WAGENINGEN UNIVERSITY AND
RESEARCH CENTRE
DEVELOPMENT ECONOMICS GROUP

THE QUALITY OF INSTITUTIONS AND THE CONTRIBUTION OF THE COPPER MINING SECTOR TO ECONOMIC GROWTH

BY

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MARCH, 2012

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DEDICATION

To my late Mum and Dad, RIP

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ABSTRACT

There is mixed evidence from the empirics that natural resource booms lead to economic growth with some claiming there is a resource curse and others that their contribution to economic growth is dependent on the quality of institutions. We explore this issue by looking at the copper mining sector in five different primary copper exporting countries and using democracy variable as the measure for the quality of institutions with time series data spanning from 1965-2010. Stationarity tests were conducted in order to ascertain the presence of unit roots and order of integration. The results revealed the presence of unit roots in all the variables with all of them being of the first order of integration. Cumulative impulse response functions and Granger causality tests from Vector Autoregressive Regressions show that in the short-run, copper price booms are beneficial for economic growth and that the effect is mainly through the increase in investment than directly to GDP. We also find that the improvement in the quality of institutions leads to a more positive response of GDP with an increase in the international price of copper. There was however very little evidence to suggest that the Dutch disease played a major role in the copper price boom's contribution to economic growth in the countries in question.

Key Words: Institutions, economic growth, Cumulative impulse response, Granger causality, Vector Autoregressive Regression, Dutch disease

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CHAPTER 1

1.0 INTRODUCTION

1.1 Background and Introduction

Copper is an important contributor to the national economies of mature, newly developed and developing countries. (International Copper Study Group, 2010). According to the (U.S Geological Survey, 2010) copper ranks third in world metal consumption after steel and aluminium. Mining, processing, recycling and the transformation of metal into a multitude of products creates jobs and generates wealth. These activities contribute to building and maintaining a country's infrastructure, and create trade and investment opportunities. (ICSG, 2010). According to ICSG data, global growth in copper demand for 2011 was expected to exceed global growth in copper production and the annual production deficit, was expected to be about 130,000 tonnes in 2011. Furthermore, the ICSG predicts that in response to prevailing high copper prices and increased end user demand, production increases were expected at operations curtailed following the 2008 economic crisis and, to a lesser extent, from the start-up of new operations. Industrial demand in 2011 in all of the major consuming regions was expected to continue the upward trend begun in 2010 and exceed the growth in refined production. The increased metal intensity in China makes it one of the largest consumers of copper in the world. In 2009, China accounted for than 38% of global copper demand even though its consumption only grew by 4.3% and in 2011 the growth rate was projected at 6% (ICSG, 2010).

In 2011[1], Chile was the leading producer of copper in the world with an estimated mine production of 5420 thousand tonnes, followed by Peru with 1220 thousand metric tonnes while Australia had 940 thousand tonnes and Zambia, Africa's largest copper producer had 715 thousand metric tonnes. In many developing countries such as Zambia and Chile, copper is one of the major contributors to these countries Gross Domestic Product (GDP). In 2010 for instance, exports of copper constituted about 19% and 37% of GDP in Chile and Zambia respectively. The increase in the demand for copper, especially by China coupled with an

1. Estimates based on the USGS mineral commodity summaries, 2012

increase in copper prices therefore implies that the copper sector is and will continue to be an important source of revenue for many developing as well as developed countries.

Extractive resources such as phosphate, mining, petroleum, natural gas, etc. typically produce a strong alliance between the state and business and in some cases where there are no national capacities for developing the industry, an alliance with foreign capital. Such collaboration between state and capital to share responsibility in the extractive industry makes competing claims more conflicting and sometimes violent, as in cases of civil strife (Singh, 2010). Singh goes on further to say , ‘’natural resources produce rents, which are subjected to sectoral and elite interests who attempt to capture the state and share mining rents. Without state institutions autonomous from these social groups, the state becomes an instrument of elite and/or sectorial interests’’. During mineral export booms, these rents are even higher and many developing countries have been known to mismanage these windfalls. Hence, Mineral rents, generally captured by the government through taxes and royalties, may cater to the ruling elite in the booming country (Davis, 2009). This problem is often exacerbated in countries with weak governance and institutions in that the concentrated wealth deriving from point resources often lends itself to corrupt practices by politicians and civil servants charged with overseeing firms exploiting them (Worldbank , 2009)

The preceding paragraph suggests that institutional quality (IQ) is an important variable in determining the contribution of the copper mining sector to economic growth. Using information from the polity IV project, the proxy for IQ will be democracy, which in this study is understood to mean the presence of institutions and procedures through which citizens can express effective preferences about alternative policies, leader constraints on the exercise of power by the executive and the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. The other aspects of democracy such as the rule of law, systems of checks and balances, freedom of the press, are means to, or specific manifestations of the above general principles. To understand the role of IQ in the copper mining sector, the countries of focus will be the major copper producing countries, i.e. Australia, Chile, Papua New Guinea, Peru and Zambia. Based on the polity IV project information, Australia and Chile had the highest democracy score at 10, followed by Peru with 9.5, Zambia with 8.5 and PNG with 4 in 2010, measured on a scale of 0 (worst IQ) and 10(best IQ). This implies that of the four countries, PNG had the worst or lowest institutional quality.

1.2 Problem Description

The argument by most economists is that point resources have had minimal positive contribution to the development of poor countries. It has been argued that point resources have not contributed much to reduction in poverty in many poor countries and in other countries it has often led to civil wars, rent seeking, corruption e.t.c. (Collier and Hoeffler, 2004; Robinson et al 2006; Singh, 2010; Worldbank, 2010) In other developing countries such as Zambia, mining is not close to achieving its potential of increased government revenue, employment and ultimately economic development (World Bank 2010). Many studies such as Sachs and Warner (1995, 2001) have sought to link the presence of natural resources to the resource curse through the effect of the Dutch disease, where countries with abundant natural resource wealth tend to grow more slowly than resource poor countries. Other cross country studies have associated the dismal contribution of mineral resources to economic growth of resource rich countries to poor quality of institutions (Brunnschweiler and Bulte 2008; Mehlum et al: 2006). Although a number of studies have been done on commodities such as oil as a single sector and its relation to economic growth (Akanni, 2007 and Ross, 2001 among others), most of the studies have focused on looking at the natural resource sector as a whole and its contribution to economic growth across countries. The growth literature has also not answered questions such as why countries with the same type of primary export commodity, others have gained from their resources while others have not, for instance the case of Chile and Zambia. Hence, the central question to be addressed in this study is what is the effect of institutions in the copper mining sector and therefore economic growth of countries rich in copper? This study will attempt to answer this question and address the gap in literature by developing a hypothesis linking the quality of institutions with copper exports and ultimately economic growth in different countries.

1.3 General objective

To determine the contribution of the copper export booms to economic growth in five different countries by examining the effect of democracy in the copper sector.

The objective will be reached by answering the following research questions;

Specific research questions

I. Do copper export booms contribute to economic growth?
II. What is the effect of democracy on the contribution of the copper export booms to economic growth?
III. What is the effect of copper export booms on the exchange rates?

Justification

In using advanced time series data modelling, this research contributes to the literature on economic growth, by isolating the effect of Institutions on a specific natural resource sector in different countries which could be vital for policy makers in understanding the independent contribution of different resource sectors . The study also tries to unravel the short run contribution of the copper exports to economic growth which could be crucial for planning and implementation of various economic programs in individual countries.

Organization of the Thesis

The rest of the study is organized into five main chapters. Chapter two gives an overview of the copper price trends, production and exports. Chapter 3 gives theory of the Dutch disease and detailed literature review of the relationship of natural resource booms with the Dutch disease, quality of institutions and economic growth. Chapter 4 contains the description of the data and its sources as well as an explanation of the econometric procedure employed in the study. Finally, chapter 5 gives the discussion, conclusions and recommendations

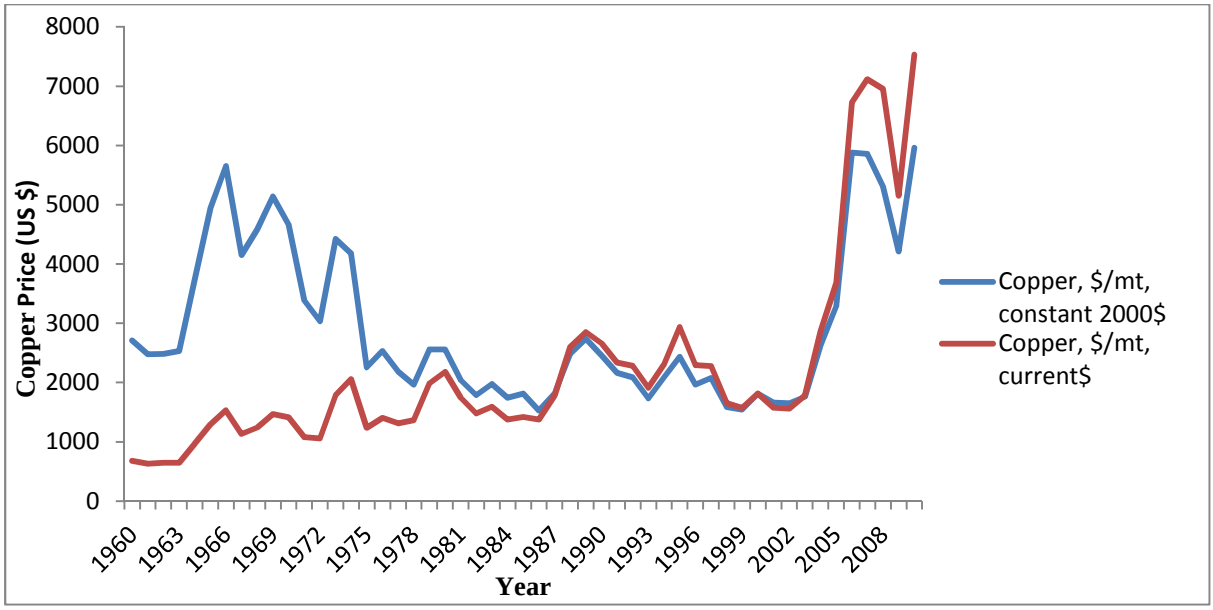
CHAPTER 2

2.0 AN OVERVIEW OF COPPER PRICES, PRODUCTION AND EXPORTS

2.1 Copper Prices

According to the World Bank (2009), several metal prices plummeted in the early 2008 because of slowing global growth and improvement of supply prospects. Copper was among the few metals whose price remained elevated during the first half of 2008, despite weak demand; numerous supply disruptions tied to strikes in Latin America and delays bringing on new capacity kept copper prices high. Global supply of copper is expected to peak at 20 million tonnes by 2013/14 and decline thereafter, resulting in a shortfall in supply. As a result, copper prices are expected to remain high in real terms, though they will be subject to cyclical fluctuations and periodic, short-term volatility, World Bank (2011). The trend in copper prices, both in current and constant prices is shown graphically in figure 2.1. From the 1960's the price of copper has been quite volatile with a sharp increase from 2001 -2008 after which it started declining partly due to the global financial crisis. After 2009, the prices rose sharply again and this could be attributed to increased metal consumption by countries such as China.

Annual Copper Prices (1960-2010)



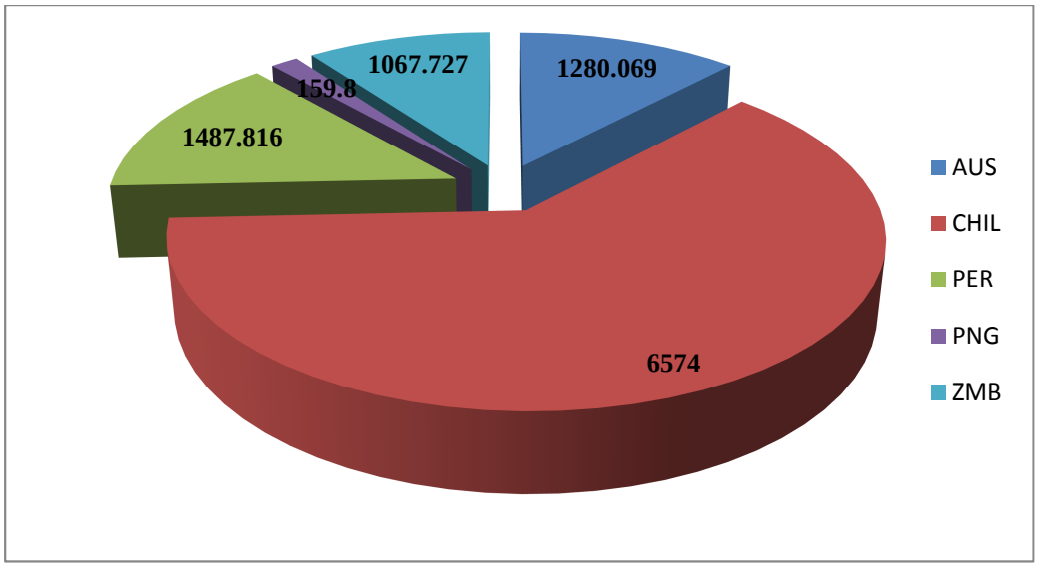
Data Source: World Bank

Figure 2.1: Annual Copper Prices (1960-2010)

2.2 Copper Production

The top 20 copper producing countries in 2010 included Chile, USA, Peru, Indonesia, China and Zambia among others. Figure 2.2 below shows the total copper production (concentrates[2] and refined copper) produced by Australia (AUS), Chile (CHIL), Papua New Guinea (PNG), Peru (PER) and Zambia (ZMB) . Chile accounted for a large portion of the world copper production of both concentrates and refined copper with a total of 6574 Kilo Metric Tonnes (KMT) followed by Peru with about 1489 (KMT) . Australia also produced considerable amounts of copper with 213 KMT more than that of Zambia while PNG only had 160 produced. It is important to mention that of the five countries, PNG is only country that did not produce any refined copper.

Total Copper Production in KMT by Country in 2010



Data Source: ICSG

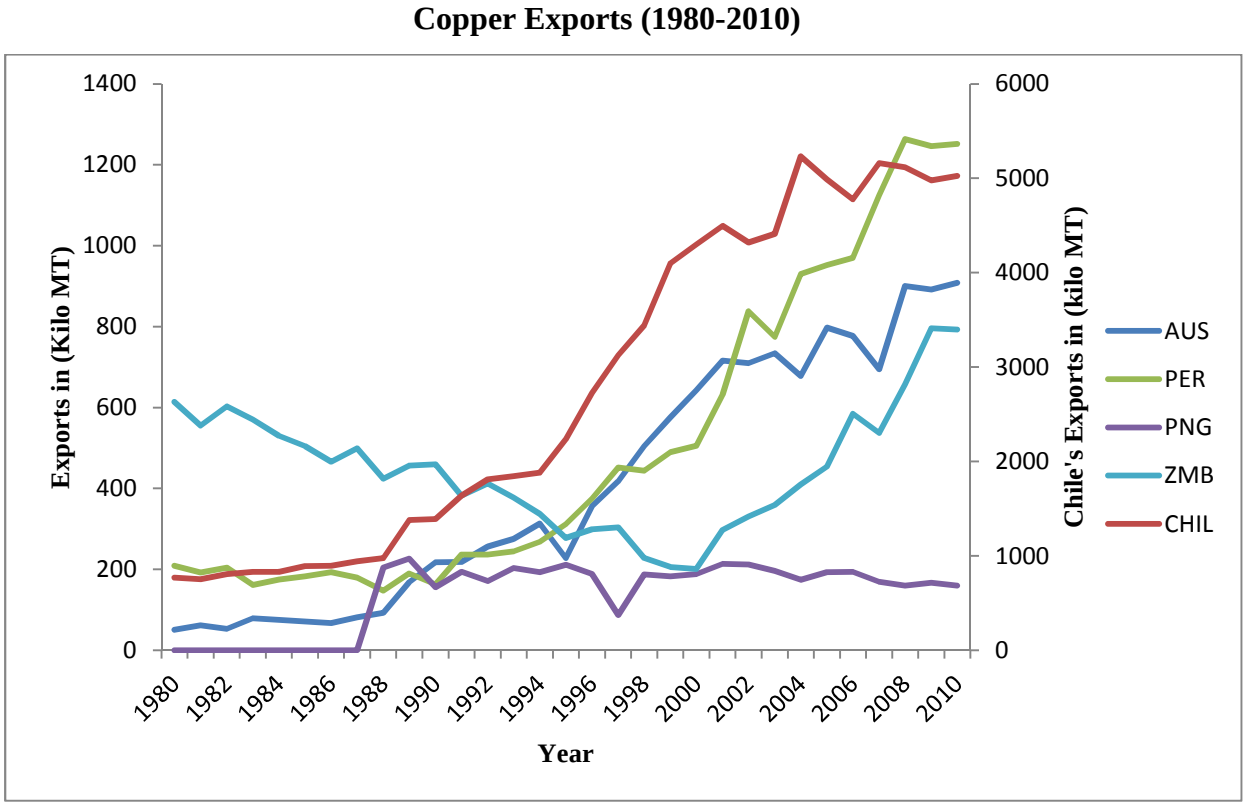
Figure 2.2: Copper production by Country

2.3 Copper Exports

On the world market, copper is traded in many forms such as copper ore, concentrates with refined copper being the most traded form with more than 8000 metric tonnes traded in 2009 (ICSG, 2010). Figure 2.3 below shows the exports of the five countries from 1980-2010, with

2. Copper concentrates contain 30% copper(ICSG, 2010)

the exports of Australia, PNG, Peru and Zambia measured on the primary y-axis and that of Chile on Secondary y-axis on the right. Similar to the production trends, the figure below shows that Chile has been the major exporter of copper from the 1980's to present, although Zambia's exports were more than the other countries including that of Chile in the early 80's its exports fell far below that of Chile and only started increasing after 2000. The exports of Australia and Peru showed a gradual steady increase over the years with Peru surpassing Australia's exports around the year 2002. The reported export figures for PNG only start in 1987 and its exports have been somewhat stagnant with most of its exports being below 200 KMT.



Data source: ICSG

Figure 2.3: Copper Exports (1980-2010)

On the world market, Chile contributed about 39.1% of the total copper world exports followed by Peru , Australia with Zambia coming in the fifth place in 2008 (See appendix 2A for details).

In order to appreciate how important copper is to the national economies of the countries under the study, table 1 below shows the percentage share of copper exports in GDP for the

respective countries. Australia had the lowest share of copper exports in GDP in 2010 as expected with 0.6%, while Zambia had the highest with about 37%. Copper exports also made a considerable contribution to the economies of Chile and PNG at 19% and 13% respectively while Peru's copper exports only contributed 6%. It is important to notice that there was considerable increase in copper's importance in GDP from 2002-2007 in all the countries which could be attributed to the corresponding increase in copper prices (copper boom) during this period. Similarly, there was also a decline it's importance after 2007 to 2009 coinciding with the effects of the global economic crises; however copper export shares rose again in 2010 in all the respective countries.

Table 1: Share of Copper in GDP (%) (2000-2010)

	AUSTRALIA	CHILE	PNG	PERU	ZAMBIA
2000	0.280	10.364	9.677	1.722	11.235
2001	0.297	10.346	10.946	1.850	12.911
2002	0.279	10.015	11.022	2.302	13.884
2003	0.279	10.608	9.860	2.246	14.594
2004	0.316	15.678	12.698	3.820	21.598
2005	0.422	15.522	14.486	4.411	23.291
2006	0.697	21.879	23.305	7.064	36.744
2007	0.577	22.359	19.010	7.465	33.135
2008	0.602	20.845	13.868	6.929	31.245
2009	0.497	15.934	10.847	5.055	32.008
2010	0.610	18.606	12.697	6.131	36.891

Data source: World Bank; ICSG

With respect to copper importing countries, China topped the ranking after taking the lead as the biggest global importer in 2002; the share of China imports increased from 11.4% (2000) to 23.6% (2008). Now China imports are larger than the combined imports of USA and Germany together, Meller and Simpasa (2011).

CHAPTER 3

3.0 THEORY AND LITERATURE REVIEW

3.1 Dutch Disease Theory

In many countries that export commodities, a boom in commodity exports is usually associated with the appreciation of the exchange rate leading to the so called ‘’Dutch disease’’. Kalter et al (2004), defines the Dutch disease as ‘’a boom in natural resource exports leading to an appreciation of the real exchange rate that in turn produces a reallocation of the factors of production away from other tradeables. In the long run this process would increase the dependence on natural resource exports and hence limit the sources of economic growth.

The term ‘’Dutch Disease” was created by The Economist in an article that appeared in The Economist in 1977 about the adverse effects on the economy of the Netherlands after the discovery of natural gas in the North Sea. In line with this, a number of broad theoretical and empirical literature has been developed to explain the Dutch disease with the most common being the core model developed by W. Max Corden and J. Peter Neary (1982). Others include those by Neary and Wijnbergen (1986), Sachs and Warner (1995) and Gylfason et al. (1999). In this study, the main reference will be the Dynamic Dutch disease Endogenous Growth Model developed by Sachs and Warner (1995), and that of W. Max Corden and J. Peter Neary.

The economy has three sectors; a tradable copper sector (natural resource), a tradable (non-resource) manufacturing sector and a non-traded sector. The greater the natural resource endowment, the higher is the demand for non-traded sector. Therefore when natural resources are abundant, i.e. when there is a boom in copper exports due to an increase in copper prices or if there is a discovery of new copper mine fields, tradeables production is concentrated in the copper sector rather than manufacturing and capital and labour that otherwise might be employed in manufacturing are pulled into the non-traded goods sector. The static real effects resulting from this, according to W. Max Corden and J. Peter Neary (1982) is the spending and factor reallocation or resource movement effect. A boom in the copper sector leads to an increase in domestic wealth thereby generating a short term spending effect. The increase in the incomes during the boom leads to a subsequent increase in domestic spending on both

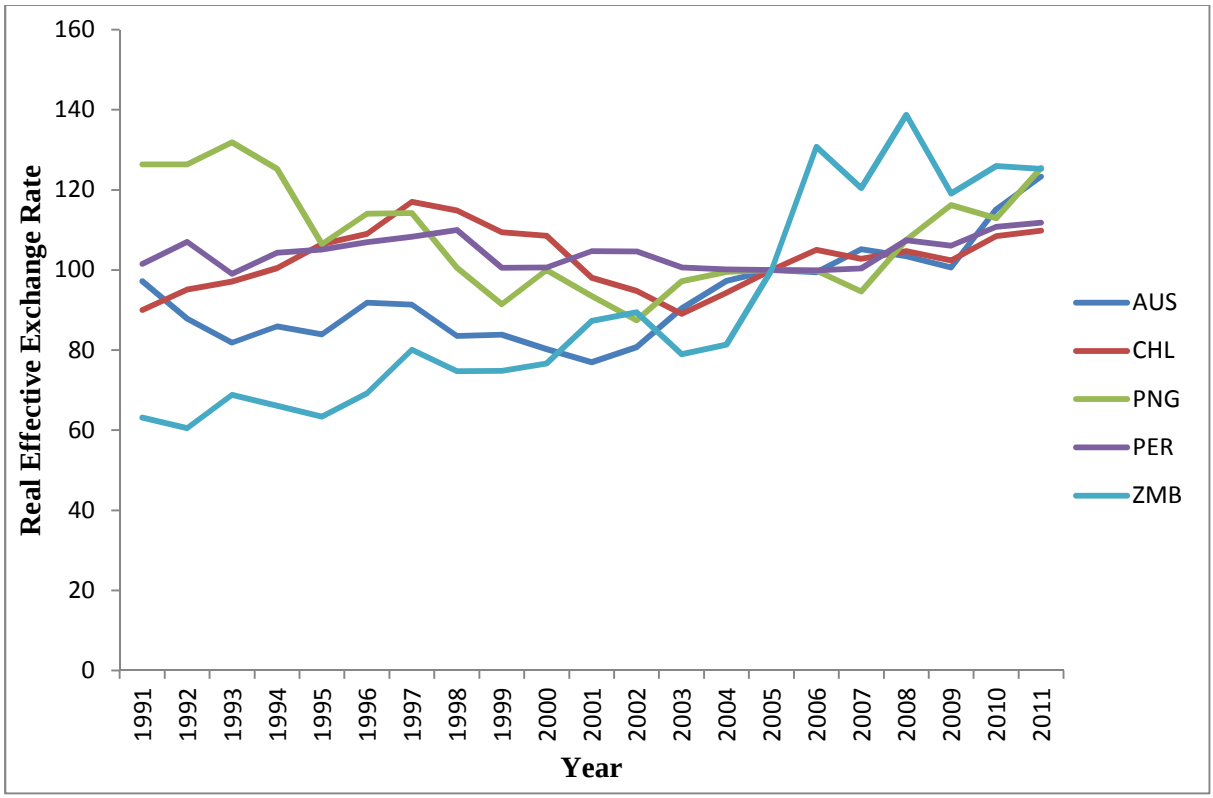
tradable and non-tradable goods. The increased domestic spending implies that the price of non-tradable commodities rise in terms of the non-booming tradable commodities and this is the appreciation of the exchange rate. This happens because the price of tradable goods is determined in international markets and does not change despite the extra domestic spending. In contrast, the price of non-tradable goods is set in the domestic market and does rise due to excess demand.

The resource movement effect (medium term effect) results because of the rise in incomes of factors in the copper sector thereby leading to a drawing of resources out of the manufacturing and non-tradable sectors. The production in the manufacturing and non-tradable sectors becomes too costly because of the increased demand for factors such as labour which tends to drive wages upwards. The real increase of mobile factor input prices and the increase in the relative price of non-tradable goods squeeze the profitability of the non-booming tradable industries that use mobile factors and non-traded goods as inputs. This resource movement effect reinforces the tendency toward the appreciation of the real exchange rate and the deindustrialization of the non-booming tradable sector (Davis 2010). The appreciation of the real exchange rate and the deindustrialization of the non-booming tradable sectors are efficient responses to the increase in mineral earnings and are therefore not necessarily a disease (Davis and Tilton 2005), if neoclassical, competitive conditions prevail in the economy Sachs and Warner (1995) . It only becomes a disease if the manufacturing sector reveals an externality that is harmful to economic growth or if there is already a distortion in the economy which is exacerbated by the mineral export boom (Neary and van Wijnbergen 1986, Sachs and Warner 1995)

3.3 Natural Resource Export Boom, Exchange Rate and Dutch Disease

Theoretically, the main effects resulting from the Dutch disease are the spending and factor reallocation effects, which in both cases results in the appreciation of the exchange rates (as explained above). These effects may in turn have an adverse impact on the economic growth of different countries in the long run depending on the economic conditions of a particular country. Figure 3.1 below shows the behavior of the Real Effective Exchange Rates (REER) over the period 1991-2011 in Australia(AUS), Chile(CHIL) , Papua New Guinea (PNG), Peru(PER) and Zambia(ZMB). Real effective exchange rate is defined as the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

Real Effective Exchange Rates by Country (1991-2011)



Data source: World Bank

Figure 3.1: Exchange Rates from year 1991-2011

The series above shows that the exchange rate of Zambia exhibited a gradual increase from 1991 to 2004 after which there was a sharp increase until the mid of 2006 and this coincides with the commodity export boom of 2004 to around 2008 . PNG's exchange rate on the other hand exhibited a declining trend from 1991 to around 2002 with a sharp increase during the period 2007- 2009 and from 2010 onwards. Chile and Peru on the other hand only exhibited relatively small increases in their exchange rates over the years with Chile's rate only rising modestly from 1991 to 1997 and from 2003 onwards.

A boom in natural resources usually leads to an increase in domestic incomes leading to an increase in domestic spending on both tradable and non-tradable goods, subsequently leading to the appreciation of the exchange rate; this in line with the spending effect . After controlling for the average cross country relationship between price and per capita income, Sachs and Warner (2001) provide evidence that natural resource intensive economies tend to have higher price levels. This implies that increasing wealth from natural resource exports lead to a rise in the price of non tradeables such as goods from the manufacturing and

services sectors as a consequence of the appreciation of the real exchange rate. Because of the high prices in these countries, they consequently miss out on export led growth. Further empirical evidence of the spending effect is provided by Stokke (2007) using a dynamic general equilibrium analysis of South African natural resource boom (Gold in this case) results. An increase in exports led to a demand-driven real exchange rate appreciation where higher incomes increased the demand for both industrial goods and services. The real appreciation during the boom period was as a result of the rise in non-tradeables price, whose price rose more than that of the composite industrial price. The real appreciation led to the allocation of capital and labor towards the resource sector at the cost of the manufacturing sector, which led to the deindustrialization, evidenced by the downward trend in the value added share along the manufacturing sector share of value added which declined by about 24 percentage during the period of the boom (factor reallocation effect).

Some studies such those of Calì and Willem te Velde (2007) and Meller and Simpasa (2011) attempted to look at the effects of copper export booms on the appreciation of the RER of primary copper exporting countries of Zambia and Chile respectively . In the case of Zambia, Calì and Willem te Velde (2007) argue that the boom in the copper prices between the years 2003 and 2006 led to the appreciation of the local currency resulting from both the spending effect and factor reallocation effect. The basis of their conclusion was that copper export values explained about 87.5% of the variation in real exchange rate between 2003 and 2006 and 90% of the variation between 2004 and 2006. By examining the composition of GDP between the periods 2000 to 2005, they further asserted that the size of the copper sector increased and that of the manufacturing sector reduced during this period. Based on this, I argue that the time period (2000 to 2006) in which they analyzed the results was too short to really conclude that the exchange rate appreciated in response to the increase in copper prices.

Contrary to the findings of Calì and Willem te Velde (2007), Meller and Simpasa (2011) maintain that increases in copper prices did not cause the real exchange rate to appreciate in Zambia during the last copper boom even though they found a positive relationship between copper prices and the appreciation of the real exchange rate, the relationship was not statistically significant. They concluded that there was no econometric evidence suggesting the presence of “Dutch disease” in Zambia. They attributed this finding to the liberalization of the exchange rates which paved the way for a market-based exchange rate system. They

argued that the reforms induced sound macroeconomic management critical for sustaining economic growth and promoting export performance. Similarly, they found no negative relationship between the last commodity price boom (after 2004) and manufacturing exports, contrary to the Dutch disease hypothesis. However they found that the manufacturing exports performed lower than that of the copper exports and they attributed this mainly to the longstanding structural supply impediments rather than due to real exchange rate misalignment. The short-sample period problem may also have been a problem in their study which the authors rightly admit and this may have biased their results.

In the case of Chile, Meller and Simpasa (2011) explain that there was an impact in terms of exchange rate appreciation during the boom period (2004-2008) i.e. the price of copper had a negative effect on the real exchange rate but its effect was statistically not significant. According to the authors, the result was due to a change in the exchange rate regime from a passive crawling peg mechanism to a free exchange rate regime induced by large inflows of foreign investment. This is similar to the argument advanced by Kalter et al (2004) who explains that the exchange rate was immunized from the copper price because of the opening of the copper industry to foreign investment which expanded Chile's mining production thereby limiting the impact of increased copper exports on the real exchange rate and the share of international price fluctuations. Regarding the factor allocation effect, Morande´ and Quiroz (1996) in Spilimbergo (2002), argue that copper in Chile had a modest effect on the increase in wages and that the mining industry being capital-intensive (of which most of the capital was largely imported) most of local resources were not displaced making the possibility of a Dutch disease very small. Similarly, Meller and Simpasa (2011) conclude that during the boom period of 2004-2008, copper prices had in fact a positive effect on the expansion of manufacturing exports in Chile with the result being statistically significant at 10% with similar reasons as above as to why this was the case .

In the case of Papua New Guinea, the real exchange appreciation in response to mineral booms induced labour movement from rural to urban regions due to a fall in the price of agricultural exports relative to the price of non-traded output, with most marketed non-tradeables being produced and consumed in urban PNG and within the mining enclaves (Chand and Levantes, 2000). Furthermore they explain that the principle of de-industrialization is not relevant in contrast to other reported cases of the Dutch disease. Nevertheless the mineral booms led to an increase in the real consumption expenditure as an

increase in the consumer price index reflecting a substantial increase in the relative prices of non-traded goods compared to the traded goods, consistent with the Dutch disease theory.

Mikesell (1997) argues that Peru may also have suffered from the Dutch disease between 1970-1980 because the real exchange rate appreciation had a depressing effect on the manufacturing sector and consequently a reduction in its GDP and this was despite a sharp increase in copper as well as other metals. He attributed this to government intervention, high import protection, fiscal deficit and high inflation.

The literature presented above shows that substantial work has been done to assess the effects of the Dutch disease in many mineral exporting countries including some of the countries of interest in this study. However none of the studies above looked at the effect of the mineral exports over a period of time on the real exchange rate, which is the interest of this study and moreover most of them were done some years ago which may suggest that the results might be different now.

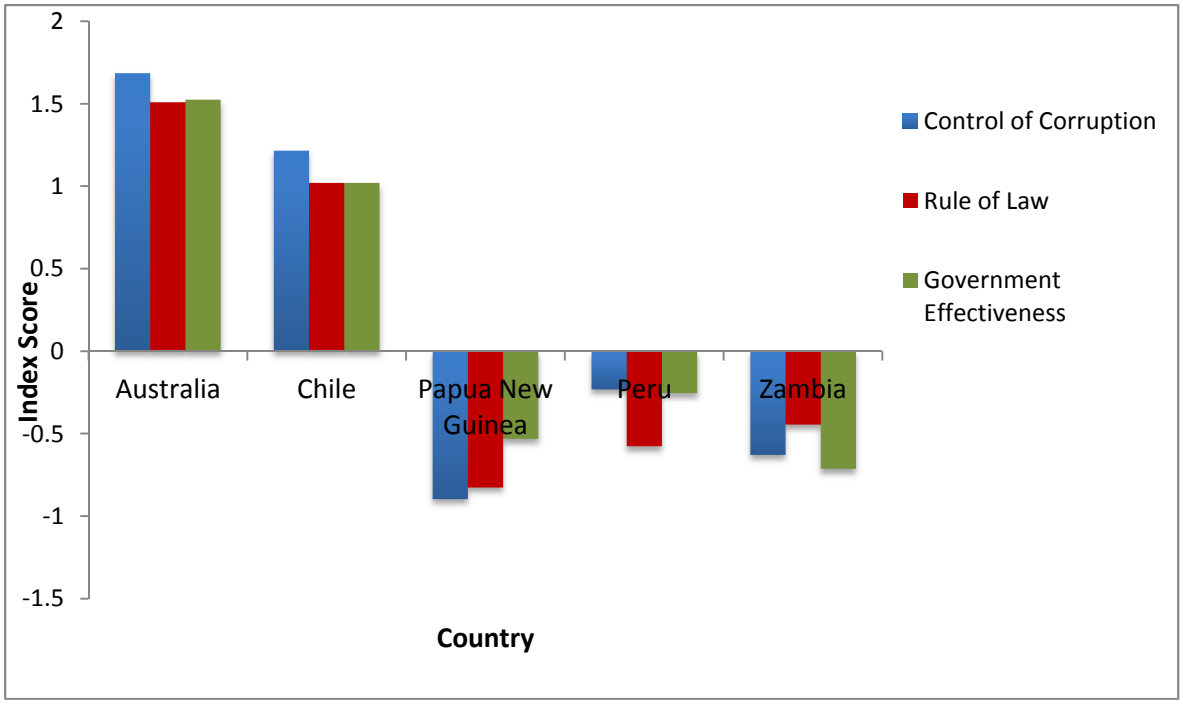
3.4 The Quality of Institutions, Natural resource Booms and Economic Growth

3.4.1 The Quality of Institutions and Natural resource Booms

Among economists, Douglas North is credited with the revival of interest in institutions and their influence on economic outcomes (Baliamoune-Lutz, 2005). North (1990) views institutions as "the rules of the game in a society. He defines 'Institutions as the humanly devised constraints that structure human interaction and they exist to reduce the ubiquitous uncertainty arising from that interaction''. According to North there are formal and informal rules. Formal rules, of which will be the focus of this study include political rules (constitutions, regulations), economic rules, and contracts. Contracts are (enforceable) agreements, embedded in property rights rules, regarding the use of or exchange of goods. The informal ones on the other hand include the norms and customs and are usually viewed as indigenous or inert and difficult to change. To facilitate quantitative analysis of how formal institutions affect such aspect as economic growth, a number of researchers and organizations have come up with indices to measure how good or bad the quality of institutions are for a number of countries. One such organization is World Bank which has a

wide range of governance indicators among them Corruption, Rule of Law and Government effectiveness.

Control of Corruption, Rule of Law and Government Effectiveness Index (1996-2010)

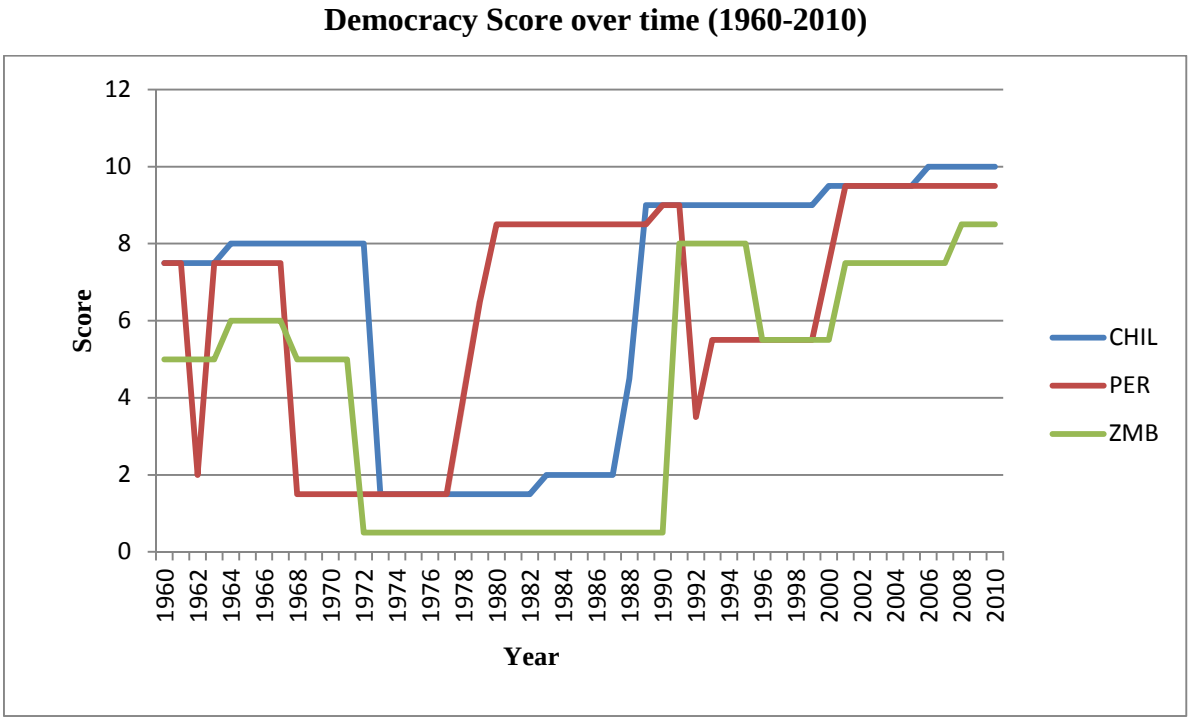


Data source: Worldwide Governance Indicators

Figure 3.2: Control of Corruption, Rule of law and Government Effectiveness Index (1996-2010)

The figure above shows the average scores of some the IQ measures from the WGI over a period of 1996-2010 for the five copper producing countries. The indexes of the above measures are between 2.5 to -2.5 with the former being the best and the latter being the worst. It is clear from the figure that Australia has the highest scores of all the three measures, followed by Chile, Peru and Zambia. PNG has the lowest quality of institutions with the average level of corruption being -0.9 which is quite low relative to the other measures to the corruption scores of other countries. The Polity IV Project also provides institutional measures commonly used by researchers in form of authority characteristics of states in the world system for purposes of comparative, quantitative analysis. According to Marshall et al (2010), the Polity IV Project conceptual scheme is unique in that it examines concomitant qualities of democratic and autocratic authority in governing institutions, rather than discreet and mutually exclusive forms of governance. The data series for most of the countries ranges from 1800-2010 making it suitable for most time series analysis. The graph below shows a change in the democracy score for Chile, Peru and Zambia from 1960-2010 and it is

measured on a scale of between 0(strongly autocratic) and 10(strongly democratic).The scores for Australia and PNG were not included in the figure because they static at 10 and 4 respectively over time. All the three countries had relatively high democracy scores during the early 60's after which they exhibited a sharp decline in the late 60's (for Peru) and the early 70's for Chile and Zambia. Between 1971 and 1990, Zambia had the lowest score of 0.5 and it was stagnant on this score for almost a decade and only rising in 1990. Similarly Chile and Peru's scores declined sharply in 1973 and 1968 respectively with the scores remaining this low for at least more than five years. The scores for all the countries however have been quite high in the last decade with all of them being above 7.5, with Chile being fully democratic from 2006 onwards.



Data Source: Polity IV project
Figure 3.3: Democracy Scores (1960-2010)

Empirical evidence has shown that institutional quality is one of the most important or fundamental determinants of economic development (Acemoglu et al 2001;; Kaufmann et al. 1999; Mehlum et al 2006 among others). The quality of institutions affects economic growth in a number of ways and in trying to explain this Mehlum et al (2006) distinguishes three strands of literature on institutions with regards to natural resources; the first being that institutions take an intermediate causal link i.e. natural resource booms lead to the decay of

institutions and the second is where institutions take a neutral role. The third is where institutions and natural resources interact. In this study, the third strand will be explored.

In more general cross country studies it has been shown empirically that natural resources and mineral resource booms in particular produce a lot of rents and economists such as Bulte et al (2005), Davis (1995, 2010) and Robinson et al, (2005) have tried to elaborate how resource rents affect institutions. They explain that the presence of rents from mineral booms in particular, the portion of these rents that the host country can capture in taxes and in other ways, can encourage perverse behavior or unproductive activities. If the rents are appropriated by the ruling elite, income disparities become even more severe at the expense of economic growth. When mining rents promote corruption, the impact on economic development is even more damaging. Davis (2010) argues that mineral booms may tend to increase the level of governmental corruption because rents can be used to bribe public officers in order to obtain support for mineral activities and reduce the governmental interference in the mineral booming industry. The increased corruption could in turn lead to the erosion of the credibility and the quality of institutions like the Courts of law, the Police, the local administrations etc. Similarly, Singh (2010) explains that natural resources may undermine the quality of the political institutions that govern resource extraction by forcing a choice between taxation and borrowing as a means of financing extractive industries.

In their model, Mehlum et al (2006) distinguished between grabber and producer friendly institutions. Rent-seeking outside the productive economy pays off when institutions are bad (grabber friendly institutions): dysfunctional democracies invite political rent appropriation; low transparency invites bureaucratic corruption; weak protection of property rights invites shady dealings, unfair takeovers and expropriation; weak protection of citizens' rights invites fraud and Corruptible practices; weak rule of law invites crime, extortions and mafia activities; a weak state invites warlordism. Furthermore, they expound that when institutions are better or more 'producer friendly', it is difficult to be an effective rent seeker unless you also are a producer. Rule of law, high bureaucratic quality, low corruption in government and low risks of government repudiation of contracts imply that effective rent-seeking must be for a legitimate cause. Hence, production and rent-seeking are complementary activities when institutions are producer friendly. In other words rents from mineral resource booms would only increase wealth when the quality of institutions is good or producer friendly since the productive sector has an incentive to attract entrepreneurs. On the other hand if institutions

are bad or grabber friendly wealth would reduce because this creates an incentive for grabbers whose wealth increase

In summary, mineral resource booms may have a negative effect on institutions especially in countries where institutions are already weak. This is also in line with the World Bank conclusion that natural resources can poison institutions possibly more when resource discoveries and booms materialize when the country's institutions are already deficient and weak institutions can in turn undermine growth. According to Isham et al (2005), who looked at the commodity booms of the 1970's and 80's ''it is not just natural resource that leads to lower quality institutions but a particular type of natural resource exports. Further, they postulated that point resource and coffee and cocoa export dependence are negatively associated with national social economic institutions implying that point resource exporters have the worst institutions.

3.4.2 Economic Growth and Natural resource Booms

In many studies with regards to natural resource booms, empirical evidence has shown that there exists a curse of natural resources; countries with great natural resource wealth tend to grow more slowly than resource-poor countries (Sachs and Warner, 1995, 1997; Collier and Goderis 2007 etc.).

In particular, Collier and Goderis (2007) distinguished the effects of an increase in the non-agricultural commodity prices into short and long run effects. Higher commodity export prices significantly reduced the long-run level of real GDP in commodity exporting countries. On the other hand they found out that in the short-run there was a positive relationship between commodity prices and GDP growth. Collier (2007) partly attributes this to the adverse consequences of volatility. 'Unless economic management is very good, the high volatility of commodity prices gets transmitted to the economy in the form of booms and busts'. He argues that at higher prices the export sector will be more valuable and so a given amount of price volatility will transmit larger shocks to the rest of the economy. He goes on f to say 'the boom-bust cycles can be highly damaging in that it makes private investment more risky and so tends to discourage it'. In the same vein, the World Bank (2009) explains that the revenues from minerals during booms and busts tend to be more volatile than revenues in agricultural commodities because changes in production mainly reflect demand

shocks. As a result, both prices and quantities move in tandem, rising during periods of high demand and declining in periods of low demand.

In a study of the effect of resource booms in Latin American countries, Sachs and Warner (1999) conclude that resource booms did little to generate long-term growth, and may in fact have hindered growth on average. They argue that the resource booms in Bolivia, Mexico and Venezuela did not permanently raise the level of per-capita GDP, and were followed by a growth slowdown rather than increase. The resource boom in Ecuador appears to have raised the level of GDP initially but was not followed by faster growth. They attributed this to the possible effects of the Dutch disease, political instability, the costs of the high variability of export earnings with imperfect financial and insurance markets.

However, the theory that non-agricultural commodity export booms does not lead to economic growth does not go unchallenged as evidenced by studies such as those of Deaton (1999) and Deaton and Miller (1995). Deaton (1999) argues that even temporary commodity price booms may provide a potential source of funds for investment important for sustained growth. Deaton and Miller (1995), also argue that commodity price booms had generally favorable effects on African economies because they stimulated investment and generated additional GDP. They found no obvious evidence that booms trigger a GDP decline, although they admitted to the fact the evidence was rather weak. Furthermore after separating the mineral and non-mineral price booms they found that price of minerals showed relatively little effect on output although there were some evidence of the effects on investment only. Other studies such as those of Mikesell (1997) explain that when Chile experienced a copper export boom in 1979-1980, the boom was accompanied by a substantial growth in real GDP. Furthermore he notes that the decline in copper prices in 1981 led to a rise in the current account deficit financed by foreign debt. Additionally the author argues that since the mid-1980s, the Chilean government has managed the economy well in the face of export booms and subsequent low copper price. In the same vein, the IMF (1996) explains that Chile's favorable record was due to the policies adopted by the government to correct foreign exchange-rate appreciation and moderate the other distortions generated by export booms. On the other hand Meller and Simpasa (2011) found no econometric evidence between the copper export booms and GDP in Zambia and therefore could not refute the null hypothesis that copper prices do not affect Zambian economic growth.

Another view of natural resource booms and economic growth which is quite prominent in the literature is that of institutions. The main argument in this line of thinking is that natural resources only influence economic growth through the quality of institutions. This particular line of reasoning has been advanced by a lot of economists including, Mehlum et al, 2006 (see above); Robinson et al 2006; Collier and Goderis (2007) etc. Robinson et al (2006), who studied the political foundations of the resource curse, argue that the incentives politicians face when they confront resource booms map into different policy choices depending on the quality of institutions. Low quality institutions invite bad policy choices since they allow politicians to engage in inefficient redistribution in order to influence the outcomes of elections. Furthermore, they explain that countries with institutions that promote accountability and state competence will tend to benefit from resource booms because the bad political incentives created by booms are removed by good institutions. Collier and Goderis (2007) also confirm the results of Robinson et al 2006 and Mehlum et al, 2006 that countries with good governance succeeded in transforming commodity booms into sustainable higher output and that in countries with bad governance, the commodity booms did not lead to economic growth. Baliamoune-Lutz and Ndikumana (2007) also report that poor quality of institutions prevents countries from reaping the benefits from trade booms. While trade booms may produce short-run growth, the ability of a country to sustain high growth is contingent upon the quality of its institutions. The evidence implies that poor quality of institutions may be one of the reasons for the failure of African countries to capitalize on trade gains associated with commodity export booms.

The literature reviewed above shows that there are two opposing views on natural resource contribution to economic growth. The results by Deaton and Miller (1995) in particular show that natural resource booms are beneficial to economic growth without looking at the role of institutions. In order to determine the contribution of copper exports to economic growth, the institutional view will be the major thrust of this study

CHAPTER 4

4.0 DATA DESCRIPTION AND THE EMPIRICAL MODEL

4.1 Data Description

The literature reviewed in this study has brought out possible reasons as to why some of the mineral rich countries have benefited from their mineral resources and others have not. The reasons range from the Dutch disease type of effects to those of institutions. In order to test the research hypothesis that the quality of institutions influence the contribution of copper exports to economic growth, data from five primary copper producing countries were explored, i.e. Australia, Chile, Peru, Papua New Guinea and Zambia. With an exception of Australia, the other four countries are developing countries whose exports primarily consist of copper and therefore are very important contributor to their national Gross domestic product (GDP). The countries were selected based on the share of their copper exports on the world market and the share of copper exports in their respective GDPs.

The data on Real GDP were obtained from the World Bank Development Indicators (WDI) data, consistent with what Collier and Goderis (2007) and other researchers used. Other variables obtained from WDI data base include, investment (gross capital formulation), Consumption, and Government Expenditure .In order to explore the relationship among commodity booms, Institutional Quality and economic growth variables, the copper price was used as a proxy for copper export booms. This was so because the data for copper exports had a large number of missing observations coupled with the fact the series was too short to have a meaningful time series analysis. Using the price of copper instead of the quantity exported also helped to avoid endogeneity problems pointed out by Easterly and Levin (2003) and Deaton and Miller (1995) in that the price is set at the international market. The assumption which was made here was that the copper boom was solely because of an increase in prices and not because of the discovery of new mine fields. The price of copper and Real Effective Exchange Rate (REER) was obtained from the Global Economic Monitor (GEM) commodities data base (World Bank) and copper exports for the five countries were obtained from the ICSG.

Kaufmann et al (2010) compiles data on various Institutional measures for the World Bank, the so called Worldwide Governance Indicators and data are available from 1996-2010. The estimates of governance range from approximately -2.5 (weak institutions) to 2.5 (strong

Institutions). Brunnschweiler and Bulte (2008) explain that it is beneficial to use these indicators because of their wide country coverage and relative objectiveness. However this data was not used in the quantitative time series analysis because the series was quite short (14 years) and due to the fact that the index did not change much over the years. Another commonly used variable as an indicator for institutions is from the Polity IV project, the Polity score found by subtracting the autocracy score from the democracy score with the scale ranging from +10 (strongly democratic) to -10 (strongly autocratic).To facilitate sound econometric analysis and interpretation, the scores were rescaled to be between 0 (strongly autocratic) and 10 (strongly democratic). The score measures the degree of competitiveness of political participation, the openness and competitiveness of executive recruitment, the regulation of participation and constraints on the chief executive. Since time series analysis is employed in this study, the modified version of the Polity variable, the Polity 2 score which was specifically formulated for the purposes of time-series analyses was used in order to study the effects of institutions over time. The other justification for using this variable was that data are available for a larger span of years for more countries than other institutional measures and that there is strong evidence that institutional quality and democracy are strongly correlated with per capita income (Murshed, 2004; Couttenier, 2008).

4.2 Model Specification

Cross sectional analysis is the most common procedure used in most studies to investigate the relationship between natural resource booms and economic growth. However this method is plagued by many problems including potential omitted variable bias and endogeneity problems. This type of methodology also does not consider commodity prices and is unable to disentangle the dynamics of natural resource contribution to economic growth (Collier and Goderis, 2007). By using Vector Autoregressive (VAR) Models endogeneity problems associated with reverse causality are corrected for by including lagged independent and dependent variables. The price of copper is also included to investigate the relationship between the copper export boom and economic growth as well as with other GDP components. Following the works of Deaton and Miller (1995) and Collier and Goderis (2007) who used the Extended Vector Autoregressive Model (VARX) and Panel Cointegration respectively, the more general model was specified as follows:

$$\Delta lnRGDP_t = \alpha + \beta_1 \Delta lnRGDP_{t-i} + \beta_2 \Delta lnC_{t-i} + \beta_3 \Delta lnI_{t-i} + \beta_4 \Delta lnE_{t-i} + \beta_5 \Delta lnP_{t-i} + \beta_6 IQ_{t-i} + \beta_7 (IQ_{t-i} * \Delta lnP_{t-i}) + \varepsilon_{ti} \quad (1)$$

i =1.....p lags

Where $RGDP_t$ *is* the Real GDP, P_t the price of copper per tonne, IQ is the institutional quality variable, C_t is consumption, I_t is Investment and E_t is Government Expenditure, Δ depicts the first difference operator**,** α is the constant,ε_{ti} is the error term (white noise process).All the variables are in constant 2000 and in natural logarithms, except the institutional quality variable. The question as to whether the copper export booms leads to economic growth and the effect of the quality of institutions will be established by the sign and coefficients on β_5 and the interaction term β_7. The use of GDP components in the regression analysis raise issues of endogeneity, however according to Sims, (1980) and Brandt and Williams, (2006) in estimating a VAR model there is often no apriori distinction between endogenous and exogenous variables and hence we are less likely to violate the model specification and incorrectly induce simultaneity biases by incorrectly specifying a variable as exogenous when it is really endogenous.

4.2.1 Econometric Procedure

The steps that were followed were as follows**;**

Step 1: Testing for Stationarity

This was be done by running Augmented Dickey Fuller test under the null hypothesis of non-stationarity and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests under the null hypothesis of stationarity. The equation of the standard Dickey Fuller test is of the form;

$$\Delta RGDP_t = \delta + \pi RGDP_{t-1} + \varepsilon_t \quad (2)$$

With π=θ-1. If the null hypothesis, $H_0 : \pi = 0$ (π =1) is not rejected, it implies that Y_t is non-stationary series and its variance increases with time. This also suggests that the differences are required to achieve stationarity. To achieve this, the Augmented Dickey Fuller test was conducted. The equation of the Augmented Dickey Fuller was of the form

$$\Delta RGDP_t = \delta + \pi RGDP_{t-1} + c_1 \Delta RGDP_{t-1} + \cdots + c_{p-1} \Delta RGDP_{t-p+1} + \varepsilon_t \quad (3)$$

With Δ representing the difference operator, p number of lags and ε_t the white noise error term. The order of integration was also established from the above tests.

Step 2: Estimation of Vector Autoregressive Model (VAR)

Since all variables were stationary with order of integration ($I(1)$) then a Vector Autoregressive model or Vector Error Correction Model could be estimated. However since the interest of this study was to find out the relationship between copper export booms and economic growth through prices, there is no theory that explains the long run relationship between prices and GDP. Hence a four Equation VAR was estimated to establish the short run relationships. Moreover, Shan and Sun, (2010) present a number of reasons as to why VAR may be preferred to VECM among them being that the Cointegration likelihood ratio (LR) tests of Johansen and Jesulius (1990) have often not provided the degree of empirical support that might reasonably have been expected for a long run relationship. A four equation system VAR model below was estimated following equation 1, where p is the number of lags and ε is there error term.

$$\begin{bmatrix} \ln RGDP_t \\ \ln C_t \\ \ln I_t \\ \ln E_t \end{bmatrix} = \alpha + \beta_1 \begin{bmatrix} \Delta \ln RGDP_{t-p} \\ \Delta \ln C_{t-p} \\ \Delta \ln I_{t-p} \\ \Delta \ln E_{t-p} \\ \Delta \ln P_{t-p} \\ IQ_{t-p} \\ (IQ_{t-p} * \Delta \ln P_{t-p}) \end{bmatrix} + \begin{bmatrix} \varepsilon_{RGDP} \\ \varepsilon_C \\ \varepsilon_I \\ \varepsilon_E \end{bmatrix} \quad (4)$$

The rationale of including GDP components is as follows; Investment is one of the key components of economic growth and research has shown that the reasons why resource rich developing countries under perform is that they underinvest and as such resource surpluses from the export booms cannot be transformed into sustained increases in income (Collier, 2008). Furthermore according to Deaton and Miller (1995) changes in international commodity prices work more strongly through Investment, therefore a positive relationship between copper prices and investment is a favourable condition for economic growth.

Therefore other things being equal an increase in investment leads to an increase in GDP and since GDP is an important determinant of Investment, an increase in GDP will further lead to the rise in investment. It is for this reason that most of the focus in this study of the effects of copper prices on GDP will be through the direct effect on GDP itself and indirectly through investment. Note that this type of relationship does not say anything about the quality of investments.

Government expenditure in this study includes all government current expenditures for purchases of goods and services (including compensation of employees). According to Collier, (2007) resource rich countries usually have large public sectors and as such resource rents accruing to the nation will then be spent by the government. In times of booms, public spending decision may become compromised with extravagant commitment being made during those booms and then force drastic cuts in vital expenditures during troughs. Hence a positive relationship with copper export boom (prices) will give us an insight whether copper booms induce governments to spend more which in turn may be harmful to economic growth depending on how effective or not the spending is.

Consumption is usually the largest component of GDP and just like investment, an increase in consumption will lead to an increase in GDP by the same amount. A positive relationship between the copper price and consumption would be a favorable indicator of economic growth to a certain extent because it implies that increase in copper prices lead to an increase in consumption. An increase in consumption triggers an increase in government revenue from taxes such as VAT, import taxes and it may improve the financial conditions for funding investment both through profits and loans.

According to Greene 2003, (section 19.6.2) in principle, the VAR model is a Seemingly Unrelated Regression model, indeed estimation by SUR gave similar results as those of a VAR. To determine the direction of causality and the effects of price and IQ on GDP, Cumulative Impulse response functions and Granger causality tests (Wald Tests) were calculated after the estimation of the VAR

To have an insight into whether the copper export booms had any effect on the appreciation of the exchange rate, the following VAR model was specified;

$$\Delta lnRER_t = \alpha + \beta_1 \Delta lnP_{t-i} + \beta_2 \, \Delta lnRER_{t-i} + \varepsilon_{ti} \quad (5)$$

i =1.....p lags

Where *RER* is the real effective exchange rate and P is the price. Real effective exchange rate was used because it measures the value of a currency against a weighted average of several foreign currencies divided by a price deflator or index of costs. This implies that an increase in the value represents a real appreciation of the home currency, and a decrease represents a real depreciation.

CHAPTER 5

5.0 RESULTS

5.1 Descriptive Statistics

Table 2 below gives the mean values of all the variables in the sample with their corresponding standard deviations. Among the five countries Australia had the largest mean GDP while PNG had the smallest as expected. The dispersion from the mean or average values of all the variables are given by the standard deviation and for GDP, Zambia had the smallest variation or dispersion while Chile had the highest. The IQ variable, democracy showed that there were some variations for Chile, Peru and Zambia and none for Australia and PNG because the score for these countries did change overtime.

Table 2: Characteristics of Sample Data

Country	**Australia**		**Chile**		**Papua New Guinea**		**Peru**		**Zambia**	
Variable	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
RGDP	2.93e+11	1.24+11	4.81e+10	2.94e+10	2.73e+09	1.02e+09	4.48e+10	1.67e+10	3.10e+09	7.74e+08
Price	2963.131	1399.336	2963.131	1399.336	2963.131	1399.336	2963.131	1399.336	2963.131	1399.336
Consumption	2.19e+11	9.14e+10	3.93e+10	2.26e+10	2.00e+09	3.78e+08	3.64e+10	1.22e+10	2.82e+09	4.74e+08
Investment	6.71e+10	3.56e+10	1.03e+10	9.19e+09	5.63e+08	1.59e+08	9.49e+09	4.95e+09	7.91e+08	4.53e+08
Expenditure	5.10e+10	2.17e+10	7.42e+09	2.54e+09	5.06e+08	6.57e+07	4.43e+09	1.78e+09	6.66e+08	2.20e+08
Democracy	10	0	3.021739	7.037958	4	0	2.847826	6.099061	-1.6087	6.564139
Dem*Price	29631.31	1.399.36	11797.83	23297.54	5597.342	5597.342	7898.014	22769.43	-1979.68	19560.06
Copper Exports(KMT)	409.903	303.301	2776.391	1731.861	136.386	85.296	501.352	380.555	449.300	380.555
RER	95.759	11.718	112.762	28.609	119.676	20.833	104.720	3.157	104.500	57.751

To explore whether or how variables are related, table 3 below gives a simple correlation matrix of Real GDP and the independent variables per country (all variables in logarithms except the IQ variable and exports). It can be seen that there is a positive correlation between the copper price and real GDP in all the countries except PNG, with Chile and Zambia having the highest positive coefficient. The democracy index also has a positive relationship with GDP in all the countries except Peru. The interaction of price and democracy index shows a similar trend as price except the sign on Zambia is negative. As expected most of the

components of GDP are positively correlated with it and so are the copper exports, except that of Australia and PNG

Table 3: Correlation between GDP and all other variables

Country	Australia	Chile	Papua New Guinea	Peru	Zambia
Variable	**RGDP**	**RGDP**	**RGDP**	**RGDP**	**RGDP**
Price	0.004	0.191	-0.088	0.083	0.129
Consumption	0.582	0.889	1.000	0.966	0.250
Investment	0.850	0.906	-0.148	0.840	0.263
Expenditure	0.320	0.375	0.302	0.629	0.026
Democracy		0.695		-0.041	0.100
Dem*Price		0.272		0.09	-0.033
Copper Exports	-0.001	0.181	-0.104	0.301	0.275

All variables are in logarithms except IQ variable

To understand how the copper export boom may affect GDP and its components, it was imperative to calculate the share of each component in GDP. The table 4 below shows the average ratios of the three GDP components (Consumption, Investment and Expenditure) to GDP from 1965-2010. Zambia had the highest level of consumption representing about 96% followed Chile, Peru PNG and Australia. Similarly Zambia had the highest ratio of investment to GDP as well the ratio of expenditure to GDP followed by Australia and PNG. Peru on the other hand had the smallest expenditure ratio to GDP of only about 10%. The table also shows that all the five countries had negative net exports (net importers) with Zambia having the largest deficit of about 45% while Peru had the smallest with 12%

Table 4: Ratio of Consumption, Investment and Expenditure to Real GDP

Country	Australia	Chile	Papua New Guinea	Peru	Zambia
Ratio Estimation	Ratio	Ratio	Ratio	Ratio	Ratio
Consumption/RGDP	0.762	0.814	0.808	0.812	0.955
Investment/RGDP	0.234	0.208	0.227	0.212	0.268
Expenditure/RGDP	0.178	0.159	0.204	0.099	0.225
Total	**1.174**	**1.181**	**1.239**	**1.123**	**1.448**
Exports/RGDP	-0.174	-0.181	-0.239	-0.123	-0.448

Data source: World Bank

5.1.1 Testing For Stationarity, Investigation Order of Integration and Selection of Lags

The Augmented Dickey Fuller (ADF) and KPSS test were used to test for level and trend stationarity of the variables using the MacKinnon (1991) test statistic critical value. All the variables were found to contain a unit root and the null hypothesis of non stationarity could not be rejected. This was evidenced by graphical analysis which showed an increasing trend in all the variables over time. After differencing once with various lags, the variables became stationary at 1% level. However the problem with the ADF test is that it has a low power (the null hypothesis of unit root may not be rejected when in reality there may be no unit root), hence a more powerful KPSS test was used to confirm the ADF test results and the KPSS results confirmed the ADF results. It was therefore concluded that all the variables were integrated of order one i.e. *I* (1). The table below shows the ADF results of differenced variable results.

Table 5: Augmented Dickey Fuller Tests (first differences)

Country	**Australia**		**Chile**		**Papua New Guinea**		**Peru**		**Zambia**	
Variable	t-statistic	lag	t-statistic	Lag	t-statistic	lag	t-statistic	lag	t-statistic	lag
lnRGDP	(-4.027)***	5	(-4.005)***	1	(-5.088)***	1	(-3.653)***	3	(-7.173)***	0
lnPrice	(-3.846)***	1	(-3.846)***	1	(-3.846)***	1	(-3.846)***	1	(-3.846)***	1
lnConsump	(-.3654)***	1	(-4.245)***	1	(-4.339)***	3	(-3.698)***	2	(-4.553)***	2
lnInvest	(-4.646)***	2	(-4.365)***	2	(-5.343)***	6	(-4.192)***	4	(-3.858)***	2
lngovtexp	(-5.382)***	2	(-3.706)***	1	(-4.240)***	2	(-4.197)***	2	(-4.652)***	1
lnREX	(-3.723)***	0	(-3.723)***	0	(-5.498)***	1	(-4.234)***	1	(-6.514)* **	5

****Significant at 1% level **Significant at 5% *Significant at 10% All tests based on MacKinnon approximate p-value*

The optimal numbers of lags used in the VAR were determined using Likelihood Ratio test statistics (LR) and Akaike's Information Criterion (AIC), (table 6 below). The LR test compares a VAR with p lags with one with p_{-1} lags, given the number of lags, p. The null hypothesis is that all the coefficients on the p^{th} lags of the endogenous variables are zero. The AIC on the other hand measures the discrepancy between the given model and the true model and the lag with the smallest value is the order selected by that criterion. In both selection criteria, the optimal number of lags is indicated by an asterisk (*).

Table 6: Selection of Lags for VAR

Country	AUS		PNG		CHIL		PER		ZMB	
Lag	**LR**	**AIC**	**LR**	**AIC**	**LR**	**AIC**	**LR**	**AIC**	**LR**	**AIC**
0		-20.952*		-5.151*		-8.296		-8.107		-2.319
1	45.945	-20.848	21.011	-4.8366	74.32	-8.354	32.664	-7.820	87.86	-2.736
2	40.312	-20.600	22.605	-4.5681	123.53	-9.642	60.244	-7.823	59.282	-2.402
3	34.994	-20.215	21.768	-4.2758	69.041	-9.568	72.141	-8.842	42.482	-1.625
4	46.449*	-20.124	43.642*	-4.6175	107.9*	-10.466*	113.76*	-9.066*	134.52*	-3.270*

**Optimal number of Lags Endogenous: first differences in Natural logs of Real GDP, Consumption, Investment, Expenditure, Price and the IQ, interaction between IQ and Price (for Chile, Peru and Zambia)*

In all the five countries, the optimal number of lags indicated by the LR was four while the AIC indicated zero for Australia and PNG and four for other three countries. Using zero lags for estimation in the two countries did not give any meaningful results. Moreover since annual data is used in this study, it is plausible to expect that a meaningful relationship would be significant after a year and more, hence in all the VAR estimations, four lags were used.

5.2 Econometric Results

The VAR model was estimated using Seemingly Unrelated Regression and in the estimation, contemporaneous prices were not included because the baseline estimation showed that almost all of its coefficients were not significant. Note that because there were no variations in the institutional variable over time for Australia and PNG(table 2 above), only the effect of copper export booms (price) on GDP and its components were explored for these countries(for the rest of the countries both variables were taken into consideration). Since there were five countries in this study, a VAR was estimated for each and all the system results are presented in appendix 3. Note that the number of lags used in the estimation for all the variables was 4 and for the equations without the IQ variable, 5 variables were used for each equation(Australia and PNG) and those with the IQ and the interaction term included, 7 variables were used. This implies that for a VAR structure with the number of lags equal to 4 and 7 variables assuming no simultaneity, trends and other complicating factors that are possible, the simple rule of thumb is $k+pk^2$ where k is the number of variables and p is the number of lags i.e. with our 7 variables, our total number of parameters to be estimated would be 203, with each of the 7 equations having 29 parameters (including the intercept). The reported SUR results in appendix 3 show that the total number of parameters estimated for the four equations was 112, with each equation having 28 parameters(without the intercept). If the number of lags were 5, then a total of 140 parameters would be estimated with each equation having 35 parameters.

In applied work, because of the complicated dynamics in the VAR, most researchers do not interpret the VAR coefficients, they are instead interested to know the response of one variable to an impulse in another variable i.e. impulse-response relationship between two variables[3]. Hence the interpretations of the results are mainly based on the Cumulative Impulse-Response Functions (CIRF) and Granger causality tests. According Lütkepohl (2005), if there is a reaction of one variable to an impulse in another variable we may call the latter causal for the former, hence the impulse response functions will in a way give us the idea about causality between the variables. To fully account for the total effect of price with the interaction of IQ, calculations based on simulations in excel were used.

3. Stoke and Watson(2001) and Lütkepohl(2005) explain this in detail

5.2.1 Contribution of Copper Export Booms and the Effect of the Quality of Institutions

5.2.1.1 Copper Export Booms and Real GDP

a) Australia

The results for Australia are presented in appendix 3A table A1. Real GDP seems to be quite autoregressive with most of its lags entering significantly in its own equation. There was no significant cross equation effect of GDP with its components including investment though the relationship was positive. The total effect of the price on GDP over the four lags (considering the significant lags) was however negative with a coefficient of -0.03 implying a 10% increase in the price results on average in a 0.3% decrease in GDP. This result is questionable and shouldn't be taken too seriously because the share of copper exports in GDP is less than 1% (table 1 above) and therefore may not explain much of the relationship. The price also has an overall negative effect on consumption, investment and government expenditure.

[Table A1]

The CIRFs of price to GDP and its components for Australia are presented in figure 5.1 below. The impulse is a one standard deviation positive shock (exogenous shock) or innovation from the international copper market with the response being the cumulative growth rates of GDP and its components at 5% confidence level. A shock in the price of copper seems to have the greatest effect on investment. A one standard deviation shock in the price initially leads to an increase in investment in the first four years and then decreases after the fourth year before rising again

Cumulative Impulse-Response functions of Price-Consumption, Expenditure, Investment and Real GDP (Australia)

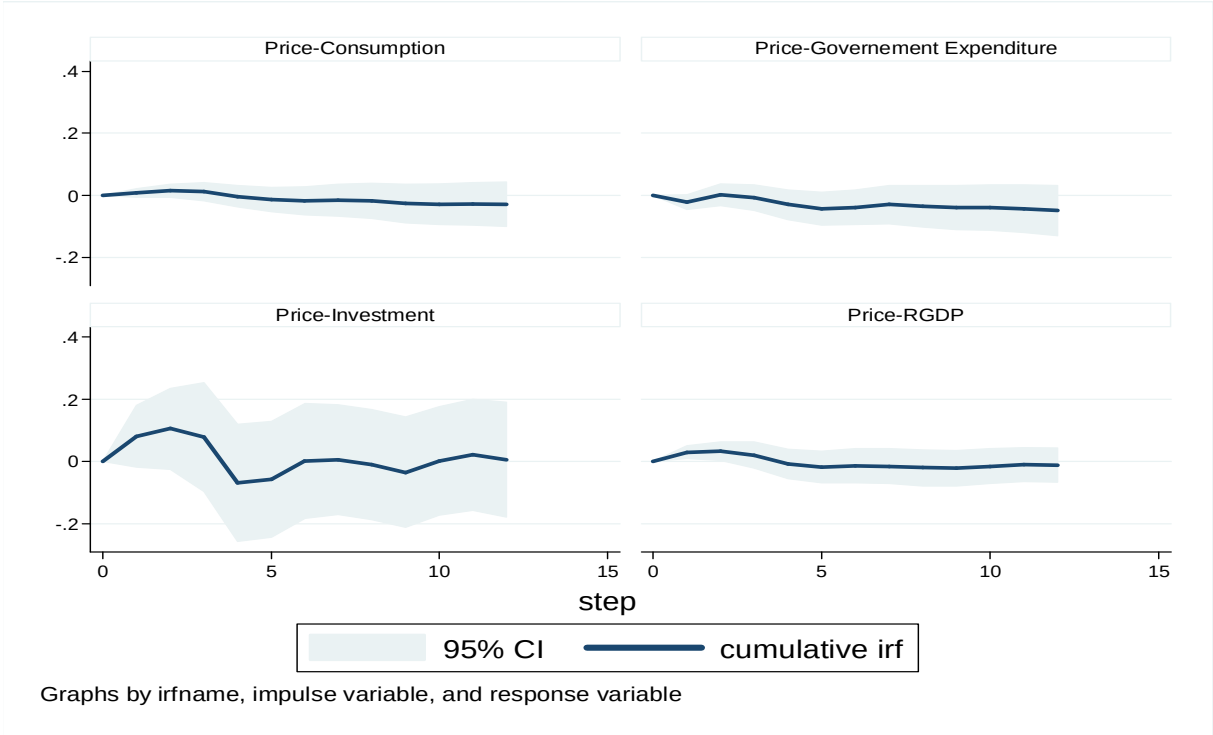


Figure 5.1: Cumulative Impulse-Response functions of Price- Consumption, Expenditure, Investment and Real GDP for Australia

The shock seems to taper off to zero after the 8th period or year. There was a slight increase in GDP in the first three years and this is understandable owing to the size of the copper sector in Australia economy. Similarly the significant response of consumption and expenditure to a shock in price was quite small implying that price did not lead to an increase in either consumption or expenditure in Australia.

b) Papua New Guinea

In the case of PNG, the consumption variable was dropped because there was perfect collinearity with GDP and so only three equations were estimated and coupled with this, the data series for PNG also had a lot of missing observations.

[Table A2]

All the coefficients in the Real GDP equation were not significantly different from zero and this may be due to the problems associated with the data explained above. The total effects of investment and price on GDP although not significant were positive with the sum of the coefficient of the four lags of 0.085 and 0.122 respectively. The positive relationship of price with GDP may imply that copper export booms are beneficial to the growth of the Papua New Guinean economy. The impulse-response functions below gives a visual representation of the results and similar to the Australian case, the price seems to generate the greatest response from investment with a shock in price leading to an increase in investment in the first year, subsiding in the second year. Investment increases again after the fourth year and the increase persist even after the 8th period. The price also appears to have an effect on GDP although the effect is smaller than that of investment. The noticeable effect on price is plausible for PNG considering the fact that copper exports contribute on average 13% to GDP.

Cumulative Impulse-Response functions of Price-Expenditure, Investment and Real GDP

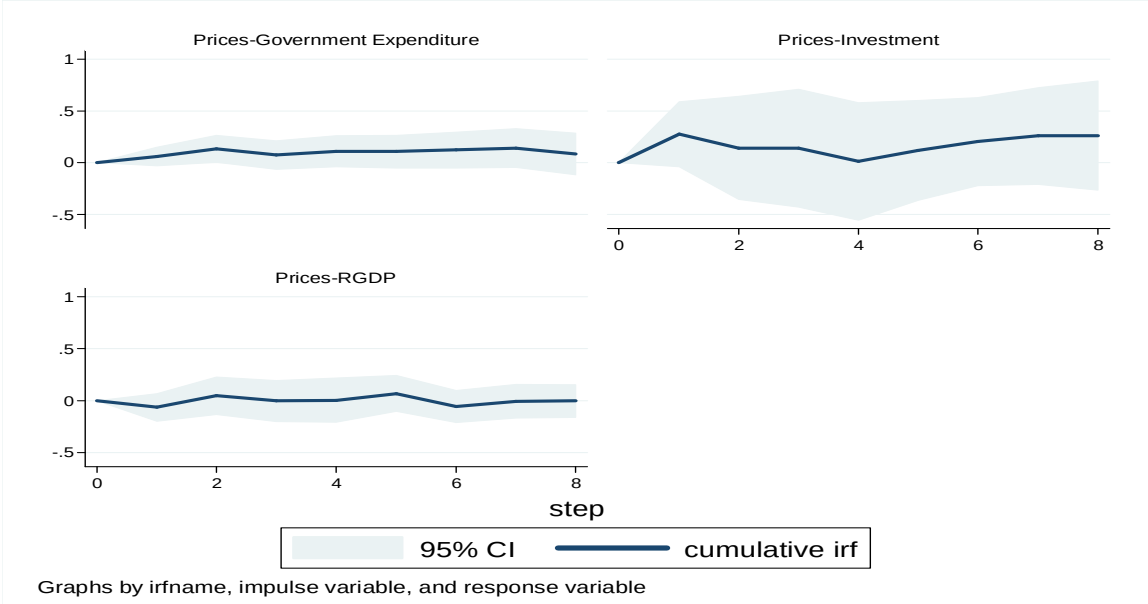


Figure 5.2: Cumulative Impulse-Response functions of Price- Expenditure, Investment and Real GDP

5.2.1.2 Copper Export Booms, IQ and Real GDP

To fully account for the effect of a one point increase in price in the case of our interaction variable, we need to account for the time dependency of the IQ values as well as the inclusion of lagged terms of price and IQ. In the VAR system, we have seven variables including the interaction term. Suppose the effect of an innovation in price in a system containing all the six variables is of interest. To isolate the effect of price on RGDP, consumption, investment and government expenditure, we assume that all the changes in the variables have values equal to zero, prior to time t = 0. To calculate the total response of RGDP to an impulse in price, we need the impulse response of a 1 unit increase in price plus the impulse response of price with the IQ variable multiplied by the given IQ values. To achieve this, regression coefficients were used to calculate the Impulse Response Functions (IRFs) taking into consideration the change in the IQ values. In the first simulation, the sum products of the regression coefficients and the initial changes in the values of the variables at time t=0 were calculated (this was done for all the four equations in the system) with our impulse variable, price set to zero, our base value for IQ to 1.5 and the intercepts at 1 to give us the IRF at t=0. In the second simulation, we introduce a one unit positive shock in price, together with a value of IQ for a specific point in time with all the changes in the other variables set to zero and the base IQ still at 1.5 to obtain impulse response after the shock. To obtain the IRF for the next year, these values are lagged by one year (up to 4 lags) and new values based on the previous year are calculated and so on up to time t=1, 2… 12. To get the IRFs for different values of IQ, we just change the values of IQ with all the other variables remaining unchanged. Note that since the equations were estimated as a system, all the cross equation effects of consumption, investment and government expenditure were taken into consideration when conducting the simulations. To obtain the correct IRFs for the total effect of price on GDP, we subtract the values of the IRF with the intercept and base IQ value only (simulation 1) from those that include the price and IQ changes (simulation 2) so as to correct for the effects of the intercepts. The same procedure was followed when calculating the IRFs at time t=1, 2… 12. To obtain the respective CIRFs, we add the individual growth rates or response of RGDP, consumption, investment and expenditure in 1 year to the value in the next year up to the 12^{th} year. In essence what we are looking for are the total growth rates of GDP and its components to a 1 unit increase in price, in the presence of varying values of IQ over the years. The simulations were done for Chile, Peru and Zambia

c) Chile

The results for Chile are presented in table A3 in the appendix. The total effect of price on GDP for the significant lags was positive (0.03) which is understandable for Chile owing to the fact that the share of copper in Chile's economy is on average about 16%. This implies that price has an impact on GDP with a 1% increase in price leading to a 0.03% increase in GDP all things being equal. The total effect of price (considering only the significant lags) on investment equation was positive (2.61) implying a 1% increase in price would lead to a 2.61% increase in investment which is quite substantial. The relationship of price with consumption and government expenditure was negative overall, with the total effect being -0.98 and -0.66

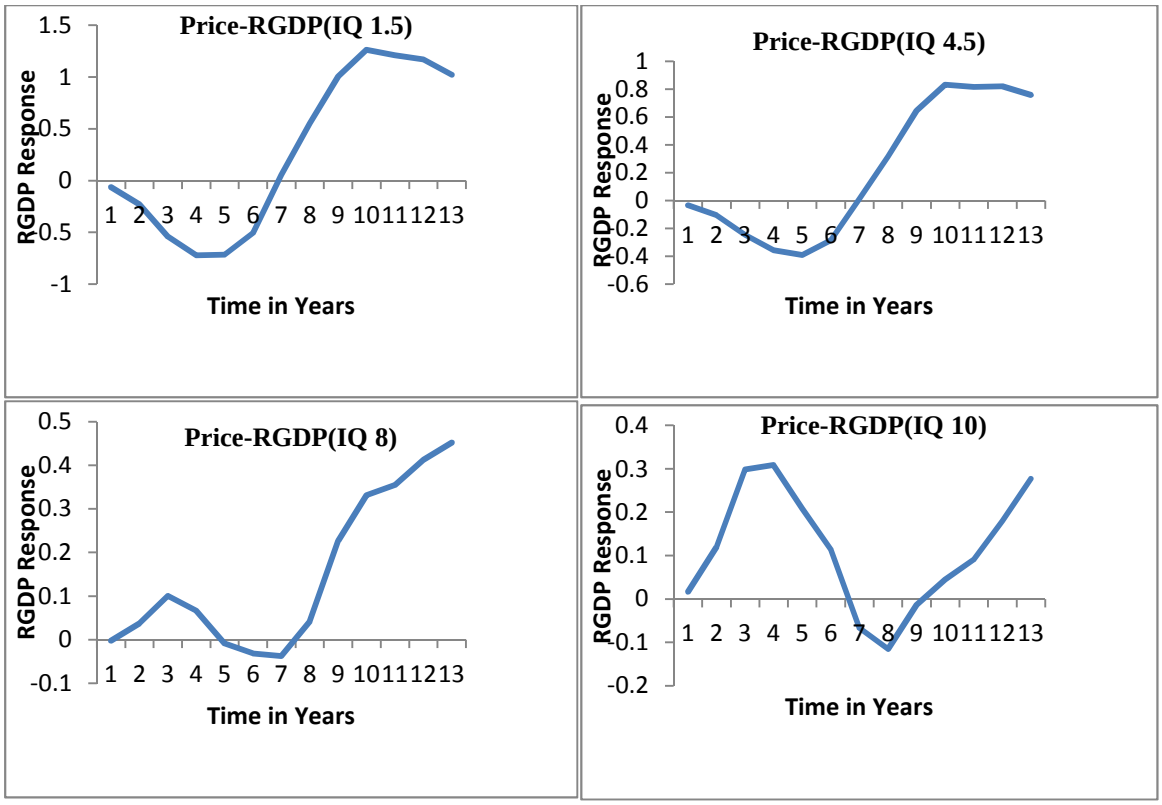
[Table A3]

The IQ variable, democracy was not significant over the four lags. Based on the regression coefficients, without fully accounting for the different values of IQ, the interaction between IQ and Price had a total effect of (-0.01).

In the three countries where we explore the role of IQ, the IQ scores range from from 1965-2010 and in the case of Chile, it's scores vary from 1.5 as the lowest score(worst IQ level) to 10 as the largest score (best IQ level). In order to understand how GDP responds to a shock in price with an improvement in the IQ scores from the worst to the best, we insert four different scores (1.5, 4.5, 8, and 10) one at a time in our simulation. The four scores depict the different levels of IQ that Chile experienced over the years and therefore included to understand what happens to GDP and it's components as IQ improves. Figure 5.3 below shows the CIRFs obtained after the simulations and starting with the lowest IQ value that Chile had in the 60's (1.5), a one unit increase in price initially leads to a decline in GDP response for the first four years before increasing in the fifth year up to the 12^{th} year. Notice that there was no big difference between the responses of GDP at 1.5 and 4.5 IQ level, suggesting that a change of 3 points in the IQ score did not bring about any significant change in GDP. Increasing the IQ score to 8 improved the GDP response substantially with the first three years turning positive. The response declined between the 3^{rd} to the 7^{th} after which we saw a sustained increase until the 12^{th} year. Increasing the IQ score to 10 led to a sharp increase in GDP in the first four years before declining until the 8^{th} period, after which there was a more sustained increase up to the 12 year. Notice that the fourth year had a GDP value that was more than twice the amount obtained with IQ 8. The result suggests that with

an improvement in IQ value, there is a corresponding increase in GDP especially for the first five years.

Cumulative Impulse-Response functions of Price -Real GDP



Source: own calculations

Figure 5.3: Cumulative Impulse-Response functions of Price -Real GDP for Chile

IRFs can also be understood as dynamic impact multipliers and as such they indicate the impact of price on GDP, for instance twelve years in the future (graphs above). To fully appreciate the impact of price taking into consideration the effect of institutions in present time, we discount responses of GDP, assuming an interest rate of 0.05(discount rate 0.952) at the different levels of IQ and sum them over the 12 years.

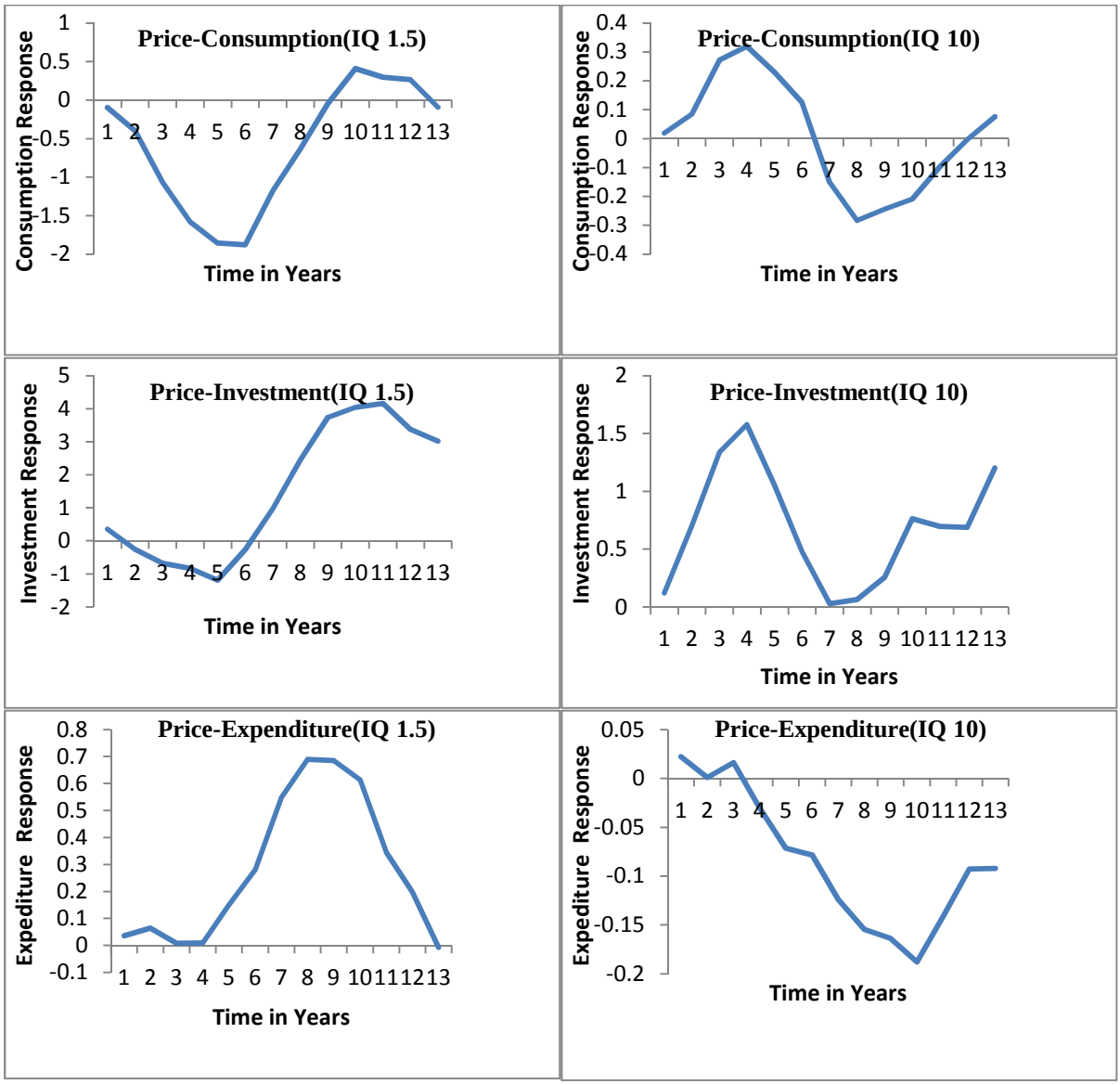
Table 7: Total Discounted Values for Chile

IQ level	1.5	4.5	8	10
Total Discounted Values	1.606	1.433	1.231	1.370

The results above suggest that with an improvement in the IQ, the total impact of a price increase on GDP declined for Chile. An increase in IQ from 8 to 10 however showed an improvement in the discounted sums by about 0.139.

The CIRFs below (figure 5.4) show the simulated total effect of price on investment, consumption and expenditure taking into consideration the IQ values at two points in time i.e. the lowest or worst and the highest or best IQ. With a low IQ value, the responses of consumption and investment to a one unit increase in price were negative at least for the initial five years in both cases. On the other hand an increase in the IQ value to 10, led to an increase in cumulative responses of both consumption and investment for first five years and after the 7^{th} period onwards suggesting that IQ has an effect on the consumption and investment as well. Notice that there was a close resemblance in CIRF graphs for GDP and consumption and this was expected since consumption forms the largest percentage in GDP at about 81.4%(see table 4) .There was a positive growth in expenditure at low IQ level especially after the 4^{th} to the 8^{th} period and a negative cumulative growth at a high IQ score, suggesting that an improvement in the IQ level leads to a decline in expenditure.

Cumulative Impulse-Response functions of Price-Consumption, Expenditure, and Investment



Source: own calculations

Figure 5.4: Cumulative Impulse-Response functions of Price- Consumption, Expenditure, Investment and Real GDP for Chile

(d)Peru

In the case of Peru, the total effect of price was positive in the GDP equation with the value of 0.31 (table A4 in the appendix). If the copper price were to increase by 1%, GDP on average would increase by 0.31%. There was no significant impact of price on investment over the four lags. There was evidence however that a 10% increase in price would on

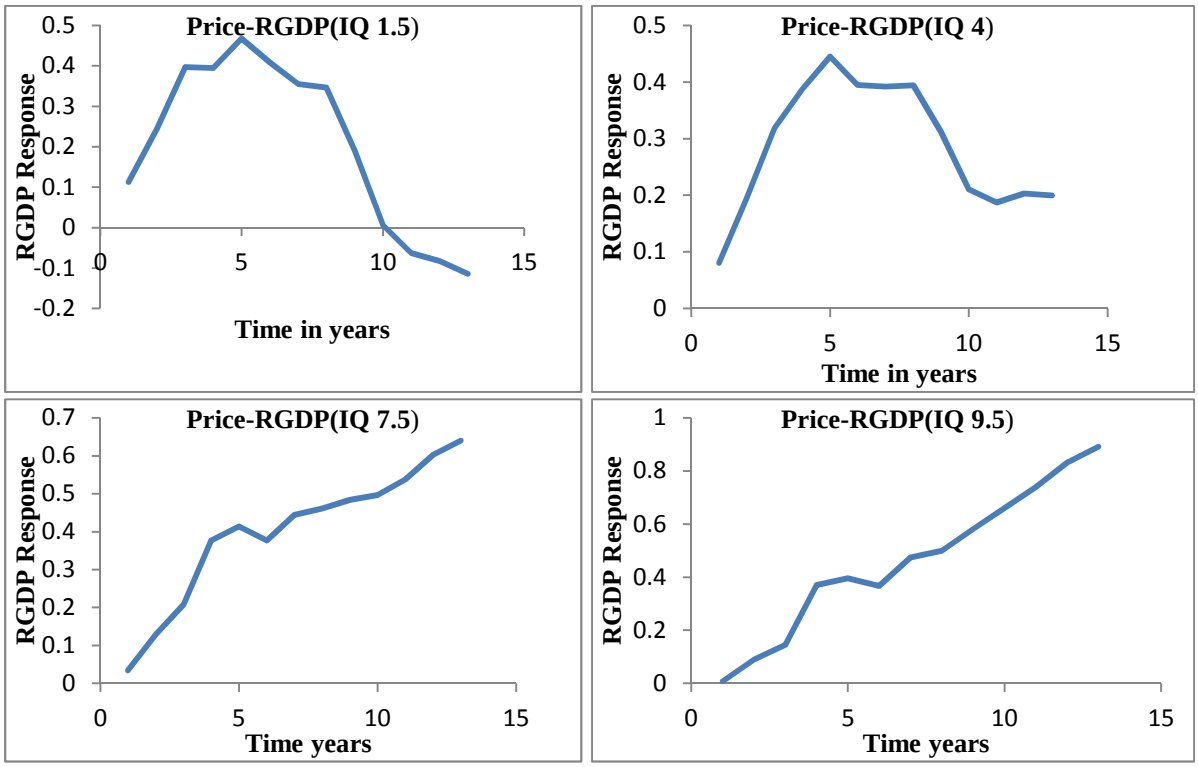
average increase consumption and government expenditure by 4.3% and 18.6% respectively considering only the significant lags.

[Table A4]

Considering the democracy and the interaction term, its overall effects on GDP considering only the significant coefficients were negative with values of -0.006 and -0.03 respectively.

To fully account for the IQ in analysing the effect of price on GDP and its components, the same simulation procedure as explained above was applied here. Figure 5.5 below shows responses of GDP to a one unit positive shock in price at IQ values 1.5(worst for Peru), 4, 7.5 and 9.5(best IQ). The CIRFs for Peru show a strong positive response to GDP with an improvement in the IQ score from 1.5 through to 9.5. Unlike Chile, there was a sustained increase in the GDP level for Peru until the 12th year and this strongly suggest that IQ has a big influence on the response or growth of GDP.

Cumulative Impulse-Response functions of Price -Real GDP

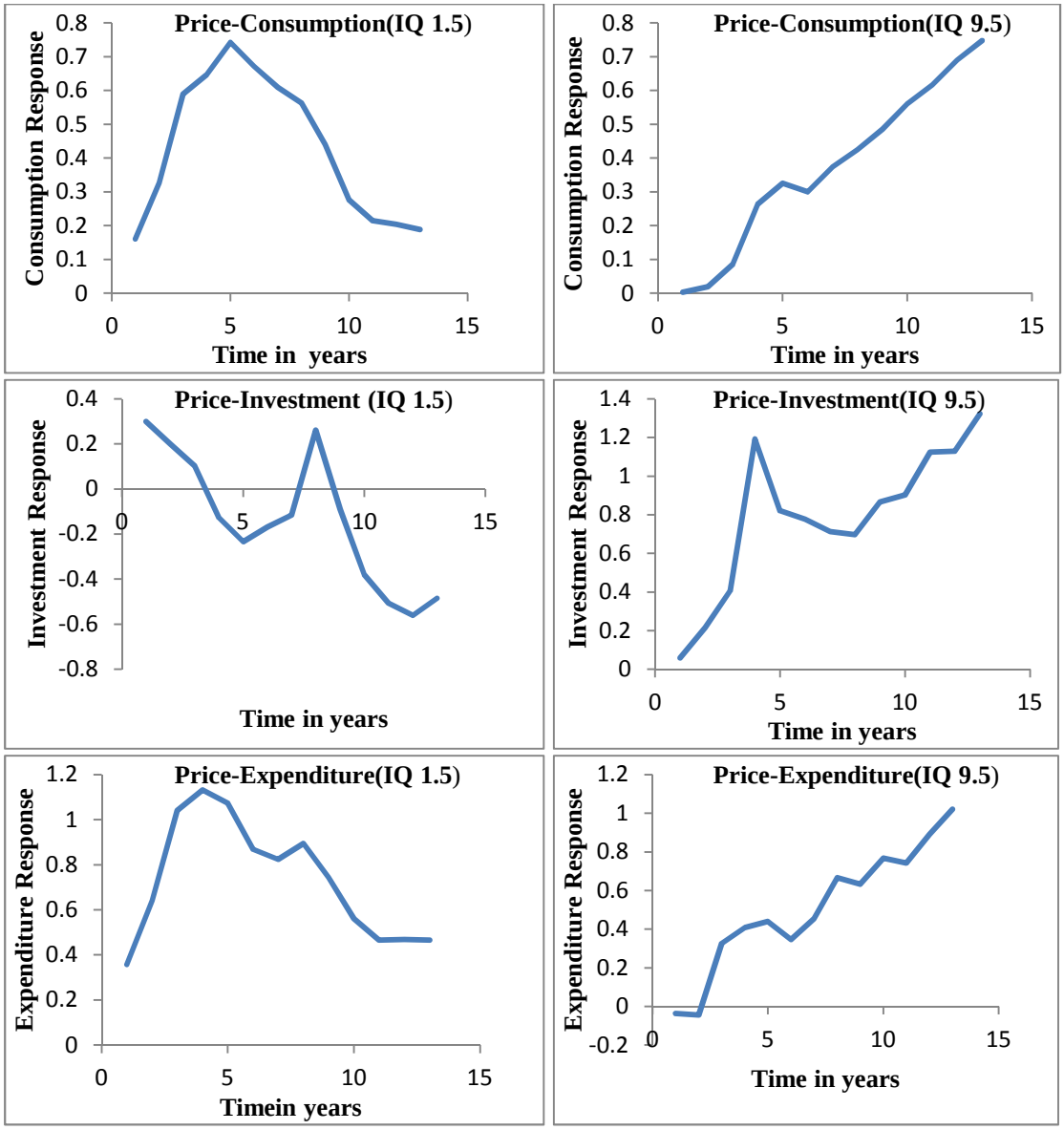


Source: own calculations

Figure 5.5: Cumulative Impulse-Response functions of Price -Real GDP for Peru

The CIRF for the GDP components are shown below in figure 5.6. The graphs for consumption and expenditure seem to follow the same trend as that of GDP with the cumulative growth in both equations increasing in the initial five years before decreasing thereafter at lower IQ levels. With an increase in the IQ score however, there is a corresponding increase in both consumption and expenditure. Investment however shows a different trend in that with a low IQ score, there is negative growth while at a higher IQ, investment increases quite steadily reaching a value of about 1.4%, higher than the response of the other variables, implying yet again that a price increase has the highest effect on investment.

Cumulative Impulse-Response functions of Price-Consumption, Expenditure, and Investment



Source: own calculations

Figure 5.6: Cumulative Impulse-Response functions of Price to Consumption, Expenditure, Investment and Real GDP for Peru

The table below show the discounted sum of impacts over the 12years, again under the assumption of the interest rate being 0.05. Unlike Chile, the total sums of GDP responses for Peru were increasing with a corresponding increase in the IQ level, showing a strong influence of institutions.

Table 8: Total Discounted Values for Peru

IQ level	1.5	4	7.5	9.5
Total Discounted Values	1.197	1.589	2.139	2.454

e) Zambia

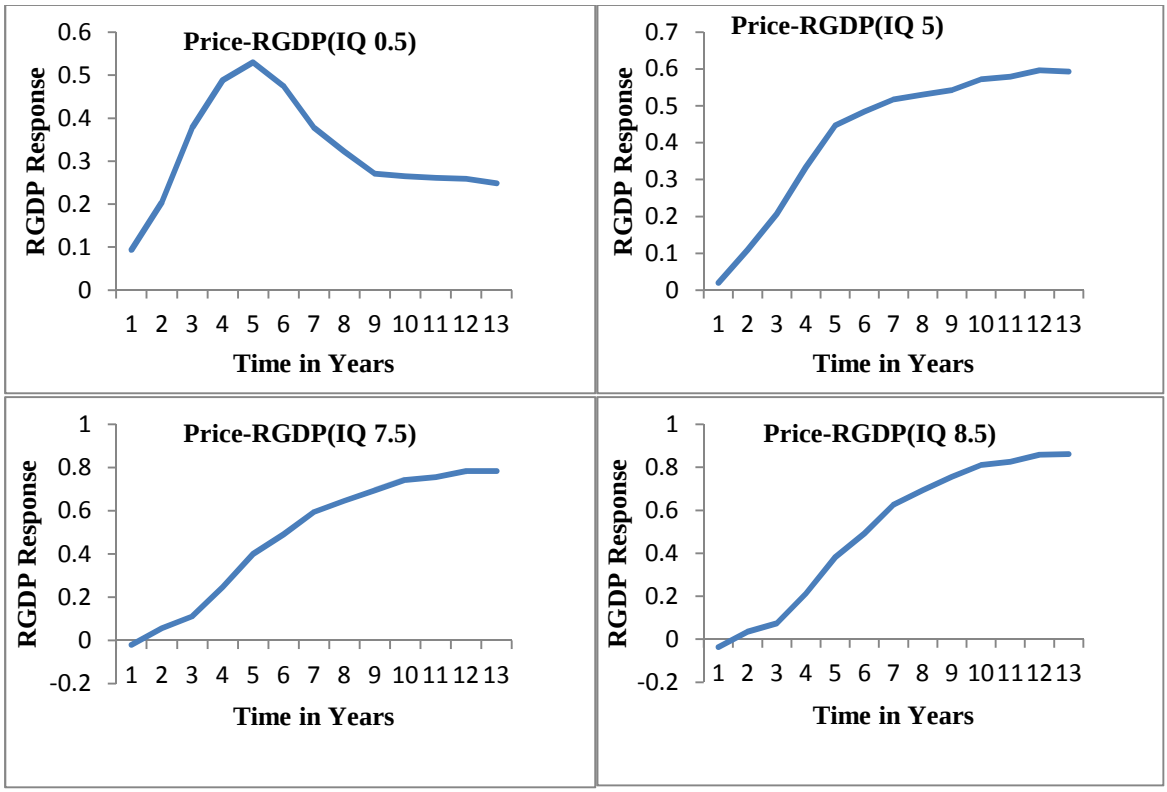
The total effect of price on GDP was negative (-0.09) considering only the significant lags implying that on average, copper exports have a negative impact on economic growth. The relationship of price and investment was positive and significant with a 10% increase in the price leading to a 11.3% increase in investment. The price also had a negative effect on consumption and a positive one on expenditure.

The IQ variable had a positive effect on GDP with the sum of the significant coefficients being positive (0.0005). The contribution of copper exports was significant with the interaction of price and IQ variable (relative to the effect of price only) positive suggesting that with an improvement in the quality of institutions, there is enhanced contribution of copper exports to economic growth. The total effect of the interaction variable was positive with a coefficient of 0.011. The increase in the copper price also induced the Zambian government to spend more in that 1% increases in price on average leads to a 2.9% increase in expenditure. On the other hand an increase in a 1% increase in price would on average lead to 0.92% decrease in consumption

[Table A5]

Accounting for changes in the IQ variable, the CIRF below show that at IQ 0.5(lowest IQ level for Zambia), cumulated GDP growth was increasing for a period of 1-6years before showing a decline with the values not turning negative . An improvement in the IQ value from 0.5 to 5 shows a sustained increase in GDP in all the years even in the 12^{th} year. A further improvement in the IQ score to 8.5 does not change the shape of graph that much but considering the 12^{th} year, the magnitude of the response is almost 1% which is higher than the other responses at the three lower IQ values. The implication is that with a higher IQ, the contribution of copper exports to economic growth is enhanced.

Cumulative Impulse-Response functions of Price -Real GDP (Zambia)



Source: own calculations

Figure 5.7: Cumulative Impulse-Response functions of Price -Real GDP (Zambia)

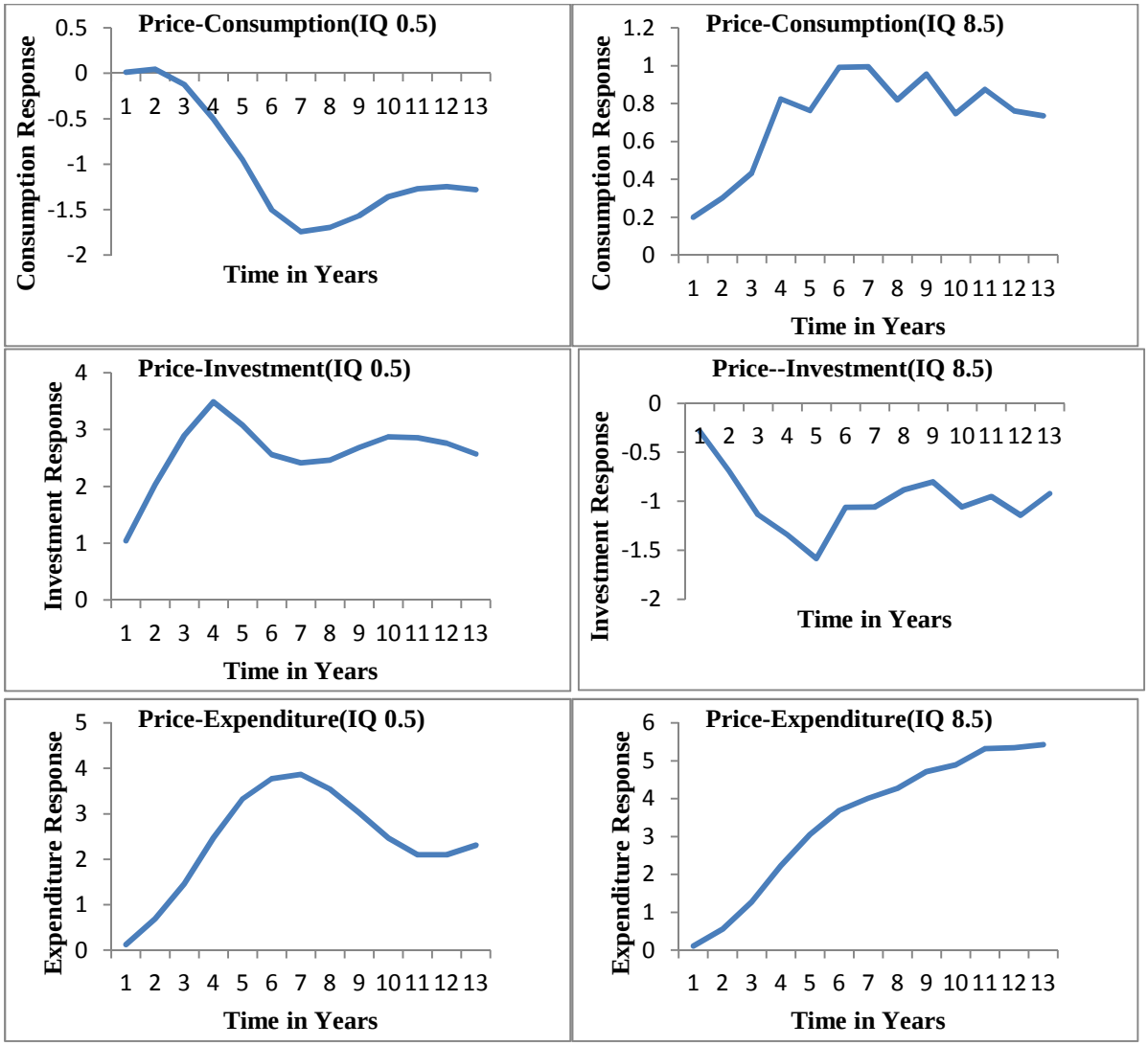
The discounted sum of impacts at the same discount rate of 0.952 for Zambia follow the same trend as that of Peru, where we see an increase in GDP response with an increase in IQ level (table below). Similar to the discounted results for Peru, Zambia shows also a very strong correlation between institutions and the response of GDP to a copper export boom.

Table 9: Total discounted values for Zambia

IQ level	0.5	5	7.5	8.5
Total Discounted Values	3.083	3.861	4.294	4.467

Consider the CIRFs in figure 5.8 below, which show cumulative responses of GDP components to a one unit increase in the price at two IQ values, the lowest and the highest IQ attained by Zambia i.e. 0.5 and 8.5. The results suggest that with an increase in the IQ value, there was an increase in consumption and expenditure while investment reduced. It is worthwhile to note that the reaction of investment is different from the corresponding reactions in the cases of Chile and Peru. Expenditure on the other responds in a similar way as that of Peru.

Cumulative Impulse-Response functions of Price- Consumption, Expenditure, and Investment



Source: own calculations

Figure 5.8: Cumulative Impulse-Response functions of Price- Consumption, Expenditure, Investment and Real GDP for Zambia

5.2.2 Granger Causality Wald Tests

Granger causality is a statistical concept of causality that is based on prediction. According to Granger causality, if a signal X_1 "Granger-causes" (or "G-causes") a signal X_2, then past values of X_1 should contain information that helps to predict X_2 above and beyond the information contained in past values of X_2 alone. Its mathematical formulation is based on linear regression modeling of stochastic processes (Granger, 1969).

Granger causality tests were conducted to determine whether price and price together with the interaction between IQ and price Granger-caused GDP. Similarly, Granger causality tests were also carried out to test whether price Granger caused investment. In Table 10 below, the first hypothesis tests that the coefficients of the four lags of price that appear in the equation with the dependent variable Real GDP are jointly equal to zero. Similarly the second hypothesis test that the coefficients of the four lags of the IQ variable that appear in the equation with the dependent variable Real GDP are jointly equal to zero. To test the total effect of price on GDP, we test whether the coefficients of the four lags of price together with the coefficients of the four lags of the interaction term that appear in the equation of Real GDP are jointly equal to zero. The same interpretation follows for the other hypotheses. This is a post-estimation test after the estimation of a VAR model that performs Wald tests of simple linear hypotheses about the parameters in our model. The hypothesis that price does not Granger-cause real GDP is rejected for Australia, but not rejected for PNG, implying that price cause Real GDP in the case of Australia. In other words this implies that copper exports cause GDP. Democracy Granger causes Real GDP in both Peru and Zambia at 10% and 5% respectively, with outcome for Chile being insignificant. The third hypothesis is rejected, implying that price together with the interaction between IQ and price Granger causes Real GDP for all the three countries where the effect of institutions is explored. This confirms the results depicted by the cumulative impulse-response functions above.

Table 10: Granger Causality Wald tests

Country	**Australia**	**Chile**	**PNG**	**Peru**	**Zambia**
Null Hypothesis	t-statistic(chi2)	t-statistic(chi2)	t-statistic(chi2)	t-statistic(chi2)	t-statistic(chi2)
Price does not Granger-cause RGDP	23.271***		4.434		
Democracy does not Granger RGDP		3.274		7.895*	13.268**
(Price +Dem*Price) does not Granger-cause RGDP		42.060 ***		13.235**	25.287***
Price does not Granger cause Investment	16.28***	30.908***	6.32	8.595*	47.943***
Investment does not Granger-cause RGDP	0.211	9.762**	1.79	23.335 ***	52.465***

****significant at 1% ** significant at 5% *significant at 10%*

The relationship between price and Investment was found to be a significant one for all the countries except PNG. The impulse-response functions on the other hand showed a high response of investment to a shock in prices for all the countries.

5.2.3 Copper Export Booms and Exchange Rate

In chapter three, explanation about the Dutch disease theory was given and that this phenomenon results in the appreciation of the real exchange rate. According to Miller and Simpasa,(2010) the exchange rate is the key mechanism for the Dutch disease argument to be valid, hence the level of the exchange rate's dependence on the international price of copper will help to give an insight of the potential Dutch disease symptoms. Equation 5 was used to study the relationship between the exchange rate and prices. The table below gives the sum of the coefficients of the VAR estimates. The most important result and the interest for this study is the effect of price on the Real Exchange rate. There was a negative relationship between RER and price for Australia, Chile and PNG and a positive one for Peru and Zambia. All the results were not significant except for Zambia which had a significant fourth lag at 5%. Table 11 below shows the sum of the coefficients for the three lags.

Table 11: Sum of VAR Coefficients

	AUS		**CHIL**		**PNG**		**PER**		**ZMB**	
Total of Three lags	**RER**	**Price**	**RER**	**Price**	**RER**	**Price**	**RER**	**Price**	**RER**	**Price**
RER	-0.031	1.041	0.684	-0.488	-0.445	3.757	-0.734	0.247	-0.142	-0.199
Price	**0.081**	**-0.044**	**-0.001**	**-0.086**	**0.113**	**-0.270**	**0.055**	**0.132**	**0.119**	**0.014****

Number of Observations=27 1980-2010

The CIRF for Zambia between price and REER is shown in fig 5.9 (for the other countries see appendix 3B). A one standard deviation shock in prices generates a highly significant response from the REER with the REER values settling at higher level than the initial one. This suggests that copper export boom led to the appreciation of the exchange rate in the case of Zambia.

Cumulative Impulse-Response functions of Price to Real Effective Exchange Rate

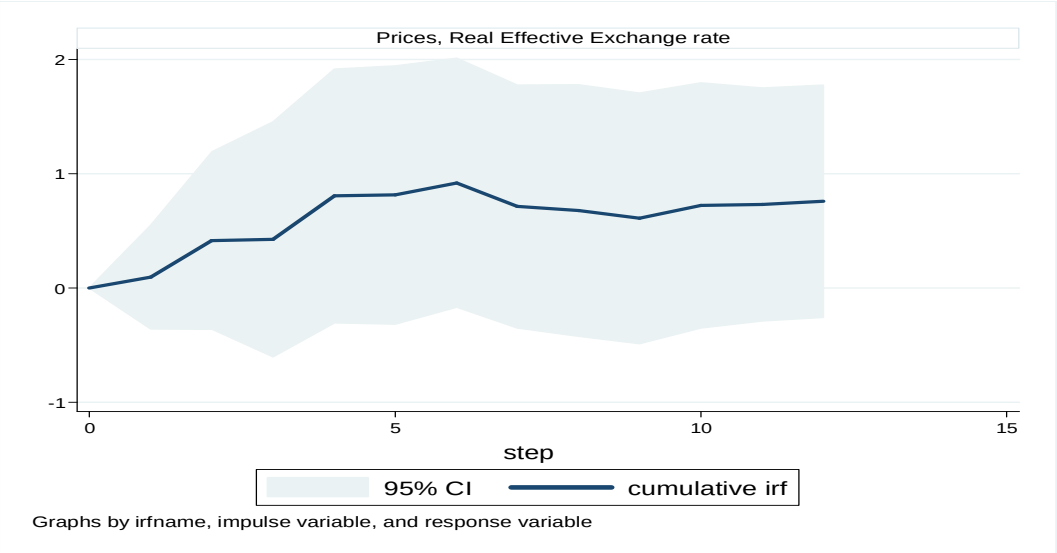


Figure 5.9: Cumulative Impulse-Response functions of Price to Real Exchange rate for Zambia

5.3 Discussion

The study has brought out four major findings (i) There is a relationship between copper booms and economic growth (ii) The copper price has a stronger effect on investment than on Real GDP, consumption and expenditure (iii) Institutional quality has an effect on the contribution of copper export to economic growth (iv) copper export booms did not have a very strong effect on the real exchange rates in four of the five countries under study.

It was evident from the results that the copper price affects GDP in all the countries except PNG which did not show any significant result mainly because of the reasons highlighted earlier and therefore no inferences will be made based on PNG results. Generally the results for the other countries compare well with the findings of Deaton and Miller (1995), considering that they used a stronger price index which included all the commodity prices, unlike the international copper price used in this study. The authors found that in the short run, copper export booms have a positive impact on GDP, especially through investment which similar to what this study has brought out. There was also some evidence that price induced an increase in consumption in all the countries and considering that consumption forms the largest share of GDP for all the countries, this suggests that copper exports forms an important part of these countries' GDP. Even though there was some evidence to suggest that price had an important effect on government expenditure for Zambia and Peru, this study could not bring to the fore whether copper export revenues reflected into an unsustainable rise in government expenditure in the short run so as to affect growth negatively after a short lived boom in both Peru and Zambia. In the case of Chile, the result that price had a little effect on expenditure is an important one in that it suggests that the Chilean government did not increase their spending in light of copper export booms.

The evidence from the cumulative impulse response functions and Granger causality tests show that the total effect of price and the interaction of democracy with price have a significant impact on GDP. The relationship is particularly stronger in Zambia and Peru which show a sustained cumulative increase in GDP with an increase in the IQ value. The discounted impacts also show that IQ had the highest impact on Zambia, followed by Peru and lastly Chile. The results was a bit surprising in that looking at table 1; the expectation was that we would see a greater impact from Zambia and Chile since their copper exports have a higher ratio in GDP than that of Peru. An explanation for Chile's results would be that the importance of the copper sector has been reducing in the Chilean economy in recent years and therefore the dependence on copper export revenues has also been reducing.

Nevertheless, an improvement in IQ in Chile led to a considerable increase in GDP in the first four to five years implying that an increase in IQ brings the positive results of price booms earlier than with lower IQ. The above results, especially for Zambia and Peru compare well with the results obtained by Collier and Goderis (2007) and Mehlum et al (2006) who contend that the contribution of natural resource booms is influenced by the quality of institutions. This study is a bit different from the above studies in that it traces out the impact of IQ at different points in time and how this influences GDP and its components.

Another interest in this study was to find out whether the countries under study had any symptoms of the Dutch disease which may in turn affect the copper's contribution to economic growth. Comparing with other studies such as those of Meller and Simpasa (2011), in the case of Chile, the results are similar since they also found a negative but insignificant result. In the case of Zambia on the other hand, the result differ only in terms of significant levels in that they found an insignificant, but positive result. Their study only focused on a few observations and furthermore they did not employ VAR estimation method to take advantage of more information concerning the variables. The results are however consistent with the findings of Calì and Willem te Velde (2007) who argued that copper export booms led to an increase in the real exchange rate in the case of Zambia. The fact that there was a positive relationship of price with the real exchange rate does not imply that Zambia suffered from the Dutch disease because this study did not go into detail to explore whether the appreciation of the exchange rate led to the spending and factor reallocation effects. In general however, the World Bank, (2009) and other recent literature discussed in chapter 3, explain that there is some evidence that most developing countries have succeeded in limiting the appreciation of their currencies, thus reducing potential adjustment costs as prices decline mainly due to prudent fiscal management and sterilizing of the inflows of foreign currency by converting them into foreign-denominated assets. Hence this could be one of the reasons of having the insignificant relationship between price and RER for the other countries.

In light of the above results another point of discussion would be that comparing the three countries above, Zambia has the smallest GDP per capital and if democracy had the largest impact on Zambia, why is Zambia's economic performance still low relative to the other countries? Of course this is a very broad question and to completely answer this question, one would have to look at the number of other factors including macroeconomic policies prevailing in the country that might have affected economic development. What is evident from the study though was that with an increase in GDP there was a corresponding increase

in expenditure, which would imply cross effects between GDP and expenditure .i.e. Increase in GDP leads to increase in expenditure which in turn feeds into GDP. If the expenditure was not effective (which is highly likely) then this could have affected Zambia's economic performance. There was also a substantial reduction investment with a price boom, suggesting that expenditure might have crowded out investment. Note also for Zambia that there is a potential of the adverse effects of the Dutch disease although not verified.

Finally there may be potential problems in the estimation of our results and one of them is that although estimating the equations separately for each country may have advantages of its own, this may have affected our results in that a number of observations and information was lost due to the inclusion of four degrees of freedom (lags) and differencing of variables. Another problem highlighted in the study by Deaton and Miller (1995) is that the split between consumption and investment should not be treated too seriously in that many statistical offices do not adhere to a uniform procedure of separating government expenditure from investment. The problem concerning the quality of data was clearly evident in the case of PNG. The choice of democracy as our IQ variable may also not be the most appropriate proxy in that it is more of a political score or variable than an indicator of governance.

5.4 Conclusions and Recommendations

The study provided evidence that in the short run copper price booms are beneficial for economic growth for most of the countries in question and that the channel of effects of the copper price booms are mainly through investment than directly on Real GDP. However including the interaction of IQ with price in the regressions resulted into a stronger relationship with Real GDP as evidenced from the cumulative impulse response functions, implying that to a certain extent the quality of Institutions are important in determining and augmenting the contribution of copper price booms to economic growth in the short run, consistent with many studies that have been done on institutions. It was also clear that in recent years, many countries have responded well to copper booms in that there was no significant real appreciation of the currencies in the countries under study, suggesting that many countries are now finding the cure for the Dutch disease. Hence for a country that wants to benefit more from its copper price boom revenues, the quality of institutions as well as the quality and amount of investment would need to be improved. The expenditures for government should also be effective so that it does not crowd investment and consequently economic growth.

Although the study attempted to find out the role of institutions in the short-run, further studies are recommended to look at these effects in the long-run; how does GDP and its components behave in the long run in response to copper export booms? This was quite a difficult study in that there were a lot of dynamics and interrelations among the variables at play, hence further in depth studies are recommended to look at these interrelationships with the use of different types of institutions that capture governance characteristics. Finally the results of this paper suggest that future research in that area may go a long way into understanding the role of macroeconomic policies prevailing in countries to properly isolate the effects of institutions.

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APPENDICES

Appendix 1: Description and Sources of Data

VARIABLE	DESCRIPTION	SOURCE
Real GDP for all the Countries	This is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in constant 2000 U.S. dollars.	WDI(World Bank)
Copper prices	Price of Copper in $/mt, in constant 2000$	GEM (World Bank)
Investment	Consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.. Data are in constant 2000 U.S. dollars.	WDI(World Bank)
Consumption	Sum of household final consumption expenditure and general government final consumption expenditure. This estimate includes any statistical discrepancy in the use of resources relative to the supply of resources. Data are in constant 2000 U.S. dollars.	WDI(World Bank)
Expenditure	Includes all government current expenditures for purchases of goods and services (including compensation of employees), but excludes government military expenditures that are part of government capital formation. Data are in constant 2000 U.S. dollars	WDI(World Bank)
Polity2	The POLITY score is computed by subtracting the AUTOC score from the DEMOC score; the resulting unified polity scale ranges from +10 (strongly democratic) to -10(strongly autocratic)	Polity IV project
Exchange Rate	Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. This implies that an increase in the value represents a real appreciation of the home currency, and a decrease represents a real depreciation.	GEM (World Bank)
Copper exports	Exports (combination) of concentrates and refined copper	International Copper Study Group (ICSG)

APPENDIX 2

Appendix2A: Percentage Share of World Copper Exports by Country

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chile	**39.3**	**38.8**	**37.8**	**38.2**	**39.6**	**44.3**	**39.9**	**38.7**	**40.4**	**39.1**
Peru	**4.6**	**4.2**	**4.5**	**6.9**	**6.4**	**6.6**	**7.8**	**6.9**	**7.8**	**8.6**
Australia	**4.7**	**5.0**	**5.8**	**5.5**	**5.6**	**5.0**	**5.4**	**5.0**	**4.8**	**5.9**
Canada	5.9	7.1	8.2	5.2	4.0	4.3	4.8	4.4	4.3	5.2
Zambia	**1.9**	**1.9**	**2.5**	**2.9**	**3.1**	**3.2**	**3.2**	**3.5**	**3.5**	**4.2**
Indonesia	5.2	6.7	6.6	7.2	6.7	4.4	6.6	5.1	4.3	4.0
Japan	3.3	3.0	3.8	3.6	2.5	1.6	1.9	2.4	3.1	3.2
USA	1.2	2.6	0.8	0.7	1.4	1.6	1.7	3.9	2.6	2.6
Kazakhstan	3.3	3.7	3.5	3.7	3.7	3.8	3.3	2.8	2.9	-
Poland	2.0	2.1	1.8	2.2	2.4	2.3	2.2	2.1	1.7	2.2
South Africa	0.5	0.3	0.6	0.4	0.3	0.2	0.3	0.5	0.6	2.0
Belgium	1.7	1.9	2.1	1.7	2.9	1.5	1.8	1.8	1.5	2.0
Other countries	23.6	20.3	18.9	18.5	18.5	18.5	18.4	20.3	18.7	18.5

Source: Miller and Simpasa (2010)

Appendix 2B: Total Copper exports by Country in Kilo MT (1990-2010)

	Australia	Chile	Peru	Zambia	Papua New Guinea
1990	217.6	1390.4	162.9	459.9	155.6
1991	218.555	1636.2	236.2	382.3	193.7
1992	256.529	1809.1	236.8	411.9	171.2
1993	275.109	1844.1	244.253	377.519	203.2
1994	312.972	1883.4	268.175	336.835	192.9
1995	228.031	2232.9	311.807	278.063	210.9
1996	356.317	2727	374.782	299.203	188.4
1997	417.766	3125.063	451.348	303.784	86.7
1998	504.829	3442.794	444.117	227.98	187.222
1999	575.7	4100.5	489.854	205.933	182.574
2000	642.672	4298.4	505.93	200.591	187.913
2001	715.702	4494.6	632.2	297.51	213.677
2002	709.589	4319.9	838.023	330.84	212
2003	733.9	4411.6	774.38	358.784	196
2004	678.12	5232.7	929.47	409.909	174
2005	797.57	4989.3	951.915	454.472	193
2006	776.99	4777.2	969.95	584.988	194.1
2007	694.555	5161.23	1124.555	537.25	169.034
2008	900.262	5116.6	1263.384	657.65	159.7
2009	891.981	4977.33	1245.957	795.895	166.7
2010	908.1349	5023.6	1251.731	792.821	159.744

Source: ICSG

APPENDIX 3

Appendix 3A: Vector Autoregressive Results (VAR) for Australia, Chile, PNG, Peru and Zambia

All the VAR results were estimated using Seemingly Unrelated Regression (SUR)

Table A1: GDP components, Copper Price and Institutions(Australia)

Dependant Variables	**RGDP**	**Consumption**	**Investment**	**Expenditure**
Independent Variables	Independent variables Coefficients (Absolute t-values in parenthesis)			
$lnRGDP_{t-1}$	0.43(1.92)**	0.05(0.35)	1.36(1.28)	-0.006(-0.03)
$lnRGDP_{t-2}$	0.56(2.56)**	0.23(1.53)	1.08(1.02)	-0.30(1.19)
$lnRGDP_{t-3}$	0.21(0.87)	0.04(0.24)	0.09(0.08)	-0.16(-0.6)
$lnRGDP_{t-4}$	-0.51(-2.08)**	0.11(0.66)	-0.72(0.62)	0.012(0.05)
lnC_{t-1}	-0.72(2.3)**	-0.15(0.69)	-4.46(3.00)***	-0.01(0.03)
lnC_{t-2}	-0.29(0.88)	-0.09(0.39)	-2.51(1.62)	0.72(1.96)**
lnC_{t-3}	0.47(1.47)	0.78(3.54)***	3.58(2.37)***	0.81(2.26)**
lnC_{t-4}	0.12(0.37)	-0.06(0.29)	1.73(1.16)	-0.50(1.41)
lnI_{t-1}	-0.06(1.16)	0.06(1.62)	-0.09(-0.36)	0.05(0.82)
lnI_{t-2}	-0.06(1.01)	0.04(0.93)	0.10(0.38)	0.03(0.5)
lnI_{t-3}	-0.05(0.96)	-0.06(1.57)	0.02(0.09)	-0.06(-0.97)
lnI_{t-4}	0.09(1.97)**	-0.02(-0.63)	0.02(0.07)	-0.0.3(-0.56)
lnG_{t-1}	0.52(3.19)***	0.09(0.80)	1.13(1.46)	0.19(1.03)
lnG_{t-2}	-0.20(1.00)	-0.06(0.4)	-0.08(-0.09)	-0.34(-1.52)
lnG_{t-3}	-0.30(1.88)*	-0.33(-2.97)***	-1.76(-2.33)**	-0.20(-1.09)
lnG_{t-4}	0.05(0.37)	0.01(0.12)	-0.34(-0.54)	0.20(1.34)
lnP_{t-1}	0.03(2.81)***	0.01(1.11)	0.08(1.60)	-0.02(1.82)*
lnP_{t-2}	0.01(1.09)	0.00(0.60)	0.05(0.96)	0.02(1.92)**
lnP_{t-3}	-0.03(2.4)**	-0.01(1.82)*	-0.03(0.5)	-0.03(1.98)**
lnP_{t-4}	-0.03 (2.26)**	-0.02(2.6)***	-0.19(3.24)***	-0.01(0.88)

***significant at 1% significant at 5% significant at 10% No of obs = 39 (1970-2008)

Table A2: GDP, GDP components and Copper Price (PNG)

Dependant Variables	**RGDP**	**Investment**	**Expenditure**
Independent Variables	Independent variables Coefficients (Absolute t-values in parenthesis)		
$lnRGDP_{t-1}$	-0.16(0.96)	-0.31(0.83)	-0.10(0.95)
$lnRGDP_{t-2}$	-0.04(0.26)	-0.07(0.18)	0.09(0.79)
$lnRGDP_{t-3}$	0.16(0.83)	0.43(0.97)	-0.52(4.1)***
$lnRGDP_{t-4}$	-0.37(1.63)	-0.22(0.42)	0.43(2.85)***
lnI_{t-1}	0.00(0.03)	0.31(1.83)*	0.01(0.3)
lnI_{t-2}	0.08(1.23)	-0.32(1.99)**	0.04(0.8)
lnI_{t-3}	-0.02(0.35)	-0.15(0.97)	-0.07(1.52)
lnI_{t-4}	0.02(0.37)	0.12(0.83)	0.05(1.12)
lnG_{t-1}	0.09(0.38)	0.85(1.47)	0.16(0.99)
lnG_{t-2}	-0.24(1.08)	-0.07(-0.14)	-0.47(3.21)***
lnG_{t-3}	-0.36(1.46)	0.75(1.31)	0.34(2.04)**
lnG_{t-4}	-0.08(0.36)	0.18(0.36)	0.11(0.78)
lnP_{t-1}	-0.06(0.93)	0.27(1.71)*	0.06(1.33)
lnP_{t-2}	0.09(1.15)	-0.27(1.48)	0.06(1.06)
lnP_{t-3}	-0.08(1.11)	0.22(1.35)	0.00(0.02)
lnP_{t-4}	0.12(1.62)	-0.23(1.29)	0.06(1.26)

***significant at 1% significant at 5% significant at 10% No of Obs =35 (1970-2004)

Table A3: GDP, GDP components, Copper Price and Institutions (Chile)

Seemingly unrelated regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
GDP	40	28	.0163495	0.8945	339.00	0.0000
Consumption	40	28	.0196529	0.9451	688.65	0.0000
Investment	40	28	.0629995	0.9274	511.16	0.0000
Expenditure	40	28	.011307	0.9290	523.59	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RGDP						
dlnRGDPC						
L1.	**.6977153**	**.2996482**	**2.33**	**0.020**	**.1104156**	**1.285015**
L2.	-.6646253	.5125588	-1.30	0.195	-1.669222	.3399714
L3.	**1.801522**	**.3906803**	**4.61**	**0.000**	**1.035803**	**2.567241**
L4.	**.8201407**	**.3582917**	**2.29**	**0.022**	**.1179019**	**1.522379**
dlnConsumpC						
L1.	-.2770036	.2649412	-1.05	0.296	-.7962789	.2422717
L2.	.291745	.3066046	0.95	0.341	-.309189	.892679
L3.	**-.8563207**	**.1797482**	**-4.76**	**0.000**	**-1.208621**	**-.5040207**
L4.	**-.4811275**	**.1644891**	**-2.92**	**0.003**	**-.8035203**	**-.1587348**
dlninvestC						
L1.	.0344988	.0578877	0.60	0.551	-.078959	.1479567
L2.	-.069119	.0624196	-1.11	0.268	-.1914592	.0532211
L3.	**-.1420095**	**.0601732**	**-2.36**	**0.018**	**-.2599468**	**-.0240721**
L4.	**-.1092604**	**.0397192**	**-2.75**	**0.006**	**-.1871086**	**-.0314122**
dlnGovtexpC						
L1.	.0185684	.2901513	0.06	0.949	-.5501177	.5872545
L2.	.1937956	.205583	0.94	0.346	-.2091398	.596731
L3.	.2177155	.2711714	0.80	0.422	-.3137707	.7492018
L4.	**-.5185098**	**.2889682**	**-1.79**	**0.073**	**-1.084877**	**.0478575**
dlnprices						
L1.	-.0759809	.0558018	-1.36	0.173	-.1853504	.0333887
L2.	**-.1326453**	**.0571849**	**-2.32**	**0.020**	**-.2447256**	**-.020565**
L3.	-.0940669	.0802224	-1.17	0.241	-.2512999	.0631661
L4.	**.1623043**	**.0909528**	**1.78**	**0.074**	**-.01596**	**.3405685**
DemC						
L1.	.0045635	.0043546	1.05	0.295	-.0039714	.0130984
L2.	.0004237	.0071176	0.06	0.953	-.0135265	.0143739
L3.	-.0039442	.0074424	-0.53	0.596	-.0185311	.0106426
L4.	-9.45e-06	.0059262	-0.00	0.999	-.0116245	.0116056
L1DemPC	.0092383	.0069635	1.33	0.185	-.0044099	.0228865
L2DemPC	**.0208702**	**.0067649**	**3.09**	**0.002**	**.0076112**	**.0341291**
L3DemPC	.0112477	.0092702	1.21	0.225	-.0069215	.0294169
L4DemPC	**-.0267799**	**.0099466**	**-2.69**	**0.007**	**-.0462749**	**-.0072849**
_cons	-.0124906	.0209982	-0.59	0.552	-.0536463	.0286651
Consumption						
dlnRGDPC						
L1.	**1.237641**	**.3601921**	**3.44**	**0.001**	**.5316769**	**1.943604**
L2.	-.9953321	.6161213	-1.62	0.106	-2.202908	.2122435
L3.	**.9442056**	**.4696173**	**2.01**	**0.044**	**.0237726**	**1.864639**
L4.	.1074232	.4306845	0.25	0.803	-.7367029	.9515494
dlnConsumpC						
L1.	**-1.277077**	**.3184726**	**-4.01**	**0.000**	**-1.901272**	**-.6528821**
L2.	.1185435	.3685541	0.32	0.748	-.6038092	.8408962

L3.	**-.4628401**	**.2160664**	**-2.14**	**0.032**	**-.8863224**	**-.0393579**
L4.	-.2984195	.1977241	-1.51	0.131	-.6859517	.0891127
dlninvestC						
L1.	**.2242469**	**.0695839**	**3.22**	**0.001**	**.0878648**	**.3606289**
L2.	**.1872784**	**.0750315**	**2.50**	**0.013**	**.0402195**	**.3343374**
L3.	.0833717	.0723312	1.15	0.249	-.0583949	.2251382
L4.	.0574688	.0477445	1.20	0.229	-.0361086	.1510463
dlnGovtexpC						
L1.	**.6551836**	**.3487764**	**1.88**	**0.060**	**-.0284055**	**1.338773**
L2.	**.4281692**	**.2471211**	**1.73**	**0.083**	**-.0561792**	**.9125177**
L3.	.3363222	.3259616	1.03	0.302	-.3025508	.9751953
L4.	-.1642445	.3473542	-0.47	0.636	-.8450463	.5165573
dlnprices						
L1.	**-.1188809**	**.0670766**	**-1.77**	**0.076**	**-.2503485**	**.0125868**
L2.	**-.3661294**	**.0687391**	**-5.33**	**0.000**	**-.5008555**	**-.2314033**
L3.	**-.4958344**	**.0964313**	**-5.14**	**0.000**	**-.6848363**	**-.3068324**
L4.	-.0379526	.1093298	-0.35	0.728	-.2522351	.1763299
DemC						
L1.	**.0090423**	**.0052345**	**1.73**	**0.084**	**-.001217**	**.0193017**
L2.	**.0171418**	**.0085557**	**2.00**	**0.045**	**.000373**	**.0339106**
L3.	-.0096963	.0089461	-1.08	0.278	-.0272304	.0078378
L4.	-.00914	.0071236	-1.28	0.199	-.0231019	.0048219
L1DemPC	**.013821**	**.0083705**	**1.65**	**0.099**	**-.0025848**	**.0302269**
L2DemPC	**.036413**	**.0081317**	**4.48**	**0.000**	**.0204752**	**.0523509**
L3DemPC	**.0479349**	**.0111432**	**4.30**	**0.000**	**.0260946**	**.0697752**
L4DemPC	-.0084122	.0119563	-0.70	0.482	-.0318462	.0150217
_cons	-.0686219	.0252409	-2.72	0.007	-.1180931	-.0191507
Investment						
dlnRGDPC						
L1.	**6.510668**	**1.154633**	**5.64**	**0.000**	**4.247629**	**8.773707**
L2.	-2.06732	1.97504	-1.05	0.295	-5.938328	1.803688
L3.	**5.287647**	**1.505407**	**3.51**	**0.000**	**2.337104**	**8.23819**
L4.	-1.567618	1.380604	-1.14	0.256	-4.273551	1.138316
dlnConsumpC						
L1.	1.592499	1.020897	1.56	0.119	-.4084221	3.59342
L2.	**3.638524**	**1.181438**	**3.08**	**0.002**	**1.322948**	**5.9541**
L3.	**-3.907586**	**.692623**	**-5.64**	**0.000**	**-5.265103**	**-2.55007**
L4.	1.027063	.6338252	1.62	0.105	-.2152118	2.269337
dlninvestC						
L1.	**-1.573434**	**.2230585**	**-7.05**	**0.000**	**-2.010621**	**-1.136247**
L2.	**-1.300385**	**.2405211**	**-5.41**	**0.000**	**-1.771798**	**-.8289722**
L3.	**-.596499**	**.2318651**	**-2.57**	**0.010**	**-1.050946**	**-.1420517**
L4.	**-.3568415**	**.1530498**	**-2.33**	**0.020**	**-.6568136**	**-.0568694**
dlnGovtexpC						
L1.	**-5.403716**	**1.118039**	**-4.83**	**0.000**	**-7.595032**	**-3.2124**
L2.	.5126899	.7921722	0.65	0.518	-1.039939	2.065319
L3.	**4.587091**	**1.044904**	**4.39**	**0.000**	**2.539117**	**6.635064**
L4.	**-5.294047**	**1.11348**	**-4.75**	**0.000**	**-7.476427**	**-3.111666**
dlnprices						
L1.	**.3920643**	**.2150209**	**1.82**	**0.068**	**-.0293688**	**.8134975**
L2.	-.1162635	.2203502	-0.53	0.598	-.548142	.3156149
L3.	**.8283993**	**.3091206**	**2.68**	**0.007**	**.2225341**	**1.434264**
L4.	**1.394419**	**.350468**	**3.98**	**0.000**	**.7075143**	**2.081324**
DemC						
L1.	**.0813382**	**.0167796**	**4.85**	**0.000**	**.0484507**	**.1142256**
L2.	**-.1796842**	**.0274261**	**-6.55**	**0.000**	**-.2334384**	**-.12593**
L3.	.0371464	.0286778	1.30	0.195	-.019061	.0933539

L4.	**.0553702**	**.0228353**	**2.42**	**0.015**	**.0106138**	**.1001266**
L1DemPC	-.0271995	.0268324	-1.01	0.311	-.07979	.0253911
L2DemPC	**.083942**	**.0260671**	**3.22**	**0.001**	**.0328515**	**.1350325**
L3DemPC	**-.0911113**	**.0357208**	**-2.55**	**0.011**	**-.1611227**	**-.0210999**
L4DemPC	**-.166721**	**.0383272**	**-4.35**	**0.000**	**-.241841**	**-.091601**
_cons	.0454074	.0809122	0.56	0.575	-.1131776	.2039925
Expenditure						
dlnRGDPC						
L1.	**-.7862156**	**.2072309**	**-3.79**	**0.000**	**-1.192381**	**-.3800505**
L2.	-.0774383	.3544758	-0.22	0.827	-.7721981	.6173215
L3.	**-.585466**	**.270187**	**-2.17**	**0.030**	**-1.115023**	**-.0559092**
L4.	**.6463514**	**.2477876**	**2.61**	**0.009**	**.1606965**	**1.132006**
dlnConsumpC						
L1.	**-.5985601**	**.1832283**	**-3.27**	**0.001**	**-.9576809**	**-.2394392**
L2.	**-.8069131**	**.2120419**	**-3.81**	**0.000**	**-1.222507**	**-.3913187**
L3.	.1539459	.1243104	1.24	0.216	-.0896981	.3975898
L4.	**-.3425829**	**.1137575**	**-3.01**	**0.003**	**-.5655436**	**-.1196223**
dlninvestC						
L1.	**.3370872**	**.040034**	**8.42**	**0.000**	**.2586219**	**.4155525**
L2.	**.3249995**	**.0431682**	**7.53**	**0.000**	**.2403914**	**.4096076**
L3.	**.1877141**	**.0416146**	**4.51**	**0.000**	**.1061509**	**.2692773**
L4.	**.0967054**	**.027469**	**3.52**	**0.000**	**.0428671**	**.1505437**
dlnGovtexpC						
L1.	**1.319906**	**.2006631**	**6.58**	**0.000**	**.9266136**	**1.713198**
L2.	**.6331505**	**.1421773**	**4.45**	**0.000**	**.3544882**	**.9118129**
L3.	**-.6376077**	**.187537**	**-3.40**	**0.001**	**-1.005173**	**-.270042**
L4.	.2820833	.1998449	1.41	0.158	-.1096054	.6737721
dlnprices						
L1.	-.0384374	.0385915	-1.00	0.319	-.1140752	.0372005
L2.	**-.1357079**	**.039548**	**-3.43**	**0.001**	**-.2132205**	**-.0581954**
L3.	**-.2621577**	**.0554803**	**-4.73**	**0.000**	**-.370897**	**-.1534184**
L4.	**-.2584899**	**.0629012**	**-4.11**	**0.000**	**-.381774**	**-.1352058**
DemC						
L1.	**-.0073923**	**.0030116**	**-2.45**	**0.014**	**-.0132949**	**-.0014897**
L2.	**.0219198**	**.0049224**	**4.45**	**0.000**	**.0122721**	**.0315675**
L3.	.0098517	.005147	1.91	0.056	-.0002363	.0199397
L4.	**-.017895**	**.0040984**	**-4.37**	**0.000**	**-.0259278**	**-.0098623**
L1DemPC	.0077139	.0048158	1.60	0.109	-.0017249	.0171528
L2DemPC	.0008664	.0046785	0.19	0.853	-.0083032	.010036
L3DemPC	**.0270915**	**.0064111**	**4.23**	**0.000**	**.0145261**	**.039657**
L4DemPC	**.0203307**	**.0068789**	**2.96**	**0.003**	**.0068483**	**.0338131**
_cons	-.0240102	.0145219	-1.65	0.098	-.0524727	.0044523

Significant figures in Bold

Table A4: GDP, GDP components, Copper Price and Institutions (Peru)

```
Seemingly unrelated regression
------------------------------------------------------------------------------
Equation           Obs  Parms        RMSE    "R-sq"       chi2        P
------------------------------------------------------------------------------
GDPPE               41     28    .0221271    0.8288     198.43   0.0000
ConsPE              41     28    .0217148    0.8071     171.56   0.0000
InvestPE            41     28    .0948627    0.7968     160.73   0.0000
ExpendPE            41     28    .0389098    0.7751     141.27   0.0000
------------------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
GDP          |
   dlnRGDPPE |
         L1. |   .9152853   .5607935     1.63   0.103    -.1838498     2.01442
         L2. |   1.172488   .6633076     1.77   0.077    -.1275715    2.472546
         L3. |   2.279419   .6871244     3.32   0.001     .9326803    3.626159
         L4. |   .0736947   .6028744     0.12   0.903    -1.107917    1.255307
             |
dlnConsumpPE |
         L1. |  -.8624301   .5667021    -1.52   0.128    -1.973146    .2482857
         L2. |  -.8606513   .5617642    -1.53   0.126    -1.961689    .2403863
         L3. |  -1.915054   .5713062    -3.35   0.001    -3.034794   -.7953149
         L4. |  -.8037157   .5178061    -1.55   0.121    -1.818597    .2111657
             |
 dlnInvestPE |
         L1. |  -.1092679   .0703944    -1.55   0.121    -.2472383    .0287025
         L2. |  -.1905326   .0771493    -2.47   0.014    -.3417424   -.0393229
         L3. |  -.3000958    .080699    -3.72   0.000     -.458263   -.1419286
         L4. |  -.0377422   .0678727    -0.56   0.578    -.1707701    .0952858
             |
dlnGovtexpPE |
         L1. |   .3462759   .1131344     3.06   0.002     .1245366    .5680153
         L2. |  -.0680005   .0900804    -0.75   0.450    -.2445549    .1085539
         L3. |   .1798268   .1116724     1.61   0.107    -.0390472    .3987008
         L4. |   .5407355   .1006831     5.37   0.000     .3434003    .7380707
             |
 L1dlnprices |   .1330062   .0513758     2.59   0.010     .0323116    .2337009
 L2dlnprices |   .0700215    .069062     1.01   0.311    -.0653375    .2053805
 L3dlnprices |   .1798144   .0563195     3.19   0.001     .0694303    .2901985
 L4dlnprices |  -.0159086   .0722872    -0.22   0.826    -.1575889    .1257717
             |
       DemPE |
         L1. |  -.0155529   .0078796    -1.97   0.048    -.0309966   -.0001093
         L2. |   .0018734   .0061454     0.30   0.760    -.0101714    .0139182
         L3. |   .0008766   .0047177     0.19   0.853     -.00837    .0101232
         L4. |   .0092937   .0044207     2.10   0.036     .0006293     .017958
             |
    L1DemPPE |  -.0131976   .0068975    -1.91   0.056    -.0267164    .0003212
    L2DemPPE |   .0027893   .0084655    -0.33   0.742    -.0193813    .0138028
    L3DemPPE |  -.0171972   .0071116    -2.42   0.016    -.0311356   -.0032588
    L4DemPPE |   .0104865   .0083613     1.25   0.210    -.0059014    .0268743
       _cons |   .0407304   .0183848     2.22   0.027     .0046968    .0767639
-------------+----------------------------------------------------------------
Consumption  |
   dlnRGDPPE |
         L1. |    .858115   .5503455     1.56   0.119    -.2205424    1.936772
         L2. |   .6117995   .6509497     0.94   0.347    -.6640385    1.887637
         L3. |   1.898716   .6743228     2.82   0.005     .5770677    3.220365
         L4. |  -.1195176   .5916424    -0.20   0.840    -1.279115     1.04008
             |
dlnConsumpPE |
         L1. |  -.6668872   .5561441    -1.20   0.230     -1.75691    .4231352
         L2. |  -.3308826   .5512982    -0.60   0.548    -1.411407    .7496419
         L3. |   -1.77772   .5606624    -3.17   0.002    -2.876598    -.678842
```

L4.	-.4518232	.508159	-0.89	0.374	-1.447797	.5441502
dlnInvestPE						
L1.	-.1006287	.0690829	-1.46	0.145	-.2360287	.0347712
L2.	**-.1472952**	**.0757119**	**-1.95**	**0.052**	**-.2956879**	**.0010974**
L3.	**-.2265999**	**.0791956**	**-2.86**	**0.004**	**-.3818203**	**-.0713795**
L4.	.0163166	.0666081	0.24	0.806	-.1142329	.1468662
dlnGovtexpPE						
L1.	**.3156898**	**.1110266**	**2.84**	**0.004**	**.0980816**	**.533298**
L2.	-.0492414	.0884022	-0.56	0.578	-.2225065	.1240236
L3.	.1632301	.1095919	1.49	0.136	-.0515661	.3780263
L4.	**.3956453**	**.0988073**	**4.00**	**0.000**	**.2019866**	**.589304**
L1dlnprices	**.1896329**	**.0504186**	**3.76**	**0.000**	**.0908142**	**.2884516**
L2dlnprices	.1047626	.0677753	1.55	0.122	-.0280745	.2375998
L3dlnprices	**.2417592**	**.0552702**	**4.37**	**0.000**	**.1334316**	**.3500868**
L4dlnprices	.0097084	.0709404	0.14	0.891	-.1293323	.1487491
DemPE						
L1.	-.0116402	.0077328	-1.51	0.132	-.0267961	.0035157
L2.	-.0030422	.0060309	-0.50	0.614	-.0148625	.0087782
L3.	.0048492	.0046298	1.05	0.295	-.0042252	.0139235
L4.	.0052864	.0043383	1.22	0.223	-.0032165	.0137894
L1DemPPE	**-.0196825**	**.006769**	**-2.91**	**0.004**	**-.0329495**	**-.0064156**
L2DemPPE	-.0079453	.0083078	-0.96	0.339	-.0242283	.0083376
L3DemPPE	**-.0225129**	**.0069791**	**-3.23**	**0.001**	**-.0361916**	**-.0088342**
L4DemPPE	.0057649	.0082055	0.70	0.482	-.0103177	.0218474
_cons	.0486459	.0180423	2.70	0.007	.0132837	.0840081
Investment						
dlnRGDPPE						
L1.	1.964089	2.404223	0.82	0.414	-2.7481	6.676279
L2.	4.316158	2.843719	1.52	0.129	-1.257429	9.889744
L3.	3.233573	2.945826	1.10	0.272	-2.54014	9.007285
L4.	-3.257924	2.584631	-1.26	0.207	-8.323708	1.807859
dlnConsumpPE						
L1.	-2.700101	2.429554	-1.11	0.266	-7.461939	2.061737
L2.	**-4.337772**	**2.408384**	**-1.80**	**0.072**	**-9.058119**	**.382574**
L3.	-1.919496	2.449292	-0.78	0.433	-6.720021	2.881029
L4.	.8527475	2.219928	0.38	0.701	-3.498231	5.203726
dlnInvestPE						
L1.	-.1903867	.3017933	-0.63	0.528	-.7818907	.4011173
L2.	-.2776661	.3307527	-0.84	0.401	-.9259294	.3705973
L3.	**-.7697854**	**.3459713**	**-2.22**	**0.026**	**-1.447877**	**-.0916942**
L4.	-.0099619	.2909823	-0.03	0.973	-.5802767	.5603529
dlnGovtexpPE						
L1.	**1.251142**	**.4850276**	**2.58**	**0.010**	**.3005059**	**2.201779**
L2.	-.6247642	.386191	-1.62	0.106	-1.381685	.1321563
L3.	**1.03841**	**.4787599**	**2.17**	**0.030**	**.1000584**	**1.976763**
L4.	**1.005245**	**.4316465**	**2.33**	**0.020**	**.1592333**	**1.851256**
L1dlnprices	.3453918	.2202572	1.57	0.117	-.0863044	.7770879
L2dlnprices	-.370646	.2960812	-1.25	0.211	-.9509545	.2096625
L3dlnprices	.2595227	.2414516	1.07	0.282	-.2137138	.7327591
L4dlnprices	-.3231241	.3099082	-1.04	0.297	-.9305331	.2842848
DemPE						
L1.	-.0119099	.0337811	-0.35	0.724	-.0781195	.0542998
L2.	.0059641	.0263465	0.23	0.821	-.045674	.0576022
L3.	-.0116229	.0202258	-0.57	0.566	-.0512647	.0280188
L4.	.0229755	.0189523	1.21	0.225	-.0141702	.0601213
L1DemPPE	-.030224	.0295707	-1.02	0.307	-.0881816	.0277335

L2DemPPE	**.060728**	**.036293**	**1.67**	**0.094**	**-.010405**	**.1318611**
L3DemPPE	-.0182841	.0304885	-0.60	0.549	-.0780405	.0414724
L4DemPPE	**.0601721**	**.0358465**	**1.68**	**0.093**	**-.0100857**	**.1304299**
_cons	-.0207206	.0788189	-0.26	0.793	-.1752028	.1337615
Expenditure						
dlnRGDPPE						
L1.	**3.674993**	**.9861379**	**3.73**	**0.000**	**1.742198**	**5.607788**
L2.	.3376363	1.166406	0.29	0.772	-1.948477	2.623749
L3.	**3.829012**	**1.208287**	**3.17**	**0.002**	**1.460814**	**6.197211**
L4.	-1.256878	1.060136	-1.19	0.236	-3.334706	.8209498
dlnConsumpPE						
L1.	**-2.64934**	**.996528**	**-2.66**	**0.008**	**-4.602499**	**-.6961808**
L2.	-.2856109	.9878449	-0.29	0.772	-2.221751	1.650529
L3.	**-3.271975**	**1.004624**	**-3.26**	**0.001**	**-5.241003**	**-1.302948**
L4.	.5541344	.9105459	0.61	0.543	-1.230503	2.338771
dlnInvestPE						
L1.	**-.513755**	**.1237863**	**-4.15**	**0.000**	**-.7563717**	**-.2711383**
L2.	-.0189609	.1356645	-0.14	0.889	-.2848585	.2469368
L3.	**-.3664776**	**.1419067**	**-2.58**	**0.010**	**-.6446097**	**-.0883456**
L4.	.0718049	.119352	0.60	0.547	-.1621206	.3057305
dlnGovtexpPE						
L1.	.1245393	.1989433	0.63	0.531	-.2653824	.5144611
L2.	**-.2917909**	**.1584036**	**-1.84**	**0.065**	**-.6022564**	**.0186745**
L3.	-.1260236	.1963725	-0.64	0.521	-.5109066	.2588595
L4.	**.5102393**	**.1770481**	**2.88**	**0.004**	**.1632314**	**.8572471**
L1**dlnprices**	**.4305327**	**.0903427**	**4.77**	**0.000**	**.2534642**	**.6076011**
L2dlnprices	**.4753776**	**.1214434**	**3.91**	**0.000**	**.237353**	**.7134022**
L3dlnprices	**.4302226**	**.099036**	**4.34**	**0.000**	**.2361156**	**.6243296**
L4dlnprices	**.5261912**	**.1271148**	**4.14**	**0.000**	**.2770508**	**.7753316**
DemPE						
L1.	**-.0319714**	**.0138559**	**-2.31**	**0.021**	**-.0591286**	**-.0048143**
L2.	.0011736	.0108065	0.11	0.914	-.0200067	.022354
L3.	.0127339	.008296	1.53	0.125	-.0035259	.0289937
L4.	-.0048431	.0077736	-0.62	0.533	-.0200791	.0103929
L1DemPPE	**-.0491977**	**.012129**	**-4.06**	**0.000**	**-.0729701**	**-.0254253**
L2DemPPE	**-.0493887**	**.0148863**	**-3.32**	**0.001**	**-.0785652**	**-.0202121**
L3DemPPE	**-.0260835**	**.0125055**	**-2.09**	**0.037**	**-.0505937**	**-.0015732**
L4DemPPE	**-.0470653**	**.0147031**	**-3.20**	**0.001**	**-.0758829**	**-.0182478**
_cons	.197153	.0323291	6.10	0.000	.1337892	.2605168

Significant figures in Bold

Table A5: GDP, GDP components, Copper Price and Institutions (Zambia)

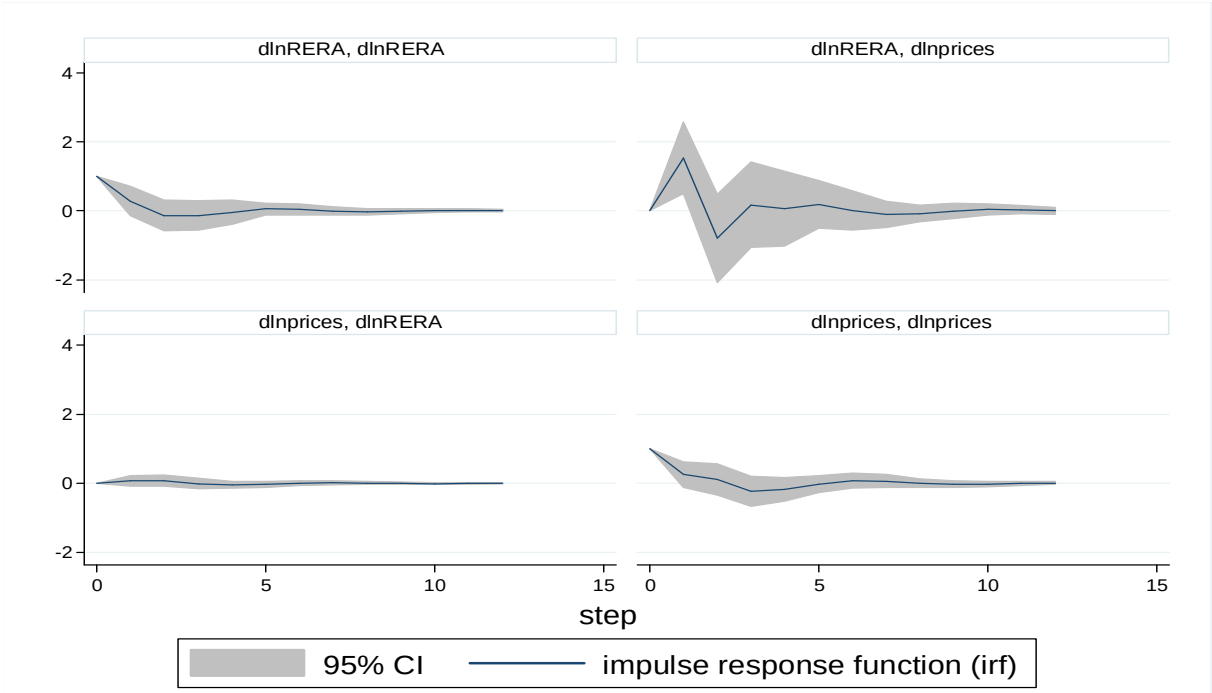
```
Seemingly unrelated regression
------------------------------------------------------------------------------
Equation           Obs  Parms        RMSE    "R-sq"       chi2        P
------------------------------------------------------------------------------
GDPZM               38     28     .012818    0.8930     317.24   0.0000
ConsZM              38     28    .0310747    0.9042     358.63   0.0000
InvestZM            38     28     .120198    0.7923     144.95   0.0000
ExpendZM            38     28    .0802103    0.8334     190.14   0.0000
------------------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
GDP          |
   dlnRGDPZM |
          L1. |  -1.059813   .1282177    -8.27   0.000    -1.311115   -.8085106
          L2. |  -.6614256   .1793162    -3.69   0.000    -1.012879   -.3099724
          L3. |  -.1461252   .1445984    -1.01   0.312    -.4295328    .1372824
          L4. |   .3723582   .1049718     3.55   0.000     .1666172    .5780991
              |
dlnConsumpZM |
          L1. |   .1730023   .0407817     4.24   0.000     .0930716    .2529331
          L2. |    .270337   .0505828     5.34   0.000     .1711965    .3694774
          L3. |   .1128029    .049038     2.30   0.021     .0166903    .2089156
          L4. |   .0121181   .0374822     0.32   0.746    -.0613457    .0855819
              |
 dlnInvestZM |
          L1. |    .072331   .0147918     4.89   0.000     .0433397    .1013223
          L2. |   .1193653   .0184964     6.45   0.000      .083113    .1556175
          L3. |   .1072141   .0213891     5.01   0.000     .0652922     .149136
          L4. |    .026814   .0123431     2.17   0.030     .0026221     .051006
              |
dlnGovtexpZM |
          L1. |    .149574   .0255387     5.86   0.000      .099519     .199629
          L2. |   .0873757   .0279872     3.12   0.002     .0325218    .1422295
          L3. |   .0214385   .0218022     0.98   0.325    -.0212931      .06417
          L4. |   .0436588   .0226788     1.93   0.054    -.0007908    .0881084
              |
   dlnprices |
          L1. |   .1016237   .0194761     5.22   0.000     .0634512    .1397961
          L2. |   .0196792   .0242201     0.81   0.416    -.0277913    .0671496
          L3. |  -.0665419   .0235705    -2.82   0.005    -.1127392   -.0203445
          L4. |   -.125032   .0330198    -3.79   0.000    -.1897497   -.0603143
              |
       DemZM |
          L1. |  -.0006945   .0020874    -0.33   0.739    -.0047857    .0033967
          L2. |   .0053478   .0029953     1.79   0.074    -.0005229    .0112185
          L3. |  -.0000394   .0038576    -0.01   0.992    -.0076001    .0075213
          L4. |  -.0048569   .0026711    -1.82   0.069    -.0100921    .0003784
              |
    L1DemPZM |  -.0163266   .0042761    -3.82   0.000    -.0247075   -.0079456
    L2DemPZM |   .0024234   .0053072     0.46   0.648    -.0079785    .0128253
    L3DemPZM |   .0081863   .0050373     1.63   0.104    -.0016867    .0180592
    L4DemPZM |   .0271093   .0076427     3.55   0.000     .0121299    .0420886
       _cons |   .0390866   .0070223     5.57   0.000     .0253232      .05285
-------------+----------------------------------------------------------------
Consumption  |
   dlnRGDPZM |
          L1. |  -1.681153   .3108389    -5.41   0.000    -2.290386   -1.071919
          L2. |  -3.130475   .4347174    -7.20   0.000    -3.982505   -2.278444
          L3. |  -.1530804   .3505508    -0.44   0.662    -.8401474    .5339865
          L4. |   1.590724   .2544838     6.25   0.000     1.091945    2.089503
              |
dlnConsumpZM |
          L1. |  -.3674564   .0988674    -3.72   0.000     -.561233   -.1736797
          L2. |   .4824378   .1226282     3.93   0.000     .2420909    .7227847
```

L3.	**.2921958**	**.1188831**	**2.46**	**0.014**	**.0591893**	**.5252023**
L4.	**-.410326**	**.0908684**	**-4.52**	**0.000**	**-.5884249**	**-.2322272**
dlnInvestZM						
L1.	**.1638808**	**.0358597**	**4.57**	**0.000**	**.0935969**	**.2341646**
L2.	**.3783757**	**.0448409**	**8.44**	**0.000**	**.2904891**	**.4662622**
L3.	**.2675573**	**.0518538**	**5.16**	**0.000**	**.1659258**	**.3691889**
L4.	-.0429327	.0299234	-1.43	0.151	-.1015814	.015716
dlnGovtexpZM						
L1.	**.2036343**	**.0619137**	**3.29**	**0.001**	**.0822856**	**.324983**
L2.	**.1411806**	**.0678495**	**2.08**	**0.037**	**.0081981**	**.2741631**
L3.	-.0504956	.0528553	-0.96	0.339	-.15409	.0530989
L4.	.0118244	.0549804	0.22	0.830	-.0959351	.1195839
dlnprices						
L1.	-.0015128	.0472161	-0.03	0.974	-.0940546	.091029
L2.	-.0057912	.0587168	-0.10	0.921	-.120874	.1092917
L3.	**-.3988588**	**.0571421**	**-6.98**	**0.000**	**-.5108553**	**-.2868623**
L4.	**-.5236046**	**.0800502**	**-6.54**	**0.000**	**-.6805001**	**-.366709**
DemZM						
L1.	**.0369528**	**.0050605**	**7.30**	**0.000**	**.0270345**	**.0468712**
L2.	**-.0599696**	**.0072615**	**-8.26**	**0.000**	**-.0742019**	**-.0457372**
L3.	-.0104911	.0093519	-1.12	0.262	-.0288205	.0078383
L4.	**.036292**	**.0064755**	**5.60**	**0.000**	**.0236002**	**.0489838**
L1DemPZM	**.0236316**	**.0103665**	**2.28**	**0.023**	**.0033135**	**.0439496**
L2DemPZM	-.006628	.0128663	-0.52	0.606	-.0318455	.0185894
L3DemPZM	**.0481763**	**.012212**	**3.94**	**0.000**	**.0242412**	**.0721113**
L4DemPZM	**.1285489**	**.0185282**	**6.94**	**0.000**	**.0922343**	**.1648634**
_cons	.0584139	.0170241	3.43	0.001	.0250472	.0917806
Investment						
dlnRGDPZM						
L1.	-1.976684	1.202335	-1.64	0.100	-4.333218	.3798503
L2.	**-4.547223**	**1.681501**	**-2.70**	**0.007**	**-7.842906**	**-1.251541**
L3.	**-4.563544**	**1.355942**	**-3.37**	**0.001**	**-7.221142**	**-1.905946**
L4.	.9238336	.9843519	0.94	0.348	-1.005461	2.853128
dlnConsumpZM						
L1.	-.0948081	.3824226	-0.25	0.804	-.8443427	.6547264
L2.	**1.193518**	**.4743301**	**2.52**	**0.012**	**.2638482**	**2.123188**
L3.	**1.000375**	**.4598437**	**2.18**	**0.030**	**.0990984**	**1.901652**
L4.	.1856988	.3514821	0.53	0.597	-.5031935	.8745911
dlnInvestZM						
L1.	**-.2580983**	**.1387067**	**-1.86**	**0.063**	**-.5299585**	**.0137619**
L2.	.2584902	.1734462	1.49	0.136	-.0814581	.5984385
L3.	.1413763	.2005721	0.70	0.481	-.2517378	.5344904
L4.	-.0052922	.1157446	-0.05	0.964	-.2321474	.2215629
dlnGovtexpZM						
L1.	**.6017757**	**.2394844**	**2.51**	**0.012**	**.1323949**	**1.071156**
L2.	**.5207416**	**.2624441**	**1.98**	**0.047**	**.0063607**	**1.035123**
L3.	.1141906	.204446	0.56	0.576	-.2865162	.5148973
L4.	**.6106722**	**.2126659**	**2.87**	**0.004**	**.1938548**	**1.02749**
dlnprices						
L1.	**1.126226**	**.1826333**	**6.17**	**0.000**	**.7682709**	**1.484181**
L2.	.3672053	.2271187	1.62	0.106	-.0779392	.8123497
L3.	-.2840868	.2210277	-1.29	0.199	-.7172931	.1491195
L4.	-.2561018	.3096369	-0.83	0.408	-.8629791	.3507754
DemZM						
L1.	.0218943	.0195741	1.12	0.263	-.0164702	.0602588
L2.	.0433948	.0280878	1.54	0.122	-.0116563	.0984459
L3.	**-.0643218**	**.0361735**	**-1.78**	**0.075**	**-.1352206**	**.006577**

L4.	**.0444623**	**.0250475**	**1.78**	**0.076**	**-.00463**	**.0935546**
L1DemPZM	**-.1661515**	**.0400981**	**-4.14**	**0.000**	**-.2447424**	**-.0875607**
L2DemPZM	-.0799644	.0497673	-1.61	0.108	-.1775065	.0175776
L3DemPZM	-.0205041	.0472364	-0.43	0.664	-.1130858	.0720776
L4DemPZM	.0459432	.0716676	0.64	0.521	-.0945228	.1864092
_cons	-.02955	.0658499	-0.45	0.654	-.1586135	.0995135
Expenditure						
dlnRGDPZM						
L1.	**2.579819**	**.8023399**	**3.22**	**0.001**	**1.007262**	**4.152376**
L2.	.6133233	1.122096	0.55	0.585	-1.585944	2.812591
L3.	1.252352	.9048445	1.38	0.166	-.5211106	3.025815
L4.	**1.539422**	**.6568757**	**2.34**	**0.019**	**.251969**	**2.826874**
dlnConsumpZM						
L1.	**-.8393073**	**.2551975**	**-3.29**	**0.001**	**-1.339485**	**-.3391295**
L2.	-.1744412	.3165289	-0.55	0.582	-.7948265	.4459442
L3.	-.0781996	.3068619	-0.25	0.799	-.6796379	.5232387
L4.	.0187394	.2345503	0.08	0.936	-.4409707	.4784496
dlnInvestZM						
L1.	-.1123204	.0925615	-1.21	0.225	-.2937375	.0690968
L2.	-.0691311	.1157437	-0.60	0.550	-.2959847	.1577224
L3.	.0351542	.1338454	0.26	0.793	-.2271779	.2974863
L4.	**-.1530767**	**.0772384**	**-1.98**	**0.047**	**-.3044612**	**-.0016921**
dlnGovtexpZM						
L1.	.2418203	.1598122	1.51	0.130	-.0714059	.5550465
L2.	**-.3370422**	**.1751336**	**-1.92**	**0.054**	**-.6802978**	**.0062134**
L3.	**-.2695034**	**.1364305**	**-1.98**	**0.048**	**-.5369022**	**-.0021046**
L4.	-.1834498	.1419157	-1.29	0.196	-.4615996	.0946999
dlnprices						
L1.	.1231881	.1218745	1.01	0.312	-.1156815	.3620577
L2.	**.2895634**	**.1515604**	**1.91**	**0.056**	**-.0074894**	**.5866163**
L3.	.1297403	.1474957	0.88	0.379	-.159346	.4188266
L4.	-.1687075	.2066263	-0.82	0.414	-.5736876	.2362725
DemZM						
L1.	-.0159632	.0130621	-1.22	0.222	-.0415646	.0096381
L2.	-.0024118	.0187435	-0.13	0.898	-.0391483	.0343248
L3.	.0277809	.0241392	1.15	0.250	-.0195311	.075093
L4.	-.0047505	.0167147	-0.28	0.776	-.0375107	.0280097
L1DemPZM	-.0015351	.0267582	-0.06	0.954	-.0539802	.05091
L2DemPZM	.0293823	.0332106	0.88	0.376	-.0357092	.0944739
L3DemPZM	-.0282495	.0315217	-0.90	0.370	-.0900309	.0335319
L4DemPZM	.0670544	.0478251	1.40	0.161	-.0266811	.1607899
_cons	-.0651113	.0439428	-1.48	0.138	-.1512377	.0210151

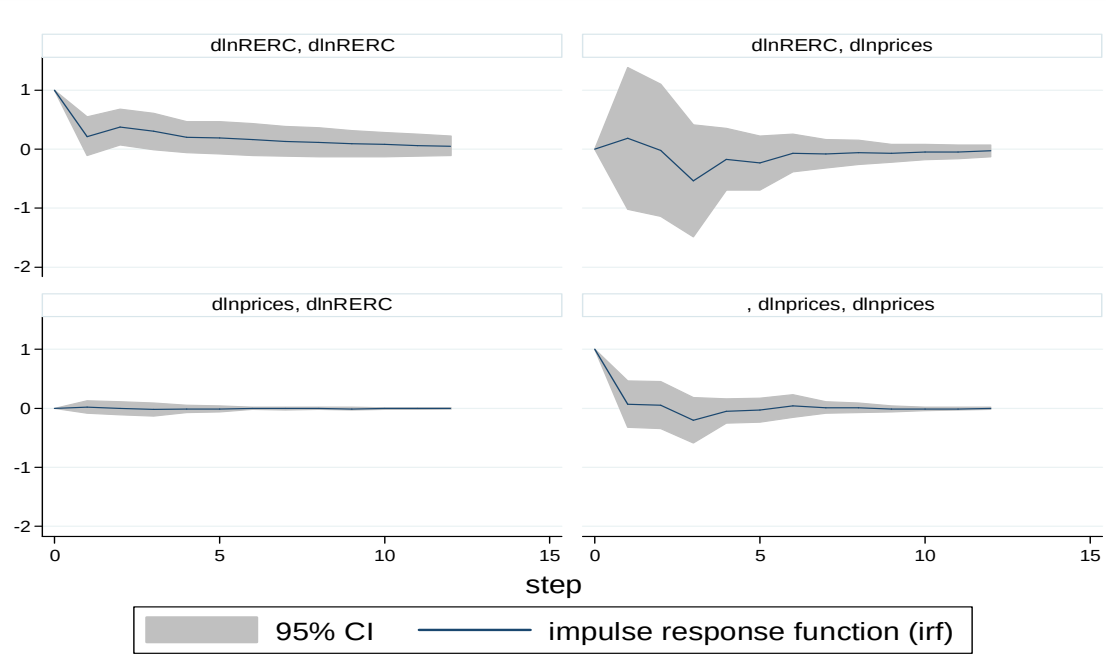
Appendix 3B: Impulse-Response functions of Price-Real Effective Exchange Rate (RER)

a) Australia



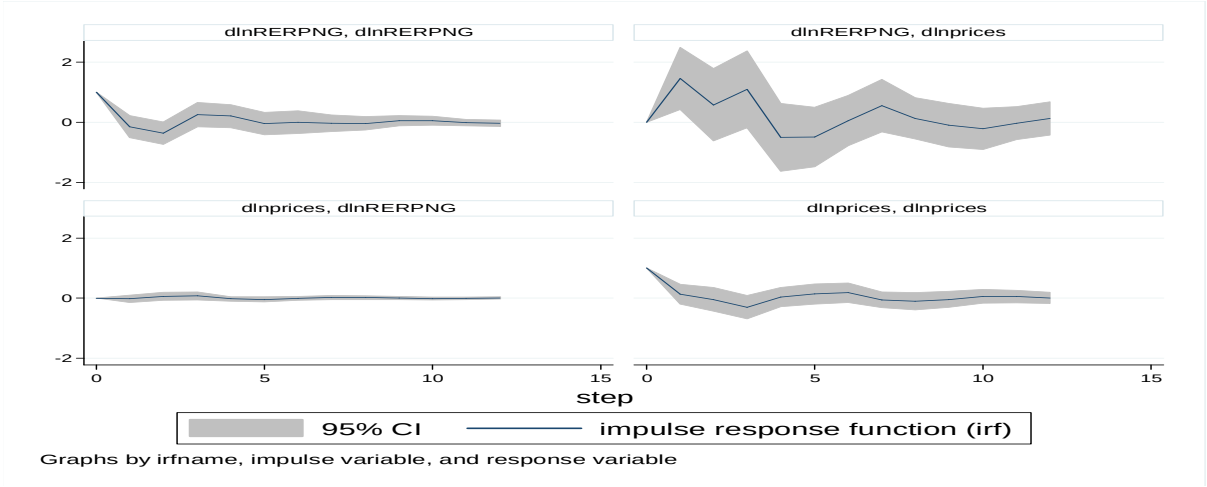
Graphs by irfname, impulse variable, and response variable

b) Chile



Graphs by irfname, impulse variable, and response variable

c) Papua New Guinea



d) Peru