ISSN 2359-7704

VOLUME 3
ISSUE 2
YEAR 2015

Expert Journal of Economics

CONTENTS

EDITORS

Expert Journal of Economics

http://economics.expertjournals.com

Aims and Scope

Expert Journal of Economics is an open access forum that attracts, selects, and publishes influential theoretical, empirical or policy related papers in the field of economics. This scientific journal aims to make a genuinely valuable contribution to current understanding of economics, the growth of new ideas in this field, and the impact of particular economic activities and policies.

The targeted audience for this scientific journal of economics consists of academics, policy makers, students, regulators, banking supervisors and business professionals from around the world.

Theoretical and empirical papers are accepted for publication on the basis that they have been submitted exclusively to Expert Journal of Economics and that they have not been already published either partially or entirely. Also, accepted manuscripts can present case analyses, industry reports, book reviews, simulations, teaching notes, and research notes that contribute to and enrich economics thinking and practices.

The submitted manuscripts should exhibit relevancy, value, originality, argumentation, reasoning, and analysis. All articles should reflect original contributions and not be under consideration for publication elsewhere. Expert Journal of Economics is an open access, double-blind refereed journal published quarterly by Sprint Investify.

Area of coverage for *Expert Journal of Economics*, although not exhaustive, can include manuscripts in Economic Theory, Applied Economics, Econometrics, Economic Development, Economic History, General Equilibrium Modeling, Economic Systems (developed, developing, emerging, and transition economies), Environmental Economics, Political Economy, Growth, Comparative Economics, Monetary Theory and Policy, Fiscal Theory and Policy, and International Economics.

Publisher

Expert Journal of Economics is published quarterly by Sprint Investify. *Expert Journal of Economics* is published online at http://economics.expertjournals.com. Visit the journal's homepage for details of the aims and scope, instructions to authors, submission process and Editor contact details. Use the website to search online tables of contents, read articles and submit your papers.

This issue is now available at: http://economics.expertjournals.com/2015-3-2

Expert Journal of Economics

Volume 3, Issue 2
Year 2015

 • ISSN-L 2359-7704 • Online ISSN 2359-7704
http://economics.expertjournals.com
economics@expertjournals.com

Article Review Process

Expert Journal of Economics has a two-stage review process in order to be accepted for publication.

In the first stage, the research articles on economics are reviewed by one editor who will verify the reasoning of the paper and if the article fits the aim and scope of Expert Journal of Economics. Articles that do not concur to the journal's scope are rejected. Articles that are already published fully or partly in other publications or websites are neither reviewed, not accepted. The editor decides if the paper should be assessed by a reviewer.

In the second stage, the paper will be verified by at least one reviewer for detailed comments on how to improve the paper. In the peer review process of Expert Journal of Economics, the identities of the reviewers and authors remain anonymous. Whether an article is accepted or rejected depends on the average score given by reviewers. The reviewer grades a submitted article on a scale of 1 to 5. To be accepted for publication, the article must obtain an average score of at least 2.5.

Originality and Plagiarism

All the articles sent to *Expert Journal of Economics* should reflect original works, and the authors should appropriately cite and quote any influential publication or work of other authors. Please take note that we examine all submitted research articles for plagiarism and check for resemblances and similitudes to existing published papers. Articles that denote any form of plagiarism are rejected.

Article Copyright

The copyrights for articles published in *Expert Journal of Economics* belong to the authors. The journal is granted the first publication right. However, the journal is not responsible for subsequent uses of the authors' work.

Expert Journal of Economics, Volume 3, Issue 2, pp.i-ii, 2015
 ISSN 2359-7704
Economics.ExpertJournals.com

Editor's Introduction to Volume 3, Issue 2 of Expert Journal of Economics

Simona VINEREAN*

Sprint Investify Research Unit

The second issue of the third volume of *Expert Journal of Economics* presents very interesting empirical studies that investigate macroeconomic issues from different geographical frameworks and valuable global applications. This issue encompasses papers on price reversal pattern for ARV drugs, the effect of fiscal and monetary policy on Indonesian stock prices, cointegration analysis based on the relationship between real exchange rate volatility and domestic investment, short-term risk premium in Poland, and an analysis of the investment function and the influencing factors at the European Union level. Further, I present a short description of each article published in *Expert Journal of Economics*, vol. 3, issue 2.

The first published article in this issue is authored by Frank Lorne and Sneh Shah, namely *'Price Reversal Pattern of ARV Drugs: A Transaction-Cost Approach Digression'*. This paper documents a price reversal pattern of ARV drug prices across these countries, suggesting several significant factors for considerations for global health management generally. The authors approach this subject with consideration of the fact that in less developed countries the drug price index was found to be higher than in developed countries. Moreover, this article discusses the transaction cost factors that may result in this price reversal pattern in the WHO data set selected for this study, and it also examiness certain normative angles of transaction costs by focusing on the buyers' relationship with the end users.

In *'Impact of Monetary Policy and Fiscal Policy on Indonesian Stock Market'*, Rossanto Dwi Handoyo, Mansor Jusoh and Mohd. Azlan Shah Zaidi examine the effect of fiscal and monetary policy on Indonesian Stock price and this research enhances knowledge on the impact of these two policies on stock market performance in general, thus proposing certain frameworks that can be extended to other countries or regions. The authors employ a near-SVAR model with a Monte Carlo simulation method to achieve the main purpose of the paper and apply these techniques on two sets of data, namely world oil price and domestic variables. The main conclusion of their study is that there is a positive short term response of the stock market to a monetary policy shock, however, on the medium and long term perspectives, the stock price will exhibit negative responses. The authors also investigate the simultaneous effect of both policies on stock prices and their findings have insights on the best courses of action for an effective macroeconomic perspective.

In Ibrahima Amadou Diallo's paper, namely '*Exchange Rate Volatility and Investment: A Panel Data Cointegration Approach*', the author presents a very interesting approach and findings of a cointegration analysis based on the relationship between real exchange rate volatility and domestic investment. The complex and thorough empirical analysis was conducted using data from 51 developing countries and the results show that real exchange rate volatility has a strong negative impact of investment. The author concludes that the

* Correspondence:
Simona Vinerean, Sprint Investify, The Bucharest University of Economic Studies, E-mail address: editor@expertjournals.com

Article History:
Available Online 25 August 2015

Cite Reference:
Vinerean, S., 2015. Editor's Introduction to Volume 3, Issue 2 of Expert Journal of Economics. *Expert Journal of Economics*, 3(2), pp. i-ii

effect of exchange rate volatility on investment is higher in low-income countries than in middle-income countries because low-income countries are more vulnerable to shocks.

Krzysztof Drachal examines short-term risk premium in Poland, in the 2005 – 2015 timeframe, in his paper *'The Structural Stability of a One-Day Risk Premium in View of the Recent Financial Crisis'*. Using current data, empirical analysis achieved in R considered the AR(1)-GARCH(1,1) as the most suitable type of model for the present research and the research techniques and results are comprehensively presented and explained in the context of Poland's yield of 10-year treasury bonds and daily data for WIG (Warsaw Stock Exchange all-stocks index). The author concludes that there is clear evidence that investors have different attitude towards the risk in different periods of a business cycle.

The article '*A New Perspective of Investment Modelling at the European Union Level*' represents a seminal work on analysis of the investment function and the influencing factors at the European Union level. Alin Opreana starts with a hypothesis that there is a negative relationship between the European Union investments and tax rates. In order to test this relationship (and other proposed hypotheses), the author employs structural equation modeling, and further expands the study by tracking the development of the investments' model at the European Union level. The outcomes of Alin Opreana's research identify a new model regarding the investment function and three confirmed hypotheses that contribute to macroeconomics knowledge.

A Final Thought

Our Editorial Board would like to extend our appreciation to our the Authors for choosing Expert Journal of Economics as their scientific publishing outlet, to our Reviewers for their involvement and their input on the articles published in this issue, and to all the Readers and Researchers for downloading, citing, and expanding on the theoretical and empirical economics article we publish.

Expert Journal of Economics, Volume 3, Issue 2, pp. 93-112, 2015
 ISSN 2359-7704
http://Economics.ExpertJournals.com

Price Reversal Pattern of ARV Drugs: A Transaction-Cost Approach Digression

Frank LORNE* and Sneh SHAH

New York Institute of Technology-Vancouver

A price reversal pattern of ARV drugs was noted across lower and middle income countries in that the lower-income countries have higher prices relative to higher-income countries based on a 2008-2009 Summary Report by World Health Organization. The transaction costs affecting AVR drug pricing can be broadly classified into two kinds: One between the final users and the opinion/knowledge experts, and the other between the opinion/knowledge experts and the manufacturers. Economist's version of price discrimination needs to be modified by including transaction costs. Transaction costs also point to institution creditability factors that will affect NGO procurement.

***Keywords**: transaction costs, price discrimination, patents, price differentials, health NGOs*

***JEL Classification:** D3, D4*

1. Introduction

Acquired Immune Deficiency Syndrome (AIDS) is a pandemic disease prevailing in many parts of the world. The cause of AIDS is HIV(Human Immune Deficiency virus), which occurs when the transmission of body fluids such as blood, semen, vaginal fluid and breast milk are passed from a HIV positive patient to a healthy human. Patients with AIDS go through a gradual weakening of their immune system as the number of CD4+T cells declines in the plasma in their bodies. AIDS patients therefore catch various types of disease easily, leading to a failing of the immune system, and eventually, death. HIV/AIDS drugs are called antiretroviral (ARV) drugs. The many and different kinds of these drugs vary in dosages according to severity of the disease. The World Health Organization (WHO) conducted a comprehensive survey of antiretroviral drugs in low income countries, low middle income and high middle income countries since 2004, enabling a comparison of ARV drug prices across countries with varying incomes per capita. For exposition purposes,

*Corresponding Author:
Frank Lorne, Professor of Management, New York Institute of Technology-Vancouver, 1700-701 W. Georgia St., Vancouver, B.C., Canada V7Y 1K8

Article History:
Received 24 March 2015 | Accepted 7 May 2015 | Available Online 25 May 2015

Cite Reference:
Lorne, F., and Shah, S., 2015. Price Reversal Pattern of ARV Drugs: A Transaction-Cost Approach Digression. *Expert Journal of Economics*, 3(2), pp. 93-112

Acknowledgements:
This study grew out of a series of classroom discussions at NYIT-Vancouver MBA microeconomics courses. We thank the contribution of Yugesh Akula, Siten Patel, Nikhul Potu, and Zi Qin. We are particularly indebted to the invaluable suggestions of Dr. V.J. Thomas of Simon Fraser University, Riddhi Shah, and Professor Patricia Danzon. All errors are ours. A summer research grant from the Academic Office of NYIT is gratefully acknowledged.

we rename the three categories of countries as low, medium and high in this paper, noting that in reality, the high income countries such as USA are excluded from this study. The list of countries in each category is provided in Appendix I.

This paper documents a price reversal pattern of ARV drug prices across these countries, suggesting several significant factors for considerations for global health management generally. A price reversal pattern is one where low income countries pay higher prices for the same drug than higher income countries. Textbook economic theory has argued that price variation across different income countries may be necessary for pharmaceutical companies to capture return on R&D (Hausman and Mackie-Mason, 1988; Danzon and Towse, 2003; Giaccotto, Santerre and Vernon, 2005; Cowan, 2007). Empirical work done on estimating the price-income relationship seems to show a significant positive relationship, but some exceptions were noted. Indeed, a recent study explicitly pointed out the possibility of a price reversal pattern (Morel et.al., 2011). Lichtenberg (2010) revealed that Mexico and Brazil drug price index to be higher than the USA price index, although a regression of price index over per capita GDP in 2006 in his paper showed an overall positive relationship. It is worth noting, however, that there was a more scattered error at the tail end among lower income countries than high income countries. Excellent summary of the results was also provided in a later piece in 2011. Danzon et.al. (2011) reported a price/income elasticity of 0.4, with lower income countries group being even lower at 0.15, p.1534. Danzon and Towse (2013) reported cross-national income elasticity of price being 0.27 across the full income range of countries, but much smaller at o.o-o.1 between countries in middle and low-income countries (MLICs).

We use a WHO 2009 report summary of ARV drugs to motivate thoughts on seeking rationales for the price reversal pattern. Although the WHO 2009 summary report is a snapshot of some moving underlying fundamentals, some positive and normative implications in the health care industry can nevertheless be inferred. The positive aspects of the inquiry focus on ARV drug pricing: Who is responsible for this price reversal? Is it mainly the greed of pharmaceutical companies, dressed in the sheepskin of dynamic economic efficiency of R&D and the protection of patent rights? Or, are there other institutional and socio-political reasons playing their roles as well? Transaction costs in the pharmaceutical industry have been sparingly studied in the literature. The term "transaction costs" has very broad meanings. Classic definitions of it can be found in Coase, 1937, with early formulation of the problem in Cheung (1969, 1987), Williamson (1975, 1981, 1996). A more specific use of the term will be used for analyzing the price reversal problem in this study. We shall further explain this in Section 4 and 5. Surprisingly, these is no mentioning of these factors in the studies of pricing referred to in the previous paragraph. An exception can be found in Frank (2001), who alluded to transaction costs being relevant for analyzing pharmarceutical drug prices, in particular with reference to "unequal bargaining power across different classes of purchasers" and various arbitrage and rebate practices in the USA; but such issues have not been further explored for countries outside North America. Addressing the pricing problem from a framework of transaction costs of marketing, including institutional and socio-political considerations in an international context could be useful.

Aside from inquiring into the price reversal issue from the angle of positive economics, the normative implications of the price reversal pattern can be quite pronounced. Although AVR drug prices have declined globally since 2009, it is still alarming to hear the proposition that "if firms can charge only one price, this price will be what higher-income consumers can pay, and the product will be unaffordable to many lower-income consumers" (Danzon et.al., 2011). Indeed, one can easily conjecture lower-income consumers in lower income countries to be generally ignorant about HIV/AIDS diseases, particularly its possibility of transmission via sexual activities. An excellent description of this problem has been provided in a YouTube video produced by Journeyman Pictures in 2008 entitled "Patents and Patients-India", (https://www.youtube.com/watch?v=dyvojf0YnrI). A study on the socio-economic background of aids patients have also been conducted in Joge et.al. (2012). The price reversal pattern opens up a question "Who *should* be responsible?" as there would be what economists will call an "externality problem" if low-income HIV/AIDS patients do not receive proper care. Recognition of transaction costs factors in marketing as well as on the buyer aide of the industry may be of paramount importance for both drugs manufacturers and policy makers.

The organization of the paper will be as follows: Section 2 describes the WHO data set and its Global Price Reporting Mechanism (GPRM). Section 3 highlights the price reveral pattern across three categories of income country groups. Section 4 discusses the transaction cost factors that may result in this price reversal pattern in the WHO data set. Section 5 explores some normative angles of transaction costs by focusing on the buyers' relationship with the end users.

2. WHO Data Set and its Global Price Reporting Mechanism (GPRM)

The World Health Organization (WHO) is well known for collecting and disseminating data on the incidence and prevalence of communicable and non-communicable diseases. One of the most virulent diseases of our times is HIV/AIDS. In response to a potential worldwide pandemic outbreak of HIV/AIDS in low income countries around the turn of the century, UNAIDS held a meeting on the need for international data collection of ARV drug prices based on observed transactions in 2001 (Sagaon-Teyssier, 2012). WHO brought awareness of the problem by noting the efforts of several NGOs prescribing unlicensed ARVs produced by Cipla and others outside North America (WHO, 2003). In order to provide a more detailed picture of the prices of ARV therapies in these countries, the WHO further established the Global Price Reporting Mechanism (GPRM) in 2004.

The GPRM provides data on the international transaction prices of Antiretroviral (ARV) therapies and HIV diagnostics across countries. This data is provided to the WHO by manufacturers and by procurement organizations such as the Global Fund, PEPFAR and UNITAID, among others. By collecting data from both ends of the spectrum, and by cleaning and validating the data by removing duplicates, the Global Price Reporting Mechanism (GPRM) provides information on prices of Antiretroviral (ARV) therapies and HIV diagnostics across low-income countries, lower middle-income countries and upper middle-income countries. The country classification has been done by the World Bank Atlas classification system.

The GPRM dataset includes information on the median prices of formulations in US$ per patient per year of a defined daily dose for children or adults. The prices are the international EX-WORKS transaction prices (INCOTERMs partially reported) and do not reflect the end-user prices in different countries. The end-user prices can be higher due to taxes, tariffs, transportation costs and markups or lower due to subsidies. The data include volume of transactions, prices, international commercial terms (INCO), country of destination, and procurement date, among others. Additionally, data can also be sorted by commodity, country, income group, region and period of time. The data are available from 2004 onwards for various formulation categories too. The current GPRM database covers nearly 75% of ARV therapies used in low- and middle-income countries but has some limitations in recording information from upper middle-income countries (WHO, 2014).

The data set is rich, with improvement in data collecting methods initiated in UNITAID for Global Data Exchange in 2009, and still continuing to present (Sagaon-Teyssier, 2012). For the purpose of this paper, however, only the summary report of 2009 will be used. This is for several reasons: First, our study of the price refusal pattern does not require the fine details of disaggregating into country by country comparision, as there are bound to be normal price-income observations as well as price reversal observations. Detecting a price reversal pattern based on some averaging aggregates can show the *existence* of the phenomenon if the *frequency based on some consistent statistical counting* is high. Second, even if the price reversal pattern is seen as diminishing over time, which could very well happen if all players in the international market of ARV drugs are set in locomotion over time, it will not negate the fact that at one transitional point in time, the price reversal pattern is found significant. For purposes of probing into the anamolies described in Lichtenberg's paper (2010), it may be sufficient. Third, our academic inquiry here is driven primarily by "second-hand" propositions in the literature in that our intention is not to use this study to discredit many scholarly works in the literature field, but rather, to use it to suggest explanations, and to provide a line of inquiry that can be consistent with a price reversal observation.

The interaction of academic theories with policies is another motivation for a peek at the data for 2008-2009. Sometimes data reflect not only policies, but how ideas can change policies. In 2004, an MIT video conference on "Alternative Models of Differential Pricing For Medicines" illustrated firsthand the thinking of academicians, industry persons, and representatives of NGOs at that time. (http://video.mit.edu/watch/alternative-models-of-differential-pricing-for-medicines-9896/) We found the following proposition to be particularly intriguing: That drug manufacturers should sell "products to wholesalers at uniform prices worldwide, then negotiate confidential rebates with final purchasers…This way, the lower prices offered to lower income countries won't spill over to higher income countries."—proposition offerred by Professor Danzon. The proposal was rather ingenious as a way to combat parallel trade, i.e. transferring drugs from low priced countries to high priced countries, a precondition for practising third-degree price discrimination across countries. It has not been further evaluated in terms of how the real world has been treating the proposition.

The WHO 2009 summary report conveniently gives a point check as to whether the proposition was accepted five years later, perhaps as a gauge of how "unpopular" economic ideas may or may not find their speed for practical implementation. If the proposition was widely adopted, we would not expect to find a price-income pattern, not to mention a price-reversal pattern, as uniform price would imply drug prices across

countries were the same. That not being the case, there must be other aspects of transaction costs that would be of relevance. Or, that the world has simply chosen to ignore a good economic argument.

3. Price Reveral Pattern Across Three Categories of Income Country Groups

In this section, we describe the price reversal pattern observed from the WHO 2009 summary report. Danzon, Mulcahy and Towse (2013) investigated the GPRM data set in great details, but emphasizing the price reversal pattern was not the paper's objective which this section will highlight. The statistical method of counting we used may be "primitive" compared with sophisticated econometric studies, but serves to highlight if the price reversal pattern is the focus. Table 1 shows the evidence of a reversed price/income relationship. A reversed price/income relationship is a phenomenon in which the price of a drug in lower income countries is higher than the same drug's price in higher income countries.

Table 1. *Evidence of Reversed Price/Income relationships from WHO for antiretroviral medicines, 2008-2009*

Classification & Frequency of reversal (%)	**Drug Name & Dosage**	**Price differentials (%)**	**Lower/Middle Income country comparison**	**Middle/High Income Country comparison**
First line Antiretroviral medicines for Adult 29.42%	Stavudine 40 mg	18.18%	✓	
	Lamivudine+ Stavudine 150+30mg	12.39%		✓
	Lamivudine + Nevirapine + Stavudine 150+200+40 mg	0.97%	✓	
	Zidovudine 300 mg	9.25%		✓
	Lamivudine + Nevirapine + zidovudine 150+200+300 mg	4.848%		✓
	Efavirenz 200 mg	4.51%		✓
	Efavirenz 600 mg	6.73%		✓
	Stavudine 30 mg	44.897%	✓	
	Lamivudine 150 mg	8.22%	✓	
	Lamivudine + Navirapine + Stavudine 150+200+30 mg	30.56%	✓	
	Zidovudine 300 mg	9.14%		✓
	Lamivudine + Zidovudine 150+ 300 mg	31.47%	✓	
	Lamivudine + Nevirapine + zidovudine 150+200+300 mg	23.57%	✓	
	Efavirenz 200 mg	57.53%		✓
	Efavirenz 600 mg	35.71%	✓	
	Tenofovir 300 mg	3.92%		✓
Second line Antiretroviral medicines for Adult 33.33%	Didanosine 100 mg	16.85%	✓	
	Didanosine 200 mg	1.67%	✓	
		7.86%		✓
	Lopinavir + Ritonavir 133 + 33 mg	10.76%		✓
	Saquinavir 200 mg	1.21%	✓	
		20.11%		✓
	Fos-amprenavir 700 mg	85.84%		✓
	Abacavir 300mg	11.48%		✓
	Didanosine 100 mg	13.14%	✓	
	Didanosine 250 mg	21.89%	✓	
	Didanosine 400 mg	2.25%	✓	
	Indinavir 400 mg	9.25%	✓	
	Abacavir 20 mg/ml	14.81%		✓
	Didanosine 25 mg	22.95%	✓	
	Lamivudine 10 mg/ml	43.30%	✓	
	Zidovudine 10 mg/ml	68.97%		✓

Antiretroviral medicines for Paediatric treatment (infant weighing 5 kg) 18.367%	Lamivudine+ satvudine 30+6 mg	8%	✓	
	Didanosine 25 mg	77.55%	✓	
	Didanosine 50 mg	27.45%	✓	
	Efavirenz 50 mg	12.70%	✓	
	Nevirapine 10 mg/ml	82.35%		✓
Antiretroviral medicines for Paediatric treatment (infant weighing 10 kg) 27.397%	Didanosine 2 5 mg	23.62%	✓	
		32.52%		✓
	Didanosine 50 mg	26.89	✓	
		30.57%		✓
	Didanosine 100 mg	16.45%	✓	
	Abacavir 20 mg/ml	11.01%		✓
	Didanosine 125 mg	8.90%	✓	
	Efavirenz 50 mg	23.19%		✓
	Efavirenz 200 mg	9.23%		✓
	Nevirapine 10 mg/ml	68.63%		✓
	Stavudine 20 mg	15.38%	✓	
	Zidovudine 10 mg/ml	82.13%		✓
	Lamivudine + Stavudine 150+30 mg	14.29%		✓
	Lamivudine + Nevirapine + Stavudine 150+200+30 mg	17.39%		✓
	Lamivudine + Stavudine 30+ 6 mg	4%	✓	
	Lamivudine + Nevirapine + Stavudine 30 + 50 + 6 mg	12.61%	✓	
	Didanosine 25 mg	34.07%	✓	
	Didanosine 50 mg	29.14%	✓	
	Didanosine 100 mg	7.01%	✓	
	Efavirenz 200 mg	86.34%		✓

The first column of the Table 1 lists the drug classification, and their frequencies of reversal. There are four classifications: (1) First line drugs for adults, (2) Second line drugs for adults, (3) Drugs for pediatrics weighing 5 kg, and (4) Infants weighing 10 kg. First line drug refers to individual drug or the combination of drugs which is recommended as an initial treatment for curing HIV, e.g. Stavudine, lamivudine+stavudine. Second line drug will be applied when the first line drugs fail to alleviate the condition of the patients, due to resistance as HIV transform their characteristics. Examples of second line drugs are Didenosine, lopinavir+ritonavir. The column also shows the frequency of reversal, which are respectively, 29.41% for the 1st classification, 33.33% for the 2nd classification, 18.37% for the 3rd classification, and 27.40% for the 4th classification. We will show how these percentages are calculated later in this section. Suffice to point out here at the outset that these percentages are high indeed, considering the normal expectation that higher income countries pay higher prices.

The percentages are calculated from a method of counting shown in the other columns in the same table 1. Column II gives the drug names and dosages in each classification. The drug names are recommended ARV drugs by WHO for proper treatment in each classification, ranking in ascending order of strength in terms of types and dosages. Because the WHO summary report includes both 2008 and 2009 survey, listing of 2008 counting precedes 2009 counting in the table 1.

Column III calculates the magnitude of the price differential, measured by difference in the Median Transaction Price (MTP) in percentage term between two income country categories. The GDP per capita of the three groups are: Low income country- Countries with gross national income(GNI) per capita of US$ 935 or less, middle income country- Countries with a GNI per capita between US$ 936 and US$ 3,705, high income country-Countries with a GNI per capita between US$ 3,706 and US$ 11,455. Since we have 3 income country categories in the WHO summary report, a price reversal pattern is said to be observed either between the low and middle countries, or between the middle and high income countries. If reversal pattern occured in the first comparison, we put a check in the Column IV. If reversal pattern occurred in the second comparison, we put a check in Column V. We did not count comparisons between low and high income countries, as that would duplicate counting.

We can show the calculation of Column III more precisely using the following stepwise procedure:

1. Reversed price pattern of MTP across country categories is identified.
2. Calculate difference in MTP of lower to middle income country or middle to higher income country (when detecting a reversed price pattern) is calculated.
3. Taking the mean of two MTP as the base value in the denominator, the percentage of the difference is calculated together with calculation in (2).

For example, stavudine 40 mg has MTP in lower income country is 36, and in middle income country is 30. This will give a differential of 6. With a mean of 33, the magnitude of price differential for this drug is 18.18%.

In order to calculate the price reversal frequency reported in Column I of the table 1, we made pairwise comparison for each drug in each classification using the Median Transaction Price (MTP) for low income to middle income countries, and then for middle income to high income countries. Thus, there is a total number of MTP pairwise comparisons. It is the denominator used for the calculation of frequency. The total number of this pairwise counting is made for all the drugs described in the 2009 Summay report, counting both 2008 & 2009, as we considered that to be the domain of a statistical sampling experiment. Thus, the domain pairwise comparison is the sum of all pairwise comparion in the 2009 Summary report, i.e. number of 2008 pair being 29, and the number of 2009 pair being 17. Thus, the domain (the denominator) is 51.

Next, we counted the number of reversed pattern in 2008, which is 7, and add that to the number of reversed pattern in 2009, which is 8. This gives us a total reversed pattern of 15. Thus, for classification 1, the frequency of reversed pattern (%) = (Total reversed pattern/Total MTP sets) x 100

$$= 15/51 \text{ X } 100$$
$$= 29.41\%$$

The same calculation is made for the other three classifications.

Table 1 further reveals that the highest frequency of price revesal being in Classification 2, the second is in Classification 1, with minor difference between these two classifications. Both classifications price reversal frequency seem higher than the children classifications of 3 and 4. This is less disquieting than a result showing a price reversal pattern to be more frequent among children, because it would imply that the most innocent group is being penalized more. In any case, we consider the frequency of occurance of a price reversal pattern to be nontrivial for all four classifications.

We want to next examine the magnitude of the price differentials. We recognize that the MTP prices are averages with standard deviations. If the price differential is small, it would have just been a statistical noise. The intuition is that a larger price differential reduces the possibility that the price reversal pattern is a statistical noise. Furthermore, concentrating on those drugs that have very high magnitude of price differential might allow us to focus on the drug type and to examine the patent strength and the competitive forces of that drug. In Table 2, we select the top 20 drugs from Table 1 that have the largest price differentials, ranging from a top 86.34% to a low 23.62%. The classification of the drug according to the 4 types are labelled corresponding as F, S. P4, and P10 in Column II of that table.

Table 2. *Top 20 drugs with the largest price differentials from WHO 2009 report*

No	Classification	Drug Name & Dosage	Price differentials (%)	Lower/Middle Income country comparison	Middle/High Income Country comparison	Patent ratio
1	P 10	Efavirenz 200 mg	86.34%		✓	0.2
2	S	Fos- amprenavir 700 mg	85.54%		✓	1
3	P 5	Nevirapine 10 mg/ml	82.35%	✓		0.125
4	P 10	Zidovudine 10 mg/ml	82.13%		✓	0.1
5	P 5	Didanosine 25 mg	77.55%	✓		0.125
6	P 5	Zidovudine 10 mg/ml	68.97%		✓	0.1
7	P 10	Nevirapine 10 mg/ml	68.63%		✓	0.125
8	F	Efavirenz 200mg	57.53%		✓	0.2
9	F	Stavudine 30 mg	44.497%	✓		0.05
10	P 5	Lamivudine 10 mg/ml	43.30%	✓		0.074
11	F	Efavirenz 600 mg	35.71%	✓		0.2
12	P 10	Didanosine 25 mg (2009)	34.07%	✓		0.125

13	P 10	Didanosine 25 mg (2008)	32.52%		✓	0.125
14	F	Lamivudine + Zidovudine 150+300 mg	31.47%	✓		0.083
15	P 10	Didanosine 50 mg	30.57%		✓	0.125
16	F	Lamivudine+Navirapine+Stavudine 150+200+30mg	30.56%	✓		0
17	P 10	Didanosine 50 mg (2009)	29.14%	✓		0.125
18	P 5	Didanosine 50 mg	27.45%	✓		0.125
19	P 10	Didanosine 50 mg (2008)	26.89%	✓		0.125
20	P 10	Didanosine 25 mg	23.62%		✓	0.125

Notes: F - First line antiretroviral medicines for Adult
S-Second line antiretroviral medicines for Adult
P 5 - Antiretroviral medicines for Pediatric treatment (infant weighing 5 kg)
P10 - Antiretroviral medicines for Pediatric treatment (infant weighing 10 kg)

An additional column for an estimation of a patent ratio for each drug is also included in Table 2. We want to see whether the price reversal pattern is related to manufactures' strength in its patent right protection. The mirrow image of patent right strength is the degree of competition. A lower patent strength as measured by a patent ratio means a higher degree of competition. It will be interesting to examine whether the price reversal pattern is related to the patent strength of a drug. We propose the patent strength to be estimated by a patent ratio, which is composed by identifying the number of originator drugs and generic drugs for each drug type. A patent is an exclusivity right provided by the governing agency of the country to the inventor in order to protect his innovation from duplication. It also provides the innovator with the financial benefits for the limited time in return to the contribution made towards the development and innovations. We want to know the patent strength of the 20 drugs which has the highest price differentials.

More precisely, the patent ratio of a drug is calculated as follows: Patent ratio = Number of originators/ Total number of companies for that drug, where the total number of company is the sum of the originators and generics of that drug type. Thus, if a drug is dominated by one strong patent, with no generics, the patent ratio will be 1. The lower is this ratio, the weaker is the patent strength of the drug, and the more intense is the competitive force of the drug.

For instance, the patent ratio calculation of Efavirenz. Efavirenz consist of two originator which are Bristol Myers Squib in USA and M.S.D in Europe and 8 generic companies. Therefore the total companies of Efavirenz comes out to be 10, and its patent ratio = 2/10 = 0.2. The list of originator drugs and generic drugs are listed in Appendix II. A rough inspection of the ratios so calculated does not reveal a strong patent strength among the top 20 drugs that has the largest price reversal differential. So the rationale may have to be found on other factors, to which we now turn.

4. Transaction Cost Factors that May Result in the Price Reversal Pattern of WHO's Data Set

Transaction costs are costs of implementing exchanges beyond the intrinsic values and production costs of goods and services. They include various efforts in seeking information (and at a more sophisticated level intelligence gathering) on product and buyer characteristics, reference pricing, bargaining and negotiation of terms, monitoring and enforcement of contractual terms, etc.; indeed, any costs beyond economists' formulation of marginal benefits (willingness to pay) and marginal costs (willingness to sell) can be considered transaction costs. Marginalism is the standard economic methodology used in neoclassical economics. Coase (1937) alerted economists that many interesting problems in economics can be assumed away if the analysis is confined to a framework with zero transaction costs. Aside from Frank (2001), application of transaction costs for problems in pharmaceutical industry has been mostly on contracting for production, i.e. the manufacturing process, e.g. Nogiera and Bataglia (2012). At the outset, there is an undeclared ignorance and indeed a hidden guilt in the economic profession that there is neither a presumption nor any empirical evidence that a uniform pricing method has lower transaction costs than price discrimination generally for any products sold anywhere. The same can be said about the transaction costs of different forms of price discrimination. Pigou (1920) defined three forms of price discrimination as 1st, 2nd, and 3rd. The first charges buyers each unit according to maximum they are willing to pay. The second gives different prices based on blocks of purchase, usually a larger block with a bigger discount. The third segregates buyers into types and charge each type a different price.

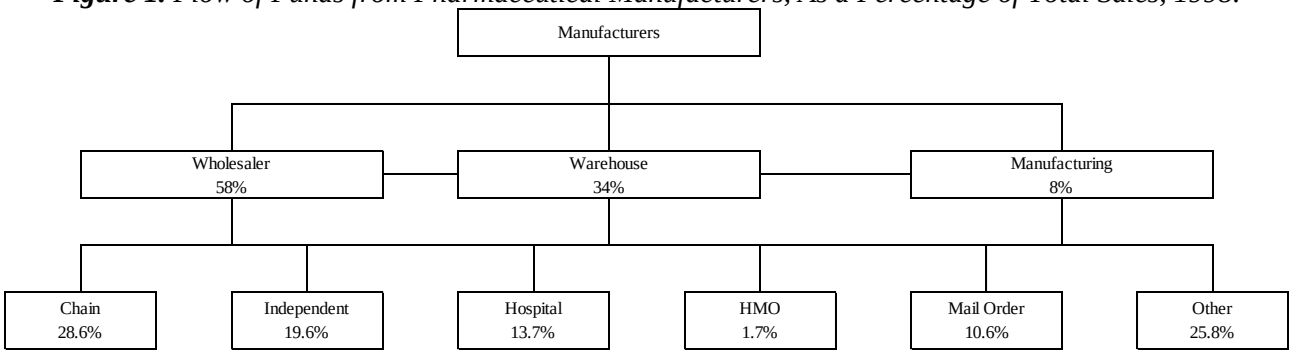
In a static world where consumer preference and technology are given, all transaction cost problems can be theorized as some forms of asymmetric information problem, i.e. one party knows more about some

parameters of exchange than the other party. Transaction costs (also known as agency costs) problems are sometimes referred to as Principal-agent problems. Early formulation of this concept can be found in (Cheung, 1969), and (Ross, 1973). Most transaction costs problems can be classified into pre-contractual problems known as adverse selection, or post-contractual problems known as moral hazard. An additional factor of asset specificities was later added also to capture opportunistic bargaining, (Klein, Crawford and Alchian, 1978; Williamson, 1975, 1981, 1983). For the demand for drugs, the distribution of information is such that most people have to rely on some sort of opinion experts to tell the person what to take. This assumption might appear odd to free market economists, but it is not different in concept from the demand for a mechanic to fix your car, or learning from a teacher/consultant for useful skills and knowledge. For the medical health industry, the expert opinions are vested in physicians, hospitals, and various health management organizations. Patients largely reply on their care takers, and pharmaceutical companies must sell through these expert opinion providers including over-the-counter pharmacists.

Transaction costs problems can arise between end users and opinion experts, as well as between manufacturers and opinion experts. For the price reversal pattern in the WHO 2009 data set described in the last section, we want to address here first the one between manufacturers and opinion experts of health care, keeping in mind that there might be transaction costs issues between end users and opinion experts also that emerge dynamically to be addressed in the next section. Frank (2001) describes the distribution of pharmaceutical drugs in USA in a schematic diagram that is reproduced in Figure 1. Although we do not have the equivalent numbers of Figure 1 for the countries in the WHO data set, we expect a general structure developing in that direction, as economic gain existed in one country is in principle duplicable in another country. Commenting on the situation in United States, the author noted,

> "Perhaps most striking is that about 92 percent of sales [in US] flow through either full-line wholesalers or warehouses owned by chain drug stores, buying groups, or other distributors. This means that very few sales are made directly from manufacturers to drug retailers or end users (such as hospitals). *Thus, price negotiations between manufacturers and end users must involve other parties*." (italics added, p.123)

Figure 1. *Flow of Funds from Pharmaceutical Manufacturers, As a Percentage of Total Sales, 1998.*



Source: Frank, 2001, pp.115-128.
Author's estimates based on data from national health Accounts, IMS, and National Wholesale Druggists Association (NWDA).
Notes**:** HMO is health maintenance organization. "Other" includes nursing homes, clinics, and other health care organizations.

According to the author, price concessions in US include chargeback, rebates and discounts. The author did not classify them in terms of the three types of price discrimination. It can be inferred, however, that the former two resemble 2nd degree price discrimination as the practice rewards volume and frequent purchase, while discounts to different expert/outlet categories could be considered as 3rd degree. No inference has been made with 1st degree price discrimination, i.e. charging each buyer the maximum willingness to pay; perhaps in agreement with Pigou that perfect price discrimination is untenable.

Yet, an important middleman to enable the distribution process between manufacturers and experts/outlets is the pharmaceutical sales representatives (PSRs). This is so whether a pharmaceutical company licenses local companies to market their products or chooses to do it themselves by its own marketing outlets. Either way, the drug manufacturers have to reply on PSRs, assisted by company policies of advertising and promotion, referencing various local institutional constraints according to needs. All PSRs should have good understanding of pharmacology—the science of medications and their effects on human body, as they

should have the intellectual capacity to understand the science behind the products they sell. They should know the chemistry of a drug, the method of action, side effects and potential interactions with other drugs. PSRs also specialize in certain expert opinion groups, class of drugs, and geographical territories with specific cultural specificities, as they must be skillful in building relationships and earning the trust of their clients. Understandably, a good PSR would also monitor physicians' prescription patterns or gauging reactions to new treatments. For all "asymmetric information" effort expected, PSRs usually are paid by commissions. The selection of PSR can be itself a transaction cost problem too. A drug manufacturer must pay careful attentions to the selection of PSRs, as they represent the brand name of the manufacturer.

PSRs process client information and enable communication with manufacturers and expert opinion leaders (rather than estimating price elasticity). Even in N. America, physicians will not easily accept a new treatment method: "[The physicians] often cling to those certainties even in the face of strong evidence to the contrary." (MacDonald and Linde-Zwirble, 2014). In countries outside N. America, these rigidity is expected to be stronger. It may be a matter of good business instinct too, for a PSR to know well the constraints of each of his/her clients for particular types of outlets under his/her account. In view of country specificities that might not be known easily to manufacturers headquarters, we expect PSRs in low income countries representing a similar if not more important role than those in N. America.

As a side note, and at least for general practice, it is not uncommon for physcians in countries outside N. America to own their pharmacies, with drug expense included as a component of medical consultation (especially in rural areas). Thus, the willingness to pay can be gauged at a very decentralized local level, particularly for customers who are brand conscious and who view high price as an assurance of quality. In a world of zero transaction costs and with full patent protection, no patients who want treatment will be denied of it. That is the concept of 1st degree price discrimination. With positive transaction costs, it is not uncommon to see manufacturers setting high prices, while allowing price concessions to be made for individual clients on a case by case basis. To some people, including perhaps A. C. Pigou, this might not be considered exactly as 1st degree price discrimination, which he considered for the case of identical demand. But he added, "Apart from this method, discrimination of the first degree might still conceivably be established by detailed separate bargaining with every separate customer. But that method would involve enormous cost and trouble. Furthermore, since it implies separate bargains with individuals, it opens the way, not only to error, but also to the perversion of agents through bribery." (Pigou, 1920, p.281).

This would be consistent with the vision suggested at the 2004MIT conference mentioned in Section 2, but the price would have to be set towards the high end of willingness to pay in order for this to approximate 1st degree price discrimination.

Any rational profit maximizing drug manufacturer would pay more attention to the bottom line than particular pricing model of economists absent of transaction costs. In setting prices for drugs, it could be the willingness to pay that matters most. Economists would not disagree with that, as revenues under 1st degree price discrimination always exceed the 2nd or the 3rd degree price discrimination. However, the transaction costs of the three types of discrimination may vary depending on a country/regional setting that may not be preset at company headquarter, as tremendous asymmetric information is likely to be associated with local conditions. It may be more realistic to say that a more practical guidance for drug manufacturer's pricing for a country would be a *combination of the three forms of price discrimination net of the transaction costs of each, subject to competition and the regulatory constraints of a country.*

That a drug manufacturer's pricing strategy cannot be solely depended on second or third degree price discrimination across countries have much to do with the transaction costs of preventing parallel trade. A precondition for any price discrimination is the inability of low priced buyers to resell to high priced buyers. If a uniform low price is set to a low income country, an entity in that country can buy large quantity and resell to a higher income country that is paying a higher price. Parallel trade can be prohibited with the cooperation of the regulatory authority in the two countries, but not with zero transaction costs. Particularly for 2nd degree price discrimination, which caters to buyers of volume purchase by charge backs or rebates, the incentive to resell to higher income countries for higher prices could be quite attractive if not explicitly prohibited. The same is true for 3rd degree price discrimination both within a country as well as across countries. Considerable coordination with regulatory authorities between countries had to be involved, and often become part of the negotiation of international trade agreements.

A search of regulatory authority of the countries in the WHO data base is shown in Table 3. This table consists of country name, drug regulatory authority name and the website links of the regulatory agencies. There are few countries in which the regulatory agency is not mentioned; therefore, in such case "NF" or "Not Found" is written. Like previous tables, countries are divided in three categories i.e. low income countries, middle income countries and high income countries. There were also websites identified that cannot be opened,

suggesting fuzziness in interpreting what is the relevant authority in a country. Thus, it seems equally uncertain that a manufacturer may or may not be able to establish an understanding with the authority for some countries, which itself is a transaction cost. The creditability of regulatory authority in low income countries also undermines a within-country price discrimination model, offering low income patients in low income countries super low or even zero price. A manufacturer will find it difficult to know whether quantities used for low income usages are for the country's internal usages or for resale. It would seem that elaborate monitoring scheme has to be set up by the manufacturers. Those are factors that add to transaction costs.

Table 3. *Drug regulatory authorities for low-middle-high income countries*

Country	Web site name	Authority name
Low income countries		
Burundi	http://www.minisante.bi/	Ministry of public Health and fight against AIDS (ministre de la santepublique et de luttecontre le sida)
Liberia	http://www.moh.gov.lr/index.php	Ministry Of Health
Eritrea	NF	
Congo	NF	
Malawi	http://www.malawi.gov.mw/index.php?option=com_content&view=article&id=55&Itemid=85	Government of the Republic of Malawi
Ethiopia	http://www.daca.gov.et/	Drug Administration and Control Authority
Niger	http://www.gouv.ne/index.php?id_page=30	Ministry of Public Health
Guinea	NF	
Madagascar	http://www.sante.gov.mg/index.php	Ministry of Public Health of Madagascar
Zimbabwe	http://www.mcaz.co.zw/	Medicines control authority of Zimbabwe
Mozambiqe	http://www.misau.gov.mz/pt/medicamentos	Mozambique - Ministry of Health
Togo	NF	
Uganda	http://www.nda.or.ug/	National Drug Authority
Afghanistan	NF	
Rwanda	http://www.moh.gov.rw/	Republic of Rwanda Ministry of health
Central African Republic	NF	
Nepal	http://www.dda.gov.np/req_modern_medicine.php	Department of Drug Administration
Sierra Leone	http://www.health.gov.sl/home/regulatory-bodies/pharmacy-board	
Tanzania	http://www.tfda.or.tz/	Tanzania Food and Drugs Authority
Guinea-Bissau	NF	
Burkina Faso	http://www.dgpml.sante.gov.bf/	General Direction of Pharmacy, Medicine and Laboratories
Gambia	http://www.moh.gov.gm/	Ministry of Health & Social Welfare
Bangladesh	http://www.dgda.gov.bd/	Directorate General of Drug Administration
Mali	http://www.sante.gov.ml/index.php?option=com_content&task=view&id=31&Itemid=72	Ministry Of Health And Public Hygiene
Tajikistan	http://health.tj/	State Scientific Centre for Expertise and Certification
Haiti	NF	
Cambodia	http://www.moh.gov.kh/?lang=en	Department of Drugs and Food, Ministry of Health, Cambodia
Benin	http://www.sante.gouv.bj/dpm.php	
Kenya	http://pharmacyboardkenya.org/	Pharmacy and Poisons Board
Comoros	NF	
Solomon Islands	NF	
Chad	http://www.sante-tchad.org/	Minister of Health, Social Action and National Solidarity

Kyrgyz Republic	http://www.pharm.kg/	Department of Drug supply and Medical Equipment
Laos	NF	
Lower middle income country		
Mauritania	http://www.sante.gov.mr/MSAS/Left/Presentation/Administrationcen/DirectionPharmacieLaboratoires.htm	Minister Of Health
Senegal	http://www.sante.gouv.sn/	Ministry of Health, Hygiene and Prevention
Pakistan	http://www.dcomoh.gov.pk/	Drug Control Organization
Zambia	http://www.zamra.co.zm/	Zambia Medicines Regulatory Authority
Sao Tome and Principe	NF	
Lesotho	NF	
Vietnam	http://www.dav.gov.vn/	Drug Administration of Vietnam
Sudan	http://www.nmpb.gov.sd/	National Medicines and Poisons Board
Uzbekistan	NF	
Cameroon	http://www.minsante.cm/intro.htm	Ministry Of Public Health
Nigeria	http://www.nafdac.gov.ng/	National Agency for Food and Drug Administration and Control
India	http://cdsco.nic.in/	Central Drugs Standard Control Organization
Papua New Guinea	http://www.health.gov.pg/	Department of Health
Cote d'Ivoire	http://www.dpmci.org/	Directorate of Pharmacy and Medicines Cote d'Ivoire
Ghana	http://www.fdbghana.gov.gh/	Food and Drugs Board
Yemen	http://www.sbd-ye.org/	Supreme Commission for Drugs and Medical Appliances
Nicaragua	NF	
Moldova	NF	
Bolivia	http://www.sns.gob.bo/	Ministry of Health Surveillance Agency
Mongolia	http://www.moh.mn/	Ministry of Health
Honduras	http://www.dgrs.gob.hn/	Directorate General of Health Regulation
Bhutan	http://www.dra.gov.bt/	Drug Regulatory Authority
Kiribati	NF	
Republic of the Congo	http://www.minisanterdc.cd/new/index.php	THE MINISTRY OF PUBLIC HEALTH
Sri Lanka	http://203.94.76.60/DRA/home.htm	Drug Regulatory Authority
West Bank and Gaza	NF	
Indonesia	http://www.pom.go.id/new/	food and drug regulatory agency
Egypt	http://www.eda.mohp.gov.eg/	Egyptian Drug Authority
Timor-Leste	NF	
Paraguay	http://www.mspbs.gov.py/v3/	Ministry of Health and welfare
Philippines	http://www.fda.gov.ph/	Food and Drug Administration Philippines
Guyana	http://www.health.gov.gy/prg_adm_food_drugs.php	Food & Drug Department
Georgia	http://gdna.georgia.gov/	Georgia Drugs & Narcotics Agency
Vanuatu	NF	
Samoa	NF	
Swaziland	http://www.gov.sz/	Ministry of Health and Social Welfare
Guatemala	http://www.mspas.gob.gt/index.php/en/	Ministry of Health and Welfare
Federated state of Micronesia	NF	

Morocco	http://srvweb.sante.gov.ma/Medicaments/Pages/default.aspx	Ministry of Health
Ukraine	http://www.pharma-center.kiev.ua/view/en/index	The State Expert Center
Armenia	http://www.pharm.am/index.php?langid=2	Scientific centre of drug and medical technology expertise
El Salvador	http://www.salud.gob.sv/	Ministry of Health
Kosovo	NF	
Tonga	NF	
Cape Verde	http://www.arfa.cv/index.php	Agency for Regulation and Supervision of Pharmaceutical and Food Products
Turkmenistan	NF	
China	http://eng.sfda.gov.cn/	China food and Drug Administration
Upper middle income countries		
Marshall Islands	NF	
Angola	http://www.minsa.gov.ao/	Ministry of Health
Thailand	http://www.fda.moph.go.th/eng/index.stm	Food and Drug Administration Thailand
Jordan	http://www.jfda.jo/	Jordan Food and Drug administration
Fiji	http://www.health.gov.fj/ira.html#.U9LtIK02y_p	Inspectorate & Regulatory Authority
Iraq	NF	
Ecuador	NF	
Namibia	http://www.nmrc.com.na/	Namibia Medicines Regulatory Council
Peru	http://www.digemid.minsa.gob.pe/	general direction of inputs medicines and drugs
Tunisia	http://www.dpm.tn/anglais.html	management of pharmacy and medicine
Algeria	http://www.ands.dz/pharmacie-med/sommaire.htm	Department of Pharmacy and Medicine
Belize	http://health.gov.bz/www/	Ministry of health
Iran	NF	
Albania	http://www.qkkb.gov.al/	National Center for Drug Control
Macedonia	NF	
Jamaica	http://www.pcoj.org/	Pharmacy Council Of Jamaica
Dominican Republic	http://www.drogasyfarmacias.gov.do/index.php	Directorate General of Drugs and Pharmacies
Bosnia and Herzegovina	http://www.alims.gov.ba/	Agency for medicinal products and medical devices of Bosnia and Herzegovina
Azerbaijan	http://www.pharm.az/	Ministry of Health of Azerbaijan Republic
Colombia	https://www.invima.gov.co/	National Institute of Food and Drug Monitoring
Maldives	http://www.mfda.gov.mv/	Maldives Food and Drug Authority
Tuvalu	NF	
Botswana	http://www.moh.gov.bw/	Ministry of Health, Botswana
Cuba	http://www.cecmed.cu/	Centre for State Control of Drugs, Medical Devices
Belarus	http://www.rceth.by/	Center of expertise and testing in health care
South Africa	http://www.mccza.com/	Medicines Control Council
Serbia	http://www.alims.gov.rs/ciril/	Medicines and Medical Devices of Serbia
Costa Rica	http://www.ministeriodesalud.go.cr/	
Bulgaria	http://www.bda.bg/	Bulgarian Drug Agency
St. Vincent and the Grenadians	NF	
Dominica	NF	
St. Lucia	NF	
Montenegro	http://sntcg.com/ulms/	Ministry Of Health Montenegro
Kazakhstan	http://www.dari.kz/?lang=rus	National Center of Expertise of medicines, medical products and medical equipment
Grenada	NF	
Suriname	NF	
Mauritius	http://www.gov.mu/English/Pages/default.aspx	Ministry of Health & Quality of Life

Panama	http://www.minsa.gob.pa/	Ministry of Health, Panama
Malaysia	http://portal.bpfk.gov.my/index.cfm	National Pharmaceutical Control Bureau
Lebanon	http://www.moph.gov.lb/Pages/Home.aspx	Ministry of Public Health
Gabon	NF	
Brazil	http://portal.anvisa.gov.br/wps/portal/anvisa/anvisa/home	National Health Surveillance Agency
Mexico	http://www.cofepris.gob.mx/	Federal Commission for the Protection against Sanitary Risk
Uruguay	http://www.msp.gub.uy/subcategorias_8_1.html	Ministry of Public Health
Romania	http://www.anm.ro/anmdm/en/	National Agency for Medicine and Medical Device
Turkey	http://www.iegm.gov.tr/	Ministry of Health of Turkey General Directorate of Pharmaceuticals and Pharmacy
Palau	NF	
Russian Federation	http://www.roszdravnadzor.ru/	Federal Service on Surveillance in Healthcare and Social Development
Chile	http://www.ispch.cl/	Public Health Institute of Chile
Venezuela	http://www.inhrr.gob.ve/	National Institute of Hygiene
Seychelles	http://www.health.gov.sc/index.php?option=com_content&view=article&id=255&Itemid=260	Ministry Of Health

Source: http://www.who.int/medicines/areas/quality_safety/regulation_legislation/list_mra_websites_nov2012.pdf
http://budding-regulatory-professionals.blogspot.ca/p/globally-identified-websites-of.html
http://www.pharmweb.net/regulatory.html#pg

We emphasize again, the hypothesized objective function of drug manufacturers does not preclude the use of third degree price discrimination, it only suggests its usage to be considered in conjunction with other price discrimination methods inclusive of transaction costs. That RSPs can approximate 1st degree discrimination is a conjecture, probably used more widely outside N. America as in India and China. In India, RSPs are called Marketing Representatives (MR). (see an article of the alleged practice: http://forbesindia.com/article/special/will-pharma-companies-have-to-stop-gifting-doctors/34031/1). In China, the distribution process entails incurring transaction costs at three levels: The foundation level entails manufacturers educating various customer groups, through advertising or group meetings. Manufacturers also have to factor in training costs for physicians, via academic conferences, medical seminars, on-site meetings, etc. The middle level of sales efforts rely greatly on commissions. That involves commission pays to doctors, hospital pharmacies, hospital purchase departments, and managers of drugstores. Lastly, there is a terminal level of sales efforts involving contractual understandings with presidents of hospitals, vice presidents in charge of procurements, hospitals' procurement departments, physicians in general or specialized diseases. All drug sales in China must first be listed on a national Health Insurance directory. At the regional level, there is also a pharmaceutical commercial company drug list that a drug must first go through the approval process before it can be marketed. All these are some type of transaction costs.

In some way, the transaction-cost advantage of using RSPs for price concessions is also its limitation: That it is small scale. A face-to-face one-on-one sales interaction (small scale) can be more informative and persuasive than large scale purchase resulting from advertising or direct negotiation from the headquarter of a manufacturer. However, a small scale transaction can also reduce the possibility reselling of large scale parallel trade with highly organized third party middleman. Thus, a manufacturer may be more comfortable with that type of price concessions than giving large discounts to the representatives of the alleged needy patients, but only find later that the ordered merchandise was re-exported elsewhere where higher prices are charged.

The price reversal pattern thus suggests a cornering of the high-willingness-to-pay buyer segment in low income countries. The following contrived examples can show how a *structure of transaction cost*s will lead to that outcome. Suppose a low income country has one wealthy individual who is willing to pay 1 million for a drug while there are 2 million patients each with willingness to pay of $1, it is not necessarily the case that if firms can charge only one price, this price will be what higher-income consumers can pay, and that the product will be unaffordable to lower-income consumers. It all depends on the structure of transaction costs. Suppose a 1st degree price discrimination of a patented drug entails individual bargaining costs of C1 for each customers while 3rd degree price discrimination entails a headquarter fixed cost decision of C3 in preventing parallel trade. The wealthy individual's willingness to pay is generalized to m, and the number of patients

willing to pay \$1 is generalized to n. If C1 is slightly higher than \$1, while C3 is greater than n, a uniform price of m will be charged only. Access by the "poor" can only be enabled if C1 is less than \$1, and for that, the choice between 1st and 3rd degree price discrimination will depend on whether n(1-C1) is greater or less than C3.

We conclude the discussion in this section on the transaction costs of pricing by noting a recent report in the *Economist* (2014):

> "Until recently in poorer countries pharmaceutical firms mainly sold off-patent branded drugs, which command a premium over local generics, since patients trust their quality. The pricier patented ones they marketed only to the few very rich patients who could pay out of pocket, says Kalipso Chalkidou of NICE International, the British agency's foreign advisory arm. The private Aga Khan University hospital in Nairobi's leafy suburbs, for example, offers cancer care to the Kenyan elite that comes close to what they would receive in the rich world."

5. Normative Angles of Transaction Costs based on Buyers' Relationship with End Users

There is also a normative implication of the price reversal pattern that can be examined from a transaction costs angle. In addition to possibly human rights and social justice issues, the "externality" component of HIV/AIDS diseases may require government intervention although that is not necessarily the only remedy. Elinor Ostrom, in her Nobel prize winning work, has provided inspirational guidance in this possibility. Her emphasis had been on the environmental problems addressing to the tragedy of commons, (Ostrom, 1990). A transaction costs angle can shed lights on the type of institutions that may emerge to handle the problem. Specifically, the transaction costs between final users and expert opinion organizations. The evolvement of the latter can be of crucial importance for the handling the externality problem. To whom the final users, and for that matter, the governments, would or should trust for conducting medical related services in a way that can enhance individuals' and society's benefits?

The credibility of an expert opinion organization is of major issue here. At the most direct level, it is needed for the building of trust in a patient-physician relationship. As pointed out in earlier sections, the distribution of asymmetric information in this principal-agent problem is of a peculiar one—the principal here does not know what he/she really needs. But that is only part of the health care infrastructure. When organizations such as the insurance companies, HMOs, and various new health care management methods are added to the infrastructure, it can complicate the analysis tremendously. Moral hazard and adverse selections can lead to an insurmountable market failure that exceeds that created by distortions of patent created monopolies. To be sure, this belongs to a general class of problem being confronted in all countries including the USA. An institutional development angle to the problem is of great importance beyond the pricing strategies of manufacturers. The discussion of transaction costs in this context is quite normative, as no one can say whether a health reform adopted by a country will be successful with absolute certainty.

For lower income countries, the institutional answers to the HIV/AIDS pandemic problem have been tackled neither exclusively by the governments nor by the private sectors, but often by the nongovernmental organizations (NGOs). As WHO's GPRM has indicated, the price procurement data set itself came from a large number of NGOs, including well-known names such as the Clinton's Foundation, HIV/AIDS Initiative/UNITAID, the Global Fund, the International Dispensary Association, USAID/deliver, Management Sciences for Health, Mission pharma, Supply Chain Management System, the United Nations Children's Fund, and the WHO's Contracting and Procurement Service (WHO, 2009)

Clearly, on price bargaining with manufacturers, NGOs have been playing a significant role, counteracting to the patent exploitation incentives of the manufacturers, in addition to the force of competition from the generic drugs. Through the emergence of these organizations, the drug pricing problem is no longer a monopoly problem (thus making the discussion of different forms of price discriminations in the last section to be rather irrelevant), but in many situation, a bilateral monopoly bargaining problem**.** There is a set of asymmetric information problems (transaction costs problems) that can be addressed to in this direction. However, there is no need to model this explicitly here, suffice to say in this inquiry that the NGOs' negotiations with manufacturers have been quite successful. AVERT.org (Avert.org, 2015) provides an excellent history of these negotiations; and indeed, illuminating on how "tiered pricing" had emerged in the industry:

> "Negotiations with Big Pharmaceutical companies have led to a system of 'tiered' pricing. Tiered pricing means that the price at which the big pharmaceutical companies sell their drugs is calculated using formulas based on average income per head, leading to lower prices in poor countries."

That might be so, as the empirical works on price-GDP/capita across countries indeed have shown a general positive relationship; but that intent alone would not negate the price reversal pattern reported in this paper. So perhaps from this perspective, it was the failure of NGOs to negotiate down the drug prices in lower income countries that had led to the price reversal pattern. It is an easy target for price reforms.

Academically speaking, of greater intellectual interests to us are the emergence of these bargaining bodies. How do they gain their credibility and emerge as the appropriate representatives of the end users in the first place? On the one hand, there are large NGOs that are supported by world famous personalities such as William Clinton and Bill Gates; and indeed, brand names such as the World Bank and WHO are in one form of another, some type of an NGO. But these high profile organizations are the exceptions rather the norm within the institution classification of NGOs.

Literature on the studies of transaction costs of NGOs is not rich; and in our opinion, a barren area that badly needs to be studied. One can perhaps understand the international, cross-border advantages of NGOs easily, and their bargaining power when supported by recognizable brand names; but what about other NGOs? What qualifies the success of one and the failure of another? In what way can transaction costs economics help us to understand the seemingly superior advantages of NGOs, and in what dimensions are these institutional structure of importance?

Guinness (2011) provided a good start in examining the nature of the problem, addressing to four angles of transaction costs problems: institutional environment (the legal system or bureaucracy's governance), information problems on targeted population (frequency of contacts and patients mobility, etc.), opportunism (corruptions), and asset specificities (project staff and site-specific advantages). But the study, while pioneer in spirit, focused on the execution of preventive cares at the grass root level. It did not address to the brand-name emergence of NGOs, and for that matter, the ability of NGOs in bargaining with the patent protected drug manufacturers.

From the perspective of drug manufacturers, doing business with an NGO that can handle preventive cares may not be of high priority. Indeed, a cynical view will assume their sole interest is to increase the demand for the drugs they sell, not the reduction of them via preventive cares. They may be quite selective in choosing (1) NGOs knowledgeable about the institutional environment in the countries that they operate, and (2) NGOs that have sufficient asset specificities and not fly-by-nights. One can imagine that a contractual negotiation would necessarily entail having an NGO's promise of not deliberately engage in parallel trade to dilute a manufacturer's contemplated pricing strategy across different countries. In any case, considerable trust is to be expected.

The inquiry raised in this section is similar to one that has been asked for centuries in the area of sustainable development. Who can be the best representative of environments? The transaction costs angle raised in this section similarly asks: Who can be the best representative of helpless victims of diseases? The philosophical responses to the two questions may be similar too—both involve addressing to the efficiency or deficiency of governments in one extreme and that of the private incentive in the other extreme. Like addressing to the tragedy of the common problem, a transaction costs approach must address to how the economic problem of externalities will be resolved. In Coasian language, how the problem of social costs is to be handled. The digression in this paper hopefully can open up some normative questions as to how health reform in different countries may want to proceed as well.

6. Conclusion

This study highlights a price reversal pattern observed across lower- and middle-income countries in the AVR drug industry. The pattern is not consistent with either third-degree price discrimination or tiered pricing, both being the current dominant views for explaining price differentials across countries for pharmaceutical drugs. It is suggested that transaction costs can play a significant role in affecting drug prices, often country specific. The transaction costs affecting AVR drug pricing can be broadly classified into two kinds: One between the final users and the opinion/knowledge experts, and the other between the opinion/knowledge experts and the manufacturers. Addressing drug pricing problem from these two angles can capture essential aspects of transaction costs on the demand as well as the supply side of AVR drugs, in addition to the relatively well known factors of patents and competition.

The study of price reversal thus also reflects on the topic of pricing behavior in economics, which is usually analyzed without transaction costs, and heavily based on demand price elasticities. A.C. Pigou in his 1920 classic entitled *The Economics of Welfare* examined three forms of price discrimination but concluded that the monopolists "cannot, except in extraordinary circumstances, introduce either the first- or the second-degree of discrimination, and that the third- degree is of chief practical importance," (p.282). Economic

literature on drug pricing has largely endorsed this viewpoint. The price reversal pattern of AVR drugs across lower- and middle- income countries in 2008-2009 suggested a combination of reasons beyond monopoly pricing of the simplest type, relying on a structure of transaction costs with all three forms of price discrimination co-existing.

At a practical level, the question of who *was*, or *should* be, responsible for the price reversal pattern involves different players and institutional constraints for any country that can be theoretically captured in terms of some notions of transaction costs in the context of that country. Our study suggests a framework for thinking, and provides some preliminary findings to identify features of importance. Thus, instead of asking who is responsible, the appropriate question to examine is how institutional development in different country setting will enable the lowering of the transaction costs in that country. The answer could well be found in the structure of NGOs serving that country, but the answer at this stage is not certain. This normative question actually is of relevance to lower-income countries as well as to advanced countries such as USA, where health care reform is under way. Long before Obamacare, Frank (2001, p.128) made the following prophetic insight for North America:

> "….*incentive formularies* appear to be effective in allowing health plans to obtain *price concessions*. Both the Clinton administration plan and the House Republicans counted on such [transaction] mechanisms to control costs under a Medicare prescription drug benefit. The differences lie not in their perceptions of how to get price concessions but rather in how to create an *institutional structure* that protects against market failure stemming from *adverse selection* (the Clinton administration) or government's inability to restrain itself from intervening in the *price-setting* arrangements (the House Republican)." (emphasis not in the original, added in *italics*)

Our price-reversal-study-led digression of transaction costs in the ARV drug world suggests that the above could be the norm rather than an exception. It could well be equally relevant that such forces are at work in less developed low-income countries as in the USA.

References

Avert.org, 2015. *Antiretroviral Drug Prices | AVERT*. [online] Available at: http://www.avert.org/antiretroviral-drug-prices.htm#sthash.bEkcD7uc.dpuf [Accessed 19 January 2015].

Cheung, S.N.S., 1987. Economic Organization and transaction costs. In *The New Palgrave: A Dictionary of Economics*, volume 2, London: Macmillan Reference, pp.55-58.

Cheung, S.N.S.,1969. Transaction Costs, Risk Aversion, and the Choice of Contractual Arrangements. *Journal of Law and Economics*, 12(1), pp. 23-42.

Coase, R. H., 1937. The Nature of the Firm. *Economica*, 4(16), pp.386-405.

Cowan, S., 2007. The welfare effects of third-degree price discrimination with non-linear demand functions. *RAND Journal of Economics*, 32(2), pp. 419-428.

Danzon, P, and Towse A., 2003. Differential pricing for pharmaceuticals: reconciling access, R&D and patents. *International Journal Health Care Finance and Econ*, 3, pp. 183-205.

Danzon, P.M., Towse, A. and Mulcahy, A.W., 2011. Setting Cost-effectiveness Thresholds As A Means To Achieve Drug Prices across Countries. *Health Affairs*, 30(8), pp. 1529-38.

Danzon, P.M., Mulcahy, A.W., and Towse, A.K., 2013. Pharmaceutical Pricing in Emerging Markets: Effects of Income, Competition, and Procurement. *Health Economics*, 24(2), pp.238-252.

Frank, R.G, 2001. Prescription Drug Prices: Why Do Some Pay More Than Others Do?. *Health Affairs*, 20(2), pp.115-128.

Giaccotto, C., Santerre, R.E, and Vernon, J.A., 2005. Drug Prices and R&D Investment Behavior in the pharmaceutical Industry. *The Journal of Law and Economics*, 48(1), pp. 195-214.

Guinness, L., 2011. What can transaction costs tell us about governance in the delivery of large scale HIV prevention programmes in southern India. *Social Science & Medicine*, 72(12-2), pp. 1939-1947.

Holtgrave, D.R., and Pinkerton, S.D., 1997. Updates of Cost of Illness and Quality of Life Estimates for Use in Economic Evaluations of HIV Prevention Programs. *Journal of Acquired Immune Deficiency Syndromes & Human Retrovirology*, 16(1), pp.54-62.

Joge, U.S., Deo, D.S., Lakde,R.N., Choudhari, S.G., Malkar, V.R, and Ughade, H.H., 2012. Sociodemographic and clinical profile of HIV/AIDS patients visiting to ART centre at a rural tertiary care hospital in Maharastra state of India. *International Journal of Biological & Medical Research*, 3(2), pp. 1568-1572.

Klein, B., Crawford, R. and Alchian, A. 1978. Vertical Integration, Appropriable Rents, and the Competitive Contracting Process. *The Journal of Law and Economics*, 21(2), pp.297-326.

Lichtenberg, F.R., 2011. Pharmaceutical Companies' Variation Of Drug Prices whithin and among countries can improve long-term social Well- Being. *Health Affairs*, 30(8), pp.1539-1544.

Lichtenberg, F.R., 2010. Pharmaceutical Price Discrimination and Social Welfare. *Capitalism and Society*, 5(1).

Lima Nogueira, A.C. and Bataglia, W., 2012. Transaction Costs and Organizational Competences: Explaining the Governance Structure for Manufacturing Stage. *Journal of Technology Management & Innovation*, 7(1), pp.159-174

MacDonald, N., and Linde-Zwirble, W., 2014 . What Really Stands in the Way of Cutting Health Care Costs. *Knowledge@Wharton*, 2014, July 31, [online] Available at: http://knowledge.wharton.upenn.edu/article/really-stands-way-cutting-health-care-costs/ [Accessed 19 January 2015].

Morel, C. M., McGuire, A., and Mossialos, E., 2011. The Level Of Income Appears To Have No Consistent Bearing On Pharmaceutical Prices Across Countries. *Health Affairs*, 30(8), pp. 1545-1552.

Ostrom, E., 1990 *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press.

Pigou, A.C., 1920. *The Economics of Welfare.* London: Macmillan.

Ringel, J.S., Hosek, S.D., Vollaard, B.A. and Mahnovski, S. 2002. *The Elasticity of Demand for Health Care: A Review of the Literature and Its Application to the Military Health System.* National Defense Research Institute/RAND Health, Santa Monica, CA: RAND Corporation.

Ross, S.A., 1973. The economic theory of agency: The principal's problem. *American Economic Review*, 62(2), pp.134-139.

Sagaon-Teyssier, L., 2012. Improving the quality of data in the Global Price Reporting Mechanism for a reliable market intelligence project. [online] Available at: http://docslide.us/documents/improving-the-quality-of-data-in-the-global-price-reporting-mechanism-for-a-reliable-market-intelligence-project-international-multi-stakeholder-consultation.html [Accessed 19 January 2015].

The Economist, (2014). *Hard pills to swallow*. [online] Available at: http://www.economist.com/news/international/21592655-drug-firms-have-new-medicines-and-patients-are-desperate-them-arguments-over [Accessed 21 February 2015].

WHO, 2009. *A Summary Report from the Global Price Reporting Mechanism--November 2009.* World Health Organization.

WHO, 2013. *Global Price Reporting Mechanism-Summary Report 2013.* World Health Organization, 2014.

—. *Surmounting Challenges: Procurement of Antiretroviral Medicines in Low- and Middle-Income Countries: The Experience of Medecins Sans Frontieres.*

WHO, 2014. *Access to Antiretroviral Drugs in Low-and Middle-Income Countires-July 2014.* World Health Organization.

Williamson, O.A., 1975. *Markets and Hierarchies: Analysis and Antitrust Implications.* New York, NY: Free Press.

Williamson, O.E., 1981. The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), pp.548-577.

Williamson, O.E., 1983. Credible Commitments: Using Hostages to Support Exchange. *American Economic Review*, 73(4), pp.519–540.

Williamson, O.E., 1996. Transaction-cost economics: the governance of contractual relations. In *Firms,organizations and contracts*, by Michie J., Buckley P.J., Oxford: Oxford University Press.

Appendices

Appendix I. *List of Country Names*

Low-income country (34)	Burundi, Liberia , Eritrea ,Congo , Malawi, Ethiopia , Niger, Guinea , Madagascar, Zimbabwe, Mozambique , Togo, Uganda, Afghanistan, Rwanda, Central African Republic, Nepal, Sierra Leone, Tanzania, Guinea-Bissau, Burkina Faso, Gambia, The , Bangladesh , Mali, Tajikistan, Haiti, Cambodia, Benin, Kenya, Comoros, Solomon Islands, Chad, Kyrgyz Republic, Leo PDR
Lower middle-income country (49)	Mauritania, Senegal, Pakistan, Zambia, Sao Tome and Principe, Lesotho, Vietnam, Sudan, Uzbekistan, Cameroon, Nigeria, India, Papua new guinea, Cote d'Ivoire, Ghana, Yemen , Nicaragua, Moldova, Bolivia, Mongolia, Honduras, Bhutan, Kiribati, Republic of the Congo, Sri Lanka, West Bank and Gaza, Indonesia, Egypt, Timor-Leste, Paraguay, Philippines, Guyana, Georgia, Vanuatu, Samoa, Swaziland, Guatemala, Federated state of Micronesia, Morocco, Ukraine, Armenia, El Salvador, Kosovo, Tonga, Cape Verde, Turkmenistan, China
Upper middle-income country(51)	Marshall Islands, Angola, Thailand, Jordan, Fiji, Iraq, Ecuador, Namibia, Peru, Tunisia, Algeria, Belize, Iran, Albania, Macedonia, Jamaica, Dominican Republic, Bosnia and Herzegovina, Azerbaijan, Colombia, Maldives, Tuvalu, Botswana, Cuba, Belarus, South Africa, Serbia, Costa Rica, Bulgaria, St. Vincent and the Grenadians, Dominica, St. Lucia, Montenegro, Kazakhstan, Grenada, Suriname, Mauritius, Panama, Malaysia, Lebanon, Gabon, Brazil, Mexico, Uruguay, Romania, Turkey, Palau, Russian Federation, Chile, Venezuela, Seychelles

Source:http://data.worldbank.org/indicator/NY.GNP.PCAP.CD?order=wbapi_data_value_2009+wbapi_data_value+wbapi_data_value-first&sort=asc

Appendix II. *Pharmaceutical Originator and Generic Drugs Companies*

Sr. No.	Drug name	Brand Names	Generic Names
1.	Efavirenz	1. Bristol-Myers Squibb 2.Msd	1. Sub-Saharan Africa Aspen Pharma care 2. Mcneil& Argus 3. Cipla 4. Emcure Pharmaceuticals 5. Ranbaxy Laboratories 6. Hetero Drugs Ltd 7. Alkem Laboratories 8. Aurobindo Pharma
2.	Fosamprenavir	1. Glaxosmithkline 2. ViiV	NF
3.	Nevirapine	1.Boehringer Ingelheim	1. Mcneil& Argus 2. Cadila 3. Cipla 4. Ranbaxy 5. Emcure 6. Alkem 7. Hetero Drugs Ltd
4.	Zidovudine	1. Glaxosmithkline 2. ViiV	1. Aurobindo Pharma Ltd Inc 2. Genix pharma Ltd 3. PharmaforceInc 4. AurobindoPharma Ltd 5. Hetero Drugs Ltd 6. Matrix Laboratories Ltd 7. Ranbaxy Laboratories Ltd 8. Roxane Laboratories Inc 9. Lupin Ltd 10. Teva Pharms 11. Luitpold 12. Mylan Pharms Inc 13. Sunshine Lake

			14. Emcure 15. Alkem 16. Cadila 17. Mcneil& Argus 18. Zydus
5.	Didanosine	1.Bristol Myers Squibb	1. Aurobindo Pharma Ltd 2. Barr Laboratories Inc 3. Matrix Laboratories Ltd 4. Mylan Pharms Inc 5. Alkem 6. Spinogen 7. Ranbaxy
6.	Stavudine	1.Britol-Myers Squibb	1. Alkem 2. Actavis 3. Spinogen 4. Wujing Medicine 5. Ranbaxy Laboratories 6. Biotoscana 7. Biogen 8. Flamingo Pharmacueticals 9. Landsteiner 10. Filaxis 11. Meijisi Pharmaceutical 12. Ivax 13. Negpf 14. Stadine 15. Hetero 16. Lkm 17. Aurobindo 18. Cipla 19. Paylos
7.	Lamivudine	1. Glaxosmithkline 2. ViiV	1. Teva Pharms 2. Lupin Ltd 3. AurobindoPharma Ltd 4. Hetero labs limited V 5. Apotex 6. Dosa 7. Mebiphar 8. Beximco 9. Ranbaxy Laboratories 10. Flamingo Pharmacueticals 11. Ivax 12. Square 13. Cadila 14. Paylos 15. Zydus 16. Zifam India 17. Incepta 18. Alkem 19. Emcure 20. Khandelwal 21. Mcneil& Argus 22. Zy.Alidac 23. Synmedic Laboratories 24. Sppl 25. Shantha Biotech
8.	Lamivudine+Zidovudine	1. ViiV	1. Hetero Labs Ltd V 2. Lupin Ltd 3. Teva Pharms 4. Alkem 5. Cipla 6. Cadila

			7. Mcneil& Argus 8. Synmedic Laboratories 9. Zydus 10. Ranbaxy Pharma 11. Emcure
9.	Lamivudine/Stavudine/Nevirapine	No originator	

Source: http://www.drugsupdate.com/brand/showavailablebrands/341
http://apps.who.int/medicinedocs/documents/s18716en/s18716en.pdf
http://www.drugbank.ca/drugs/DB00238?utf8=%E2%9C%93&query=Nevirapine&search_type=drugs&button=
http://www.accessdata.fda.gov/scripts/cder/ob/docs/queryai.cfm

Expert Journal of Economics, Volume 3, Issue 2, pp. 113-126, 2015
 ISSN 2359-7704
Economics.ExpertJournals.com

Impact of Monetary Policy and Fiscal Policy on Indonesian Stock Market

Rossanto Dwi HANDOYO[1*], Mansor JUSOH[2], and Mohd. Azlan SHAH ZAIDI[2]

[1]Airlangga University, Surabaya, Indonesia
[2]National University of Malaysia, Bangi Selangor, Malaysia

This paper attempts to investigate the effect of fiscal and monetary policy on Indonesian Stock price as well as main sectors stock price such as agricultural, mining, manufacture, and financial sector indexes. We consider the world oil price as a foreign variable that will influence domestic economy as in regular small open economy model. In this paper, we employ the Monte Carlo algorithm to Near-SVAR models (if some of the VAR equations have regressors not included in the others). We find that there is a positive stock price response to monetary policy shock both aggregated and sectoral stock price. In term of interaction between fiscal policy shock and stock market, we find that all sectors respond negative relationship. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. We also provide the evidence that not only both policies are able to influence the stock price individually, but also the interaction between monetary and fiscal policy is important in explaining stock market performance.

Keywords*: monetary policy, fiscal policy, stock price, Monte Carlo SVAR model, impulses response*

JEL Classification*: C32, E63, G12*

1. Introduction

Many empirical studies attempt to scrutinize both impact fiscal and monetary policies on output and inflation rather than stock price. The objective of our paper is to investigate the effect of fiscal and monetary policy on Indonesian Stock price. We use stock prices because they are the most responsive, while output and

* Corresponding Author:
Rossanto Dwi Handoyo, Department of Economics, Faculty of Economics and Business, Airlangga University Indonesia, 4th Airlangga Road, Surabaya, East Java, Indonesia, 60285

Article History:
Received 28 April 2015 | Accepted 8 May 2015 | Available Online 26 May 2015

Cite Reference:
Handoyo, R.D., Jusoh, M., and Shah Zaidi, M.A., 2015. Impact of Monetary Policy and Fiscal Policy on Indonesian Stock Market. *Expert Journal of Economics*, 3(2), pp.113-126

Acknowledgements:
The earlier version of this article was presented at the Malaysian National Economic Conference (Persidangan Kebangsaan Ekonomi Malaysia or PERKEM) VIII, Johor Bahru, Malaysia, 7-9 June, 2013. The authors are indebted to Prof. Zulkiefli Abdul Karim for his valuable comments.

inflation are the sluggish ones due to many restrictions to various sort of adjustment costs in determining the quantities of most goods and services (Sims and Zha, 2006; Cheng and Jin, 2013). Several authors have discussed in detail the effect of monetary policy shock on stock market (e.g., Thorbecke, 1997; Bernanke and Kuttner, 2005; Cheng and Jin, 2013; Bouakez, et al., 2010; Laeven and Tong, 2012; Pirovano, 2012). Studies that attempt to test the impact of fiscal policy on stock market are also voluminous (e.g., Darrat, 1990; Laopodis, 2009; Afonso and Sousa, 2011 and 2012; Agnello and Sousa, 2012). On the other hand, the studies of incorporating the effect of fiscal and monetary policy on the stock market performance are not voluminous (e.g., Jansen, et. al., 2008; Chatziantoniou, 2013). Our study perhaps complements this literature gap.

The study of the effect of monetary and fiscal policy is important in case of Indonesia that implements the inflation targeting framework because of the potential conflicting objectives between fiscal and monetary policies will lead to a crucial strategic interaction between two policy instruments. The interaction arises as both monetary and fiscal policies have implication for the output gap and inflation. Fiscal authorities are more concern about output, otherwise the monetary authorities emphasize on controlling inflation. Under standard economic theory, the sign of the budget deficit is expected to be positive, which means that the larger the budget deficits will lead to larger the interest rate. Under these circumstances, the Central Bank needs to stabilize the economy from overheating and inflationary pressure. Meanwhile, many empirical studies that attempt to scrutinize the effect of impact fiscal and monetary policies focus more on output and inflation rather than stock price.

In the context of Indonesia, to our best knowledge, study relating to stock market response on both fiscal and monetary policy shocks is not well documented and sometimes only in individually rather than jointly (e.g., Praptiningsih, 2013). Meanwhile, studies relating to both the effect of monetary and fiscal policy analysis emphasized on those policies shocks on macroeconomic objective mainly on inflation and output not on stock market (e.g., Surjaningsih, et al., 2012; Hermawan and Munro, 2008). Our study perhaps fills this literature gap.

This paper also attempts to investigate the effect of monetary and fiscal policy on main sectors stock price index in Indonesian Stock market such as agricultural, mining, manufacture, and financial sectors indexes. We use only 4 main sectors in our analysis that represent three kinds of aggregated development sectors group namely primary, secondary and tertiary sectors. We use mining and agriculture sectors to represent the primary sector as well as the top stock price index. As a developing country, the contribution of these two sectors is still quite high to national output which are 12.7% and 7.67% in 2011, respectively (Indonesian Statistics Bureau, 2011). Meanwhile, the manufacture and financial sectors contribute 25.7% and 10.7% of total output, respectively. The last two sectors represent secondary and tertiary sectors as well as the medium and the low stock price sector index. This analysis is crucial in order to investigate the strength of such an association whether tend to varies extensively across sectors. Under these circumstances, sector stockholder will be affected by the change of the policies and then, in turn the firm's ability to finance the production level will vary across sectors due to different consumption (wealth effect) and investment pattern.

From the methodological perspective, we employ a near-SVAR model because some of the VAR equations have regressors not included in the others. This model provides an extension of the structural VAR approach, as it does not impose the same variables treated in all right-hand side of the equations of the reduced form model since we employ the world oil price as an exogenous variables and unaffected by any domestic variables. In the context of the present paper, the near-SVAR model is estimated using the method of seemingly unrelated regressions (SUR). SUR offers a robust statistical framework with the ability to give consistent and efficient estimates of the coefficients (Enders, 1995; Zaidi and Fisher, 2010; Piroli et al, 2012) particularly if the lag length is long because this erodes the degree of freedom. Numerous studies have attempted to improve the better SVAR methods by applying Bayesian analysis to obtain accurate infinite sample inferences from the posterior distribution (Sims and Zha, 1999; Wagonner and Zha, 2003). In this paper, we employ the Monte Carlo simulation method, particularly Gibbs Sampler, to our near SVAR model which has been proposed by Sims and Zha (1999), and developed extensively by Wagonner and Zha (2003).

This study is organized as follows. Section 2 explores the data used in the models. Section 3 mentions the methodological and model identification strategy. Section 4 reports the estimation results and discusses the empirical results. Section 5 concludes with the main findings and policy recommendations.

2. Data Description

As a small open economy, we employ the world oil price rather than output or commodity price as the foreign variables that affect Indonesian economy. The oil price data is crude oil or petroleum price in US$/barrel and taken from Dubai Fateh oil market. Our studies decompose variables into two blocks as a

standard form model of SVAR for small open Economy. The first block consists of one foreign variable that is world oil price. The reason why we use the world oil price is that regarding the fact that since 2003, Indonesia becomes net importer oil country and suffer from any increase of such shock in which the deficit of trade balance on oil become larger as the world oil price tend to rise for over the last decade. Hence, rising oil prices are bad for stock market of oil importing country such as Indonesia. Kim and Roubini (2000) use oil prices rather than commodity prices as a proxy for future inflation and the world economic variable. On the other hand, Zaidi et. al., (2011) use the world commodity prices for Malaysia cases due to the fact that Malaysia is oil producing country and the oil price in the domestic market is heavily regulated.

The second block contains the domestic variables consisting of: industrial production index (LY), Debt to GDP ratio (DYR), the inflation rate (INF, the growth rate of consumer price index/CPI), money market interest rate (R, 3 month SBI rate), real exchange rate (LXR, nominal exchange rate times the ratio of US CPI/Indonesian CPI), and stock price both in composite index (LSP) and sector price index (LAGR for agriculture, LMINE for mining, LFINE for banking and finance). We use Industrial production index to represent national output (we also use this indicator due to the data availability in monthly basis instead of national income that employed in quarterly basis), Debt to GDP ratio for the fiscal policy variables and 3 months SBI rate for monetary policy variable. For this purpose, we decompose the shock of domestic and foreign shock on stock price both composite index and sectors index into 5 models; model 1 for the composite index, model 2 (mining), model 3 (agriculture), model 4 (finance), and model 5 (manufacture industry). We use industrial production index rather than GDP that has been used in stock market studies, such as Binswanger (2000, 2001, 2004), and Mackowiak (2006). All variables (except the inflation rate, Debt to GDP ratio and interest rate) are transformed by taking natural logarithms. All variables are in real term (constant price at certain base year depending the published report or if not available, we calculated them ourselves with base year 2003, similar to BPS or Indonesian Statistic Agency base year) and seasonally adjusted using X11 multiplicative provided by Eviews6 and RATS. Our SVAR model is specified in levels rather than in the first difference following Zaidi et. al., (2011) since there is no theoretically foundation to impose cointegration restriction on VAR model.

We use monthly data from 2001.1 until 2011.12. We start our data from January in year 2001 is to avoid the turbulence 1998 economic Crisis and of course data treatment using structural break are no longer needed. Data are collected from various sources such as the Monthly Indonesian Economics and Financial Statistics produced by Bank Indonesia (www.bi.go.id), Economic Indicators of Indonesian Statistics Agency or BPS/Badan Pusat Statistik (www.bps.go.id), Indonesian Stock Exchange market (www.idx.co.id), Directorate General of Debt Management of treasury department (www.djpu.kemenkeu.go.id), our world oil price data taken from the website www.indexmundi.com. Some variables that are not available in monthly data, such as GDP and Debt (data from 2000 until 2008 are not provided on monthly but quarterly) are interpolated using cubic match. The detailed formula of cubic match last is available at EVIEWS 6 user's guide.

3. Methodology and Identification

We investigate the dynamic relationship among fiscal and monetary policies and the stock market performance using near SVAR framework. In estimation, we emphasized on identifying only the monetary and fiscal policies shock and we do not aim to identify all structural shock. Our estimations follow the step by the step the methodology developed by Wagonner and Zha (2003). In order to choose the optimal lag length for our SVAR model, the residual of each equation are examined for evidence of serial correlation using Akaike's Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

Following Wagonner and Zha (2003), the structural VAR models typically take the form of

$$y_t'A = \sum_{t=1}^{p} y_{t-l}' A_l + z_t'D + \varepsilon_t', \quad \text{for } t = 1, \dots, T, \tag{1}$$

where A and A_l are 6×6 parameter matrices, D is an $h \times 6$ parameter matrix, y_t is an 6×1 column vector of endogenous variables at time t, z_t is an $h \times 1$ column vector of exogenous variables at time t, ε_t is an 7×1 column vector of structural disturbances at time t; p is the lag length, and T is the sample size. The parameters of individual equations in (1) correspond to the columns of A, A_l and D. The structural disturbances have a Gaussian distribution with

$$E(\varepsilon_t | y_1, \dots, y_{t-1}, z_1, \dots, z_T) = 0$$
$$E(\varepsilon_t \varepsilon_t' | y_1, \dots, y_{t-1}, z_1, \dots, z_T) = I. \tag{2}$$

The structural disturbances in (2) are normalized to have an identity covariance matrix. Right multiplying the structural form (1) by A^{-1}, the usual representation of a reduced-form VAR can be obtained with the reduced-form variance matrix being

$$\Omega = (AA')^{-1} \tag{3}$$

Equation (4) below indicates the set of restriction that are imposed on the contemporaneous parameters of the SVAR model of Indonesian Stock market. Our identification structures are more likely the upper triangular rather than the lower one. The coefficient β_{ij} indicates of how variable j contemporaneously influence on variable i. The coefficients on the diagonal are set to be unity, while the number of zero restriction on the coefficient is 23, hence the model is over-identified since exactly identified require 49-7=42/2=21 restrictions. If there are $(n^2 - n/2)$ additional restrictions, meaning that the the system is over-identified, hence χ^2 test of statistic need to be conducted. Following Zaidi and Karim (2012), χ^2 test of statistic is $\chi^2 = |\Sigma_e^R| - |\Sigma_e|$, where R (number of resctriction exceeding $(n^2 - n/2)$) degrees of freedom can be used to test the restricted system, $|\Sigma_e^R|$ is the restricted variance-covariance matrix, $|\Sigma_e|$ is the unrestricted variance-covariance matrix.

The short-run restrictions applied in this model are the following:

$$\begin{bmatrix} \varepsilon_{LSP} \\ \varepsilon_{LXR} \\ \varepsilon_{R} \\ \varepsilon_{INF} \\ \varepsilon_{DYR} \\ \varepsilon_{LY} \\ \varepsilon_{LOIL} \end{bmatrix} = \begin{bmatrix} 1 & A_{12} & A_{13} & A_{14} & A_{15} & A_{16} & A_{17} \\ A_{21} & 1 & A_{23} & A_{24} & 0 & A_{26} & A_{27} \\ 0 & A_{32} & 1 & A_{34} & 0 & 0 & A_{37} \\ 0 & 0 & 0 & 1 & 0 & A_{46} & A_{47} \\ 0 & 0 & 0 & 0 & 1 & A_{56} & A_{57} \\ 0 & 0 & 0 & 0 & 0 & 1 & A_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} x \begin{bmatrix} e_{LSP} \\ e_{LXR} \\ e_{R} \\ e_{INF} \\ e_{DYR} \\ e_{LY} \\ e_{LOIL} \end{bmatrix} \tag{4}$$

where, industrial production index (LY), Debt to GDP ratio (DYR), the inflation rate (INF), money market interest rate or 3 month SBI rate (R), real exchange rate (LXR), and stock price both in composite index (LSP) and World oil price (LOIL). We put the foreign variables at the last ordering to adjust the equation in the SUR model that place the oil equation at the last. Consequently, our restriction structure is more likely upper triangular rather than the lower one. In addition, Waggoner and Zha (2003) state that for the methodological purpose, the Gibbs sampler will produce independent draws of A matrix if the transformed form of A matrix is upper triangular after an appropriate reordering of equations and variables (for detailed discussion, see Waggoner and Zha, 2003).

We focus on examining the interaction between the macroeconomic policies and stock price. Our restrictions follow the previous studies that concern on macroeconomic modeling and stock market analysis. Below we provide the explanation of the model's restriction. Stock prices are contemporaneously influenced by all variables (Afonso and Sousa, 2011; Bouakez et al., 2010; Chatziantoniou et.al, 2013). Exchange rate is contemporaneously influenced by all variables except debt to GDP ratio (Kim and Roubini, 2000; Zaidi,et.al., 2011; Dungey and Fry, 2009). Monetary policy is also contemporaneously influenced by exchange rate. The interdependence between exchange rate and interest rate has been assumed because it helps to solve the exchange rate puzzle (Kim and Roubini, 2000; Zaidi et al., 2011). The foreign shock contemporaneously affects all domestic variables. Inflation reacts contemporaneously only to income shock and foreign shock (Bjornland and Leitemo, 2009; Kim and Roubini, 2000; Chatziantoniou et.al, 2013). Monetary policy tool is contemporaneously affected by inflation. However the national income cannot be contemporaneously influenced by any other domestic variables (Kim and Roubini, 2000). In contrast, it can contemporaneously influence all domestic variables.

We conduct inference from a Bayesian approach, as is common in the VAR literature (see Sims and Zha, 1998, 1999; Waggoner and Zha, 2003). We take draws from the posterior pdf of the parameters of the reduced-form VAR. This pdf is a product of an inverse-Wishart density for Ω and a Gaussian density for the equation's coefficients $B(s)$ for all $s > 0$, conditional on Ω. In the past, researchers have used an importance sampler to approximate the posterior density function of A.

4. Result Estimation

To begin with, we start our estimation with determining optimal lag length using Akaike Information Criteria (AIC) and Schwartz Bayesian Criterion (SBC). According to the two tests (Table 1), our five model both composite index and 4 sector index recommend to employ two lag orders. By using 2 lag orders, our models are expected to have consistent and efficient coefficient since they do not consume degrees of freedom.

Table 1. *Optimal Lag Length*

Lags	AIC	SBC
1	-26.4542	-25.2818*
2	-26.8719*	-24.7688
3	-26.5634	-23.6441
4	-26.2624	-22.6743
5	-25.4871	-21.4222
6	-24.8955	-20.6076
7	-23.9693	-19.8012
8	-22.3896	-18.8150
9	-20.2409	-17.9369
10	-16.9447	-16.9192
11	-12.9457	-16.7851
12	-6.3145	-16.7159

*Note: * represents lag recommended by AIC or SBC*

Next, we develop our Seemingly Unrelated Regression (SUR) model to estimate our near-SVAR model. We treat world oil price as an exogenous variable against all equation and only be influenced by its own lag. Table 2 presents the estimates of the coefficients of A Matrix in equation (4). From the table, we find that all models produce the same sign on each coefficients, except coefficient (a_{17}) in model 5; (a_{23}) in model 4; (a_{26}) in model 2 and 3. The sign and the coefficient significancies across the models look similar. Unfortunately, many coefficients are insignificant. For the stock price variable, all coefficients are of expected sign except the real output which produce the negative sign (a_{16}). Stock price decreases contemporaneously with an increase in exchange rate, interest rate, real output, and oil price whereas the other variables such as inflation rate and fiscal policy rate move in the same direction. For the inflation variable, the estimation also indicates that inflation has significant contemporaneous relationship with monetary policy. Furthermore, the oil price has significant contemporaneous effect on interest rate and budget deficit. From this finding, the inflation and the oil price play an important role in determining the interest rate adjustment undertaken by the Central Bank. Meanwhile, these results imply that a change in oil price takes into account the fiscal policy.

Table 2. *SVAR Result – Contemporaneous Coefficient*

Variables	Coefficient	Model 1 (composite)	Model 2 (mining sector)	Model 3 (agriculture sector)	Model 4 (finance sector)	Model 5 (manufacture industry sector)
LSP	a_{12}	-7.507	-9.897	-7.628*	-9.284	-9.005
	a_{13}	-30.892	-39.932	-27.796	-36.921	-32.679
	a_{14}	1.473	2.292	0.862	0.021	0.011
	a_{15}	0.489	0.656	0.597*	0.639	0.604
	a_{16}	-0.076	-0.581	-0.479	-0.732	-0.678
	a_{17}	-0.069	-0.430	-0.383	-0.026	0.133
LXR	a_{21}	0.801*	0.567*	0.363*	0.731*	0.907*
	a_{23}	1.053	0.923	1.843	-0.303	2.347*
	a_{24}	0.801*	1.233*	0.298	0.014	0.004
	a_{26}	-0.039	0.054	0.057	-0.047	-0.089
	a_{27}	-0.116*	-0.247*	-0.163*	-0.107*	-0.052
R	a_{32}	-0.048*	-0.047*	-0.046*	-0.043*	-0.046*
	a_{34}	-0.201*	-0.199*	-0.195*	-0.001*	-0.002*
	a_{37}	0.007*	0.008*	0.008*	0.007*	0.008*
INF	a_{46}	0.022	0.018	0.020	2.314	2.901
	a_{47}	-0.002	-0.007	-0.003	-0.178	-0.073

DYR	a_{56}	0.438	0.134	0.212	0.188	0.458
	a_{57}	1.056*	1.025*	1.164*	1.044*	1.253*
LY	a_{67}	0.047	0.038	0.051	0.058	0.069
Diagnostic Test:						
χ^2 statistic test		3.999	4.370	3.767	3.403	5.103
p-value		0.135	0.112	0.152	0.182	0.077
Convergence in (iteration)		71	74	52	72	67

*Note: Sign * Indicates that the coefficients are statistically significant at the 10% level. Model 1-5 represent model for composite stock price index, mining, agriculture, finance and manufacture industrial sectors index, respectively.*

To test the over identifying restrictions on the SVAR model, we employ a chi-squared with 2 degrees of freedom provided by RATS program output. We find the value of chi-square test for model 1of 3.999 with the χ^2 value of 0.135. It means that the overidentifying restrictions cannot be rejected. All models perform the same result (except model 5) and based on our calculation all models also perform well since they converge below 100 iterations. Our identification strategy is also valid since our model generates the significant of the contemporaneous coefficients outside the upper triangular of A matrix ($a_{21}$and a_{32}) as seen in equation (4).

Figure 1 and 4 plot the impulse response function of macroeconomic (stock price, exchange rate, inflation and output) response to one standard deviation shocks in monetary policy and fiscal policy for the aggregated stock price (model 1). Figure 2 and 5 display the sectors stock price response to one standard deviation shocks in monetary policy and fiscal policy respectively. The solid line corresponds to the median response and we provide 68% posterior confidence intervals from near-SVAR model. The confidence bands are constructed by using a Monte-Carlo Gibbs sampling algorithm as developed further for SVAR model by Waggoner and Zha (2003) and calculated by taking the estimated coefficient in structural model to form the data generating process on 2,000 burns and 10,000 draws.

4.1. The Effect of Monetary Policy Shocks

As shown, in a response to the positive innovation in the central bank policy rate (tightening monetary policy shock), Composite Stock price (figure 1) rise initially and then fall until reaches the peak in 16 months. This finding is in line with the work of Praptiningsih (2013) and Handoyo et al., (2014). These delayed responses of stock prices imply that stock prices adjust sluggishly to a monetary policy shock. The falling of stock price initially is to earn the higher discount factor which reduces the present value of expected future earnings of firms. Theoretically, a rise in interest rate is predicted to have a negative effect on the stock market. This sluggish response may be due to investing in the Indonesian stock market has grown significantly since the last two decades and become an interesting option for the investor to expand their business for both local and foreign investors regardless the policy undertaken by the central bank in the short horizon although in medium and long horizon stock price will fall.

From the perspective of the sectoral stock price, similar response patterns exist in all models (see figure 2) except model 4 (Finance and banking sector). The positive initial responses of both composite and sectoral stock prices are short-lived. The different response between the sectoral and the composite stock prices is in the period of initial response. Composite stock prices responds positively to the monetary policy shocks in month 5 and then negatively after that. Meanwhile, the mining, agriculture and manufacture industry responds positively in 3, 2, and 4 month, respectively. These findings reveal that the strength of the correlation between the monetary policy and the stock prices does not vary across sectors. The sector stockholder will be affected by the change in monetary policy. There are several reasons why initially they respond positively to monetary policy shock. First of all, this may be due to the probability of the asset price bubble increase for the last two decades regardless the policy actions conducted by monetary authority. In short run, Investors expect that as long as the future business prospect still profitable and the government perform the economy well, the demand for the asset still high. Secondly, this finding confirms that monetary policy is not effective for the Bank Indonesia (Indonesian Central bank) to intervene the Stock market. This is because the rapid development in financial market is not only affected by the monetary policy but also by the liberalization policy and reform in the financial sector that has been done so far.

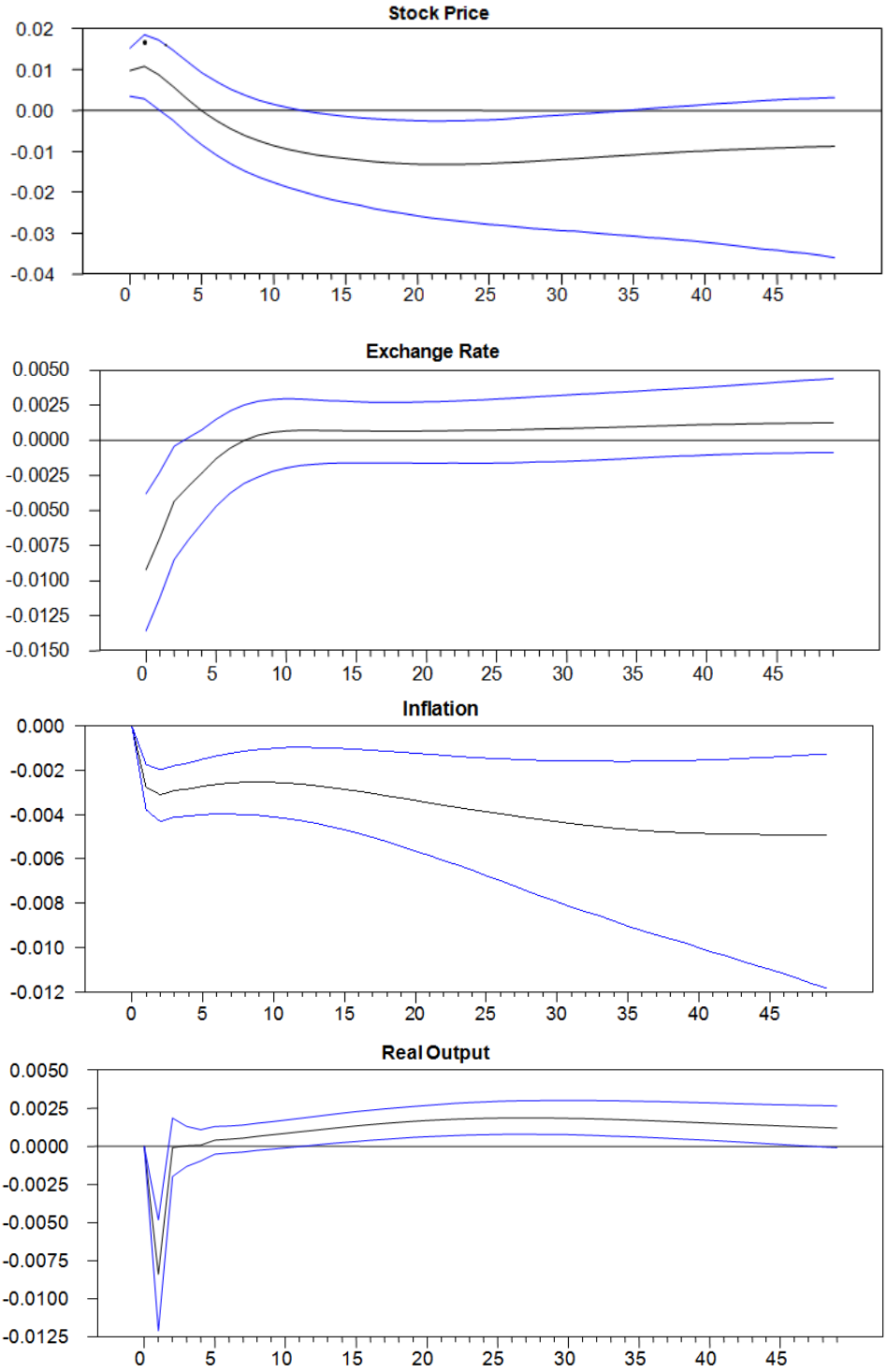


Figure 1. *Impulse Response to Monetary Policy Shock for Model 1 (Composite Stock Price Index)*

With so many studies on investigating in monetary policy shocks, the model has an appropriate behavior of the components of the model to domestic interest rate. The Impulse response functions for a domestic interest rate shock shown in Figure 1 reveals that many problems associated with identification of interest rate effects in a small open economy SVAR models are not present in the model. A rise in domestic interest rate generates a decline in domestic output and the real exchange rate (REER) appreciates. As the consequences of a decline in domestic output and the appreciation of the exchange rate, inflation rate falls. The inflation rate falls immediately after the increase in the domestic interest rate, the peak decline occurs 38 months after the shock. From this finding, the output puzzle, prize puzzle and the exchange rate puzzle do not exist in our model.

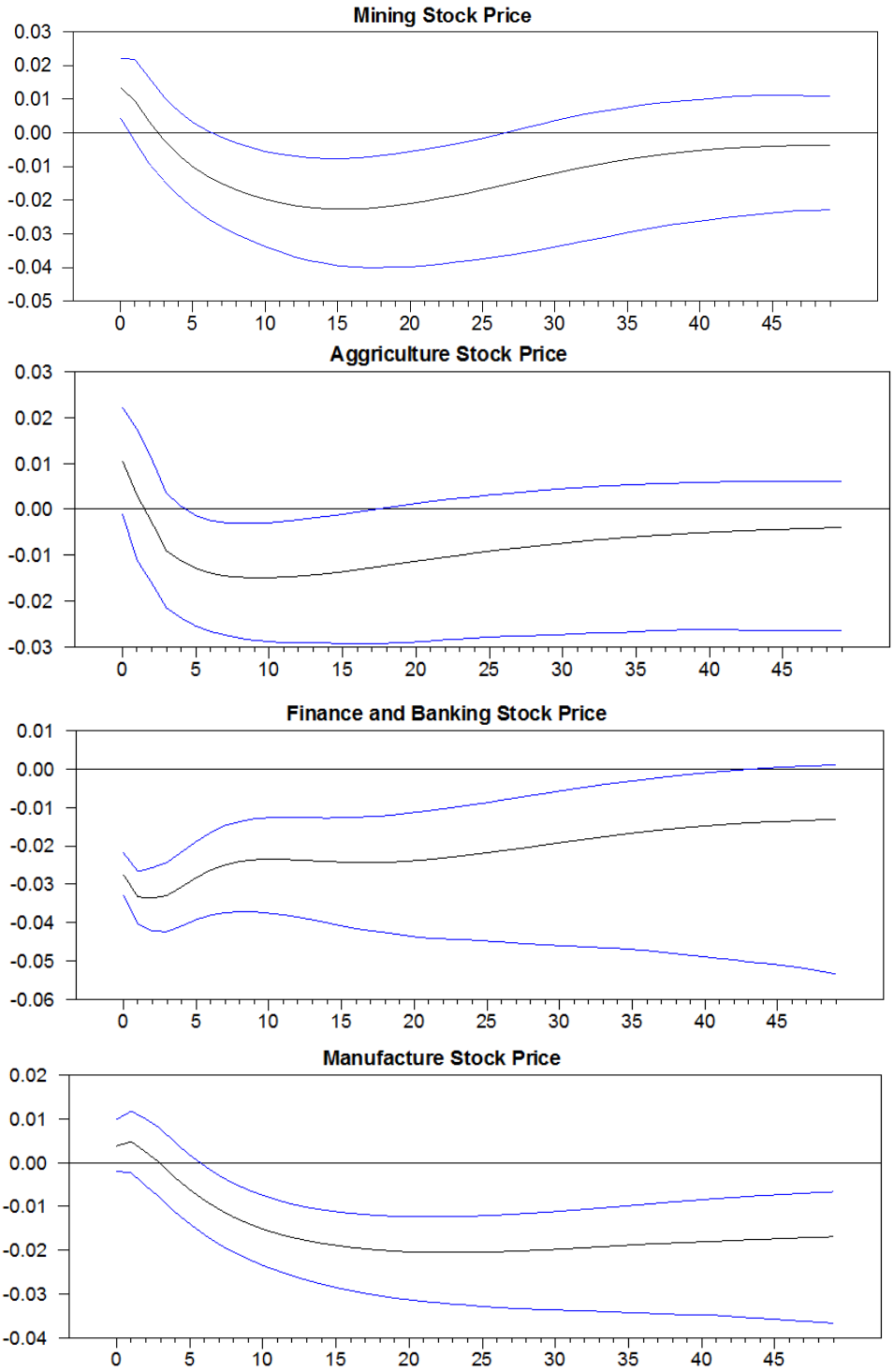


Figure 2. *Sector Stock Price Responses to Monetary Policy Shock*

In figure 3, our model also produces the responses the innovations of composite stock price. In response to a rise in stock price, the income increase immediately. This income response is consistent with a Tobin's q effect. The increase in income in turn will lead to create higher investment demand by firms and a wealth effect will lead to higher consumption demand by household.

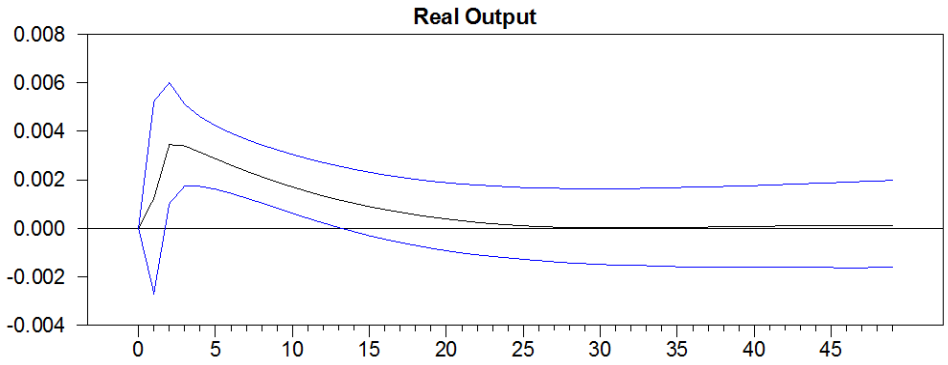
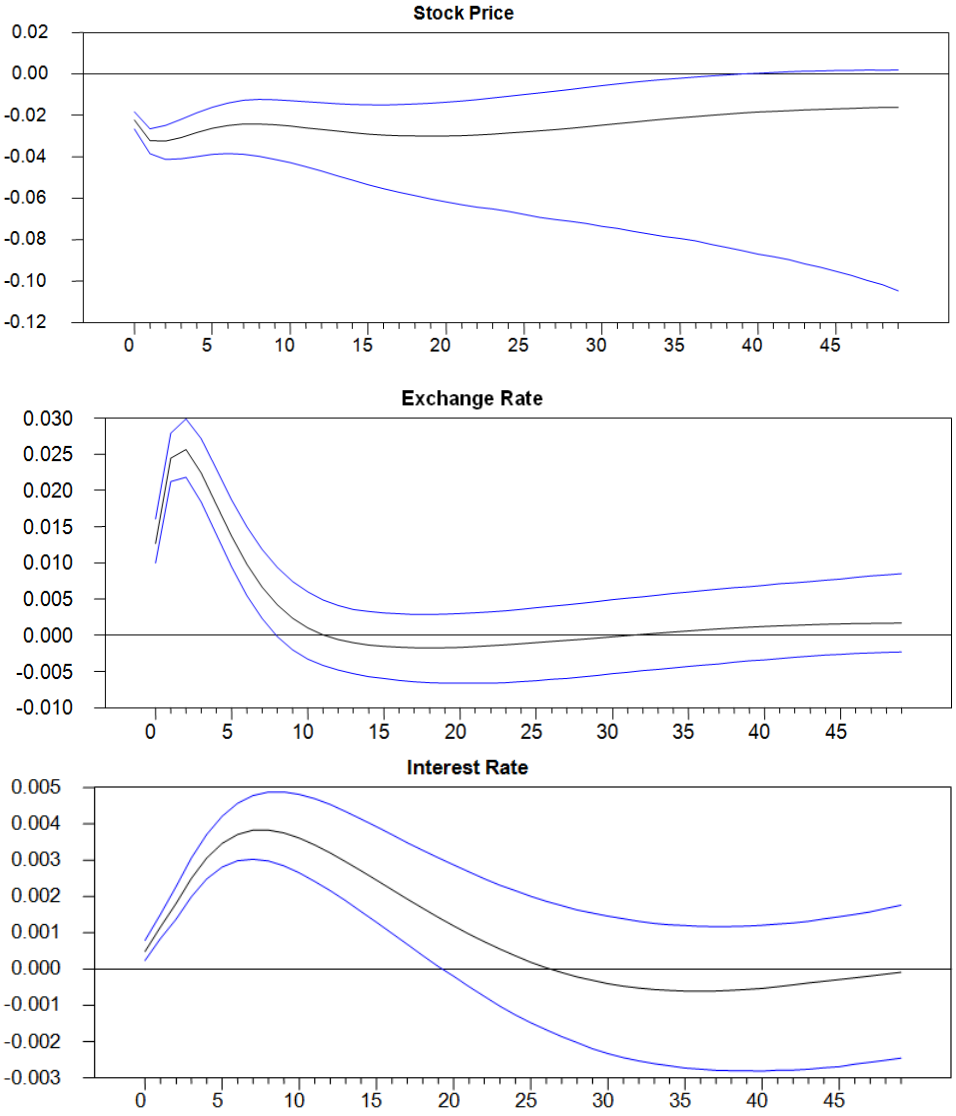


Figure 3. *Real Output Responses to Stock Price Shock*

4.2. The Effect of Fiscal Policy Shocks

In contrast to monetary policy shock, the stock market's response to one standard deviation increase in fiscal policy is similar since all models perform the similar pattern of initially response which all falls both composite stock price (see figure 4) and sectors stock price (figure 5). Looking at the reaction of stock price both composite and its sectors, the fiscal shock has a negative impact but it is less persistent. This finding is in line with the findings of Darrat (1990), Agnella and Sousa (2012), Afonso and Sousa (2011) which stated that there is a negative response of stock prices to fiscal policy shocks.



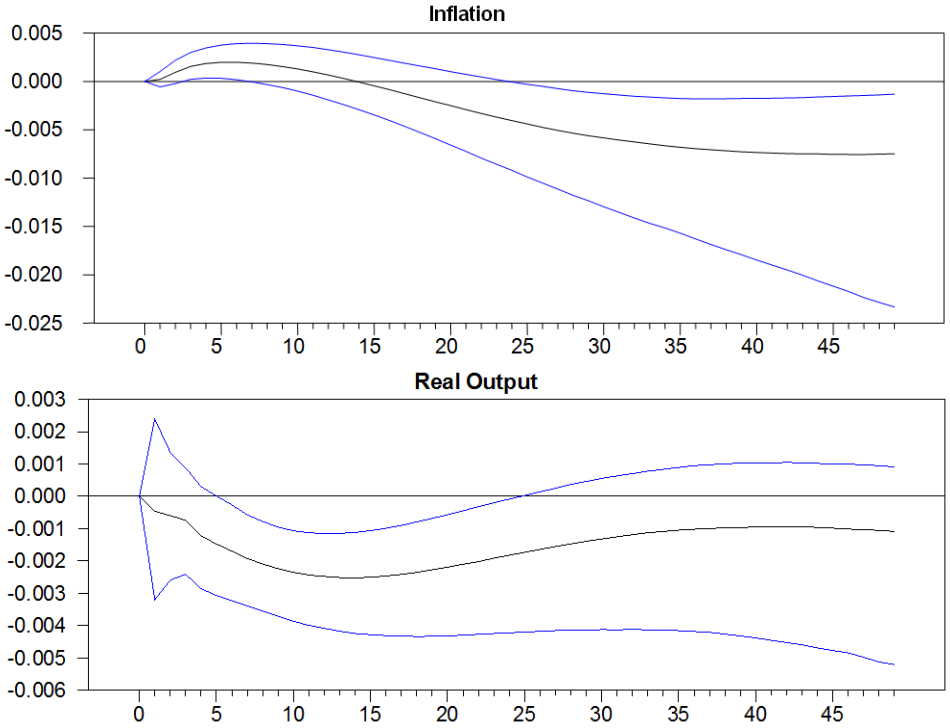
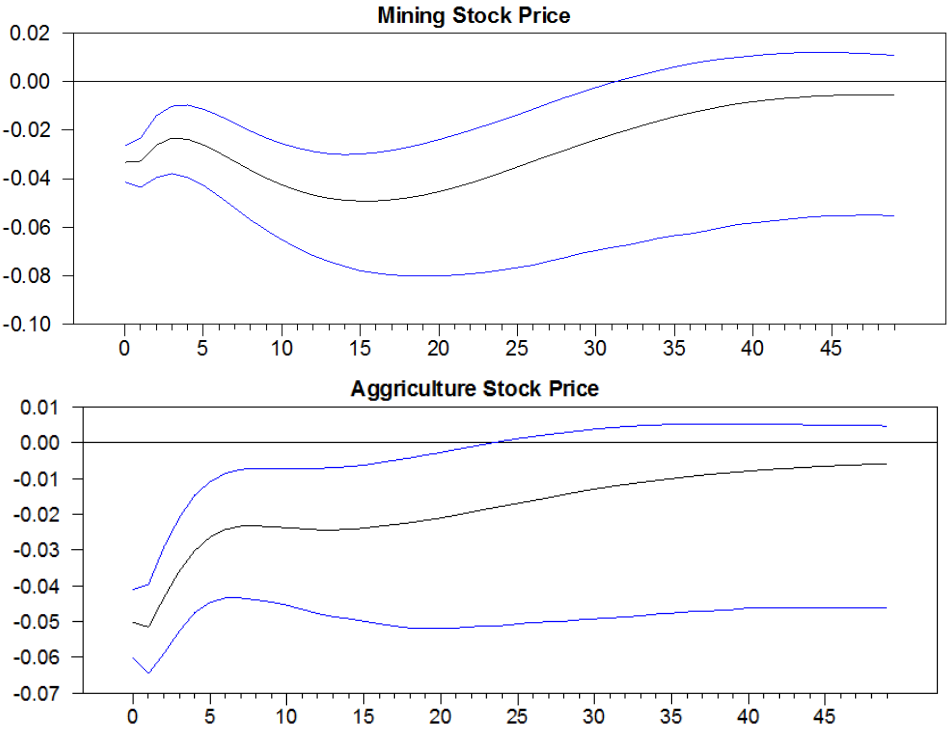


Figure 4. *Impulse Response to Fiscal Policy Shock for Model 1 (Composite Stock Price Index)*

In figure 4, the effect of fiscal policy shock on output is negative and this is in line with the study of Afonso and Sousa (2011), who also find a negative effect of government budget deficit on GDP. With reference to inflation, we have evidenced that they react positively to fiscal policy shock. This finding is also in line with the work of Perotti (2005).



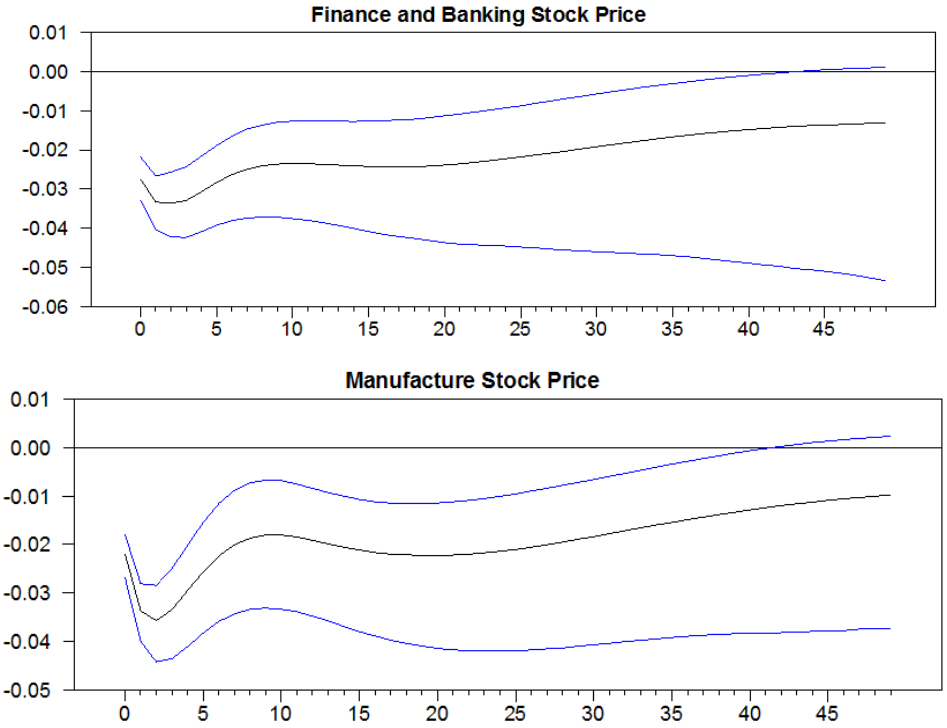


Figure 5. *Sectors Stock Price Response to Fiscal Policy Shock*

Response of interest rate seems to react positively to a fiscal shock. This reaction of the interest rate to fiscal policy is in the direction with the crowding out hypothesis. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. This is in line with the work of Gale and Orszag (2003), Afonso and Sousa (2011) and Handoyo et al., (2014) who argue that there are two important reasons for why budget deficits may raise interest rates. Firstly, public deficits reduce aggregate savings when private savings do not increase by the same amount and there are no compensating foreign capital inflows. Secondly, deficits increase the stock of government debt. Furthermore, the effect of government budget deficits on long-term interest rates and emphasizes the "crowding-out" hypothesis, whereby fiscal policy can negatively influence investment expenditures. After the fiscal shock occurs, the rise in the interest rates makes the stock market a less attractive place for the allocation of savings. As a consequence, share prices immediately fall. However, as the shock erodes, stock prices start recovering in anticipation of the expansionary effects of fiscal policy on output. We provide this evidence to prove that not only both policies are able to influence the stock price individually, but also the interaction between monetary and fiscal policy is important in explaining stock market performance. Below we will provide the model that excludes the fiscal variable to analyze the importance of both policies in affecting the stock market performance.

4.3. Does the Fiscal Policy Variable Matter?

Although our main focus of study is the SVAR model described in the previous sections, it is interesting to verify the importance of the fiscal policy variable in the previous model. In addition, this can add a significant value to the understanding of the stock market behavior. Hence, the short run restrictions are as follows.

$$\begin{bmatrix} \varepsilon_{LSP} \\ \varepsilon_{LXR} \\ \varepsilon_{R} \\ \varepsilon_{INF} \\ \varepsilon_{LY} \\ \varepsilon_{LOIL} \end{bmatrix} = \begin{bmatrix} 1 & A_{12} & A_{13} & A_{14} & A_{15} & A_{16} \\ A_{21} & 1 & A_{23} & A_{24} & A_{25} & A_{26} \\ 0 & A_{32} & 1 & A_{34} & 0 & A_{36} \\ 0 & 0 & 0 & 1 & A_{45} & A_{46} \\ 0 & 0 & 0 & 0 & 1 & A_{56} \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} x \begin{bmatrix} e_{LSP} \\ e_{LXR} \\ e_{R} \\ e_{INF} \\ e_{LY} \\ e_{LOIL} \end{bmatrix} \quad (5)$$

Focusing on the responses of all variables to monetary policy shocks, we expect important findings compare to our original model's findings which take into account the fiscal policy instrument. In the absence

of fiscal policy instrument (see fig. 6), interest rates do not seem to have the significant impact on stock market development and our study is in line with the study of Chatziantoniou, et al., (2013). Furthermore, contrary to the fiscal inclusion model, the fiscal exclusion model experiences the exchange rate puzzle. Comparing these results with the original model, we are able to suggest that the fiscal exclusion variables does not provide a better representation of the Indonesian stock market model. Hence, the incorporation of the fiscal policy variable has added to the insight value in determining the stock market behavior.

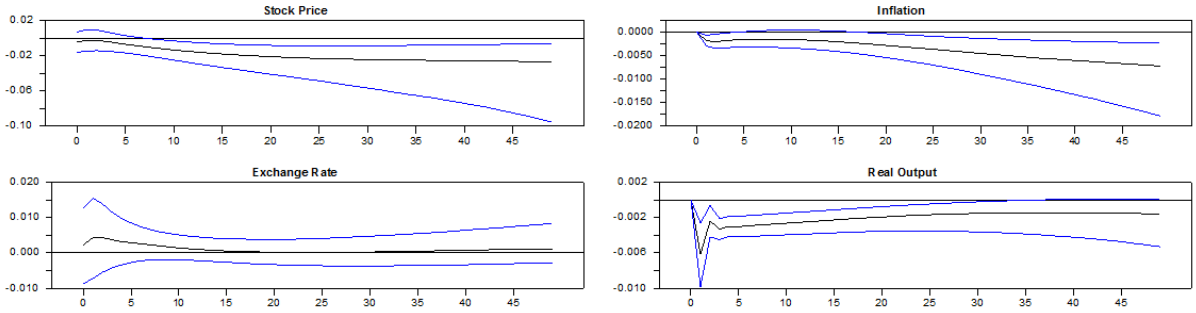


Figure 6. *Impulse Responses to Monetary policy Shocks for Fiscal Exclusion Model.*

5. Summary and Policy Recommendation

Our main conclusion is that the stock market responds positively to monetary policy shock on the short horizon although in medium and long horizon stock price will respond negatively. These delayed responses of stock prices suggest that stock prices adjust sluggishly to a monetary policy shock. From this empirical finding, it seems ineffective for the Bank Indonesia to intervene in the stock market on the short run. The monetary policy seems effective to influence the stock prices only on the Banking and finance sectors as suggested in the study. The change in stock market is not only affected by the monetary policy but also by the liberalization policy in the financial sector such as abolition of foreign exchange control, investment policies consistent with global economic development, free flow of foreign exchange, the development of technology in communications and trading systems, the introduction of innovative financial product, information availability, implementation of international accounting standard and the relaxation of foreign ownership. This generally supports the role of financial system in improving the economy. Continuing this liberalization policy in the future would seem beneficial for the economy as a whole.

In term of interaction between fiscal policy shock and stock market, we find that all sectors respond homogeneously in a negative relationship. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. The ineffectiveness of fiscal policy on stimulating the economy can be due to the fact that most of the government spending (30%-40%) is used to pay the interest and the principal of debt rather than to finance the public investment which take less than 10% of government spending. Hence, it is important for the government to increase its expenditure for the public goods, in particular for the infrastructure sector. This policy perhaps will improve the macroeconomic performance and the investors' confidence and eventually will increase the stock price.

In this study, we also prove that not only both monetary and fiscal policy are able to influence the stock price individually, but also the interaction between two policies is important in explaining stock market performance. Due to different focused objectives between the fiscal and monetary authorities under the inflation targeting framework, the coordination between two authorities are needed. In the absence of coordination, the government may fail to attain the objective of stable and non-inflationary economic growth.

As in other time series modeling, this study also has some limitations. First of all, this study covers the sample period from January 2001 to avoid the effect of 1998 economic crisis. Nevertheless, the sample period still covers the period of global financial crisis of 2008. Then there exists a structural break and one should treat it carefully and we do not take into account the structural break. Secondly, in developing the model of Indonesian stock market, the oil price is the only variable that represents the foreign variable. Many studies have taken into account other foreign variables such as world commodity price, US monetary policy, US output, US inflation and world energy price in constructing the stock market model in particular.

References

Afonso, A., Sousa, R.M., 2011. What are the effects of fiscal policy on asset markets? *Economic Modelling, 28*(4), pp. 1871-1890. doi: http://dx.doi.org/10.1016/j.econmod.2011.03.018

Afonso, A., Sousa, R.M., 2012. The macroeconomic effects of fiscal policy. *Applied Economics, 44*(34), pp. 4439-4454.

Agnello, L., Sousa, R.M., 2012. Fiscal policy and asset prices. *Bulletin of Economic Research*.

Bank Indonesia, 2012. http://www.bi.go.id (Accessed on January 29th , 2013)

BAPEPAM-LK, 2011. *Statistical Database. Indonesian Capital Market and Other Financial Institution Supervisory Agency* (BAPEPAM-LK), Indonesian Stock Exchange, http://www.idx.co.id (Accessed on January 29th , 2013)

BPS, 2012. *Statistical Database. Indonesian Statistics Bureau or Badan Pusat Statistik* (BPS). http://www.bps.go.id (Accessed on January 5th , 2013)

Binswanger, M., 2000. Stock market booms and real economic activity: Is this time different? *International Review of Economics & Finance, 9*(4), pp. 387-415.

Binswanger, M., 2001. Does the stock market still lead real activity?—an investigation for the g-7 countries. *Financial Markets and Portfolio Management, 15*(1), pp. 15-29.

Binswanger, M., 2004. How important are fundamentals?—evidence from a structural var model for the stock markets in the US, Japan and Europe. *Journal of International Financial Markets, Institutions and Money, 14*(2), pp. 185-201.

Bernanke, B.S., Kuttner, K.N., 2005. What explains the stock market's reaction to federal reserve policy? *The Journal of Finance, 60*(3), pp. 1221-1257.

Bouakez, H., Essid, B.O., Normandin, M., 2010. Stock returns and monetary policy: Are there any ties? *Cahier de recherche/Working Paper, 10*, pp. 26.

Bjørnland, H.C., Leitemo, K., 2009. Identifying the interdependence between us monetary policy and the stock market. *Journal of Monetary Economics, 56*(2), pp. 275-282.

Chatziantoniou I., Duffy D., Filis G., 2013. Stock market response to monetary and fiscal policy shocks: Multi-country evidence. *Economic Modelling*, 30(0), pp. 754-769. doi: http://dx.doi.org/10.1016/j.econmod.2012.10.005

Cheng, L., Jin, Y., 2013. Asset prices, monetary policy, and aggregate fluctuations: An empirical investigation. *Economics Letters, 119*(1), pp. 24-27.

Ioannidis, C., Kontonikas, A., 2008. The impact of monetary policy on stock prices. *Journal of Policy Modeling, 30*(1), pp. 33-53.

Darrat, A.F., 1990. Stock returns, money, and fiscal deficits. *Journal of Financial and Quantitative Analysis, 25*(03), pp. 387-398.

DGDMTD, 2012. *Statistical Database. Directorate General of Debt Management of Treasury Department*. http://www.djpu.kemenkeu.go.id (Accessed on February 5th , 2013)

Doan TA, 1992. RATS User's manual version 4. Estima. USA

Dungey, M., Fry, R., 2009. The identification of fiscal and monetary policy in a structural var. *Economic Modelling, 26*(6), pp. 1147-1160.

Enders, W., 1995. *Applied Econometric time series: Wiley series in probability and mathematical statistics*, John Wiley & Sons.

Eviews User Guide, 2007. Quantitative Micro Software, CA.

Gale, W, Orszag P.R., 2003. Economic effects of sustained budget deficits. *National Tax Journal*, 56(3).

Handoyo, R.D., Jusoh, M., Zaidi, M.A.S., 2014. Oil Price, Monetary and Fiscal Policy: Indonesia Evidence. *Proceeding - Kuala Lampur International Business, Economics and Law Conference*, Vol. 3, November 29-30, 2014, Kuala Lampur, Malaysia

Hermawan, D., Munro, A., 2008. Monetary-fiscal interaction in indonesia. *Journal on Bank for International Settlements, 272*.

Ioannidis, C., Kontonikas, A., 2008. The impact of monetary policy on stock prices. *Journal of Policy Modeling, 30*(1), pp. 33-53.

Jansen, D.W., Li, Q., Wang, Z., Yang, J. 2008. Fiscal policy and asset markets: A semiparametric analysis. *Journal of Econometrics, 147*(1), pp. 141-150.

Kim, S., Roubini, N., 2000. Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics, 45*(3), pp. 561-586.

Laopodis, N.T., 2009. Fiscal policy and stock market efficiency: Evidence for the united states. *The quarterly Review of Economics and finance, 49*(2), pp. 633-650.

Laeven, L, Tong, H., 2012. US monetary shocks and global stock prices. *Journal of Financial Intermediation*, pp. 530-547

Maćkowiak, B., 2006. What does the Bank of Japan do to East Asia? *Journal of International Economics*, 70(1), pp. 253-270.

Perotti, R., 2005. Estimating the effects of fiscal policy in OECD countries. Bocconi University, *IGIER Working Paper*. No. 276.

Piroli, G., Ciaian, P., Kancs, d.A., 2012. Land use change impacts of biofuels: Near-var evidence from the us. *Ecological Economics, 84*(0), pp. 98-109. doi: http://dx.doi.org/10.1016/j.ecolecon.2012.09.007

Pirovano, M. (2012). Monetary policy and stock prices in small open economies: Empirical evidence for the new eu member states. *Economic System*.,36(3), pp. 372-390

Praptiningsih, M., 2013. The Effect of Monetary Policy On MacroEconomic Stability And Stock Market: Evidence From Indonesia. *AU Journal of Management*, 9(1), pp. 13-22.

Sims, C.A., Zha, T., 1998. Bayesian methods for dynamic multivariate models. *International Economic Review, 39*(4), pp. 949-968. doi: 10.2307/2527347

Sims, C.A., Zha, T., 1999. Error bands for impulse responses. *Econometrica, 67*(5), pp. 1113-1155.

Sims, C.A., Zha, T,. 2006. Does monetary policy generate recessions? *Macroeconomic Dynamics, 10*(02), pp. 231-272.

Surjaningsih, Utari, Trisnanto, 2012. The Impact of Fiscal Policy on the Output and Inflation. *Bulletin of Monetary Economics and Banking*, 14(4), pp. 367-396.

Thorbecke, W., 1997. On stock market returns and monetary policy. *The Journal of Finance*, 52(2), pp. 635-654.

Waggoner, D.F., Zha, T., 2003. A Gibbs sampler for structural vector autoregressions. *Journal of Economic Dynamics and Control*, 28(2), pp. 349-366.

World Bank, 2012. *Statistical Database*. http:// www.indexmundi.com (Accessed on March 5th, 2013)

Zaidi, M.A.S., Fisher, L.A., 2010. Monetary Policy and Foreign Shocks: A SVAR Analysis for Malaysia. *Korean and The World Economy*, 11(3), pp.527-550.

Zaidi, M.S.A., Kariem Z.A., Azman-Saini, 2011. Relative price effects of monetary policy shock in Malaysia. *MPRA Paper* No. 38768, posted 13. May 2012 / 06:58. Online at http://mpra.ub.uni-muenchen.de/38768/

Zaidi, M.S.A., Karim, Z.A., 2012. Relative Importance of Singapore, US and Japanese Shocks on Malaysian Economy: An SVAR with Sign Restriction Analysis. *Paper presented at the Persidangan Kebangsaan Ekonomi Malaysia VII (PERKEM VII)*, Malaysia.

Expert Journal of Economics. Volume 3, Issue 2, pp. 127-135, 2015
 ISSN 2359-7704
http://Economics.ExpertJournals.com

Exchange Rate Volatility and Investment: A Panel Data Cointegration Approach

Ibrahima Amadou DIALLO*

University of Auvergne,
Centre d'Études et de Recherches sur le Développement International (CERDI), France

This paper examines the link between real exchange rate volatility and domestic investment by using panel data cointegration techniques. We study the empirical connection between real effective exchange rate volatility and investment for 51 developing countries (23 low-income and 28 middle-income countries). The theoretical relationship between investment and real exchange rate volatility predicts that the effects of exchange rate uncertainty on profits are ambiguous. The empirical results illustrate that real effective exchange rate volatility has a strong negative impact on investment. This outcome is robust in low income and middle income countries, and by using an alternative measurement of exchange rate volatility.

Keywords: *exchange rate volatility, investment, appreciation, depreciation, panel data cointegration, capacity principle*

JEL Classification: *O11, O16, O19, O57*

1. Introduction

Multiples efforts have been deployed by governments and international organizations to maintain a stable macroeconomic environment in developing countries but, unfortunately, instability still remains one of their greatest economic problems.

The theoretical link investment-exchange rate volatility has been the subject of many studies. (Campa and Goldberg, 1995) model predicts that the effects of exchange rate uncertainty on profits are ambiguous. Increases in exchange rate augment expected profit if the firm exports more than it imports and lower expected profit in the opposite case. (Goldberg, 1993), using a duality theory, and (Darby et al., 1999) an adapted model of (Dixit and Pindyck, 1994), found the same threshold effects of exchange rate uncertainty on investment.

Empirical investigations of the relation between exchange rate volatility and investment in developing countries use, in general, OLS, Two-Stage Least Squares, Fixed effects, GMM and system GMM. A significant

* Corresponding Author:
Ibrahima Amadou Diallo, University of Auvergne, Centre d'Études et de Recherches sur le Développement International (CERDI), 65, bd François Mitterrand, 63000 Clermont-Ferrand, France

Article History:
Received 16 April 2015 | Accepted 20 May 2015 | Available Online 30 May 2015

Cite Reference:
Diallo, I.A., 2015. Exchange Rate Volatility and Investment: A Panel Data Cointegration Approach. *Expert Journal of Economics*, 3(2), pp.127-135

Acknowledgements:
The author thanks Richard Schiere and Omgba Luc Désiré for their helpful comments and suggestions on an earlier draft. He also thanks the FERDI (Fondation pour les Études et Recherches sur le Développement International) for generous financial support. All comments are welcome. Errors and inaccuracies are mine.

negative impact of exchange rate volatility on investment is reported by the major part of the studies (Serven, 1998, Bleaney and Greenaway, 2001, and Serven, 2002). The impact of exchange rate instability on investment is nonlinear. (Serven, 2002) illustrates that the effect is large when, firstly, volatility is high and secondly, when there is large trade openness combined with low financial development. Contrary, in an environment with low openness and high financial development, exchange rate volatility tends to act positively on investment. Furthermore, (Guillaumont et al., 1999) find that "primary" instabilities (climatic, terms of trade and political instabilities) act on Africa growth through the negative effect that "intermediate" instabilities (instability of real exchange rate and instability of the rate of investment) exert on growth.

This paper fits in these researches of the link between investment and real exchange rate volatility. But it distinguishes itself in the following way. We apply panel data cointegration techniques to study the empirical relation between investment and exchange rate volatility for 51 developing countries (23 low-income and 28 middle-income countries presented in Appendix 1, note that countries and time period selection depend on the availability of data). There are some previous studies which employ microeconomic panel data methods (Fixed Effects, GMM, etc.) on annual data with a relatively long period. But given the existence of potential unit roots in variables, these estimations could be seriously affected by spurious regressions effects (See Kao, 1999 for further details on spurious regressions in panel data). This is why we think using panel data cointegration methods is more appropriate. For this study we use the original Program of Pedroni (1999) converted in RATS Procedure by Estima Corporation. Kao and Chiang (2000) have put together a set of GAUSS subroutines called NPT, for studying nonstationary panel data (Available online at: http://www.maxwell.syr.edu/maxpages/faculty/cdkao/working/npt.html). The latest version of Eviews (Eviews 8) also provides many tests on panel data cointegration. I have also introduced a new User-Written Stata command named **"xtdolshm"** which performs Dynamic Ordinary Least Squares for Cointegrated Panel Data with homogeneous covariance structure (Kao and Chiang, 2000).

The application of panel data cointegration techniques has several advantages. Initially, annual data enable us not to lose information contrary to the method of averages over sub-periods. Then, the addition of the cross sectional dimension makes that statistical tests are normally distributed, more powerful and do not depend on the number of regressors in the estimation as in individual time series. Among the panel data cointegration techniques, we utilize (Pedroni, 1999) *Fully Modified Ordinary Least Squares* (FMOLS) estimator which deals with possible autocorrelation and heteroskedasticity of the residuals, takes into account the presence of nuisance parameters, is asymptotically unbiased and, more importantly, deals with potential endogeneity of regressors. The results demonstrates firstly, that exchange rate volatility has a strong negative impact on investment, secondly, the effect of REER volatility is higher in countries which rely heavily on imports. Furthermore, robustness checks shows that this negative impact of REER volatility on investment is stable to the use of an alternative measurement of REER volatility and on subsamples of countries (low-income and middle-income developing countries).

The remaining of the paper is organized as follow: section 2 gives the estimation methods, section 3 presents the data and variables, section 4 provides the results of the study and the last part concludes.

2. Estimation Methods

Since our data base is composed of annually data going from 1975 to 2004, we run panel data unit root tests on all variables. Table 1 shows that among the five unit root tests, there exist at least one which tells us that each variable is non-stationary and I(1).

This outcome led us to apply recent panel data cointegration techniques to estimate a model of the form

$$\frac{I_{it}}{K_{it-1}} = \gamma EV_{it} + \beta' X_{it} + \alpha_i + \varepsilon_{it} \qquad (1)$$

Where $\frac{I_{it}}{K_{it-1}}$ is investment I_{it} over lagged capital stock K_{it-1}, EV_{it} the exchange rate volatility, X_{it} all other explanatory variables, α_i country individual specific effects, and ε_{it} the idiosyncratic error. i specifies countries and t the time. To estimate equation (1), we use the FMOLS *(Fully Modified Ordinary Least Squares)* estimator developed in panel data context by (Pedroni, 1996) and (Phillips and Moon, 1999).

This estimator was initially introduced in time series context by (Phillips and Hansen, 1990). The advantage of the FMOLS estimator over the OLS estimator (which is super-consistent but is asymptotically biased and is function of nuisance parameters; Kao and Chen, 1995, 2000; Pedroni, 1996). is that it deals with possible autocorrelation and heteroskedasticity of the residuals, potential endogeneity of the regressors, takes

into account the presence of nuisance parameters and is asymptotically unbiased (A good survey on recent panel data cointegration is provided by Baltagi and Kao, 2000 and Hurlin and Mignon, 2006*)*. Other estimators used for estimations and inferences in panel data cointegration are the DOLS *(Dynamic Ordinary Least Squares)*, (Kao and Chiang, 2000), (Mark and Sul, 1999), (Pedroni, 2001), PMGE *(Pooled Mean Group Estimator)*, (Pesaran et al. 1999), and the vector error-correction representation, (Breitung, 2005), (Mark and Sul, 2003). (Pedroni, 1996) and (Phillips and Moon, 1999) showed that the FMOLS estimator is normally distributed. Analogous results were also obtained by (Kao and Chiang, 2000) for the methods FMOLS and DOLS.

The use of panel data cointegration techniques in estimating equation (1) has several advantages. Initially, annual data enable us not to lose information contrary to the method of averages over sub-periods employed in some previous studies. Then, the additions of the cross sectional dimension makes that statistical tests are normally distributed, more powerful and do not depend on the number of regressors as in individual time series.

To test the presence of cointegration in equation (1), we utilize (Pedroni, 1999) tests. To explain the tests procedure, we rewrite equation (1) in the following manner

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1,it} + \beta_{2i} x_{2,it} + \ldots + \beta_{Mi} x_{M,it} + \varepsilon_{it} \qquad (2)$$

Where δ_i are time specific effects, $i=1,\ldots,N$, $t=1,\ldots,T$ and $m=1,\ldots,$M. (Pedroni, 1999) compute four within tests and three between tests. If we write the residuals in equation (2) as an *AR(1)* process $\hat{\varepsilon}_{it} = \rho_i \hat{\varepsilon}_{it-1} + u_{it}$ the alternatives hypothesis for the tests are formulated in the following manner

- For within tests, the alternative hypothesis is $H_A : \rho_i = \rho < 1 \quad \forall i$
- For between tests, the alternative hypothesis is $H_A : \rho_i < 1 \quad \forall i$

We have seven (4 within and 3 between) tests in (Pedroni, 1999). See that paper for more details.

Table 1. *Panel unit root tests*

Variables	Levin, Lin and Chu t	Breitung t-stat	Im, Pesaran and Shin W-stat	Maddala Wu		Hadri Z-stat
				ADF - Fisher Chi-square	PP - Fisher Chi-square	
Investment, t / Capital stock, t-1	1.2975	0.3458	-1.9590	116.8340	139.6890	9.7625
	(0.9028)	(0.6352)	(0.0251)	(0.1496)	(0.0079	(0.0000)
GDP, t / Capital stock, t-1	3.3161	0.8132	0.4463	93.9174	104.5540	12.0348
	(0.9995)	(0.7919)	(0.6723)	(0.7035)	(0.4114)	(0.0000)
REER volatility 1, t	3.4882	-1.2381	-1.1465	122.8660	3021.0700	6.6479
	(0.9998)	(0.1078)	(0.1258)	(0.0781)	(0.0000)	(0.0000)
Real interest rate, t	-1.5507	-3.5656	-2.9037	94.2369	658.1490	13.4941
	(0.0605)	(0.0002)	(0.0018)	(0.3592)	(0.0000)	(0.0000)
Investment deflator, t / GDP deflator, t	-0.2080	-0.6727	-1.5745	108.5020	188.7280	6.5644
	(0.4176)	(0.2506)	(0.0577)	(0.3112)	(0.0000)	(0.0000)
Long term debt, t / GDP, t	1.6168	-3.0040	2.2875	69.1210	59.2335	9.8184
	(0.9470)	(0.0013)	(0.9889)	(0.9948)	(0.9998)	(0.0000)
ln(1+Inflation), t	1.8531	-2.9731	-2.4724	134.8430	782.8750	8.6758
	(0.9681)	(0.0015)	(0.0067)	(0.0163)	(0.0000)	(0.0000)
REER volatility 1, t × Imports of GS, t	-0.6414	-0.5348	-0.9650	103.9010	1136.6900	6.9685
	(0.2606)	(0.2964)	(0.1673)	(0.4290)	(0.0000)	(0.0000)
Terms of trade, t	2.02646	1.2532	-3.5582	188.3260	211.3420	7.5547
	(0.9786)	(0.8949)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
REER Volatility 2, t	2.5109	-0.5354	-2.7373	133.3530	2501.2300	7.6559
	(0.9940)	(0.2962)	(0.0031)	(0.0202)	(0.0000)	(0.0000)
REER volatility 1, t × Exports of GS, t	0.3174	-1.0508	-0.1375	98.9928	931.1110	8.2079
	(0.6245)	(0.1467)	(0.4453)	(0.5659)	(0.0000)	(0.0000)

Note: The p-values are in parenthesis. All tests include intercepts (fixed effects) and individual trends. For the autocorrelation correction methods, the specified lags are 3 or 4 and Newey-West bandwidth selection using either Barlett, Parzen or Quadratic Spectral kernel depending on the variable and the test type

Source: Author's Calculations

3. Data and Variables

To study the effect of volatility on investment, we utilize annually data from 1975 to 2004 of 51 developing countries (23 low-income and 28 middle-income countries). The choice of the sample is based on the availability of data. The data are from World Development Indicators (WDI) 2006, International Financial Statistics (IFS), April, 2006 and CERDI 2006. The REER is calculated in foreign-currency terms meaning that an increase of the REER indicates an appreciation and, hence a potential loss of competitiveness. A decrease is considered as a depreciation.

After calculating the exchange rate, we compute as in (Serven, 1998; Serven, 2002) and (Bleaney and Greenaway, 2001) real exchange rate volatility using ARCH family methods. We proceed as such because many ARCH family methods can take account asymmetric chocks effects. We employ two ARCH-Family methods: GARCH (Generalized Autoregressive Conditional Heteroskedasticity), (Bollersev, 1986), and GARCH-M (GARCH-in-Mean), (Engle et al., 1987). The former specification implies symmetric effect of innovations while the second assumes asymmetric impact of good and bad news. The two estimated models, for each country of the sample, are

GARCH(1,1)

$$\begin{aligned} \ln(REER_t) - \ln(REER_{t-1}) &= \beta_0 + \varepsilon_t \\ \sigma_t^2 &= \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \delta_1 \sigma_{t-1}^2 \end{aligned} \tag{3}$$

GARCH-M(1,1)

$$\begin{aligned} \ln(REER_t) - \ln(REER_{t-1}) &= \beta_0 + \psi \sigma_t^2 + \varepsilon_t \\ \sigma_t^2 &= \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \delta_1 \sigma_{t-1}^2 \end{aligned} \tag{4}$$

Where $\varepsilon_t \sim N\left(0, \sigma_t^2\right)$, ε_t^2 is the squared residuals, σ_t^2 the variance of the regression model's disturbances, γ_0 and γ_1 the ARCH parameters, δ_1 the GARCH parameter and ψ the GARCH-M parameter. We compute the exchange rate volatility as the square root of the conditional variance of the regression. In the paper, the GARCH(1,1) measure of exchange rate volatility is referred to as *REER volatility 1, t* and the GARCH-M(1,1) measure as *REER volatility 2, t (*The weights used to generate the REER, from which these two measurements come, are respectively: general trade including oil countries, general trade without oil countries).

As dependent variable, we use the ratio of actual investment over lagged capital stock (computed by the perpetual-inventory method). Formulating investment this way is known as capacity principle, (Chenery, 1952). Other formulations close to this are the capital stock adjustment principle, (Goodwin, 1951) and the flexible accelerator, (Koyck, 1954). Traditional determinants of investment are considered as control variables: GDP over lagged capital stock, real interest rate, user cost of capital (investment deflator over GDP deflator), inflation, long term debt and the terms of trade. Table 2 gives summary statistics on all variables.

Table 2. *Summary statistics on variables*

Variables	Observations	Mean	Std. Dev.	Min	Max
Investment, t / Capital stock, t-1	1472	0.0725	0.0296	-0.0050	0.1994
GDP, t / Capital stock, t-1	1475	0.3599	0.1928	0.0584	1.6920
Real interest rate, t	1087	0.0767	0.2799	-0.9781	7.8980
Investment deflator, t / GDP deflator, t	1523	1.0586	0.3474	0.1198	3.4958
REER volatility 1, t	1499	0.1323	0.2534	0.0000	6.8452
REER volatility 1, t × Imports of GS, t	1498	0.0437	0.1409	0.0000	4.4626
ln(1+Inflation), t	1530	0.1733	0.3717	-0.2763	4.7749
Long term debt, t / GDP, t	1517	0.6140	0.6023	0.0233	8.2349
Terms of trade, t	1518	1.0853	0.3759	0.3213	6.0800
REER volatility 2, t	1499	0.1213	0.1364	0.0000	2.2887

REER volatility 1, t × Exports of GS, t	1498	0.0338	0.0698	0.0000	2.2272

Source: Author's Calculations

4. Estimation Results

In this section, we describe first the panel data cointegration tests and second present the estimation results.

Table 3 illustrates that among the seven tests of (Pedroni, 1999), there is at least one that shows that we reject the null hypothesis of no cointegration in all 5 equations (See Table 4 for a list of these equations). This allows us to estimate the panel data cointegration relationships.

As mentioned earlier, panel data cointegration estimators, in particular the FMOLS, deal with possible autocorrelation and heteroskedasticity of the residuals, takes into account the presence of nuisance parameters, are asymptotically unbiased and, more importantly, deal with potential endogeneity of the regressors. Table 4 present the results of (Pedroni, 1999) panel data cointegration estimation results.

All five equations illustrates that the real exchange rate volatility is statistically significant and has the expected sign. Regression 1 represents the *capacity principle* model in which we add the real exchange rate volatility. In this model, the REER volatility is negative and marginally significant. The coefficient increases in magnitude and statistical significance when we control for traditional investment determinants, beginning from regression 2. These regressions show that the impact of REER volatility is high. Referring to regression 2, an increase in REER volatility by one standard deviation reduces the ratio of investment to lagged capital stock by an amount approximately equivalent to eight standard deviations. If we take regression 5, the impact become higher because an increase of REER volatility equal to the its interquartile range make the ratio of investment to lagged capital pass from the ninetieth percentile to approximately the tenth percentile, a drop higher than the interquartile range. The absolute value of REER volatility coefficient diminish by more than a half when we introduce long term debt in regression 4, suggesting that the effect of volatility on investment may pass through long term debt. The coefficient of actual GDP over lagged capital stock is positive and highly significant in all regressions. This is in line with (Chenery, 1952) capacity principle which state that an augmentation in capacity usage rise investment. The real interest rate and the user cost of capital have the expected signs and are, generally, statistically significant. Meaning that large costs of capital reduce investment. The other remaining variables have the expected signs and are, generally, statistically significant.

Table 5 presents the results of the interaction of the real exchange rate volatility with the variable imports, in the first place, and with the variable exports, in the second place.

In all four regressions, the REER volatility coefficient is negative and significant at 1 percent level. The interaction of REER volatility with imports of goods and services is negative, statistically significant with a high coefficient in absolute value in all first three equations. This suggests that the effect of REER volatility is higher in countries which rely heavily on imports. This outcome corroborates the theoretical predictions cited in the introduction. In regression 4, the interaction of REER volatility with exports of goods and services has the expected sign. This result implies that, the more an economy exports, the less exchange rate volatility has negative impact on investment. The export threshold for which the marginal impact of REER volatility on investment is nil is 2.54. This value is out of range of exports of goods and services in the sample (The minimum of export of goods and services over GDP is 0.0290 and the maximum 1.2441). Then in our sample, we could consider that the effect of REER volatility on investment is negative in regression 4.

Table 6 gives an estimation using an alternative measurement of REER volatility. It also provides regressions on subsamples of low-income and middle-income countries.

As mentioned, the alternative measurement of REER volatility, the GARCH-M(1,1), takes into account asymmetric effects of innovations. Regression 1 in Table 6 shows that the impact of the GARCH-M(1,1) measurement is significant and very high. This demonstrates that if we take account asymmetric effects, volatility can have a strong negative impact on investment. The coefficients of the REER volatility for regressions on the subsamples of countries are significant and have the expected signs. The absolute value of the coefficient of the REER volatility for low-income countries is larger than that of middle-income countries. Thus the effect of exchange rate volatility on investment is higher in low-income countries than in middle-income countries. This is the case because low income countries are more vulnerable to shocks.

Table 3. *Panel data cointegration tests*

Pedroni Panel Cointegration Tests		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Panel Cointegration tests	**panel v-stat**	-0.2949	-2.6656	-2.9809	-3.1164	-3.6536
	panel rho-stat	0.4283	4.1791	4.9366	4.8765	6.5996
	panel pp-stat	-3.1529	-2.1764	-3.9206	-3.0677	-2.9631
	panel adf-stat	-2.4911	2.0490	5.6660	-0.4804	0.3043
Group mean cointegration tests	**group rho-stat**	2.5166	7.3718	8.1990	8.2804	9.6908
	group pp-stat	-1.9672	-1.6667	-4.2611	-2.9673	-4.6715
	group adf-stat	-1.4405	0.3701	1.9417	0.5910	2.8247

Note: All reported values are distributed N(0,1) under null of no cointegration

Source: Author's Calculations

Table 4. *Panel data cointegration estimation results. Dependent Variable: Investment, t / Capital stock, t-1*

Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
GDP, t / Capital stock, t-1	0.2361***	0.1391***	0.2217***	0.2194***	0.3585***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Real interest rate, t		-0.0121*	-0.1675	-0.0170***	-0.5345***
		(0.0778)	(0.1575)	(0.0006)	(0.0000)
Investment deflator, t / GDP deflator, t		-0.0506***	-0.0663***	-0.0257***	-0.0611***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
REER volatility 1, t	-0.0213*	-0.9431***	-0.7822***	-0.3318***	-1.0195***
	(0.0595)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ln(1+Inflation), t			-0.1615		-0.6314***
			(0.1989)		(0.0000)
Long term debt, t / GDP, t				-0.0987***	
				(0.0000)	
Terms of trade, t					0.0695***
					(0.0000)

Source: Author's Calculations

Note: ***, ** and * significant at 1%, 5% and 10% respectively. P-values in brackets

Table 5. *Exchange rate volatility pass-through. Dependent Variable: Investment, t / Capital stock, t-1*

Regressors	**(1)**	**(2)**	**(3)**	**(4)**
GDP, t / Capital stock, t-1	0.2459***	0.2929***	0.2933***	0.3043***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
REER volatility 1, t	-1.4319***	-0.9161***	-1.3506***	-0.5971***
	(0.0016)	(0.0042)	(0.0045)	(0.0049)
Imports of GS, t	0.3553	0.3565***	0.3242***	
	(0.1328)	(0.0013)	(0.0005)	
REER volatility 1, t × Imports of GS, t	-0.1067***	-0.4744***	-0.1905***	
	(0.0033)	(0.0044)	(0.0023)	
Terms of trade, t	0.0254***		0.0128***	
	(0.0000)		(0.0000)	
Investment deflator, t / GDP deflator, t		-0.0525***	-0.0498***	-0.0421***
		(0.0000)	(0.0000)	(0.0000)
ln(1+Inflation), t		0.0073	0.0066	0.0118
		(0.4298)	(0.3045)	(0.1891)
Exports of GS, t				0.0115**
				(0.0220)
REER volatility 1, t × Exports of GS, t				0.2349**
				(0.0117)

Source: Author's Calculations

Note: ***, ** and * significant at 1%, 5% and 10% respectively. P-values in brackets

Table 6. *Estimation results using an alternative measurement of real effective exchange rate volatility and on sub-samples of countries. Dependent Variable: Investment, t / Capital stock, t-1*

	Full sample	**Middle-Income Countries**	**Low-Income Countries**
Regressors	(2)	(2)	(5)
GDP, t / Capital stock, t-1	0.4308***	0.3096***	0.4067***
	(0.0000)	(0.0000)	(0.0000)
Real interest rate, t	-0.0119***	-0.0411***	-1.2375***
	(0.0000)	(0.0000)	(0.0000)
Investment deflator, t / GDP deflator, t	-0.0827***	-0.0463***	-0.1172***
	(0.0000)	(0.0000)	(0.0000)
REER volatility 1, t		-0.0489***	-1.8454***
		(0.0040)	(0.0000)
REER volatility 2, t	-7.7435***		
	(0.0000)		
ln(1+Inflation), t			-1.3942***
			(0.0000)
Terms of trade, t			0.0578***
			(0.0000)

Source: Author's Calculations

Note: ***, ** and * significant at 1%, 5% and 10% respectively. P-values in brackets

5. Conclusion

This paper examines the relationship between REER volatility and investment empirically. The theory indicates that exchange rate volatility have nonlinear effects on investment. Using new developments on panel data cointegration techniques, we find that real exchange rate volatility has a strong negative impact of investment. An increase in REER volatility by one standard deviation reduces the ratio of investment to lagged capital stock by an amount approximately equivalent to eight standard deviations. The robustness checks illustrates that this negative impact of REER volatility on investment is stable to the use of an alternative measurement of REER volatility and on subsamples of countries (low-income and high-income countries).

Though the results found were informative, some caveats remain. If data on both public and private investment are available, some regressions on these two variables would allow us to compare the effects of REER between these two variables and domestic investment. Some studies on structural change in the context of panel cointegration could also provide helpful information on the impact of REER volatility on investment.

From economic policy perspectives, the results illustrate that macroeconomic instability, in particular exchange rate volatility could have negative impacts on investment and that efforts made to reduce them might revive investment and productivity.

References

Baltagi, B. H. and Kao C., 2000. Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey, in *Advances in Econometrics 15*. Edited by Baltagi, B., and Kao C., pp.7-51, Elsevier Science.

Bleaney, M. and Greenaway D., 2001. The impact of terms of trade and real exchange rate volatility on investment and growth in Sub-Saharan Africa. *Journal of Development Economics 65*, pp. 491-500.

Bollersev, T., 1986. Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics 31*, pp. 307-327.

Breitung, J., 2005. A parametric approach to the estimation of cointegrating vectors in panel data. *Econometric Reviews 24*, pp. 151-173.

Campa, J. and Goldberg L. S., 1995. Investment in manufacturing, exchange rates and external exposure. *Journal of International Economics 38*, pp. 297-320.

Chenery, H. B., 1952. Overcapacity and the acceleration principle. *Econometrica* 20, pp. 1-28.

Darby, J., Hallett A. H., Ireland J. and Piscitelli L., 1999. The impact of exchange rate uncertainty on the level of investment. *The Economic Journal 109(454),* pp. C55-C67.

Dixit, A. and Pindyck R., 1994. *Investment under uncertainty*. Princeton University Press, Rinceton, N.J.

Engle, R. F., Lilien D. M. and Robins R. P., 1987. Estimating time varying risk premia in the term structure: the arch-m model. *Econometrica 55*, pp. 391-407.

Goldberg, S. L., 1993. Exchange rates and investment in United States industry. *The Review of Economics and Statistics 75(4)*, pp.575-588.

Goodwin, R., 1951. The nonlinear accelerator and the persistence of business cycles. *Econometrica 19*, pp. 1-17.

Guillaumont, P., Guillaumont-Jeanneney S., and Brun J. F, 1999. How instability lowers African growth. *Journal of African Economies 8(1)*, pp. 87-107.

Hurlin, C. and Mignon V., 2006. Une Synthèse des Tests de Cointégration sur Données de Panel. *Working Paper from LEO, Université d'Orléans.*

Kao, C. and Chen B., 1995. On the estimation and inference for cointegration in panel data when the cross section and time series dimensions are comparable. *Manuscript, Center for Policy Research, Syracuse University, New York.*

Kao, C. and Chiang M. H, 2000. On the estimation and inference of a cointegrated regression in panel data. *Advances in Econometrics 15*.

Kao, C., 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics 90*, pp. 1-44.

Koyck, L., 1954. *Distributed lags and Investment Analysis*. North Holland Publishing Company, Amsterdam.

Mark, N. and Sul D., 1999. A computationally simple cointegration vector estimator for panel data. *Manuscript, Ohio State University.*

Mark, N. and Sul D., 2003. Cointegration vector estimation by panel DOLS and long-run money demand. *Oxford Bulletin of Economics and Statistics 65*, pp. 655-680.

Pedroni, P., 1996. Fully modified OLS for heterogeneous panels and the case of purchasing power parity. *Working Paper in Economics Indiana University.*

Pedroni, P., 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics 61*, pp. 653-678.

Pedroni, P., 2001. Purchasing power parity tests in cointegrated panels. *Review of Economics and Statistics 83*, pp. 727-731.

Pesaran, H., Shin Y. and Smith R., 1999. Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association 94*, pp. 621-634.

Phillips, P. C. B. and Hansen B. E., 1990. Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies 57*, pp. 99-125.

Phillips, P. C. B. and Moon H., 1999. Linear regression limit theory for nonstationary panel data. *Econometrica 67*, pp. 1057-1111.

Serven, L., 1998. Macroeconomic uncertainty and private investment in LDCs: an empirical investigation. *World Bank Policy Research Working Paper 2035.*

Serven, L., 2002. Real exchange rate uncertainty and private investment in developing countries. *World Bank Policy Research Working Paper 2823.*

Appendix

Appendix 1. *List of 51 countries*

Low Income countries				**Middle Income countries**	
N°	**Word Bank Code**	**Countries**	**N°**	**Word Bank Code**	**Countries**
1	BDI	Burundi	**1**	ARG	Argentina
2	BEN	Benin	**2**	BOL	Bolivia
3	BFA	Burkina Faso	**3**	CHL	Chile
4	BGD	Bangladesh	**4**	CHN	China
5	CIV	Cote d'Ivoire	**5**	COL	Colombia
6	CMR	Cameroon	**6**	CRI	Costa Rica
7	COG	Congo, Rep.	**7**	DOM	Dominican Republic
8	GHA	Ghana	**8**	DZA	Algeria
9	GMB	Gambia, The	**9**	ECU	Ecuador
10	GNB	Guinea-Bissau	**10**	EGY	Egypt, Arab Rep.
11	IND	India	**11**	GAB	Gabon

12	KEN	Kenya
13	LSO	Lesotho
14	MDG	Madagascar
15	MLI	Mali
16	MRT	Mauritania
17	MWI	Malawi
18	NIC	Nicaragua
19	RWA	Rwanda
20	SEN	Senegal
21	TGO	Togo
22	ZMB	Zambia
23	ZWE	Zimbabwe

12	GTM	Guatemala
13	HND	Honduras
14	HUN	Hungary
15	IDN	Indonesia
16	LKA	Sri Lanka
17	MAR	Morocco
18	MEX	Mexico
19	MYS	Malaysia
20	PER	Peru
21	PHL	Philippines
22	PRY	Paraguay
23	SWZ	Swaziland
24	THA	Thailand
25	TTO	Trinidad and Tobago
26	TUN	Tunisia
27	URY	Uruguay
28	VEN	Venezuela, RB

Note: This subdivision is from the Word Development Indicators 2006 classification based on countries 2004 GNI per capita: Low Income Countries (GNI/per capita ≤ US $825); Middle Income Countries (US $826 ≤ GNI per capita ≤ US $10065).

Source: Author's Calculations

Expert Journal of Economics. Volume 3, Issue 2, pp. 136-142, 2015
 ISSN 2359-7704
http://Economics.ExpertJournals.com

The Structural Stability of a One-Day Risk Premium in View of the Recent Financial Crisis

Krzysztof DRACHAL*

Warsaw University of Technology

The aim of this research is to analyze a short-term risk premium in Poland between 2005 and 2015. In particular one-day periods are considered. It is studies whether the same GARCH type model can be applied for the whole period, or whether the estimated parameters differ significantly for selected sub-periods.

Keywords: *financial crisis, GARCH, risk premium, structural stability*

JEL Classification*: C22, G12, G17*

1. Introduction

The risk premium is quite an important measure in economic. Both in theory and practice. Not only can it be estimated on different theoretical basis (i.e., one usually considers term "risk premium" for many slightly different concepts like "required market risk premium", "historical market risk premium", "expected market risk premium", "implied market risk premium", etc.).

For example the expected risk premium is a measure of expectations on the future returns over some small risk investments (usually: treasuries). Required risk premium is connected with portfolio diversification. Finally, the implied risk premium is derived from pricing models under the assumption that the real market can be modeled by a certain description.

Here, the historical risk premium is considered. In particular – the difference between returns from stocks over treasury bonds. Measuring the risk premium is important due to various arguments, indeed. For example, it can be used as some kind of indicator of the risk aversion of investors. Moreover, its estimation is used in estimating the cost of capital and asset valuation (Damodaran, 2011).

In this article the risk premium volatility is studied. In particular, with a help of GARCH model. This model uses two equations: one describing the behavior of the risk premium itself, and the second – describing volatility. In other words, the second equation is responsible for the variation of the error term from the first equation. Choosing such a model is reasonable, because it is expected that the risk premium is characterized by volatility clustering, i.e., there are periods of high volatility, then periods of small volatility, and so on.

* Corresponding Author:
Krzysztof Drachal, Warsaw University of Technology, Faculty of Mathematics and Information Science, Poland

Article History:
Received 6 July 2015 | Accepted 18 July 2015 | Available Online 26 July 2015

Cite Reference:
Drachal, K., 2015. The Structural Stability of a One-Day Risk Premium in View of the Recent Financial Crisis. *Expert Journal of Economics*, 3(2), pp.136-142

2. Literature Review

Quite comprehensive review of various kinds of risk premium is presented by Fernandez (2004). Estimations of various types of risk premium for many countries are presented by Damodaran (2015). Yet, these estimates are based on quite long time horizon. Yet, taking too long time horizon can make a significant bias, as too long investments seem practically useless. Indeed, various methodologies and restrictions lead to very different outcomes in the estimation of a risk premium.

The discussion from the theoretical point of view is still interesting for economists. Among plenty of literature, for example, works of Asness (2000), Duang and Zhang (2013), Mehra and Prescott (1985) and Sfiridis (2012) can be of a first interest.

Chen et al. (1990) discussed the time-variability of a risk premium. Recently, Heryan (2014) discussed the volatility of a risk premium in context of GARCH models. For the recent empirical estimations of a risk premium in Poland, the Reader should consult, for example, papers of Sekuła (2011) and Waszczuk (2013). For example, Sekuła (2011) estimated the risk premium for Poland in the period of 1995 – 2010 to be between 2.9% and 8.6%.

On the other hand, in 1986 Bollerslev proposed a GARCH model. In particular, the variable x_t is said to follow AR(m)-GARCH(p,q) process, if

$$x_t = a_0 + a_1 \cdot x_{t-1} + \ldots + a_m \cdot x_{t-m} + e_t ,$$

where $e_t = u_t \sqrt{h_t}$ and $u_t \sim N(0,1)$ and

$$h_t = c_0 + c_1 \cdot (e_{t-1})^2 + \ldots + c_p \cdot (e_{t-p})^2 + d_1 \cdot h_{t-1} + \ldots + d_q \cdot h_{t-q} .$$

Actually, the above equations describe a particular kind of GARCH-type model, i.e., AR-GARCH. Yet, this type was found were useful in applications. Especially, in the context of Polish capital market (see, for example: Fiszeder, 2009; Fiszeder and Kwiatkowski, 2005; Małecka, 2011).

More information about GARCH family of models can be found in the book of Xekalaki and Degiannakis (2010) and a chapter by Zivot (2009). Later, in this paper, also the methods described by Alexander (2001) and Andersen et al. (2009) will be used.

Yet, as the mentioned researches for Poland indicate AR-GARCH type model is especially useful. Usually, in practice there is no need to consider GARCH(p,q) with p or q higher than 1 (Hansen et al., 2005; Chou, 1988; Matei, 2009).

3. Methodology

The daily data for WIG (Warsaw Stock Exchange all-stocks index) and the yield of 10-year treasury Polish bonds were obtained from Stooq. If wig_t denotes the level of WIG index in points and ytm_t – a 10-year bond rate in percentages, and t stands for time index, then the daily risk premium, x_t, is computed by the following formula:

$$x_t = [(wig_t / wig_{t-1}) - 1] - [(1 + ytm_t)^{1/360} - 1] .$$

It should be noticed that usually a risk premium is considered for much longer time horizon than one day. However, the aim of this research is to analyze such a specific "high-frequency" estimate. (Yet, notice that this has nothing to do with high-frequency data which term is used to describe sec or min frequencies or market microstructure, etc.). It is just emphasized that more frequent than usual time series is considered.

The computations were done in R programme (R Core Team, 2015) in rugarch package (Ghalanos, 2014).

4. Analysis and Results

The graphical analysis suggests that the obtained time series is stationary and there exists the clustering of variance (see Fig. 1). Therefore, it seem reasonable to use the GARCH methodology further.

Yet, as mentioned, for example, by Heryan (2014), it seems interesting also to analyze the structural stability if some sub-periods are considered. The initial data consist of 2336 observations beginning on 28/11/2005 and ending on 27/03/2015. On 27/02/2007 Freddie Mac announced that they will no longer buy the most risky sub-prime mortgages and mortgage-related securities. On 15/09/2008 Lehman Brothers filed for bankruptcy protection. On 23/04/2010 Greece supplied for an initial loan from EU and IMF to cover its

financial needs for the remaining part of the year, S&P rated Greece's sovereign debt as "junk" and Euro currency declined. Theses events divide the whole analyzed period into 4 sub-periods.

However, first some descriptive statistics are presented for the whole sample. The minimum daily risk premium for the considered period is -7.97% and the maximum one is 6.25%. The mean (arithmetic) is 0.015%, which corresponds to 5.46% annual rate. The geometric mean is 0.0059%, which corresponds to 2.15% annual rate.

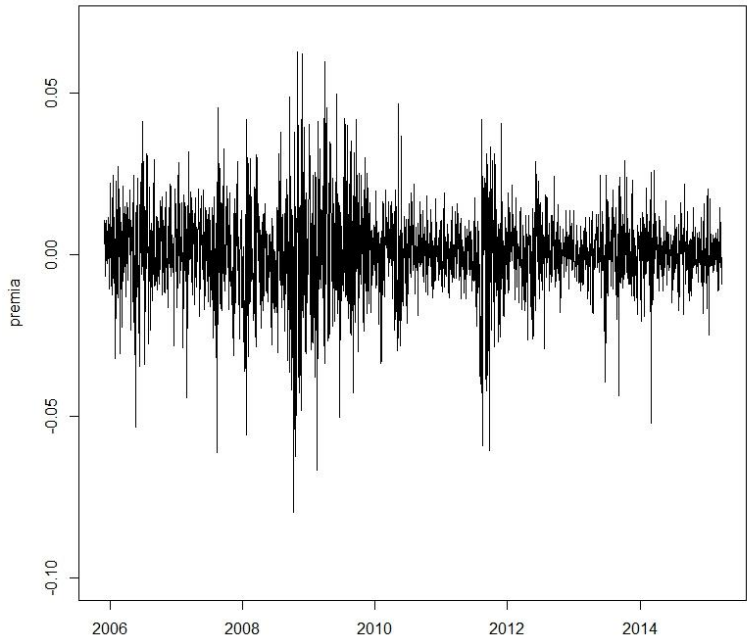


***Figure 1**. Risk premium (x_t)*
Source: Own calculations in R

As stated before, AR(1)-GARCH(1,1) was *a priori* taken as the most suitable type of model for the present research. In particular, it is assumed that

$$x_t = a_0 + a_1 \cdot x_{t-1} + e_t ,$$

where $e_t = u_t \sqrt{h_t}$ and $u_t \sim N(0,1)$ and

$$h_t = c_0 + c_1 \cdot (e_{t-1})^2 + d_1 \cdot h_{t-1} .$$

Table 1. Estimates of AR(1)-GARCH(1,1)

	2005-11-28/ 2015-03-27	**2005-11-28/ 2007-02-27**	**2007-02-27/ 2008-09-15**	**2008-09-15/ 2010-04-23**	**2010-04-23/ 2015-03-27**
Augmented Dickey-Fuller (p-value)	0.01	0.01	0.01	0.01	0.01
ARCH LM (p-value)	0.0000	0.1376	0.0000	0.0000	0.0000
a_0	0.000395 *	0.001668	-0.000723 *	0.000848 *	0.000299 *
a_1	0.067740	0.064227 *	0.038342 *	0.110164	0.058222 *
c_0	0.000001 *	0.000006	0.000015	0.000000 *	0.000002 *
c_1	0.078482	0.051288	0.100333	0.028394	0.078981
d_1	0.914829	0.919600	0.824101	0.966963	0.897321
$c_1 + d_1$	0.993311	0.970888	0.924434	0.995357	0.976302
Ljung-Box (p-value)	0.4689	0.8785	0.8913	0.68690	0.4667
ARCH LM on st. resid. (p-value)	0.6367	0.9175	0.03533	0.3375	0.6125

* not significant at p = 0.05

Source: Own calculations in R

The augmented Dickey-Fuller test allows to assume that all considered time series are stationary (see p-values reported in Tab. 1). If not stated otherwise, the significance level is assumed to be 0.05. For every period, except 28/11/2005 – 27/02/2007, the LM test suggest that there exists the ARCH effect (see p-values Tab. 1). Yet, it is reasonable to perform GARCH models, indeed.

Unfortunately, the parameter a_0 is not stable for all sub-periods. Moreover, it is statistically not significant for all periods, except 28/11/2005 – 27/02/2007. Similarly, the parameter a_1 varies significantly with time periods. Moreover, for there sub-periods it is statistically not significant. It suggests that the AR(1) specification should be somehow modified and is not the best one by itself.

On the other hand, the variance equations present better estimations. Although, the parameter c_0 is not significant for three models, it can be assumed to be equal to 0. The parameter c_1 takes (statistically significant) the smallest value for 15/09/2008 – 23/04/2010 sub-period and the highest for 27/02/2007 – 15/09/2008 sub-period. This can be interpreted as if shocks and innovations would have smaller impact on the present volatility than the past volatility. For the parameter d_1 the conclusions are just opposite. The variance equation seems to be quite stable, except the sub-period 27/02/2007 – 23/04/2010. This suggests that the root period of financial crisis is described by different parameters (see Tab. 1).

Yet, all evaluated models are free of autocorrelation of residuals. This is indicated by high p-values of the Ljung-Box test. Also, the LM test for standardized residuals suggests that after the GARCH type estimation there remained no further ARCH effects (see reported p-values in Tab. 1).

For all sub-periods, except 27/02/2007 – 15/09/2008 and 23/04/2010 – 27/03/2015, sign bias tests (Engle and Ng, 1993) do not indicate any problems (not reported here). In particular, positive and negative innovations affect the future volatility in the same way. The practical aspects of these tests in a more general context and other examples are explained, for example, by Kumar (2014) and Seddighi (2012).

From the news impact curve (see Fig. 2) it can be seen that the impact of shocks on volatility is different in certain periods (Pagan and Schwert, 1990; Jondeau et al., 2007). The highest impact is in the beginning of the financial crisis and the smallest – just afterwards.

Finally, it should be clearly emphasized that even the statistical significance of the AR model does not violate the efficient market hypothesis. This hypothesis requires no arbitrage, but some kind of predictability of returns can remain (Timmermann and Granger, 2004; Timmermann, 1993; Woooldridge, 2013). Moreover, the estimation of the parameters of models is done *ex-post*, i.e., basing on the already known observations. Therefore, it is not known if an information obtained in such a way could have been used in the past. Moreover, no transactional costs were incorporated into the estimated models, etc.

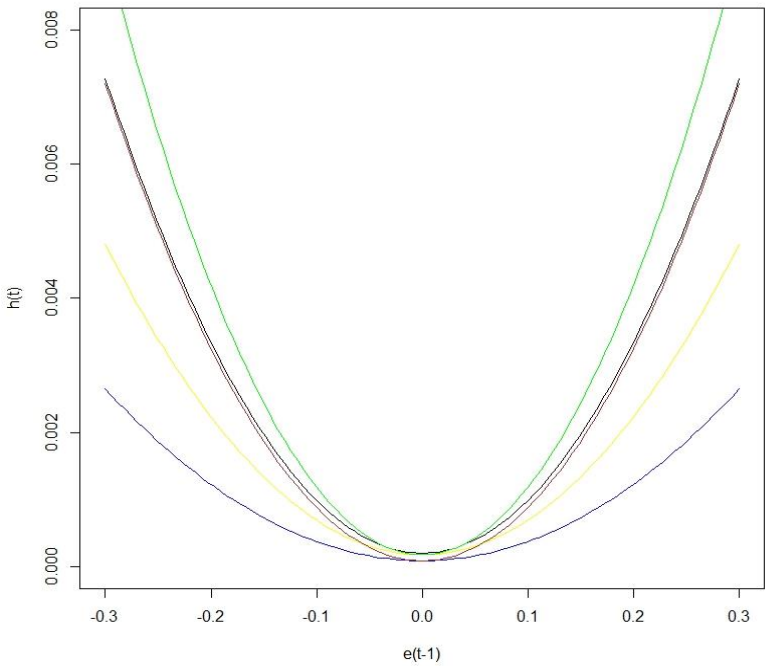


Figure 2. *News impact curves (28/11/2005 - 27/03/2015 black, 28/11/2005 - 27/02/2007 yellow, 27/02/2007 - 15/09/2008 green, 15/09/2008 - 23/04/2010 blue, 23/04/2010 - 27/03/2015 brown)*
Source: Own calculations in R

Of course, also the rolling estimation can be used to determine the discussed structural stability. The first estimation was done after the first 500 observations. Such a number of observations correspond to approximately two calendar years. Then, the re-fitting was done after every 25 new observations, which corresponds to approximately a period a bit longer than a one calendar month. As a result, 74 evaluations of GARCH type models were done. The results are presented on Fig. 3.

It can be observed that in 2009 and 2010 all estimated parameters were very volatile. The parameters a_0 and a_1 are more stable in the period after the occurrence of the recent global financial crisis. However, parameters connected with the variance equation, i.e., c_1 and d_1 are more volatile after the occurrence of the recent global financial crisis. Although, the numerical values seem to follow quite stable paths, the standard deviations of the estimations are very explosive in 2009 and 2010. Also, their confidence intervals significantly widened after the occurrence of the recent global financial crisis (see Fig. 3).

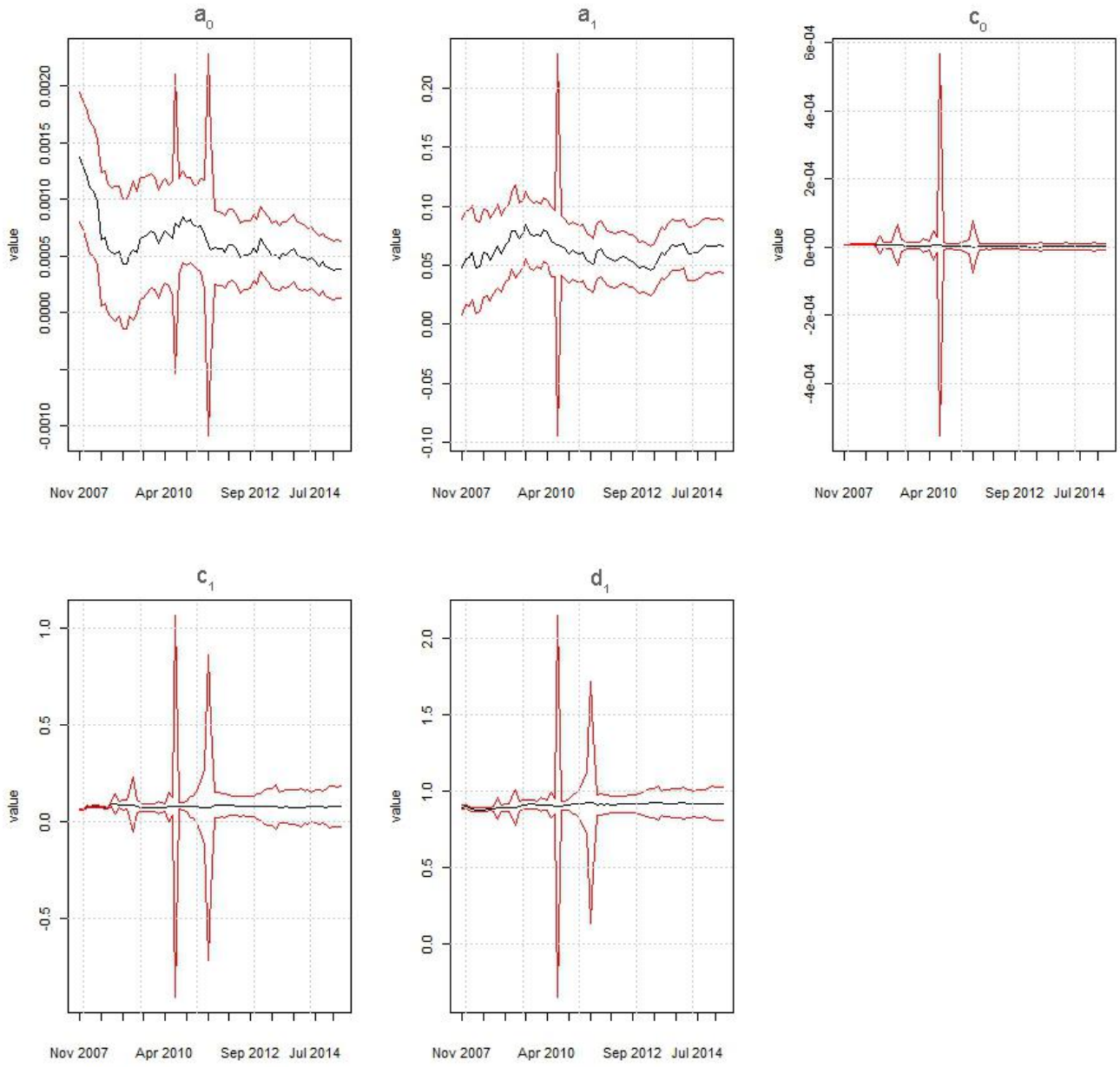


Figure 3. *Rolling estimations (recursive)*
Source: Own calculations in R

5. Discussion and Conclusion

The daily risk premium was estimated to be between -7.97% and the maximum one is 6.25% in the period of 28/11/2005 – 27/03/2015. The arithmetic mean was estimated to 0.015% and the geometric mean to 0.0059% (daily). It corresponds to values between 2.15% and 5.46% *per annum*. Although, the base period for computing the premium was just one day, the outcomes are quite consistent with some other researches.

The AR(1)-GARCH(1,1) model estimation failed. However, the estimation of the variance equation was quite successful. This seems to be of the interest of some future researches with a help of the GARCH family of models. In case of the structural stability, a significant evidence was found to support the hypothesis that the parameters of the GARCH model vary significantly with time, depending on the sub-period of the recent global financial crisis. This is also with an agreement with some other researches reported in this paper.

In this sense, there is a clear evidence that investors have different attitude towards the risk in different periods of a business cycle. From the news impact curves, it could be observed that the impact of shocks on volatility has different size depending on the time period. On the other hand, the choice of the time horizon for computing the risk premium was quite specific in this paper. Therefore, it seems interesting to lead similar researches, but with different time horizons.

References

Alexander, C., 2001, *Market Models: A Guide to Financial Data Analysis*. Wiley.

Andersen, T.G., Davis, R.A., Kreiss, J.-P., Mikosch, T., 2009, *Handbook of Financial Time Series*, Springer.

Asness, C.S., 2000, Stocks versus bonds: explaining the equity risk premium, *Financial Analysts Journal* 56, pp. 96-113.

Bollerslev, T., 1986, Generalized autoregressive conditional heteroskedasticity, *Journal of Econometrics* 31, pp. 307-327.

Chen, N.-F., Grundy, B., Stambaugh, R.F., 1990, Changing risk, changing risk premiums, and dividend yield effects, *The Journal of Business* 63, pp. 51-70.

Chou, R.Y., 1988, Volatility persistence and stock valuations: Some empirical evidence using GARCH, *Journal of Applied Econometrics* 3, pp. 279-294.

Damodaran, A., 2011, *Risk premiums: Looking backwards and forwards…,* presentation.

Damodaran, A., 2015, Equity risk premiums (ERP): determinants, estimation and implications, *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2581517*.

Duan, J.-C., Zhang, W., 2013, Forward-looking market risk premium. *Management Science* 60(2), pp. 521-538.

Engle, R.F., Ng, V.K., 1993, Measuring and testing the impact of news on volatility, *Journal of Finance* 48, pp. 1749-1778.

Fernandez, P., 2004, Market risk premium: required, historical and expected, *Working Paper of IESE CIIF* 574.

Fiszeder, P., 2009, *Modele klasy GARCH w empirycznych badaniach finansowych,* Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika: Toruń, (in Polish).

Fiszeder, P., Kwiatkowski, J., 2005, Model GARCH-M ze zmiennym parametrem - analiza wybranych spółek i indeksów notowanych na GPW w Warszawie, *Przegląd Statystyczny* 52(3), pp. 73-88, (in Polish).

Ghalanos, A., 2014, *rugarch: univariate GARCH models*.

Hansen, P.R., Lunde, A., 2005, A comparison of volatility models: does anything beat a GARCH(1,1)? *Journal of Applied Econometric* 20(7), pp. 873-889.

Heryan, T., 2014, Errors in short run forecasts next-day volatility of equity risk premium in the UK and U.S. market: Empirical research before and after the global financial crisis, *Procedia Economics and Finance* 14, pp. 243-252.

Jondeau, E., Poon, S.-H., Rockinger, M., 2007, *Financial Modeling Under Non-Gaussian Distributions*, Springer.

Kumar, D., 2014, *Long Memory in the Volatility of Indian Financial Market: An Empirical Analysis Based on Indian Data*, Anchor Academic Publishing.

Małecka, M., 2011, Prognozowanie zmienności indeksów giełdowych przy wykorzystaniu modelu klasy GARCH. *Ekonomista* 6, pp. 843-859, (in Polish).

Matei, M., 2009, Assessing volatility forecasting models: why GARCH models take the lead. *Romanian Journal of Economic Forecasting* 4, pp. 42-65.

Mehra, R., Prescott, E.C., 1985, The equity premium – a puzzle, *Journal of Monetary Economics* 15, pp. 145-

161.
Pagan, A.R., Schwert, G.W., 1990, Alternative models for conditional stock volatility, *Journal of Econometrics* 45, pp. 267-290.
R Core Team, 2015, *R: A Language and Environment for Statistical Computing*, R Foundation for Statistical Computing, Vienna, Austria, http://www.R-project.org
Seddighi, H., 2012, *Introductory Econometrics: A Practical Approach*, Routledge.
Sekuła, P., 2011, Szacunek premii za ryzyko dla Polski – próba empirycznej weryfikacji premii ex post i ex ante, *Acta Universitatis Lodziensis – Folia Oeconomica* 258, pp. 95-108, (in Polish).
Sfiridis, J.M., 2012, Revisiting the market risk premium. *Journal of Financial and Economic Practice* 12(2), pp. 10-22.
Stooq.pl, 2015, http://stooq.pl
Timmermann, A., 1993, How learning in financial markets generates excess volatility and predictability in stock prices, *The Quarterly Journal of Economics* 108, pp. 1135-1145.
Timmermann, A., C.W.J. Granger, 2004, Efficient market hypothesis and forecasting, *International Journal of Forecasting* 20(1), pp. 15-27.
Waszczuk, A., 2013, A risk-based explanation of return patterns – Evidence from the Polish stock market. *Emerging Markets Review* 15, pp. 186-210.
Wooldridge, J., 2013, *Introductory Econometrics: A Modern Approach*, Cengage Learning.
Xekalaki, E., Degiannakis, S. 2010, *ARCH Models for Financial Applications*, Wiley.
Zivot, E., 2009, Practical issues in the analysis of univariate GARCH models. In: (eds.) Andersen, T.G., Davis, R.A., Kreiss, J.-P., Mikosch, T., *Handbook of Financial Times Series*, Springer, pp. 113-155.

Expert Journal of Economics. Volume 3, Issue 2, pp. 143-148, 2015
 ISSN 2359-7704
http://Economics.ExpertJournals.com

A New Perspective of Investment Modelling at the European Union Level

Alin OPREANA*

Lucian Blaga University of Sibiu

The study that represents the subject of this paper follows the analysis of the investment function and the influencing factors at the European Union level. The research has, as a starting point, the hypothesis that there is a negative relationship between the European Union investments and tax rates. For verifying this hypothesis, the structural equation modeling is used (SEM), and the same technique is applied in the second part of the research, which will track the development of the investments' model at the European Union level. The results will highlight the relationships that are established between specific variables that characterize the volume of investments.

Keywords: *investment, interest rate, taxes, gross domestic product, European Union*

JEL classification: *E22*

1. Introduction

This work is a continuation of previous research regarding the modeling the investment function in in relation to specific factors. Previous research had as their starting point the elimination of the limitation according to which the investment function is a function dependent on interest rate and I introduced in the analysis the aspect related to fiscal pressure. Following these previous studies, I obtained the following results:

- a new model for determining long-term investments, but also an identification of the measures that would lead to increased investments (Opreana, 2010, pp.227-237, and Opreana, 2013, pp.4-12);
- obtaining a model in terms of investment analysis that will also allow us to identify a set of tools and measures to boost investments that can be used by countries with economies that are experiencing difficult periods in the current economic context (Opreana, 2014).

Maintaining the same direction research, in this current study which represents the object of this continued work on investment analysis and identifying the relationships that are established between investments and specific factors at the level of EU.

2. Literature Review

The analysis of investment represents the research objective of many researchers who approach, on the one hand, investments at a macroeconomic level and their relationships with consumption, and on the other hand,

* Corresponding Author:
Alin Opreana, Lucian Blaga University of Sibiu, Faculty of Economic Sciences, Romania

Article History:
Received 14 July 2015 | Accepted 11 August 2015 | Available Online 19 August 2015

Cite Reference:
Opreana, A., 2015. A New Perspective of Investment Modelling at the European Union Level. *Expert Journal of Economics*, 3(2), pp.143-148

investments on financial markets. Therefore, the analysis presented in this article falls into the following research framework.

In a post-Keynesian/Kaleckian model of growth and distribution, Commendatore, Pinto, Sushko (2014: 12-28) suggested a constraint on firms' investment induced by increasing adjustment costs and/or limited financial resources.

Eslamloueyan & Jafari (2014: 209-220) used the correlated effects mean group (CCEMG) technique to a set of balanced panel error correction model and they studied the repercussions of the 1997's Asian financial crisis and of 2008's global financial crisis on the savings and investing behavior in East Asian countries. Eslamloueyan & Jafari (2014: 209-220) found that the rates of both savings and investments are highly dependent across countries of East Asia.

García-Belenguer & Santos (2013: 150-169) explored a simple version of the neoclassical growth model and studied empirically the main determinants of aggregate investment across countries. In their work, the neoclassical growth model predicts that aggregate investment may be influenced by income growth, capital income share, relative price of capital, taxes, and other market distortions (García-Belenguer & Santos, 2013: 150-169).

Using a fully general specification for the instantaneous utility function, Furlanetto & Seneca (2014: 111-126) presented that the size of the wealth effect on labor supply is largely inconsequential for macroeconomic dynamics.

Casalin & Dia (2014: 60-79) developed a simple theoretical model of investment by assuming that financial frictions generate certain adjustment costs that are different from those of industrial origin which are usually discussed in the literature.

Lim (2014: 160-177) analyzed 129 developed and developing economies in terms of their institutional and structural factors related to their investment activity. The author introduced these institutional and structural factors to a standard neoclassical investment function for open economies and found that financial development and institutional quality tend to be determinants of cross-country capital formation. Nonetheless, institutional quality seemed to show o higher level of stability in its sign and significance of its coefficient.

Rieger (2012: 239-240) developed and proved a formula for the computation of optimal financial investments in an expected utility framework with arbitrary (not necessarily concave) utility functions.

In their paper, Pirvu & Zhang (2014:142:150) approached the problem of consumption and investment in a financial market within a continuous time stochastic economy. Their results show that a change in the discount rate leads to time inconsistencies of the investor's decisions.

In another paper about optimal investment, Zeng, Wu, Lai (2013: 462-470) explored the multi-period optimal strategies for an investment-only problem and an investment–consumption problem.

Moreover, Di Corato, Moretto, Vergalli (2014: 80-89) introduced an analytical approximation of the short-run investment rule and presented how such an approximation can be used in order to derive the corresponding i) steady-state distribution of the optimal stock of capital and ii) the long-run average rate of capital accumulation.

Zhao, Shen and Wei (2014: 824-835) considered the consumption–investment problem with a general discount function and a logarithmic utility function in a non-Markovian framework. Their model's coefficients follow the assumption of adapted stochastic processes, including the coefficients of the interest rate, appreciation rate, and volatility of the stock. The work of Zhao, Shen and Wei (2014: 824-835) demonstrate that a time-consistent equilibrium consumption–investment strategy of the original problem consists of a deterministic function and the ratio of the market price of risk to the volatility. Nonetheless, the corresponding equilibrium value function can be described by the unique solution of a family of BSDEs parameterized by a time variable.

3. Research Methodology

To achieve the purpose of the research, the structural equation model (SEM) technique will be used to verify the hypotheses of the proposed model.

A structural equation model is a set of assumptions about how the variables in an analysis are generated and related to each other (Hu and Bentler, 1999).

This methodology will be applied by using the SPSS AMOS software on empirical data to achieve the main objective of the research and examine the hypotheses. Thus, for hypotheses testing, I used quarterly macroeconomic data, from Eurostat, related European Union, during the 2001Q1-2014Q4 timeframe.

For the empirical analysis of the investment function I will use independent variables such as interest rate and the level of fiscal pressure expressed by tax volume or tax rate.

4. Analysis and Results

4.1. Verification of the model in terms of the existence of a relationship between investment (EU28_I) and tax rate (EU28_T/Y) at the European Union level

Current research is a continuation of previous research (Opreana, 2014), in which it was observed that at EU level, there is a negative relationship is established between investments (EU28_I) and tax rate (EU28_T/Y). The main objective of this step is to verify the relationship between investment and tax rate. The hypotheses of this model are the following:

H_1: There is a relationship between investment (EU28_I) and tax rate (EU28_T/Y)

Structural equation modeling was used to test the hypotheses proposed for the model examined in this paper. The structural model was tested in accordance with the criteria established by Hu and Bentler (1999).

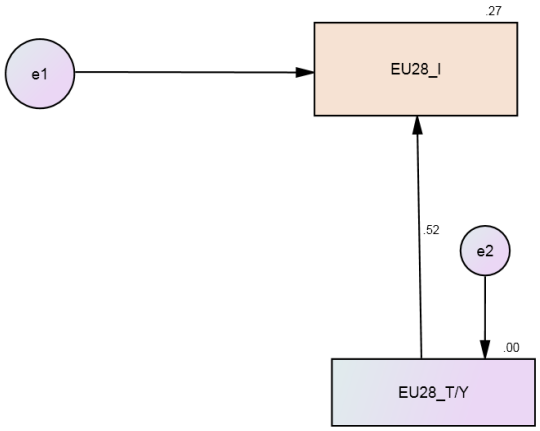


Figure 1. *Standardized results of the model*

Note: EU28_I = Investment at European Union level, EU28_T/Y = tax rate at European Union level

After applying the criteria set by Hu and Bentler (1999), the proposed model did not concur to the validation criteria in this form and needs a improvement by including more relationships between endogenous and exogenous variables.

Regarding the analysis of the hypotheses considered were obtained the following results presented in the following tables:

Table 1.1. *Regression Weights*

	Estimate	S.E.	C.R.	P
EU28_I <--- EU28_TY	16542514.109	3644604.846	4.539	***

Table 1.2. *Standardized Regression Weights*

	Estimate
EU28_I <--- EU28_TY	.522

Table 1.3. *Intercepts*

	Estimate	S.E.	C.R.	P	Label
EU28_TY	0.104	0.000	371.286	***	par_3
EU28_I	-1072116.344	377769.672	-2.838	.005	par_2

Table 1.4. *Variances*

	Estimate	S.E.	C.R.	P	Label
e2	.000	.000	5.244	***	par_4
e1	3130322122.303	596929007.181	5.244	***	par_5

Table 1.5. *Standardized Direct Effects*

	EU28_TY
EU28_I	.522

Table 1.6. *Standardized Indirect Effects*

	EU28_TY
EU28_I	.000

From the obtained results, it can be observed that there is a relationship between tax rate and investment at an EU level, but the model is not statistically valid. Thus, there is a need for developing a new conceptual model.

Also, table 1.1. shows that Hypothesis 1 is confirmed, and there is a relationship between these 2 variables.

From table 1.3 it can be observed that the result of the residual value is statistically invalid. Therefore, this shows the need for a new working model, which includes other related relationships.

4.2. Proposing a new model regarding investments at the European Union level

Next, in this upcoming paper and research, the investments' function will be achieved, and also factors determining the investments will be identified. Following the re-estimation model, it results in a new form of the model according to the type of European Economy and the influence of other factors.

The hypotheses considered in terms of obtaining this model are:

H_2: Taxes affect investments in the European Union

H_3: GDP influences the amount of taxes in the European Union

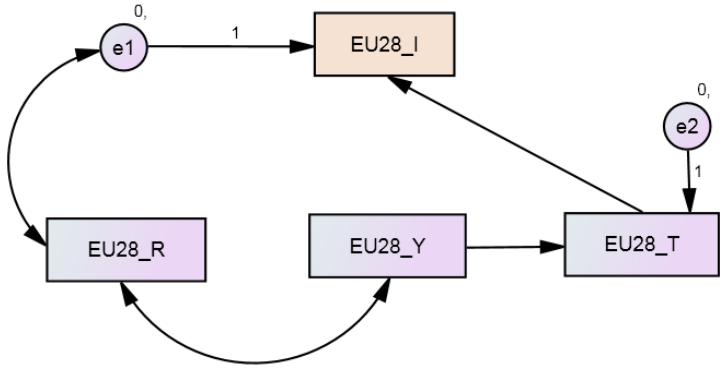


Figure 2. *The New Investment Model*

Note: EU28_R = Interest Rate at the EU level, EU28_Y = EU Gross Domestic Product, EU28_T = Taxes at the EU level, EU28_I = Investment at the EU level

Again, structural equation modeling was used to test the hypotheses proposed for the model examined in this section. The structural model was tested in accordance with the criteria established by Hu and Bentler (1999) and developed in Table 2.

Table 2.1. *Model accuracy*

Measurement	*Measurement model result*	*Recommended values*
χ^2	8.373 (p=0.015, 2df)	$p \leq 0.05$
χ^2 /df	4.187	≤5
NFI	0.975	≥0.90
RFI	0.925	≥0.90
CFI	0.981	≥0.90
RMSEA	0.241	≤0.10

Note: χ^2 =Chi-square, χ^2 /df = ratio of Chi-square and degrees of freedom, GFI = Goodness of fit index, NFI = Normed fit index, RFI = Relative fit index, CFI = Comparative fit index, RMSEA = Root mean square error of approximation.

To analyze the new investment model using the structural equation modeling technique, I analyzed the path coefficients of the hypothetical relationships between variables.

The following tables reflect information regarding the unstandardized and standardized coefficients estimates, statistical significance, and standard error of each relationship.

Table 2.2. *Regression Weights*

			Estimate	S.E.	C.R.	P	Label
EU28_T	<---	EU28_Y	.111	.003	44.340	***	par_2
EU28_I	<---	EU28_T	1.553	.144	10.769	***	par_1

Table 2.3. *Standardized Regression Weights*

			Estimate
EU28_T	<---	EU28_Y	.986
EU28_I	<---	EU28_T	.820

Table 2.4. *Intercepts*

	Estimate	S.E.	C.R.	P
EU28_T	-23299.594	7683.829	-3.032	.002
EU28_I	152005.080	45816.036	3.318	***

Table 2.5. *Covariances*

			Estimate	S.E.	C.R.	P
e1	<-->	EU28_R	16079.333	3695.867	4.351	***
EU28_R	<-->	EU28_Y	-142194.580	36248.761	-3.923	***

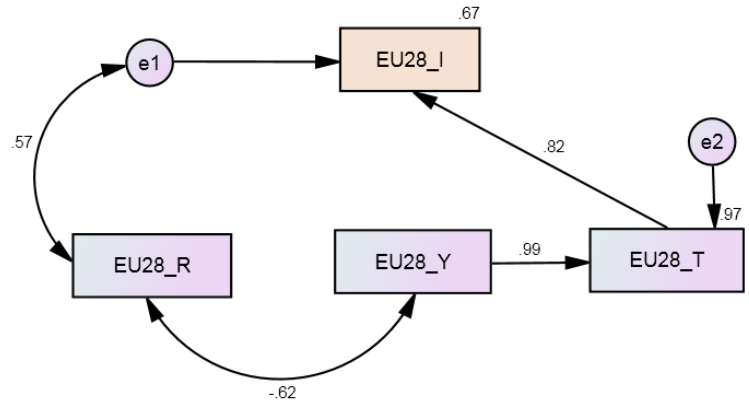


Figure 3. *Standardized results of the new investment model*

Table 3. *Estimates of hypotheses testing*

Hypotheses	*Significance*	*Hypothesis Result*
H_2. EU28_T→EU28_I	***	Confirmed
H_3. EU28_Y →EU28_T	***	Confirmed

**** Significant at a 0.001 level (Two-tailed)*
*** Significant at a 0.005 level (Two-tailed)*
** Significant at a 0.010 level (Two-tailed)*

5. Conclusions

Following this present research, a new model regarding the investment function was identified. The results obtained confirm the three proposed hypotheses, namely:

H1: There is a relationship between investment and tax rates.

H2: Taxes affect investment in the European Union

H3: GDP influences the amount of taxes in the European Union

Regarding the limits of this research it should be mentioned that the RMSEA value in Table 2.1. shows that the new model of investments needs a development and it is necessary to identify specific variables that influence the behavior of variables at the level of the European Union's economies.

However, the results from this research will enable us to achieve and identify a new set of specific measures for each country, which will lead to boosted investments in the current economic context.

6. References

Casalin, F. & Dia, E. (2014). Adjustment costs, financial frictions and aggregate investment. *Journal of Economics and Business* 75: 60-79.

Commendatore, P., Pinto, A., Sushko, I. (2014). A post-Keynesian model of growth and distribution with a constraint on investment. *Structural Change and Economic Dynamics* 28: 12-24.

Di Corato, L., Moretto, M. & Vergalli, S. (2014). Long-run investment under uncertain demand. *Economic Modelling* 41: 80-89.

Eslamloueyan, K. & Jafari, M. (2014). Financial crisis and saving–investment dynamics in the presence of cross-sectional dependence: The case of East Asia. *China Economic Review* 30: 209-220.

Furlanetto, F. & Seneca, M. (2014). Investment shocks and consumption. *European Economic Review* 66: 111-126.

García-Belenguer, F. & Santos, M.S. (2013). Investment rates and the aggregate production function. *European Economic Review* 63: 150-169.

Hu, L., Bentler, P. (1999), Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1): 1-55

Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money.* London: MacMillan

Lim, J.J. (2014). Institutional and structural determinants of investment worldwide. *Journal of Macroeconomics* 41:160-177.

Opreana, A. (2010). The Long-Run Determinants Of Investment: A Dynamic Approach For The Future Economic Policies. *Studies in Business and Economics* 5(3): 227–237.

Opreana, A. (2013). A New Approach of Investment for the Future Economic Policies. *Expert Journal of Economics* 1(1): 4-12

Opreana, A. (2014). Modelling Investment Function in Relationship to Specific Factors from European Economies. Paper presented at *Joint International Conference of Doctoral and Post-Doctoral Researchers, Craiova, 12-13 September 2014*

Pirvu, T.A. & Zhang, H. (2014). Investment–consumption with regime-switching discount rates. *Mathematical Social Sciences* 71: 142-150.

Quantitative Micro Software, (2007). *EViews 6 User's Guide.* Irvine CA: Quantitative Micro Software, LLC

Rieger, M.O. (2012). Optimal financial investments for non-concave utility functions. *Economic Letters* 114: 239-240.

Vinerean, S. (2013). Applying Online Behavioral Models in Internet Retailing. LAP Lambert Academic Publishing, Saarbrucken, Germany

Zeng, Y., Wu, H. & Lai, Y. (2013). Optimal investment and consumption strategies with state-dependent utility functions and uncertain time-horizon. *Economic Modelling* 33: 462-470.

Zhao, Q., Shen, Y., Wei, J. (2014). Consumption–investment strategies with non-exponential discounting and logarithmic utility. *European Journal of Operational Research* 238: 824-835.

Acknowledgement

This work was supported by the strategic grant POSDRU/159/1.5/S/133255, Project ID 133255 (2014), co-financed by the European Social Fund within the Sectorial Operational Program Human Resources Development 2007-2013.

Expert Journals

Currently, Expert Journals represents four open access journals: Expert Journal of Business and Management, Expert Journal of Economics, Expert Journal of Finance and Expert Journal of Marketing.

Expert Journals is committed to publishing papers that are thought-provoking and exploratory in order to make contributions to each field of study.

These journals deliver original, peer-reviewed papers from international authors meant to provide new theoretical and empirical frameworks and ideas in their respective fields. The research articles in all the journals are available in full-text and free of charge to our web visitors.

High-Quality Manuscripts. Manuscripts submitted to Expert Journals can present empirical, conceptual and review papers, teaching notes, case studies, book reviews that provide relevant insights in banking and finance. The submitted articles should exhibit relevancy, value, originality, clear argumentation, reasoning, persuasive evidence, intelligent analysis, and clear writing. Also, we highly recommend that authors concur to generally accepted publication ethics in developing their articles.

All online journals for Expert Journals are open access, meaning that the accepted articles are available for any reader to access and download for free.

 • ISSN-L 2359-7704 • Online ISSN 2359-7704
http://economics.expertjournals.com
economics@expertjournals.com

ISSN-L 2359-7704
Online ISSN 2359-7704

EXPERT JOURNALS
Finance Marketing Economics Business and Management