravitation. However, instead of dealing with gravity constant and masses it relates bilateral trade to GDPs of the two countries as a proxy for their economic size and distance, and selected dummy variables for the two as a proxy for the cost of trade (Baldwin & Taglioni, 2006).

However, these are not the only variables, the micro-founded model adds 2 more to deal with the bias burdening the intuitive (or naïve) model. The variables added are so called multilateral resistance terms (in many papers called by different name, like gravitational un-constant in Baldwin paper or remote-ness in paper by Frankel-Wei) (Baldwin & Taglioni, 2006).

The gravity model equation looks as follows (Yotov, 2016):

$$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\prod_{i,t}P_{j,t}}\right)^{(1-\sigma)} \quad (1)$$

The lowercase index t stands for time period and i and j for the country i and country j respectively. The term $X_{ij,t}$ signifies export (or alternatively imports) from country i to country j in time t, $Y_{i,t}$ is country i's GDP in period t and $E_{j,t}$ is country j's expenditure at time t, which in aggregate terms equal country j's GDP in period t. Y_t represents the world's GDP (i.e. $Y_t = \sum_{i=1}^{n} Y_{i,t}$), σ represents elasticity of substitution and $t_{ij,t}$ is a symbol for trade costs burdening exports from i to j at time t (since international trade is largely based on principle of reciprocity, it's likely that costs will be symmetric for exports from i to j and exports from j to i (Pauknerová & Růžička, 2014)).

Multilateral resistance terms $\prod_{i,t}$and P_j^ksignify outward multilateral resistance and inward multilateral resistance, respectively. The outward multilateral resistance deals with the fact, that exports from one country to another depend on trade costs across all export markets. Inward multilateral resistance term similarly shows dependence of imports from one country to another on trade costs across suppliers (Shepherd, 2012).

3.3. Data

For our gravity model we're using a bilateral panel data for 140 countries for years 2002-2015. This should give us 272 440 observations, in reality, with values missing in some datasets, we get about 183 thousand observations for OLS and for Poisson pseudo-maximum likelihood we end up with approximately 300 observations more[7].

[7] the reason why will be clarified below in section 3.4.2.

The data used for the regression are taken from a number of reliable datasets. [8]

3.3.1. Trade

Data on trade were taken from Comtrade database. Unfortunately while downloading, Comtrade doesn't specify whether the observations are missing because they are unrecorded, or because they are in fact zero. And although there is a way to determine whether the missing observations should be replaced with zero or not, use of such method is beyond the scope of this paper. Even though we're dealing with yearly aggregate data, which makes it seem plausible, that the portion of missing or zero values won't be high and therefore won't distort the result, it is actually about 30% of the trade values. It will be easy to confirm how much that alters the results by comparing estimates for OLS and Poisson pseudo-maximum likelihood. As for the trade flows, we tested, with Poisson pseudo-maximum likelihood estimator of gravity model with Taylor-series approximation whether imports or exports perform better and based on beta-estimates of GDPs, we decided to use exports from IMF, because their estimates for GDPs are closer to zero than estimates that were obtained using import data or Comtrade export data.

3.3.2. GDP

Two GDP sources were used for the regressions run in this thesis. Even though WTO was meant as the main data source, because of its precision and IMF data, which although less precise, was supposed to serve as a tool for verification of robustness of our findings and corroboration of the faultlessness of the WTO data, it ended up outperforming the WTO data and thus was kept as the main data source. The two are very highly correlated, more than 99% and both have about 8000 missing values, where little over half are missing from both samples at the time.

The GDP selected for the model is nominal, in order to avoid the bronze-medal mistake introduced by Baldwin and Taglioni (2006)

[8] Links to these datasets are provided in the bibliography.

3.3.3. Distance and dummies

Distance and colony dummies were taken from CEPII database. Dataset for dummy variable for regional trade agreements (RTAs) was acquired from de Sousa (2012). The dummies were selected based on Shepherd's user guide (2012) and WTO guide (Yotov, 2016) and are following:

- ***Colony*** is a dummy variable showing whether countries have ever had a colonial relationship.
- ***Comlangoff*** is 1 when the two countries have the same official language.
- ***Contig*** represents a case when two countries share a common border, i.e. are contiguous.
- ***Comcol*** is a dummy for a common colonizer after 1945
- ***RTA*** represents dummy for regional trade agreements (RTAs), which is required by the WTO handbook to be part of the trade cost term. This dummy is 1 whenever the two countries in question belong to the same regional trade agreement. (Yotov, 2016)

3.3.4. Risk

The data estimating risk is collected and reported by the political risk services (PRS) group. The publicly-available risk data are annual for years 2002-2015 and report 6 indicators of political risk. The magnitudes are between zero and one, with values close to zero meaning high risk and values close to one signifying low risk.

The indicators of the political risk are following:

- ***VA*** stands for 'Voice and Accountability' and is composed of two indicators, military in politics and democratic accountability.
- ***PV*** is a variable called 'Political Stability and Absence of Violence' is built up by four segments measuring government stability, internal and external conflict and ethnic tension
- ***RL*** is short for 'Rule of Law', which how reliable and abided the laws
- ***RQ*** represents 'Regulatory Quality' and is measured through country's investment profile.
- ***GE*** stands for 'Government Effectiveness' and measures bureaucratic effectiveness

- ***CC***, or 'Control of Corruption' measures how common is corruption in the given country. Each of these indicators has values from zero to one, where 0 means the greatest amount risky and 1 the least.

3.4. Methodology

3.4.1. Estimation equation

Because of the multiplicative nature of the Gravity equation (1), we need to take natural logarithms of both sides which produces the following estimation equation (UNCTAD, 2012).

$$\ln(X_{ij,t}) = a_0 + a_1 \ln(Y_{i,t}) + a_2 \ln(Y_{j,t}) + a_3 \ln(t_{ij,t}) + a_4 \ln(\prod_{i,t}) + a_5 \ln(P_{j,t}) + \varepsilon_{ij,t} \quad (2a)$$

where a_0 is a constant, $a_3 = (1 - \sigma)$ and we specify the trade cost in the following way:

$$t_{ij,t} = dist_{ij}^{\delta_1} * \exp(\delta_2 contig_{ij} + \delta_3 comlang\text{--}off_{ij,t} + \delta_4 comcol_{ij} + \delta_5 colony_{ij} + \delta_6 RTA + \delta_7 risk) \quad (2b)$$

3.4.2. Estimation methods and specification

Although there is a number of estimation methods, there are two widely used when it comes to multilateral gravity models run on panel data; OLS and Poisson pseudo-maximum likelihood estimator, which will be the ones that we'll be using as well. The specification of the OLS (whether random effects, fixed effects or pooled OLS should be used) has to be determined with the proper test of data, according to Park's guidelines (Park, 2015). Poisson then has to follow the same specification.

Poisson carries one large advantage, that is that it allows for zero trade observations and thus does not create a data selection bias from zeros being dropped due to logarithmic form of the equation.

The multilateral resistance terms can be approximated in a number of ways, the approximation methods that were chosen for our model are approximation with use of time variant country specific dummied and Taylor-series approximation. However, it turns out, that the dataset is actually too small to bear reasonable results when the time variant

country specific variables are included[9], so we'll have to proceed according to WTO guide's council (UNCTAD, 2012, 109) and add time invariant importer and exporter dummies instead.

Haussmann test determines[10] that OLS for the Gravity model with dummy estimation of multilateral resistance terms has to have fixed effects specification. This means that the Poisson estimation should have country pair dummy variables included, because selected fixed effects option in the OLS model provides for country-pair fixed effects. (UNCTAD, 2012, 126) However Stata[11] does not allow for that many variables in one command, so instead of using the ppml command with all these dummies included, so xtpoisson with fe specification will be used instead, which in fact is a synonym with Poisson pseudo-maximum likelihood estimator with fe specification as understood by Silva and Tenreyro (2006) paper. We still keep the simple time dummies to adjust for global economic shocks and trends.

Taylor-series approximation should be run with pooled OLS, i.e. regress command (Shepherd,30), or it can be also estimated with ppml command for the Poisson pseudo-maximum likelihood estimation.

3.4.3. PCA

If we correlate our political risk indicators, as done in Table 1, we can see that there is indeed some correlation between the indicators. To address this issue, we'll be using the approach suggested by Francois and Manchin (2013) Principal Components Analysis (PCA). The results of this analysis for the five indicators other than VA are reported in table 2 and table 3. For our regressions we'll use first two components, to make sure that they account for about 80% of the political risk indicators and we'll avoid the omitted variable bias.

[9] We infer that from the way GDP behaves, its coefficients become unreasonably small, or even negative (see Appendix 1)
[10] after testing FE and RE separately and finding that they are significant
[11] the computer program used for running our regressions

Table 1 – Correlation of political risk indicators

	Var	Ger	CCr	PVr	RLr	RQr
Var	1.0000					
Ger	0.7176	1.0000				
CCr	0.6358	0.7359	1.0000			
PVr	0.3928	0.3773	0.3918	1.0000		
RLr	0.5230	0.6141	0.6609	0.4665	1.0000	
RQr	0.6368	0.6583	0.6124	0.5167	0.5707	1.0000

Table 2 – PCA information

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.26564	2.55029	0.6531	0.6531
Comp2	.715349	.276118	0.1431	0.7962
Comp3	.439232	.110374	0.0878	0.8840
Comp4	.328857	.0779401	0.0658	0.9498
Comp5	.250917	.	0.0502	1.0000

Table 3 – PCA values

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
Ger	0.4722	-0.3502	-0.2502	0.3249	0.6973	0
CCr	0.4740	-0.3384	0.1136	0.4567	-0.6629	0
PVr	0.3602	0.8663	0.0628	0.3356	0.0573	0
RLr	0.4569	-0.0631	0.7261	-0.4883	0.1470	0
RQr	0.4625	0.0921	-0.6272	-0.5786	-0.2224	0

4. Results

In this section[12], first four subsections, which correspond to estimation method described above, will introduce the results obtained by each. Every one will contain a table of results for the Gravity model where the risks aren't included[13] and table of risk estimators with their standard errors. The last section is a discussion of results as whole.

Before the results are reported, the variable names used in these regressions have to be clarified[14]:

exprescimf is a variable for exports rescaled so that they are in the same unit as GDPs from the IMF database.
lexprescimf is the logarithmic form of the previous variable
limfGDPr is exporter country's GDP from IMF database
limfGDPp is importer country's GDP from IMF database
ldist is logarithmic form of distance
com=comcol, col=colony, clg=comlang_off, ctg=contig
[risk abbreviation]r is the value of given indicator in export country
[risk abbreviation]p is the value of given indicator in import country
_star means that the variable in question was modified in a way described in Shepherd's manual (2012, pg 30)[15]

4.1. OLS estimation method of Gravity model using Taylor approximation

It's obvious from the F-test that the model is not insignificant and R-squared is also encouraging, but RMSE seems quite high. However that is not an uncommon sighting in panel data gravity model estimations, an excellent example of that is paper from Baier & Bergstrand (2004).

Each of the estimators in Table 4 is highly statistically significant, has the anticipated sign and seemingly plausible magnitude, with GDPs not too far from one, as suggested by theory.

[12] More detailed tables are provided in the Appendix 2-5.
[13] This is to show magnitudes of the other variables and verify that the model is indeed well-specified and working properly.
[14] Only those that were not already mentioned in section 3.3..
[15] The only modification is that there is a different number before the last variable, because we have sample of 140 states, not 218.

The same cannot unfortunately be said about the risk indicators estimates. Although all but two are statistically significant at a reasonable level, half of these significant variables carry a negative sign, which is not in line with our expectations, because interpretation of such sign would mean that higher the indicator (i.e. lower the risk), the less countries trade.

The Rule of Law (RL) and Political Stability and Absence of Violence (PV) are the only indicators that have positive statistically significant value for both the exporting and the importing country. Out of the two RL seems to behave more in line with our expectations, because the magnitude of PV estimator is more than 5 times as high as the one estimated for the RTA dummy. This would mean that change of only 0.1 in the PV on either side of trade would result in 25-27,5% change in trade volume, which is highly unlikely. RL estimates "only" 2,5 or 3,5% change in trade the event of RL indicator, based on whether it's the exporter or the importer(respectively), which seems a lot more plausible.

Table 4 - OLS Gravity model with Taylor approximation

Linear regression Number of obs = 183043
F(8, 8606) = 5507.20
Prob> F = 0.0000
R-squared = 0.6416
Root MSE = 2.3035
(Std. Err. adjusted for 8607 clusters in dist)

lexprescimf	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf	Interval]
limfGDPr	1.289437	.0074471	173.15	0.000	1.274839	1.304035
limfGDPp	.8889013	.007512	118.33	0.000	.8741761	.9036266
ldist_star	-1.42309	.0324225	-43.89	0.000	-1.486646	-1.359534
col_star	.8727926	.1256744	6.94	0.000	.6264406	1.119145
cmc_star	.6129218	.095746	6.40	0.000	.4252366	.8006069
clg_star	.5766646	.0669215	8.62	0.000	.4454825	.7078468
ctg_star	.7333443	.1252073	5.86	0.000	.487908	.9787806
rta_star	.4891424	.0504193	9.70	0.000	.3903084	.5879764
_cons	139.3649	3.650269	38.18	0.000	132.2095	146.5203

Table 5 - Risk indicators results for OLS Gravity model with Taylor approximation

lexprescimf	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf	Interval]
VAr_star	-.087126	.1104794	-0.79	0.430	-.3036922	.1294402
VAp_star	-.5260369	.0983764	-5.35	0.000	-.7188783	-.3331955
GEr_star	-1.502239	.3412389	-4.40	0.000	-2.171149	-.8333288
GEp_star	-.7548711	.2118809	-3.56	0.000	-1.170208	-.3395337
CCr_star	-.5806042	.0770547	-7.53	0.000	-.7316498	-.4295586
CCp_star	-.2966656	.0777768	-3.81	0.000	-.4491268	-.1442045
PVr_star	2.746491	.1174613	23.38	0.000	2.516238	2.976743
PVp_star	2.508503	.1173535	21.38	0.000	2.278462	2.738544
RLr_star	.2451558	.1183504	2.07	0.038	.0131606	.4771509
RLp_star	.3535195	.116752	3.03	0.002	.1246575	.5823815
RQr_star	-.0344758	.0534663	-0.64	0.519	-.1392826	.070331
RQp_star	.573071	.0663553	8.64	0.000	.4429988	.7031432

4.2. Poisson pseudo-maximum likelihood estimation of Gravity model using Taylor approximation

The R-squared of this regression is quite high, little over 0.57. Even though, R-squared is not fully reliable, this seems to be a good sign about the goodness-of-fit of the regression.

When we examine Table 6, we see that magnitude of each of the three main gravity equation components (GDPs and distance) estimators dropped significantly, compared to the previous estimation method, but remains on highly acceptable level. According to this estimation method, colonial link is ten times less economically significant than under the OLS estimation. Dummy for the shared colonizer in the past is the only variable (in the risk-less model) that changed sign with different method and also became statistically insignificant.

Out of the risk variables only four are now statistically significant and only at 0.05 level of significance (none of them reach 0.01 significance level). Out of these four only one has a negative sign, the rest are positive. Voice and Accountability (VA) indicator of political risk has both estimators (for importer and also for exporter) statistically significant, positive and

magnitudes of 0.645 and 0.548, although they are quite high, don't seem as unreasonable as the ones obtained for PV in previous subsection.

Table 6 - PPML estimation of Gravity model with Taylor approximation

Number of parameters: 9
Number of observations: 248178
Number of observations dropped: 0
Pseudo log-likelihood: -132086.04
R-squared: .57074234

		Robust				
exprescimf	Coef.	Std. Err.	z	P>|z|	[95% Conf	Interval]
limfGDPr	.7691652	.0086434	88.99	0.000	.7522246	.7861059
limfGDPp	.7512789	.0085106	88.28	0.000	.7345985	.7679594
ldist_star	-.6478603	.0154364	-41.97	0.000	-.6781151	-.6176055
col_star	.098537	.0325284	3.03	0.002	.0347825	.1622914
cmc_star	-.1666272	.1124943	-1.48	0.139	-.3871119	.0538576
clg_star	.2974639	.04154	7.16	0.000	.2160471	.3788807
ctg_star	.5069492	.0375972	13.48	0.000	.4332601	.5806384
rta_star	.4693909	.03083	15.23	0.000	.4089652	.5298166
_cons	60.6342	1.70311	35.60	0.000	57.29617	63.97224

Table 7 - Risk indicators results from PPML estimation of Gravity model with Taylor approximation

		Robust				
exprescim	Coef.	Std. Err.	z	P>|z|	[95% Conf	Interval]
VAr_star	.6453824	.3189127	2.02	0.043	.0203251	1.27044
VAp_star	.548087	.2436478	2.25	0.024	.0705461	1.025628
GEr_star	-1.036498	.56367	-1.84	0.066	-2.141271	.068275
GEp_star	-.9233774	.4234542	-2.18	0.029	-1.753332	-.0934224
CCr_star	-.2164064	.1990323	-1.09	0.277	-.6065026	.1736897
CCp_star	-.2172476	.2033281	-1.07	0.285	-.6157633	.1812682
PVr_star	.4055993	.350881	1.16	0.248	-.2821149	1.093313
PVp_star	.7588291	.3245874	2.34	0.019	.1226495	1.395009
RLr_star	.1097436	.4029081	0.27	0.785	-.6799416	.8994289
RLp_star	.6444	.3570369	1.80	0.071	-.0553795	1.344179
RQr_star	-.0474828	.1248936	-0.38	0.704	-.2922698	.1973042
RQp_star	-.029436	.1220158	-0.24	0.809	-.2685826	.2097106

4.3. OLS with FE specification estimation of Gravity model with time invariant country-specific dummies

The R-squared for the within estimation of the model is only 0.15, but that is to be expected for the FE specification. The result of the F-test clearly shows that the model in itself is in no way statistically insignificant.

Because the FE option is specified, all variables that don't vary in time (or don't vary in time sufficiently), are dropped. From the gravity model without the risk variable specification that leaves only GDPs, RTAs and time dummies, as seen in Table 8. The GDPs are lower than when we are using the Taylor series approximation of multilateral resistance terms, but they do not warrant any upheaval, since in no regression do they drop below .54. (see appendix 4).

In table 9. we see, that only six out of our twelve risk factors are significant, and out of those, half are negative. Control of corruption is the single one that is statistically significant and positive. Magnitudes also seem reasonable with 3.7% or 4.5% change in trade with change of 0.1 in reporting country's (exporter) or partner country's (importer) cost of corruption, respectively. This doesn't seem inconceivably high, together with the statistical significance it is an optimal result.

Table 8 - OLS estimation of Gravity model using dummies

Fixed-effects (within) regression — Number of obs = 183043
Group variable: ID2 — Number of groups= 16163
R-sq: within = 0.1540 — Obs per group: min = 1
between = 0.5321 — avg = 11.3
overall = 0.4869 max = 14

F(16,16162) = 712.79
corr(u_i, Xb) = 0.3801 — Prob> F = 0.0000

(Std. Err. adjusted for 16163 clusters in ID2)

		Robust				
lexprescimf	Coef.	Std. Err.	t	P>|t|	[95% Conf	Interval]
---	---	---	---	---	---	---
limfGDPr	.5513168	.0282551	19.51	0.000	.4959337	.6067
limfGDPp	.681276	.0244613	27.85	0.000	.6333291	.7292229
ldist	0	(omitted)				
comcol	0	(omitted)				
contig	0	(omitted)				
comlang_off	0	(omitted)				
colony	0	(omitted)				
rta	.0332739	.0275131	1.21	0.227	-.0206549	.0872027
year_1	0	(omitted)				
year_2	-.0503828	.0144581	-3.48	0.000	-.0787224	-.0220432
year_3	.0157035	.0177986	0.88	0.378	-.0191837	.0505907
year_4	.0290348	.0212287	1.37	0.171	-.0125758	.0706455
year_5	.0296289	.0252623	1.17	0.241	-.0198879	.0791457
year_6	.0354415	.030147	1.18	0.240	-.02365	.094533
year_7	.0717053	.0352553	2.03	0.042	.002601	.1408096
year_8	-.0032539	.0326249	-0.10	0.921	-.0672023	.0606945
year_9	.0800541	.0357078	2.24	0.025	.010063	.1500453
year_10	.1297637	.039754	3.26	0.001	.0518416	.2076859
year_11	.1331524	.0402692	3.31	0.001	.0542203	.2120845
year_12	.1327009	.0418805	3.17	0.002	.0506104	.2147913
year_13	.1410321	.0424038	3.33	0.001	.0579158	.2241483
year_14	.1130639	.0395296	2.86	0.004	.0355815	.1905464
_cons	-10.29968	.1439315	-71.56	0.000	-10.5818	-10.01756

Table 9 - Risk indicators results from OLS estimation of Gravity model using dummies

lexprescim	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf	Interval]
VAr	-.0803597	.0965183	-0.83	0.405	-.2695463	.108827
VAp	.0866862	.0844428	1.03	0.305	-.078831	.2522034
GEr	.2260108	.2285362	0.99	0.323	-.2219454	.6739671
GEp	.3300268	.1572986	2.10	0.036	.0217042	.6383494
CCr	.3793139	.0689476	5.50	0.000	.2441689	.5144589
CCp	.4488094	.0675458	6.64	0.000	.3164121	.5812067
PVr	.0400446	.104981	0.38	0.703	-.1657299	.245819
PVp	.0221517	.0951923	0.23	0.816	-.1644356	.2087391
RLr	-.3369549	.1033659	-3.26	0.001	-.5395636	-.1343463
RLp	-.2377866	.0956045	-2.49	0.013	-.4251819	-.0503913
RQr	-.2510921	.056866	-4.42	0.000	-.3625557	-.1396284
RQp	.0306407	.0595306	0.51	0.607	-.0860459	.1473274

4.4. Poisson pseudo-maximum likelihood estimation of Gravity model with time invariant country specific dummies

Looking at Table 10, the two GDPs seem to be more balanced than in the previous subsection (where we used OLS on gravity model with dummies), because exporter's GDP (GDPr) was increased by 0.03, to satisfactory 0.58, and importer's GDP (GDPp) declined to 0.61. RTA dummy got twice as large and statistically significant at 0.05 level.

As far as risks are concerned, only three of them are statistically significant: CCp (Control of Corruption in importer state), PVr (Political Stability and Absence of Violence in exporter country), and RQr (Regulatory quality in the exporter country). Out of those three, RQr is sub-zero, which, as analogously explained in section 4.1., doesn't appear plausible. Although CCp and PVr are believable in direction and magnitude, their counter-part variables for their trade partner (CCr and PVp) are not statistically significant.

Table 10 - PPML estimation of Gravity model using dummies

Conditional fixed-effects Poisson regression Numberofobs =225047
Group variable: ID2 Numberofgroups= 16163
Obs per group: min =9
avg = 13.9
max =14
Wald chi2(16) = 11517.62
Log pseudolikelihood = -49964.693 Prob> chi2 = 0.0000
(Std. Err. adjusted for clustering on ID2)

		Robust				
exprescim	Coef.	Std. Err.	z	P>|z|	[95% Conf	Interval]
limfGDPr	.5823468	.0235893	24.69	0.000	.5361125	.6285811
limfGDPp	.6085401	.037368	16.29	0.000	.5353003	.68178
rta	.0761932	.0299976	2.54	0.011	.017399	.1349874
year_1	.0659976	.0396407	1.66	0.096	-.0116968	.1436919
year_2	.0569419	.0315307	1.81	0.071	-.0048571	.1187408
year_3	.0875102	.0264978	3.30	0.001	.0355754	.139445
year_4	.1048791	.0244337	4.29	0.000	.0569899	.1527684
year_5	.14668	.0215673	6.80	0.000	.1044089	.1889511
year_6	.1167724	.0178695	6.53	0.000	.081749	.1517959
year_7	.1307082	.015204	8.60	0.000	.1009088	.1605075
year_8	-.0339525	.0133897	-2.54	0.011	-.0601958	-.0077091
year_9	.0585767	.0122439	4.78	0.000	.034579	.0825744
year_10	.0945552	.0105077	9.00	0.000	.0739604	.11515
year_11	.0874598	.0094813	9.22	0.000	.0688768	.1060429
year_12	.0715207	.0103138	6.93	0.000	.0513059	.0917354
year_13	.0450141	.0064783	6.95	0.000	.0323168	.0577114

Table 11 - Risk factor estimates for PPML estimation of Gravity model using dummies

		Robust				
exprescimf	Coef.	Std. Err.	z	P>|z|	[95% Conf	Interval]
VAr	.1137715	.1242681	0.92	0.360	-.1297895	.3573325
VAp	-.0442852	.1487544	-0.30	0.766	-.3358385	.247268
GEr	-.2742107	.2118208	-1.29	0.195	-.689372	.1409505
GEp	-.0498166	.3024811	-0.16	0.869	-.6426686	.5430354
CCr	-.0175107	.0730025	-0.24	0.810	-.1605931	.1255716
CCp	.1582415	.0745416	2.12	0.034	.0121428	.3043403
PVr	.457187	.1150242	3.97	0.000	.2317437	.6826303
PVp	.0956219	.108193	0.88	0.377	-.1164324	.3076762
RLr	.0822864	.1548612	0.53	0.595	-.221236	.3858087
RLp	-.085124	.137076	-0.62	0.535	-.353788	.18354
RQr	-.2639521	.0463509	-5.69	0.000	-.3547981	-.173106
RQp	-.007541	.0572596	-0.13	0.895	-.1197677	.1046858

4.5. Discussion of results

Although we've once again re-confirmed, that Gravity model of trade is a reliable tool, which fits data quite nicely, we fell short in showing, that including variables indicating political risk would have an effect on the outcome of the model. Even though in some cases several indicators had estimators which we deemed, based on the intuition that countries with less political risk will enjoy more trade, plausible, the findings just weren't robust enough. Out of the six indicators not one group had all four estimators both positive and statistically significant.

The variability of results under different estimation methods and specifications to deal with multilateral resistance terms suggests that the main reason for this result lies, doubtlessly, in the data. More precisely in the methodology for measuring political risk factors, PRS group, similarly to for example WTO[16], affirms that "The political risk assessments are made on the basis of subjective analysis of the available information,..."[17]. With subjective analysis being used to quantify the risk factors, it's not surprising that we cannot get robust findings from our model. However, this is the only type of data generation available at the moment, so until it becomes more objective or is otherwise improved, we cannot expect much different outcomes.

This problem is identical to the largely discussed CPI one. Corruption Perception Index (CPI), is a variable based on pools and surveys intended to measure the level of corruption, which makes it a "subjective measurement" of corruption levels, just like our indicators are subjective measurements of the political risk levels.

Urra (2007) offers an overview of three crucial problems of CPI which are valid for all subjective measurements.

First one is the perception problem. This deals with the fact, that for corruption, as for risks, objective measurements are very rare and with the elaborate statistics can create an illusion that the CPI is the real level of corruption. However, the gap between the two is quite large.

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[16] http://info.worldbank.org/governance/wgi/index.aspx#doc

17 International Country Risk Guide Methodology [online]. [cit. 2017-05-05]. Accessible at: https://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf

Second is the error problem. When there is objectively measured data obtained by a survey, a confidence interval can be statistically inferred from them. But the CPI data are perception data, they do not reflect objective value. Because of that, the data already have large margins of error.

Third is a utility problem. Data on corruption (and on political risk as well) are highly used and demanded by NGOs (Non-governmental organizations) and banks operating on international level. For whose benefit are the data collected shows in their scope and phrasing. That makes the data useless for purposes of other kinds of entities, such as the policy-makers.

It is not a stretch to imagine, that our political risk indicators suffer from the same set of problems and that this is the reason why we didn't get the results we were expecting from out regressions.

But even though the results don't align with the notion that political risk influences international trade, that doesn't mean that the intuition is incorrect. It still seems highly likely, that the statement is correct, but until better methodology for data collection and manipulation emerges, there is not much that can be done to prove it.

5. Conclusion

Risk is an important part of trade. This statement is even more true for international trade. It is therefore important to keep it in mind, when taking part on international trade operations.

This thesis provided, in the literature review, an overview of risk types, explaining along the way what is meant by the term and outlined the most important international trade operations that are affected by these risks, scoping the potential "zone" of impact. Then it went on to show how the risks are dealt with on an individual company' level, with risk analysis tools and description of possible subsequent decisions. The risk analysis was enriched by summary of the most important, practically used, international trade risk mitigation tools.

After the literature review a micro-founded gravity model was introduced in order to provide support for the claim of importance of risks. To do that a variable for measuring importer's and exporter's political risk vas added into the micro founded gravity model.The model was estimated in four ways, using dummies and Taylor series for approximation of the multilateral resistance, and OLS and Poisson pseudo-maximum likelihood estimation method. Because the size of our panel data sample, more specifically insufficient number of years and the results of Hausman test, the dummies specified in the regression had to be country pair dummies (equivalent of using FE specification) and year dummies and not country time-variant importer and exporter country dummies as is customary. Although the results proved consistent and significant for all the variables traditionally included in the gravity model, regrettably the country political risk estimators results didn't. They turned out to be un-robust for all (i.e. for no political risk indicator were all estimates similar and significant), half of the estimates weren't even significant and in a large number of cases they were negative. This however probably doesn't stem from non-existence of the relationship between bilateral international trade and political risk in countries in question, but rather from a methodology of quantifying the risk factors which relies on subjective assessment of data.

Even though the gravity model didn't provide the coveted support for the statement that international trade risks are so important, that their influence can be seen on bilateral trade flows between countries, it still seems intuitively right.

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Data sources are available at following websites:

Trade data Comtrade: http://comtrade.un.org/data/

GDP IMF: http://www.imf.org/en/Data

WTO: https://www.wto.org/english/res_e/res_e.htm

Dummies and distance CEPII: http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp

RTA José de Sousa: http://jdesousa.univ.free.fr/data/rta/rta_faq.htm#Frequently+Asked+Questions+about%A0regional+trade+agreement+do-files

Risk data PRS group, but accessible at: https://info.worldbank.org/governance/wgi/pdf/PRS.xlsx

Appendices

Appendix 1 - OLS regression of gravity model with time variant country specific dummies

Appendix 2 - Poisson pseudo-maximum likelihood estimation of gravity model with dummies

Appendix 3 - Poisson pseudo-maximum likelihood estimation of gravity model using Taylor series approximation

Appendix 4 - OLS estimation of gravity model with dummies

Appendix 5 - OLS estimation of gravity model using Taylor series approximation

Appendix 1 – OLS regression of gravity model with time variant country specific dummies

	Comtrade exports						IMF exports					
lexp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lGDPcpar	.3291035	1.488611	0.22	0.825	-2.588736	3.246943	.6858656	.1534241	4.47	0.000	.3851374	.9865939
lGDPcrep	.6706155	.3755505	1.79	0.074	-.065504	1.406735	-.2409537	.2829084	-0.85	0.394	-.7954855	.313578
ldist	0	(omitted)					0	(omitted)				
comcol	0	(omitted)					0	(omitted)				
contig	0	(omitted)					0	(omitted)				
colony	0	(omitted)					0	(omitted)				
comlang_off	0	(omitted)					0	(omitted)				
rta	.052294	.0292716	1.79	0.074	-.0050815	.1096694	.0507005	.029143	1.74	0.082	-.006423	.107824
year_1	-3.020304	.	.	.	.	.	-1.148727	.6197089	-1.85	0.064	-2.363425	.0659715
year_2	-3.561982	.	.	.	.	.	2.022702	.9673947	2.09	0.037	.1265016	3.918903

Appendix 2 – OLS estimation of gravity model using Taylor series approximation

		Robust			Robust			Robust			Robust			Robust			Robust			Robust	
lexprescir	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t
limfGDPr	1.289437	.0074471	173.15	1.303117	.00761	171.24	1.303345	.0076114	171.24	1.303098	.0076075	171.29	1.3008	.0075794	171.62	1.303259	.0076104	171.25	1.303364	.0076126	171.21
limfGDPp	.8889013	.007512	118.33	.9009436	.0076368	117.97	.9014403	.0076322	118.11	.9010302	.0076353	118.01	.8993202	.0076164	118.08	.901062	.0076404	117.93	.900786	.0076387	117.92
ldist_star	-1.42309	.0324225	-43.89	-1.40951	.0324008	-43.50	-1.40977	.0324039	-43.51	-1.410001	.0324051	-43.51	-1.412432	.0324092	-43.58	-1.409644	.0324041	-43.50	-1.41018	.0324091	-43.51
col_star	.8727926	.1256744	6.94	.8778033	.1256906	6.98	.877544	.1257181	6.98	.8772803	.1257257	6.98	.8766226	.1256687	6.98	.8775065	.1257212	6.98	.8773847	.1257299	6.98
cmc_star	.6129218	.095746	6.40	.6148491	.0958052	6.42	.6146806	.0958088	6.42	.6148104	.0958112	6.42	.6144979	.0957798	6.42	.6148445	.0958143	6.42	.6147889	.0958107	6.42
clg_star	.5766646	.0669215	8.62	.5716859	.0667587	8.56	.5719286	.0667595	8.57	.5722943	.066765	8.57	.5728471	.0667824	8.58	.572051	.0667625	8.57	.5721421	.0667651	8.57
ctg_star	.7333443	.1252073	5.86	.7274249	.1262428	5.76	.7279537	.1262519	5.77	.7280598	.1262611	5.77	.72782	.1261083	5.77	.7280201	.1262617	5.77	.7280056	.1262634	5.77
rta_star	.4891424	.0504193	9.70	.5484359	.0504507	10.87	.5471086	.0504524	10.84	.5457578	.0504696	10.81	.5354892	.050491	10.61	.5474209	.0504726	10.85	.5454198	.0505193	10.80
_cons	139.3649	3.650269	38.18	110.998	4.322126	25.68	117.554	5.05501	23.25	109.4541	4.332104	25.27	96.98182	4.38767	22.10	111.0588	4.330614	25.65	109.0897	4.451972	24.50
VAr_star	…	…	…	-.087126	.1104794	-0.79	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
VAp_star	…	…	…	-.5260369	.0983764	-5.35	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
GEr_star	…	…	…	…	…	…	-1.502239	.3412389	-4.40	…	…	…	…	…	…	…	…	…	…	…	…
GEp_star	…	…	…	…	…	…	-.7548711	.2118809	-3.56	…	…	…	…	…	…	…	…	…	…	…	…
CCr_star	…	…	…	…	…	…	…	…	…	-.5806042	.0770547	-7.53	…	…	…	…	…	…	…	…	…
CCp_star	…	…	…	…	…	…	…	…	…	-.2966656	.0777768	-3.81	…	…	…	…	…	…	…	…	…
PVr_star	…	…	…	…	…	…	…	…	…	…	…	…	2.746491	.1174613	23.38	…	…	…	…	…	…
PVp_star	…	…	…	…	…	…	…	…	…	…	…	…	2.508503	.1173535	21.38	…	…	…	…	…	…
RLr_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.2451558	.1183504	2.07	…	…	…
RLp_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.3535195	.116752	3.03	…	…	…
RQr_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.0344758	.0534663	-0.64
RQp_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.573071	.0663553	8.64

Appendix 3 – Poisson pseudo-maximum likelihood estimation of gravity model using Taylor series approximation

		Robust			Robust			Robust			Robust			Robust			Robust			Robust	
exprescim	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z
limfGDPr	.7691652	.0086434	88.99	.7715733	.0087311	88.37	.7711205	.0087407	88.22	.7711559	.0086903	88.74	.7705957	.0086532	89.05	.7715379	.0085918	89.80	.7713018	.0086931	88.73
limfGDPp	.7512789	.0085106	88.28	.7546378	.0087331	86.41	.7542049	.0087543	86.15	.7543589	.0087396	86.31	.7542721	.0087551	86.15	.7552629	.0087252	86.56	.7547429	.0087596	86.16
ldist_star	-.6478603	.0154364	-41.97	-.6469352	.0152785	-42.34	-.6464434	.0152763	-42.32	-.6460752	.0152681	-42.32	-.6459351	.0153172	-42.17	-.6458306	.0153177	-42.16	-.6457781	.0153103	-42.18
col_star	.098537	.0325284	3.03	.1018596	.0323087	3.15	.0963193	.0325229	2.96	.0971356	.0324476	2.99	.0980424	.0323546	3.03	.0958638	.0324904	2.95	.097056	.0325085	2.99
cmc_star	-.1666272	.1124943	-1.48	-.1840009	.1131622	-1.63	-.1838751	.1131496	-1.63	-.1843194	.1128408	-1.63	-.1844061	.1126998	-1.64	-.1881713	.1131716	-1.66	-.1880485	.113178	-1.66
clg_star	.2974639	.04154	7.16	.2993834	.0413396	7.24	.3023383	.0413474	7.31	.3001283	.0412324	7.28	.2999502	.0412212	7.28	.301435	.0412801	7.30	.3009352	.041342	7.28
ctg_star	.5069492	.0375972	13.48	.4927709	.0374354	13.16	.5004572	.0372474	13.44	.4996411	.0373929	13.36	.4996027	.0373782	13.37	.4997859	.0374291	13.35	.4991317	.0375784	13.28
rta_star	.4693909	.03083	15.23	.4794903	.0312909	15.32	.473283	.0309468	15.29	.4750781	.0310588	15.30	.4748679	.0312032	15.22	.4749073	.0309288	15.35	.4751639	.030949	15.35
_cons	60.6342	1.70311	35.60	50.37601	4.759389	10.58	65.52633	6.086196	10.77	54.2988	4.384134	12.39	51.39799	4.523811	11.36	54.34161	4.562082	11.91	51.9612	5.712512	9.10
VAr_star	…	…	…	.6453824	.3189127	2.02	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
VAp_star	…	…	…	.548087	.2436478	2.25	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
GEr_star	…	…	…	…	…	…	-1.036498	.56367	-1.84	…	…	…	…	…	…	…	…	…	…	…	…
GEp_star	…	…	…	…	…	…	-.9233774	.4234542	-2.18	…	…	…	…	…	…	…	…	…	…	…	…
CCr_star	…	…	…	…	…	…	…	…	…	-.2164064	.1990323	-1.09	…	…	…	…	…	…	…	…	…
CCp_star	…	…	…	…	…	…	…	…	…	-.2172476	.2033281	-1.07	…	…	…	…	…	…	…	…	…
PVr_star	…	…	…	…	…	…	…	…	…	…	…	…	.4055993	.350881	1.16	…	…	…	…	…	…
PVp_star	…	…	…	…	…	…	…	…	…	…	…	…	.7588291	.3245874	2.34	…	…	…	…	…	…
RLr_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.1097436	.4029081	0.27	…	…	…
RLp_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.6444	.3570369	1.80	…	…	…
RQr_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.0474828	.1248936	-0.38
RQp_star	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.029436	.1220158	-0.24

Appendix 4 – OLS estimation of gravity model with dummies

		Robust			Robust			Robust			Robust			Robust			Robust			Robust	
lexprescin	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t	Coef.	Std. Err.	t
limfGDPr	.5513168	.0282551	19.51	.5539895	.0294311	18.82	.5566282	.0289975	19.20	.567699	.0290154	19.57	.5615879	.029682	18.92	.5400893	.0297182	18.17	.5916858	.0307903	19.22
limfGDPp	.681276	.0244613	27.85	.6627093	.0249446	26.57	.6626467	.0249134	26.60	.6735195	.0248457	27.11	.659869	.0251419	26.25	.6449373	.0252013	25.59	.6741375	.0256151	26.32
rta	.0332739	.0275131	1.21	.0344281	.0275234	1.25	.0343784	.0274963	1.25	.0337914	.0275037	1.23	.0315157	.0274743	1.15	.0361549	.0275059	1.31	.0321243	.0274568	1.17
_cons	-10.29968	.1439315	-71.56	-10.50551	.1986987	-52.87	-10.67492	.2278328	-46.85	-10.29016	.1967138	-52.31	-10.6384	.2053787	-51.80	-10.31246	.2037608	-50.61	-10.89166	.2200289	-49.50
VAr	...	...	...	-.0803597	.0965183	-0.83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VAp	...	...	...	.0866862	.0844428	1.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
GEr	...	...	...	...	...	...	.2260108	.2285362	0.99	...	...	...	...	...	...	...	...	...	...	...	...
GEp	...	...	...	...	...	...	.3300268	.1572986	2.10	...	...	...	...	...	...	...	...	...	...	...	...
CCr	...	...	...	...	...	...	...	...	...	.3793139	.0689476	5.50	...	...	...	...	...	...	...	...	...
CCp	...	...	...	...	...	...	...	...	...	.4488094	.0675458	6.64	...	...	...	...	...	...	...	...	...
PVr	...	...	...	...	...	...	...	...	...	...	...	...	.0400446	.104981	0.38	...	...	...	...	...	...
PVp	...	...	...	...	...	...	...	...	...	...	...	...	.0221517	.0951923	0.23	...	...	...	...	...	...
RLr	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-.3369549	.1033659	-3.26	...	...	...
RLp	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-.2377866	.0956045	-2.49	...	...	...
RQr	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-.2510921	.056866	-4.42
RQp	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.0306407	.0595306	0.51

Appendix 5 – Poisson pseudo-maximum likelihood estimation of gravity model with dummies

		Robust			Robust			Robust			Robust			Robust			Robust			Robust	
exprescim	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z
limfGDPr	.5823468	.0235893	24.69	.5950601	.0232969	25.54	.5976805	.0238233	25.09	.6174474	.0245541	25.15	.6411147	.0257112	24.94	.6106345	.0275523	22.16	.6556584	.0248609	26.37
limfGDPp	.6085401	.037368	16.29	.6096916	.0332127	18.36	.6082268	.0327179	18.59	.6209954	.0314567	19.74	.6264128	.0307692	20.36	.5979395	.0319892	18.69	.628072	.0325681	19.28
rta	.0761932	.0299976	2.54	.0786555	.0303992	2.59	.0762214	.0301328	2.53	.0763673	.0305188	2.50	.0754756	.0298161	2.53	.075558	.0299432	2.52	.0788447	.0299137	2.64
VAr	…	…	…	.1137715	.1242681	0.92	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
VAp	…	…	…	-.0442852	.1487544	-0.30	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
GEr	…	…	…	…	…	…	-.2742107	.2118208	-1.29	…	…	…	…	…	…	…	…	…	…	…	…
GEp	…	…	…	…	…	…	-.0498166	.3024811	-0.16	…	…	…	…	…	…	…	…	…	…	…	…
CCr	…	…	…	…	…	…	…	…	…	-.0175107	.0730025	-0.24	…	…	…	…	…	…	…	…	…
CCp	…	…	…	…	…	…	…	…	…	.1582415	.0745416	2.12	…	…	…	…	…	…	…	…	…
PVr	…	…	…	…	…	…	…	…	…	…	…	…	.457187	.1150242	3.97	…	…	…	…	…	…
PVp	…	…	…	…	…	…	…	…	…	…	…	…	.0956219	.108193	0.88	…	…	…	…	…	…
RLr	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	.0822864	.1548612	0.53	…	…	…
RLp	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.085124	.137076	-0.62	…	…	…
RQr	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.2639521	.0463509	-5.69
RQp	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	-.007541	.0572596	-0.13