REVENUE FUNDS COUNTERACT THE DETERMINANTS OF DUTCH DISEASE:

LESSONS FOR WESTERN AUSTRALIA[1]

JASON HART

School of Agricultural and Resource Economics
Faculty of Natural and Agricultural Sciences,
University of Western Australia

jhart@greenbase.com.au
(08) 9455 5455

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Abstract:

Dutch disease occurs when government revenue from a booming non-renewable natural resource export sector is spent on recurrent domestic activities. Dutch disease amplifies the cyclical influence of commodity prices and inflicts adjustment costs on the economy through movements in the exchange rate. Revenue funds, such as revenue stabilisation funds or sovereign wealth funds, can help avoid this problem by either investing revenue abroad until downturns or holding revenue abroad indefinitely. Through an investigation of six open, natural resource exporting countries, revenue funds were found to delink exchange rate movements from the terms of trade. Although it is unlikely that revenue funds are the sole cause of this effect, revenue funds are considered a useful tool for, but not essential to, responsible fiscal management. Western Australia has been found to have Dutch disease. Recurrent government expenditure is vulnerable to decreases in royalty receipts. High levels of mineral exports are partly responsible for the high Australian dollar. Revenue funds are a potential policy tool if the Western Australian government decides to limit the impact of export prices on Australia's exchange rate. As this is unlikely to be an objective for a state government, it should instead be seen as an added benefit to countercyclical or sustainable fiscal policies. In this case, only a sovereign wealth fund is considered appropriate at the state level and could be used to manage royalties sustainably, reduce movements in Australia's exchange rate and gain greater fiscal autonomy for the states.

INTRODUCTION

Dutch disease occurs when governments of natural resource exporting countries ignore the finiteness of revenue from non-renewable exports and use this revenue to fund recurrent general expenditure. Through both changes in government expenditure and the Gregory effect, where spending and exchange rate movements cause export and import competing sectors to expand and contract with export price fluctuations, Dutch disease leads to adjustment costs and slower growth rates than in non-commodity exporting countries (Gregory 1976). The phenomenon was named in reference to the slow growth of the Netherlands following the increase in social service expenditure, exchange rate boom and contraction of the manufacturing sector caused by the extraction and export of off-shore natural gas in the 1960's (Economist 1977).

There are three interrelated aspects of Dutch disease: unsustainable government spending (both short term and long term), the resource movement effect, and the spending effect. First, unsustainable government spending during the boom phase leads to politically difficult taxation or social service provision adjustments during downturns in commodity prices. This pro-cyclical government spending retards the average rate of economic growth and increases output variability (Bornhorst *et al.* 2009). Second, the resource movement effect causes adjustments in the relative competitiveness of exporting and import competing sectors of the economy. This is because the exchange rate moves in the same direction as the terms of trade (TOT), where the TOT is the price of exports relative to the price of imports (Davis *et al.* 2003; McKissack *et al.* 2008). Third, the spending effect can exacerbate the link between the TOT and the exchange rate through increased domestic prices of goods in the non-traded sector of the economy, such as housing (Cordon & Neary 1982). To a degree, the resource movement effect is a desirable outcome. However, any reduction in growth due to exchange rate movements caused by government expenditure can be considered Dutch disease (Cuddington 1989).

Western Australia is an exporter of non-renewable resources with large proven gas and mineral reserves. As non-renewable exports are likely to be important for Western Australia for many years to come, the Western Australian government should be concerned about the short and long term problems non-renewable exports can cause. Revenue funds, such as revenue stabilisation funds or sovereign wealth funds, are a possible solution to Dutch disease. This paper investigates the success of revenue funds in delinking the relationship between a country's terms of trade and the exchange rate. Firstly, before considering the case of Western Australia in detail, it is necessary to elaborate on the theoretical framework underpinning the issue. Next the role of revenue funds is described. The study ends with international observations and recommendations for Western Australian policy.

THEORETICAL FRAMEWORK

The Gregory Effect

Typically, the start of the Gregory effect is characterised by a surge in foreign exchange sales due to a substantial increase in export prices, which by definition also implies a rise in the TOT. This additional foreign currency is converted to domestic income, which results in an increase in the exchange rate. The extra income drives demand for domestic and imported products (the spending effect) and the increase in the exchange rate reduces the price received for all internationally traded commodities. This disadvantages export and import competing sectors, which contract as capital and labour are drawn to the booming export and domestic sectors (the resource movement effect). The Gregory effect is exacerbated by increased foreign investment or borrowing (Cordon & Neary 1982; Corden 1984; Neary & van Wijnbergen 1986).

An illustration of the Gregory effect for a small open economy is shown in Figure 1, which has been adapted from Hjort (2006). In the figure it is assumed that there is one mobile factor (labour), there is full employment, and that efficient production of both tradable and non-tradable commodities takes place. In the upper right panel the production of tradable and non-tradable goods (B) is determined by the tangency between the production possibility frontier (PPF) and the economy wide budget constraint (BC), and this production combination generates the welfare level (W). The upper left panel shows the price of tradable goods. In the figure, price is on the horizontal axis and quantity is on the vertical axis, so the demand curve faced by a small open economy is a vertical line at the market price, i.e. demand is perfectly elastic. The lower right panel shows the demand and supply curves of non-tradable goods, which are determined domestically. The lower left panel shows the effective exchange rate (E), or the price of non-tradables relative to the price of tradables.
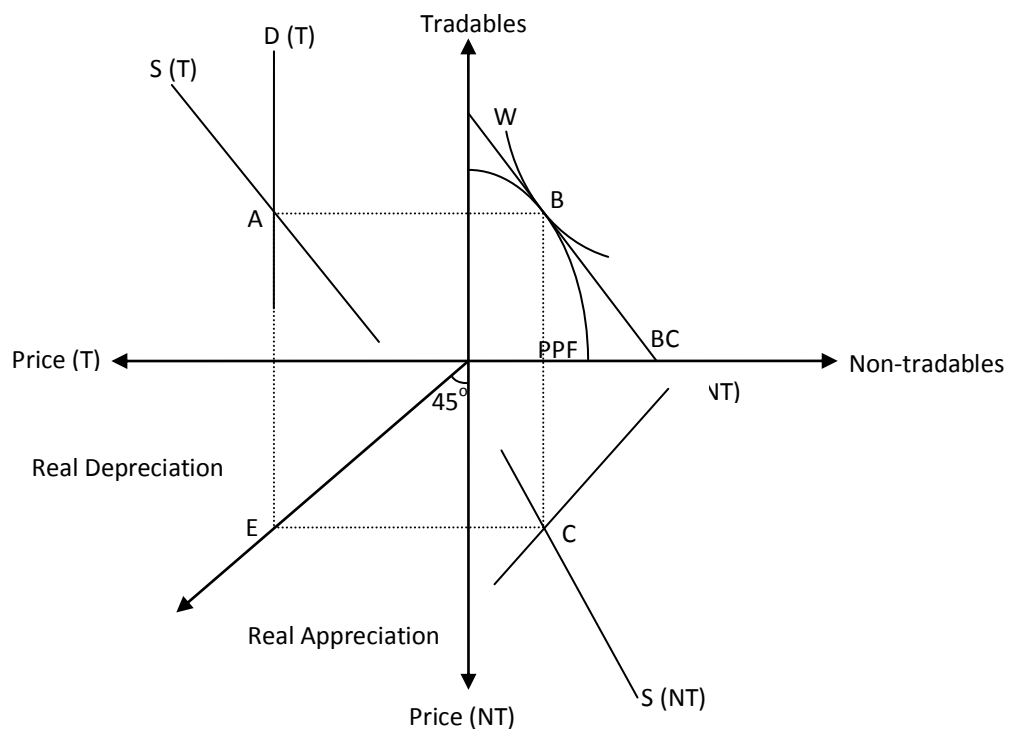

Figure 1   A small open economy prior to an increase in export prices, adapted from Hjort (2006).

The adjustment following an increase in export prices is shown in Figure 2. An increase in export prices produces an increase in income which shifts the demand curve for non-tradables out to D` (NT) and moves production to C`. The exchange rate increases and the price of tradables rises on the international market, causing labour to move to the non-tradables sector (this effect is surpassed in the booming export sector by the increase in activity), shifting the supply curves to S` (T) and S` (NT), production to A` and C`` and the exchange rate to E`. This is represented as a shift along the PPF to B`, however the BC has shifted out to BC` due to increased income, and has become steeper due to changes in relative prices, resulting in consumption B``. The distance between A` and A`` is made up by imports financed by the return from higher commodity prices. Overall social welfare is increased from W to W`.

Figure 2   A small open economy following a windfall from higher international commodity prices, adapted from Hjort (2006). An increase in income leads to an increase in production of non-tradables, the exchange rate and social welfare at the expense of the production of tradables.

It is important to understand that the Gregory effect is the process by which an economy adjusts to an increase in comparative advantage in export production and that this process itself does not necessarily lead to lower economic growth (Davis 1995). Rather, it is the adjustment process that can cause problems; especially if the export price shocks are temporary or there are cyclical price movements (Ebrahim-Zadeh 2003).

Dutch Disease

Once a mineral, oil or gas deposit has been exhausted it cannot be exhausted again. As such, extractive non-renewable resource based revenues are a once off windfall, and a depletion of natural wealth. Royalties are a payment to the government for the title to the resource. Since the title belongs to current and future generations, the government has an obligation to manage the returns sustainably. This study takes a narrow definition of sustainability as maintaining the real long term value of publicly held assets (McLure 2008). Royalties can be seen as a single increase in government revenue rather than the continuous revenue accruing from conventional taxation, making management of extractive non-renewable resource based revenues fundamentally different to taxation based revenues. The most commonly cited non-renewable revenue type in the literature is oil revenue, and many countries recognise the non-renewable aspect to this revenue by separating oil based revenues from the conventional budget accounting process (Barnett & Ossowski 2003). There has also been a large amount of effort devoted to developing measures of growth that take account of the depreciation of non-renewable resources (for example: Harris & Fraser 2002).

For the eponymous example of the Netherlands, the government was increasingly involved in the provision of social services before their gas discoveries (Kremers 1986). The discovery of large quantities of natural gas then saw the booming sector's revenues used to fund unsustainable levels of social services that were politically difficult to remove. By not accounting for the temporary nature of the revenue, fiscal policy evolved around unrealistic expectations. When the expectations were not met, growth was held back. This trend was exacerbated by the resource movement effect and the spending effect, which forced costly adjustments on industry through exchange rate movements (Cordon & Neary 1982).

The specific roles of each effect and their interactions have been deemed impossible to estimate (Clements *et al.* 2008). Individual empirical studies have found mixed results for the spending effect, which would at best be a short term phenomenon (Enders *et al.* 2008). The direct effect of fiscal policy on growth is generally minor, but the adjustment costs of shocks are not (Perotti 2002; Steigum & Thøgersen 2003). The positive relationship between the terms of trade and the exchange rate which underpins the resource movement effect has been well documented (for example: Gruen & Wilkinson 1991; Aizenman & Riera-Crichton 2006; Clements & Fry 2008; Clements *et al.* 2008). While empirical evidence on the movement of resources has not been as strong as the theory suggests, any movement invariably brings adjustment costs. As the exchange rate is the central variable behind Dutch disease they will be used as an indicator in this study.

It appears that over time the definition of Dutch disease has been limited to the Gregory effect. For example Davis *et al.*(2003) considers Dutch disease a sidenote only connected to the exchange rate and the non-resource tradable sector when considering volatile oil-based government revenues. Clements *et al.* (2008) acknowledges the role of fiscal policy, but do not factor it into their definition of Dutch disease. The matching

definitions of the Gregory effect and Dutch disease are rejected in this paper as it leads to the confusing situation where there must exist an optimal level of Dutch disease where the economy adjusts in the fashion described by the Gregory effect, but economic growth rates are not hindered, so that there is in fact no 'disease' present despite the term being appropriate. In this paper only the government's role in the Gregory effect will be considered Dutch disease. This usage is contrary to much of the contemporary literature, but is aligned with the original intention of the term (Economist 1977).

WESTERN AUSTRALIA

Starting in late 2003, the world market witnessed a rise in commodity prices, led primarily by minerals and oil. Between 2003 and 2008 Australia's non-rural commodity index tripled (Figure 3). This resulted in a 50 percent increase in Australia's terms of trade. The rise was primarily driven by increased demand in Asia, one of Western Australia's major export destinations. The rise in export prices led to a strong Australian dollar (shown as a trade weighted index in Figure 4), high business profits and investment, a strong stock market and very strong company tax revenue. The mining industry recruited both skilled and non-skilled workers, giving Western Australia the fastest growing population in Australia and dramatically increasing housing prices. The Western Australian economy received a net inflow of wealth and an increase in purchasing power (Ye 2008). Australia's monetary policy of inflation targeting and a floating exchange rate also resulted in an increase in the interest rate.
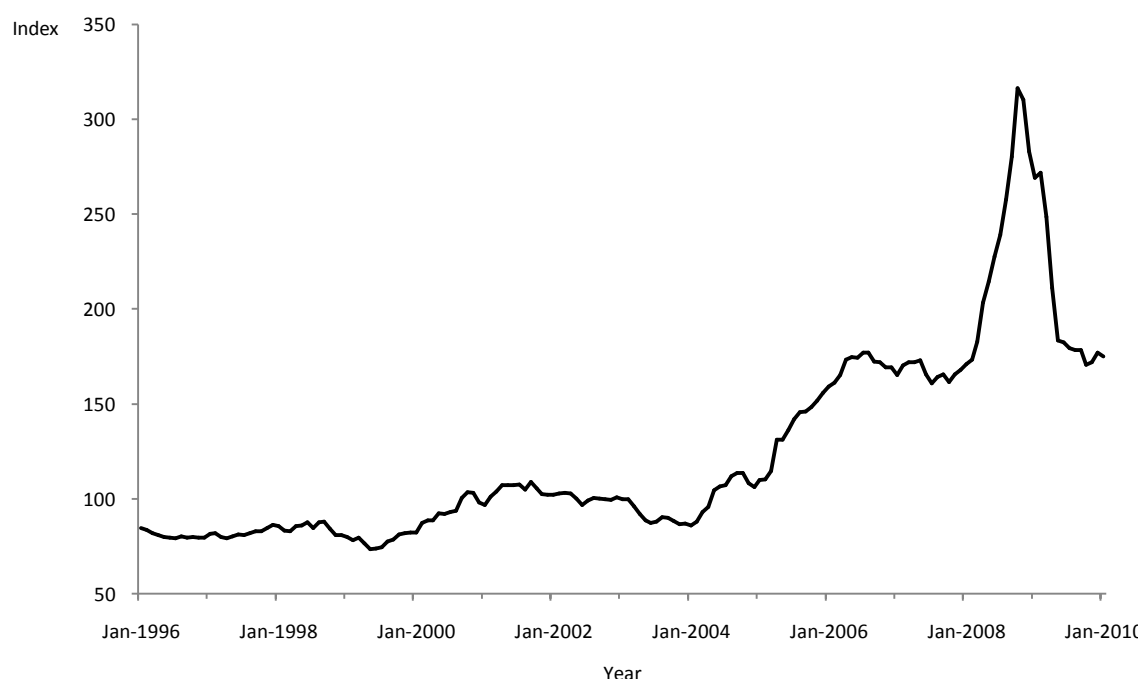

Figure 3   Monthly non-rural component of Australia's commodity price index from January 1996 to January 2010.
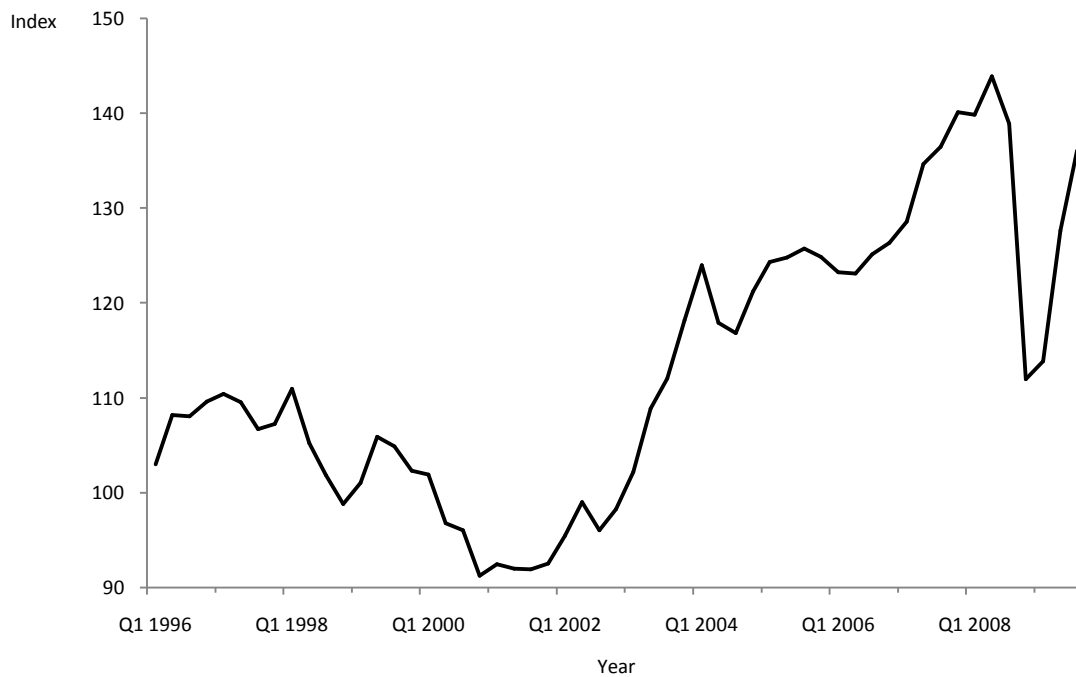
Figure 4   Australia's quarterly real trade weighted index from Q1 1996 to Q3 2009. Base = 1995.

McKissack *et al.* (2008) found the response of the Australian economy to the export price increase matched the theory, except that manufacturing growth was slightly higher during the boom than the preceding decade due to strong connections to the mining industry. This exception did not hold for Western Australian based and non-mining related manufacturing. Other traded sectors did not contract as much as expected and some non-traded sectors showed slower growth than predicted, arguably as a result of increased interest rates which are not considered in the models. Another explanation given for this finding was that the economy started at less than full employment, so that initially the mining industry soaked up the excess before attracting labour away from other sectors. This theory is backed up by the drop in Western Australia's unemployment levels from 6.1 percent in 2002 to 3.1 percent in 2008 and modelling results.

In Western Australia, after the 2003-04 financial year, government expenditure stabilised and moved from annual average growth of 2.0% to 2.6%. This rise in growth was partly underpinned by royalty receipts, which increased from less than $300 to over $1300 per person (Figure 5).
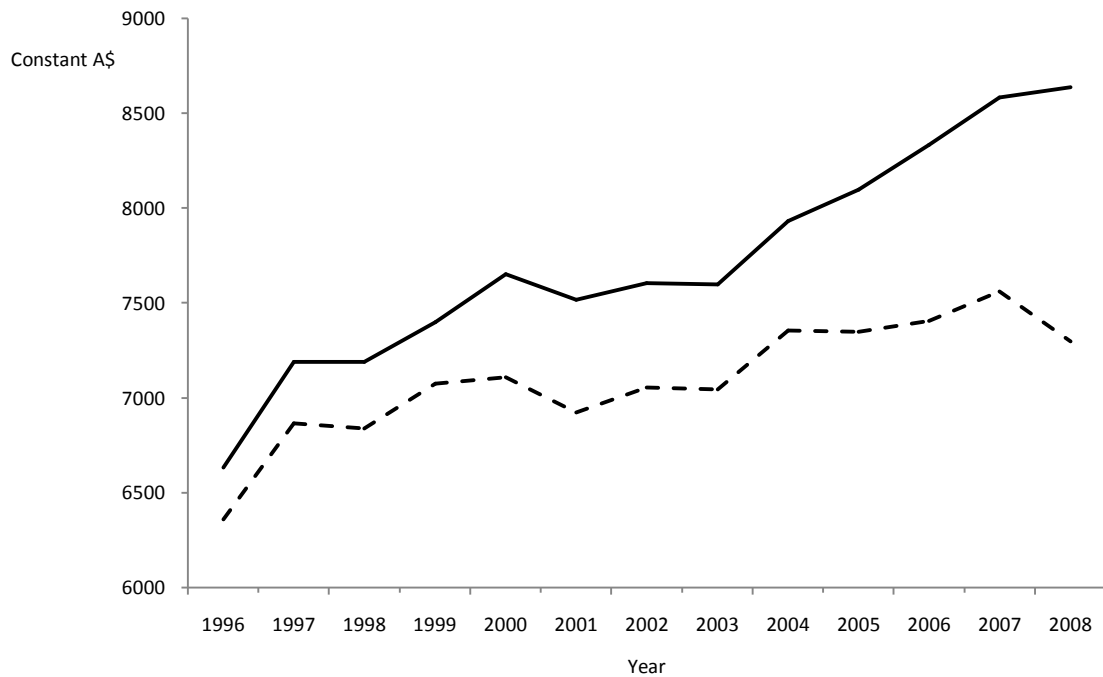
Figure 5 The Western Australian Governments expenditure (solid line) and expenditure minus royalty receipts (dashed line) from 1996 to 2008.

Determining the final impact of Western Australia's royalty based revenue is not as simple as it would appear, as state revenues are redistributed. The Western Australian government collects royalties from on-shore enterprises while the Federal government collects off-shore royalties and company tax. The royalties the state does collect are redistributed via the Commonwealth Grants Commission, which varies the states' GST grant allocation based on revenue collection to ensure each state has equal capacity to provide services (CGC 2009). This process has a lag of two to seven years, as it takes two years to collect the data and grants are based on five year rolling averages. This means that the Western Australian government can spend revenue years before it is redistributed. This lack of fiscal autonomy is poorly communicated, as states feel that the revenue they collect should remain theirs. When the redistribution of royalties is taken into account, their upward pressure on the budget is cancelled out (Figure 6).
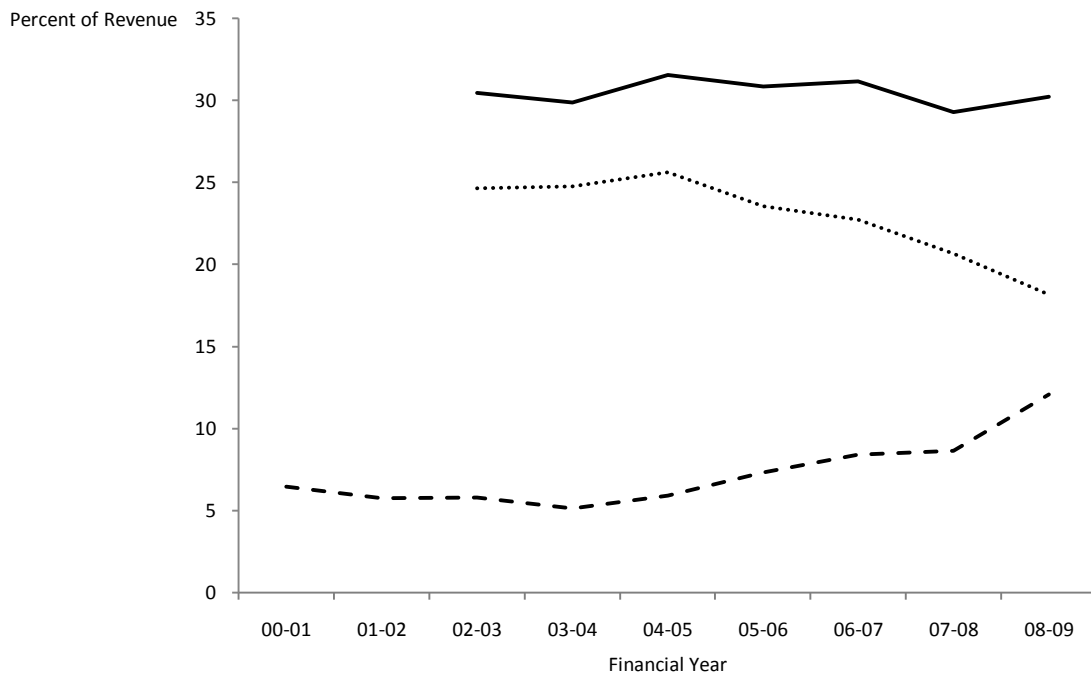
Figure 6 The Western Australian government's revenue from royalties (dashed line), GST grants (dotted line) and their combined value (solid line) as a percent of total revenue.

Starting in September 2007 the global financial crisis hit, reducing commodity prices and economic activity worldwide. The decreased activity flowed through to decreased government revenue. The situation was colourfully described by Wright (2009):

> Australia partied very hard during the good years, gave away money to those who didn't need it and is now trying to work out how to pay the bills while keeping people in work.

This is very similar to The Economist's (1977) description of the Netherland's "waking up one morning [...] with a monumental hangover". In Western Australia the government's budget strategy was to cut spending on recurrent activities (DTF 2009). The strategy has been mildly successful; however, just like in the Netherlands, health and education expenditure failed to meet the targets. Even after considerable effort to decrease expenditure, overall public expenditure was described as "unsustainable" by Treasurer Troy Buswell (cited in Taylor & Kerr 2009).

REVENUE FUNDS

'Curing' Dutch disease requires solutions for all three aspects of the problem; unsustainable government spending (both short term and long term), the resource movement effect and the spending effect. Unsustainable government spending can be countered by recognising the temporary nature of extractive non-renewable resource based revenue and spending the revenue accordingly, for example on infrastructure with depreciation covered from general expenditure. In the 1960's the Netherlands transformed Rotterdam into a world leading port, securing its place as one of Europe's main shipping hubs. Around the turn of the 20th century Western Australia enjoyed a brief moment of autonomy before federation and the Forrest government used the proceeds of the gold rush to build key infrastructure which is still in use a century later (Bolton 2008). These policies have many benefits; however they do not deal with the other two determinants; the resource movement effect and the spending effect, and their influence on the exchange rate.

In order to counter the effect of foreign currency on exchange rates, commonly known as sterilisation, a policy would have to use the income to repay foreign debt, purchase imports, increase foreign reserves or invest abroad. Responsible fiscal management which is based around medium term goals and utilises the repayment of foreign debt and accumulating international reserves can be effective (Barnett & Ossowski 2003). In the longer term, foreign reserves' investment strategies do not generate large dividends, making a managed fund a superior option. When responsible fiscal management is difficult to achieve there is often an institutional cause behind it, such as political incentives towards short-sightedness, which in many cases has bolstered support for an institutionally separate policy option (Alesina & Tabellini 2005; Asfaha 2007). Only investing revenues abroad is not a complete blueprint for effective fiscal management, but such practices do provide solutions for all three determinants of Dutch disease (Auty 2007). The practice of using a revenue fund can also make a valuable contribution to fiscal management by focusing attention on longer term strategies that involve saving part of a limited windfall, thereby changing the political incentive structure.

Since the 1970's, two methods for investing government revenue abroad have emerged worldwide: sovereign wealth funds (or savings funds) and revenue stabilisation funds (Davis *et al.* 2003). Both are medium to long-term fiscal strategies based on accumulating excess government revenue from non-renewable resources and investing them in foreign assets. Excess revenue is usually calculated by a static or annually calculated base price for commodities or by government discretion, however in the case of sovereign wealth funds it can be calculated using predetermined formulae designed to generate a stable income or to hold the total worth of royalty receipts indefinitely (Hannesson 2001). Revenue stabilisation funds objectives are to avoid the negative impacts of Dutch disease through revenue sterilisation and stabilisation, while sovereign wealth funds objectives are the sustainable intergenerational allocation of funds, with

revenue sterilisation as a beneficial externality. Revenue stabilisation funds are medium term counter cyclical strategies whereas sovereign wealth funds are long term strategies, and it is common for both objectives to be used within a flexible framework. There are also no shortages of failed revenue funds which had conflicting or unrealistic objectives, such as in Nauru and Venezuela. It is estimated that by 2015, $US6 trillion will be invested in revenue funds worldwide, making revenue funds an important international trend (Bahgat 2009).

In 2007, the Western Australian Resources Heritage Fund Bill was proposed in the Western Australian legislative assembly and rejected by majority vote. The bill described a revenue stabilisation fund fashioned on the Alberta Heritage Fund, which is considered a relative failure due to conflicting objectives and politically based unproductive investments which were not liquid enough to allow for short term revenue stabilisation (Hannesson 2001). In debate Ripper (2007), the Treasurer of the time, acknowledged the attractiveness of the idea but criticised a lack of clear details and guidelines. The Bill was based on the intergenerational arguments of a sovereign wealth fund but allowed for the total balance (minus inflation) of the fund to be spent after only a four year period, making its long term objectives near impossible to achieve. There were also no specifications on whether the fund would be invested domestically or abroad (Day 2007). While the Bill was a failure, this does not remove the possibility of a successful fund being tailored for Western Australia based on internationally successful examples.

Davis *et al.* (2003) found that revenue funds had no influence on government expenditure. Expenditure in countries with revenue funds was not sensitive to export earnings before or after implementation, and expenditure in countries without revenue funds was sensitive to export earnings. This suggests that countries with more responsible fiscal strategies established revenue funds, instead of revenue funds leading to more responsible fiscal strategies. Based on these findings, this paper seeks to assess the success of revenue funds in counteracting two of the determinants of Dutch disease, the resource effect and the spending effect, as represented by the exchange rate.

PARAMETERS
Countries

Australia, Canada, Chile, Mexico, Norway and South Africa were selected as study countries as they are all small or medium open economies with a high proportion of primary commodity export and experienced a substantial increase in their TOT over the 2003-2008 period (Table 1). Of this group of countries Australia, Canada and South Africa do not have revenue funds, and Norway, Chile and Mexico do have revenue funds[2]. The major primary commodities produced in each country are minerals (copper in Chile and gold and other precious metals in South Africa), oil or coal (Mexico and

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[2] Canada's Alberta Heritage Fund was excluded from the study as no deposits have been made since 1986, and funds are held domestically.

Norway) or a mix of both (Australia and Canada). All of the countries in the sample have flexible exchange rates and well developed monetary policy and financial sectors which use a mix of inflation targeting, exchange rate intervention and foreign exchange hedging where appropriate.

Table 1 Changes in TOT between 2002 and 2008 and revenue fund qualifiers for each country.

	Australia	Canada	South Africa	Chile	Mexico	Norway
ΔTOT 2002-08 (%)	64	20	15	75	16	16
Revenue Fund	NO	NO	NO	YES	YES	YES

Variables

Real Effective Exchange Rates (REER) (also called real trade weighted indexes) are nominal exchange rate indexes adjusted for relative price movements using the formula shown in equation (1):

$$REER_t = 100 \prod_{i=1}^{n} \left(\left(\frac{e_{it}}{e_{ib}} \right) \left(\frac{p_t}{p_{it}} \right) \right)^{w_{it}} . \qquad (1)$$

The REER for a country is found as the product of weighted exchange rate and inflation indexes over n currencies. Exchange rates e_{it} and e_{ib} are the number of units of currency i per domestic currency at time t or at the base period b. In some instances, such as the Canadian-dollar Effective Exchange Rate (CERI), the previous year's value is used instead of the base year. Price levels in the domestic country and country i at time t are represented by p_t and p_{it} respectively. The weight assigned to currency i at time t is w_{it}. The REER can be calculated by a variety of methods depending on the mix of currencies, weights and base periods chosen. As such there is no generally accepted "correct" method. However, while some choices are arbitrary, such as base years, others can be more or less appropriate depending on the questions that the REER is used to answer (Ellis 2001). In this study REER's from each country's central bank were chosen in preference to the JP Morgan index. For Canada and Norway only Nominal Effective Exchange Rates (NEER) were available and were adjusted to REER's using the formula:

$$REER_t = NEER_t \prod_{i=1}^{n} \left(\frac{p_t}{p_{it}} \right)^{w_{it}} \qquad (2)$$

and using all but Chinese inflation to estimate the REER for Canada (97% of the weights) and 7-10 of Norway's 25 main trading partners' inflation rates (80-94% of the weights) instead of the full set of currencies . In order to illustrate the REER consider a theoretical country A that trades with countries B and C at relative weights 0.75 and 0.25

respectively. In the base period one of country A's currency is worth two of country B's and a half of country C's. Assuming price levels are equal at 100 the:

$$\text{REER}_A = 100 \times \left(\frac{2}{2} \times \frac{100}{100}\right)^{.75} \times \left(\frac{\frac{1}{2}}{\frac{1}{2}} \times \frac{100}{100}\right)^{.25} = 100. \tag{3}$$

In the next period country A's currency is worth 3 of country B's and a half of country C's. The:

$$\text{NEER}_A = 100 \times \left(\frac{3}{2}\right)^{.75} \times \left(\frac{\frac{1}{2}}{\frac{1}{2}}\right)^{.25} = 136. \tag{4}$$

Country A's currency appreciated due to the appreciation in the exchange rate with country B, but it does not tell us how the purchasing power of country A changed. If prices have increased to 103 in country A, 110 in country B and 101 in country C, the:

$$\text{REER}_A = 100 \times \left(\frac{3}{2} \times \frac{103}{110}\right)^{.75} \times \left(\frac{\frac{1}{2}}{\frac{1}{2}} \times \frac{103}{101}\right)^{.25} = 130. \tag{5}$$

Country A's currency has still appreciated, but to a lesser extent as the extra currency of country B is not able to purchase as much as the previous period. Despite identical exchange rates, lower inflation in country C has caused an appreciation of country A's currency.

Terms of trade (TOT) are the ratio of the export price index to the import price index. Interest rates (IR) are the difference between interest rates in the home country and the US, and are included as an indicator of capital movements. Trade openness (TO) is calculated using:

$$\text{TO}_{it} = \frac{(\text{imports}+\text{exports})_{it}}{2\text{GDPQ}_{it}}. \tag{6}$$

Where imports and exports are the quarterly value of total imports and exports and GDPQ is the quarterly gross domestic product. By including trade openness with terms of trade, price changes are combined with volume to give an indicator of the *effective TOT*.

Proxies for international reserves (RES), revenue funds (FUND) and their combined value (BOTH) are calculated in the same manner, except that GDPA is a measure of the annual gross domestic product:

$$\text{RES}_{it} = \frac{\text{international reserves}_{it}}{\text{GDPA}_{it}}. \tag{7}$$

$$\text{FUND}_{it} = \frac{\text{revenue funds}_{it}}{\text{GDPA}_{it}}. \tag{8}$$

$$\text{BOTH}_{it} = \frac{\text{revenue funds}_{it} + \text{international reserves}_{it}}{\text{GDPA}_{it}}. \tag{9}$$

Where international reserves are the stock of international reserves held by the central bank and revenue funds is the value of any revenue stabilisation funds or sovereign wealth funds (Aizenman & Riera-Crichton 2006).

To illustrate the parameters consider Mexico in 2004. For the four quarters of 2004 Mexico's GDP measured in current pesos was 2047, 2111, 2169 and 2239 billion respectively, making the annual GDP 8566 billion pesos. In the first quarter Mexico imported 566 billion pesos and exported 539 billion pesos worth of goods. As such Mexico's trade openness in the first quarter of 2003 is:

$$\text{TO}_{Mexico\ Q1\ 2004} = \frac{566+539}{2\times2047} = 0.27. \tag{10}$$

Over the study period trade openness ranged from 0.18 in Australia in 2003-04 to 0.46 in Chile in 2008. In the first quarter of 2004 Mexico held the equivalent of 654 billion pesos in international reserves and had 6 billion pesos in their Oil Revenue Stabilization Fund. As such:

$$\text{RES}_{Mexico\ Q1\ 2004} = \frac{654}{8566} = 0.076 \text{ and} \tag{11}$$

$$\text{FUND}_{Mexico\ Q1\ 2004} = \frac{6}{8566} = 0.001. \tag{12}$$

Over the study period international reserves varied from 0.02 to 0.25 and revenue funds varied from a maximum of 0.005 and 0.17 in Mexico and Chile respectively to 0.96 in Norway.

Data Sources

The dataset runs from the first quarter of 1996 to the first quarter of 2009. Except for the revenue funds, Mexico's national accounts, Canada's RER and South Africa's CPI, data was obtained through Thomson Reuter's Datastream database. Monthly data was converted to quarterly using the middle month of each quarter.

Chile's Fondo de Compensación del Cobre (Copper Compensation Fund) only had annual balances available for the period 1996 and 2002 (Arellano 2006). As the annual balance refers to the balance at years end, this figure was assigned to the last quarter of the year then carried forward, so the balance for the first three quarters of 1996 were taken from the 1995 end of year balance. From the end of 2002 the balance of the fund was obtained from quarterly reports published by the Government of Chile's Ministry of Finances. In March 2007 the Copper Compensation Fund was split into the Fondo de Estabilización Económica y Social and Fondo de Reserva de Pensiones (The Economic and Social Stabilization Fund and Pension Reserve Fund). Balances of the two new funds were averaged from monthly reports published by the Government of

Chiles' Ministry of Finance. The balance of Mexico's Fondo de Estabilización de los Ingresos Petroleros (Oil Revenue Stabilization Fund) was obtained from a synthesis of quarterly reports published by the Government of Mexico's Ministry of Finance by FUNDAR[3]. Mexico's national accounts were not available prior to 2003, so estimates from the OECD were used. The balance of Norway's Government Pension Fund – Global was obtained from annual and quarterly reports published by Norges Bank and estimates for the balance in 1996. When deposits were made on the last day of a quarter they were added to the balance of the fund in the following quarter. South Africa's CPI was obtained from Statistics South Africa and Canada's NEER (CERI) was obtained from the Bank of Canada. The full data set is attached in Appendix 1.

ANALYSIS

Australia

Australia's REER closely follows the TOT and almost appears to pre-empt movements in commodity prices (Figure 7). During the Global Financial Crisis the Australian Dollar proved particularly volatile, and at one stage dropped by 20% in a single quarter, only to regain most of that ground in the following year. Little attention was paid to exchange rate adjustments, as the prevailing view was that higher commodity prices were due to a permanent structural adjustment in the Asian economies.
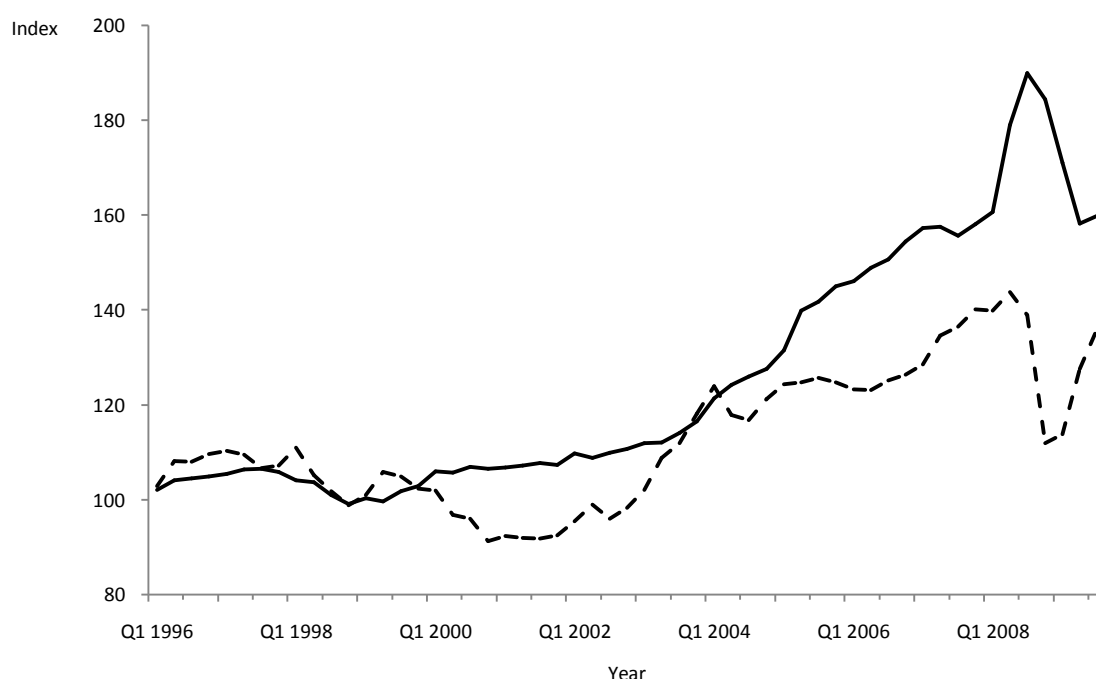
Figure 7   Australia's Terms of Trade (solid line) and Real Effective Exchange Rate (dashed line) from the first quarter of 1996 to the third quarter of 2009.

Canada

Over the period considered, Canada's REER tracked very closely to its TOT (Figure 8). The Canadian Dollar appreciated steadily during the 2003-2008 period, and then lost most of that accumulation in 2008-09.
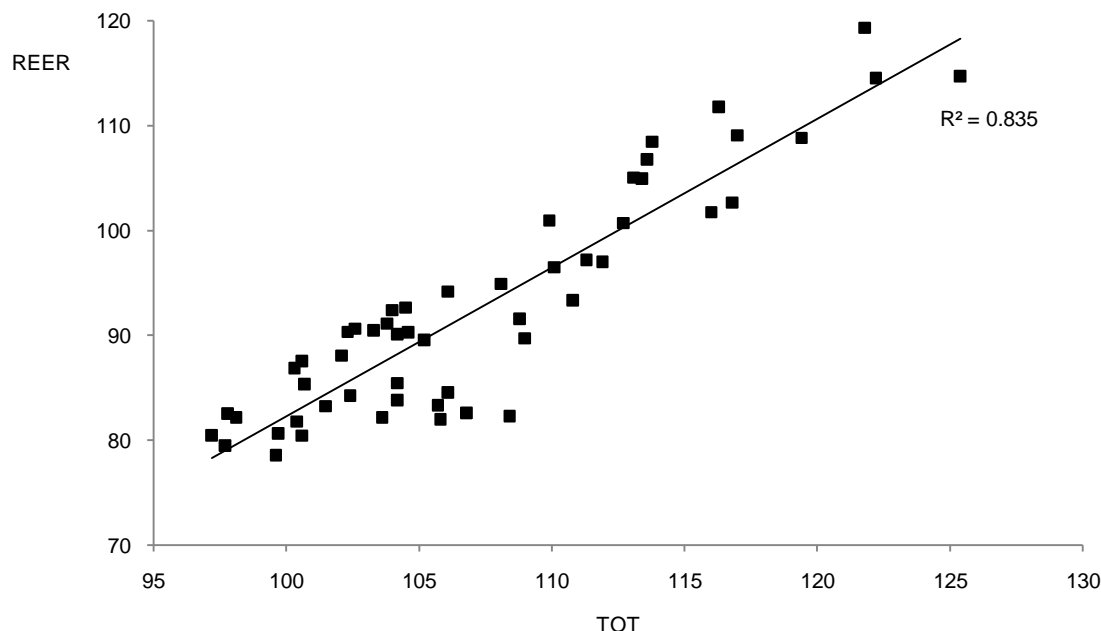

Figure 8 Canada's Terms of Trade (horizontal axis) and Real Effective Exchange Rate (vertical axis) from the first quarter of 1996 to the first quarter of 2009.

South Africa

Over the 1990's South Africa was adjusting to post-apartheid democracy and an open economy. In response to the excesses of the apartheid government, stable and responsible monetary and fiscal policies were primary objectives. The repayment of foreign debt was a powerful tool for these objectives and helped sterilise revenue from exporting sectors, as was the accumulation of international reserves. The relative size of the exporting sector also decreased as financial services occupied an increasingly large part of activity (Aron *et al*. 2009). Overall it appears that the South African Rand was more sensitive to large interest rate movements than to the steady rise in the Terms of Trade.

Chile

Chile's fiscal policy has evolved around a high dependency on copper and, as such, has been considered sound since the 1980's (Perry 2003). Chile has had a revenue fund since the 1980's and its value jumped considerably after it was reformed in 2007. The reformation of Chile's revenue funds occurred well after Chile saw a sustained and dramatic rise in their TOT, suggesting other policies were responsible for keeping the Peso down during this period (Figure 9).
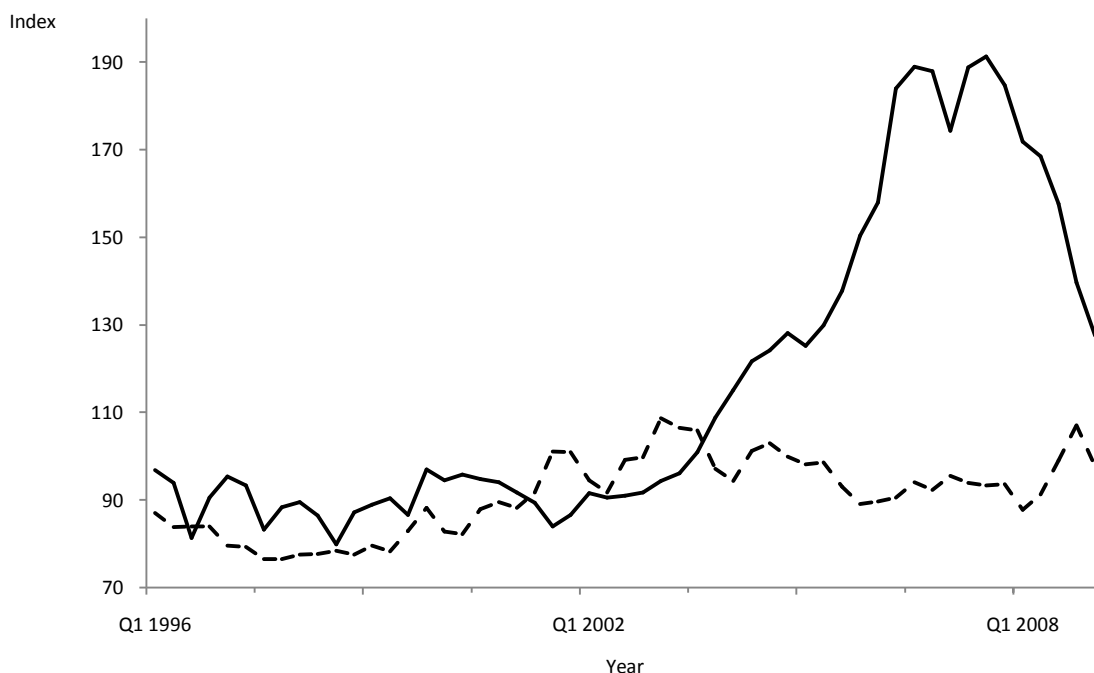
Figure 9 Chile's Terms of Trade (solid line) and Real Effective Exchange Rate (dashed line) from the first quarter of 1996 to the first quarter of 2009.

Mexico

In Mexico the emphasis of policy in the 1990's was inflation control and improving the government's weak fiscal position, after the virtual bankruptcy of the banking system in 1994-95 (Sánchez 2005). By the turn of the millennium the policy focus had shifted to revenue stabilisation (Everhart & Duval-Hernandez 2001). Despite the implementation of an Oil Revenue Stabilisation Fund in 2001, public expenditure has continued to be highly dependent on oil revenues, shifting the policy focus to hedging oil prices in preference to the fund. The resulting lack of interest and oversight of Mexico's fund has led to the fund's failure as a policy tool (Moreno *pers. comm.*).

Norway

Since the discovery of North Sea oil, Norway has been very conscious of the challenges that a large non-renewable export sector brings. Initially, the repayment of foreign debt was an important strategy for Norway, who only established their fund once all their foreign debt was repaid. As far back as the 1970's Norway recognised the unsustainable nature of oil revenue, with a government official (cited in Hannesson 2001) remarking at the time:

> People need to realise that it's oil and not nurses that we're pumping from the North Sea.

Since establishing their fund, Norway has developed as a world leader in managing revenue funds. The fund currently sits at around $A490 billion, which is around the same size as Norway's annual GDP. The fund has immunised the Government budget from fluctuating oil receipts, helped stabilise the exchange rate and

provided the basis for a long term income stream, reducing the countries reliance on petroleum exports (Figure 10).
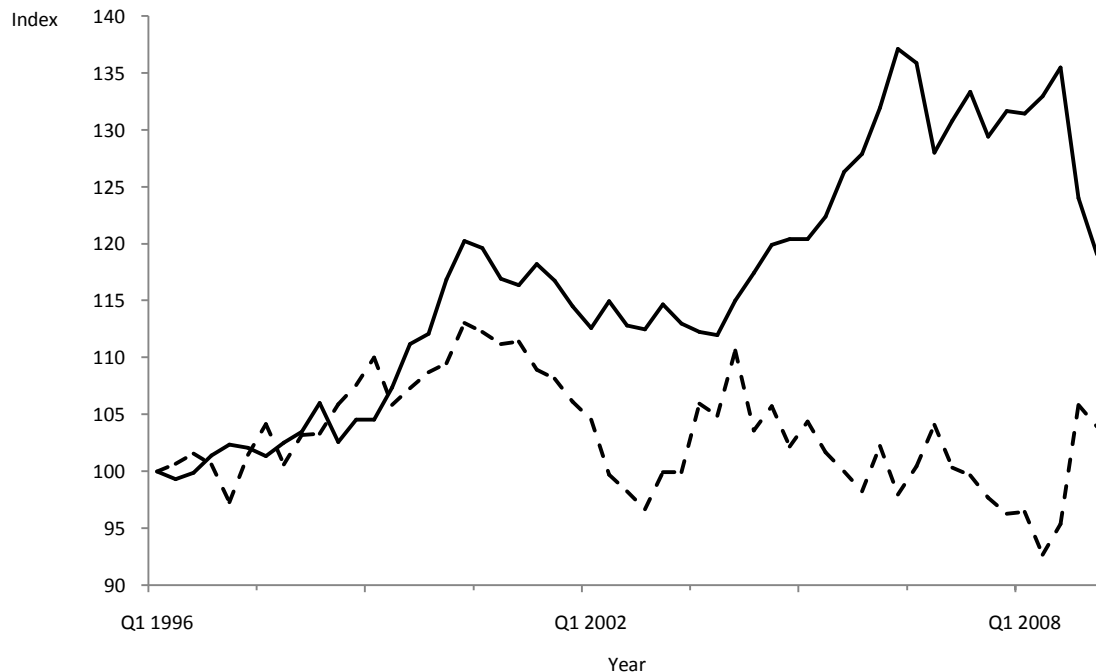

Figure 10   Norway's Terms of Trade (solid line) and Real Effective Exchange Rate (dashed line) from the first quarter of 1996 to the first quarter of 2009.

DISCUSSION

These observations suggest that revenue funds are not the main cause behind the decoupling of exchange rates from commodity prices. Instead the cause is likely to be fiscal policy, with revenue funds entering as a useful, but not essential, tool. This finding is in line with the previous research on revenue funds (Fasano 2000; Davis *et al.* 2003). Other policies are often preferential, for example while foreign debt remains there is little benefit to be gained from establishing a revenue fund, especially if the returns to the fund are below interest repayments on the debt.

For Australia, the correlation between the REER and the TOT should be a cause for concern. In general, developing countries have higher elasticities than industrialised countries (Aizenman & Riera-Crichton 2006). This suggests that in terms of commodity prices and exchange rates, Australia and Canada act more like developing countries than the four other countries considered. There is also little indication that the situation is improving.

Australian states have historically had low fiscal responsibility and accountability, as the Federal government has retained jurisdiction over the majority of tax assignment (McLure Jr 2001). Being a state, the overall effects of Western Australia's fiscal policy are combined with the effects of the Federal and other state governments, making them less obvious. For the Western Australian government, unsustainable spending is an internal liability. The spending and resource movement effect is forced on the rest of

Australia through the exchange rate, which also dampens the final impact on Western Australia. Due to geographical differences in resource availability, the persistence of lagging and booming sectors has lead to Australia's characterisation as a "dual economy". Federal governments are regarded as the most appropriate domain for revenue stabilisation objectives as they have more policy options, but the dual economy makes targeted action difficult (Ahmad & Mottu 2003). Redistribution efforts between states are a practical option for reducing horizontal imbalances, however in Australia to date they have a considerable lag and are poorly understood by the public, reducing their effectiveness (McLure Jr 2001). States can and do account for the impact of federal fiscal policy on state budgets and can provide accounts of 'net royalties'. A revenue stabilisation fund would have to use 'net royalties' instead of 'gross royalties', which is a considerably reduced amount (McLure 2008). This process is also unnecessarily complex, and would be more effective if the Federal government collected and distributed royalties. This suggestion may be unpopular, as royalties are generally regarded as property of the state, however in practice states only receive a fair share of nationwide royalties, making their claim to state based royalties a widely believed fiction. A sovereign wealth fund could be used to argue that royalty revenue is the heritage of the state and should be invested by the state in a sustainable manner. As such royalty revenue should not be measured as conventional revenue and should not be redistributed, similar to in US and Canadian law (McLure Jr 2001). It is likely that removing royalty revenue from the budget will cause rearrangement of taxes, which may cause deadweight losses which will need to be considered.

This study does not completely cover the issue of Dutch disease as it stops at the determinants and does not look at growth rates. This is an important assumption behind the whole theory and needs to be considered. The omission is due to timing, as the theory and experience predicts reduced growth during downturns. Currently the World is enjoying comparatively high commodity prices, which are generally viewed as a structural rather than a cyclical change. Australia has also experienced comparatively high growth rates due to debt funded countercyclical fiscal policy. Further investigation designed to extend the current study should look at growth rates after commodity prices have decreased or output has dropped to see if the determinants of Dutch disease identified do decrease growth.

There are several limitations in the current study which need to be accounted for by future research. In this study, revenue stabilisation funds and sovereign wealth funds were considered as identical for statistical purposes. Decreases in the balance of funds can be caused by multiple means. They may be spent, lost, or, as was the case when in late 2008 Norway's Government Pension Fund – Global dropped in value by $100US billion, due to the conversion to a different currency for reporting purposes. Interest rate differentials between the home country and the US were the only measure of capital movement and are unlikely to fully capture their effects. Capital movements are a complex field with close ties to exchange rate movements, and the World contains many more countries than were considered. Government debt would have been a simple and useful parameter to include; unfortunately complete and accurate data on debt for the countries studied were not available. The important role fiscal policy plays in exchange

rate dynamics suggests that more focus should be given to the various fiscal policy options and their outcomes, rather than the one mechanism considered in this study.

CONCLUSION

Western Australia currently has Dutch disease. Recurrent government expenditure is vulnerable to decreases in royalty receipts. High levels of exports are partly responsible for the high and possibly overvalued Australian dollar. Revenue funds are a potential policy tool if the Western Australian government decides to limit the impact of export prices on Australia's exchange rate. As this is unlikely to be an objective for a state government, it should instead be seen as an added benefit to countercyclical or sustainable fiscal policies. While a revenue fund is unlikely to be successful in achieving these objectives alone, they can be a powerful tool for drawing attention to fiscal policy and establishing incentives for responsible management, two areas which have been neglected to date. If a fund is to be established, the legal and political structure of any revenue funds needs to be considered. International experience can provide several lessons. Firstly, rules must be clear and designed so that they cannot be easily circumvented by a parliamentary majority. Second, the management of the fund needs to capture the interest of the public, for example by giving citizens a direct stake through dividends or pensions, which translates into political incentives for responsible management. Institutions separate from the government are adept at achieving single objectives, removing the need for politicians to balance competing objectives. Australia has already developed similar systems, such as Lotterywest in Western Australia or the Future Fund at the national level, which have been successful to date.

There are considerable differences in the style and objectives of revenue funds. Due to the Commonwealth Grants Commission's redistribution of state revenue, Western Australia will only have access to 'net royalties'. Considering the small contribution net royalties make to total revenue a revenue stabilization fund will not have much impact and is more suited to federal policy. If sustainable management of mineral wealth is an objective for Western Australia, a sovereign wealth fund is a serious option. A sovereign wealth fund could also be used to argue that royalty revenue is the heritage of the state and should not be redistributed, increasing the state's fiscal autonomy and providing a clear framework for future responsible management. Regardless of choice, any proposal will need to be implemented in consultation with the Federal government, who have considerable power over state fiscal policy and have the option of setting up their own revenue funds as well. There are signs that the Commonwealth is not interested in a revenue fund, as the national Treasury is well aware of the benefits and has not translated them into a policy position (Cleary 2009). The Commonwealth has used the logic of countercyclical fiscal policy during the Global Financial Crisis, and it should repay the accumulated debt before a fund is established. Management will also need to be implemented in consultation with the Reserve Bank of Australia, who have control of monetary policy and will need to consider and potentially guide any export revenue sterilisation. The final choices need to be made in comparison to other potential

options, such as foreign debt repayment or infrastructure provision, which may provide greater immediate benefits. Due to the political landscape it would be difficult for the State Government to balance these objectives, forcing it to either establish a revenue fund for all royalty receipts or none. As such, the Western Australian government has the opportunity to avoid Dutch disease through a Sovereign Wealth Fund style revenue fund, which can make government revenue from royalties sustainable and reduce the impact of commodity prices on the exchange rate, and in doing so reduce the economy wide adjustments that a volatile exchange rate causes.

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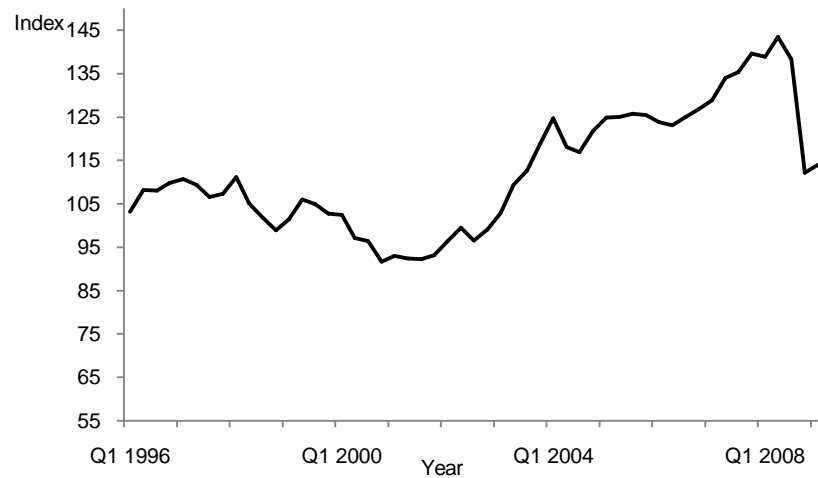
APPENDIX A

COUNTRY DATA

Australia

Figure 1   Australia's Trade Weighted Exchange Rate, Real Q1 1996 to Q1 2009. Base = 1995. Source: Reserve Bank of Australia.
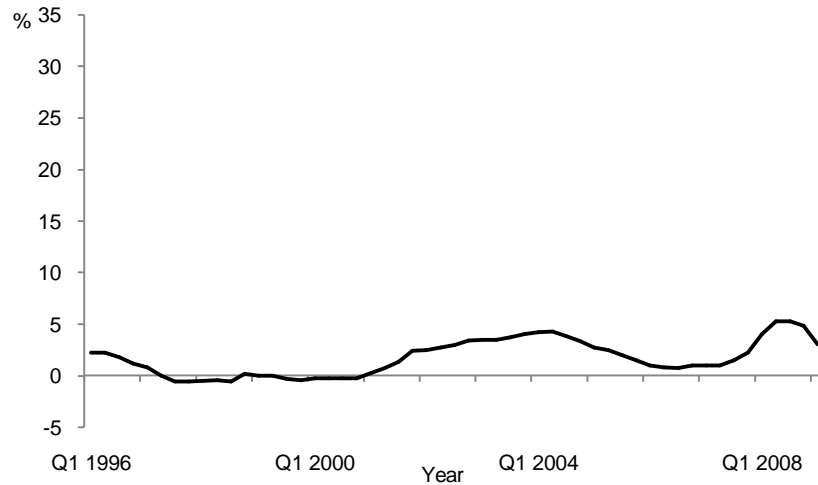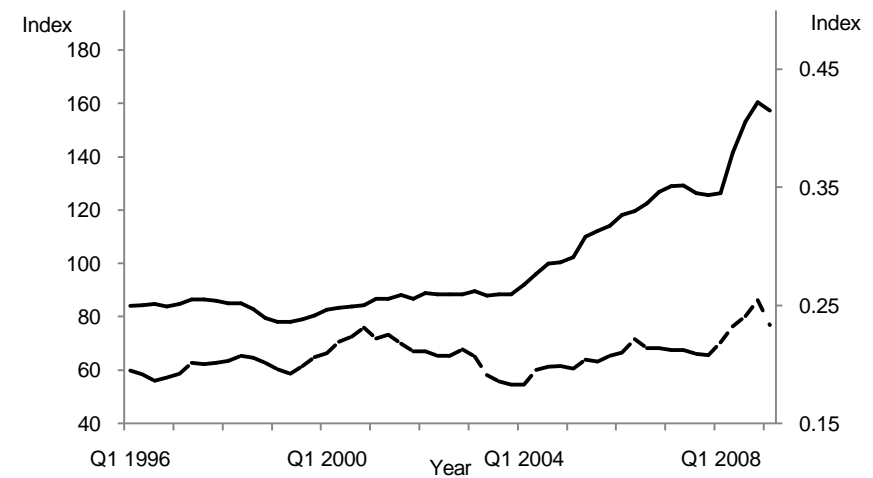
Figure 2   Left hand axis: Australia's terms of trade (solid line). Base = 1989-90. Right hand axis: Australia's trade openness (dashed line) Q1 1996 to Q1 2009. Source: ABS.
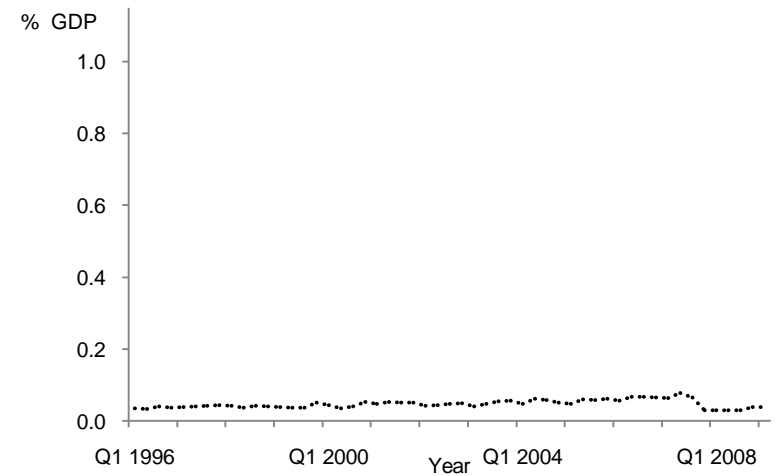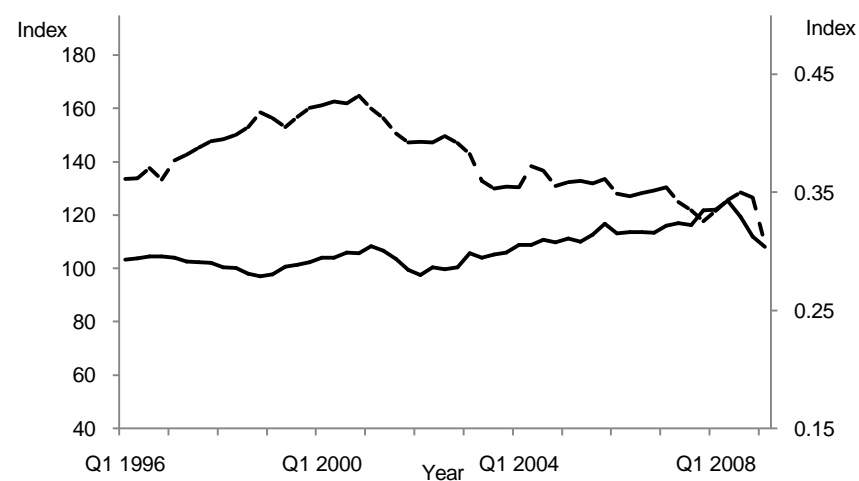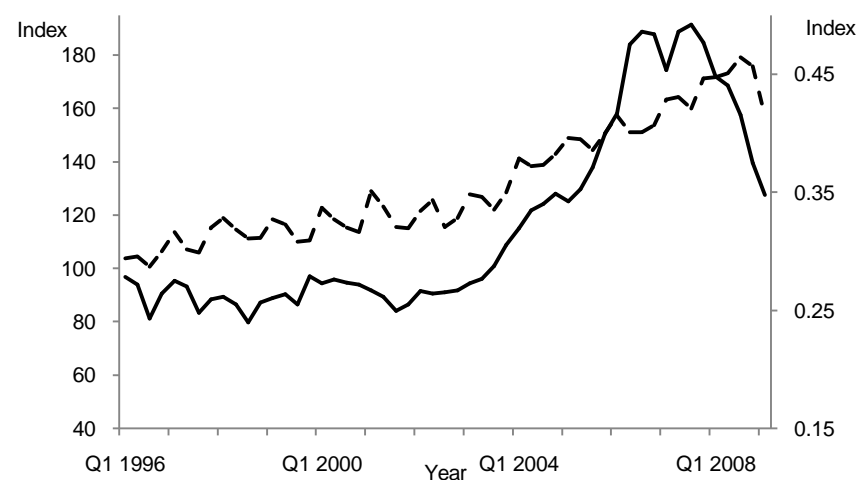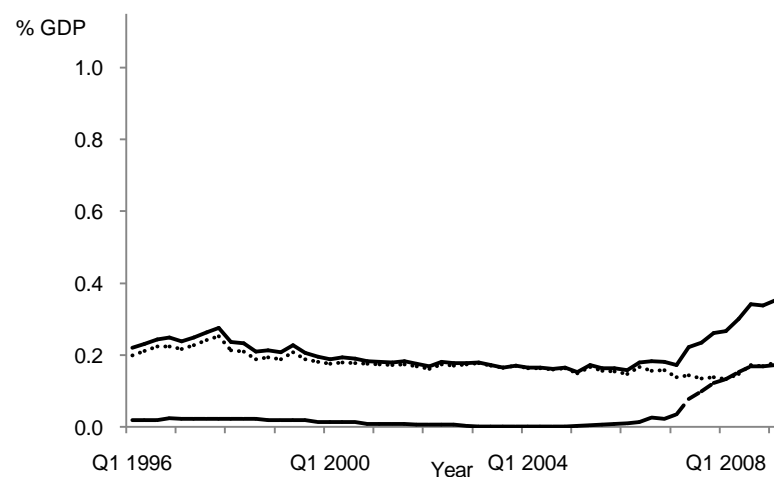
Figure 3   Australia and the US's interest rate differential Q1 1996 to Q1 2009. Source: Reserve Bank of Australia and US Federal Reserve.

Figure 4   Australia's international reserves as a proportion of GDP Q1 1996 to Q1 2009. Source: Reserve Bank of Australia.
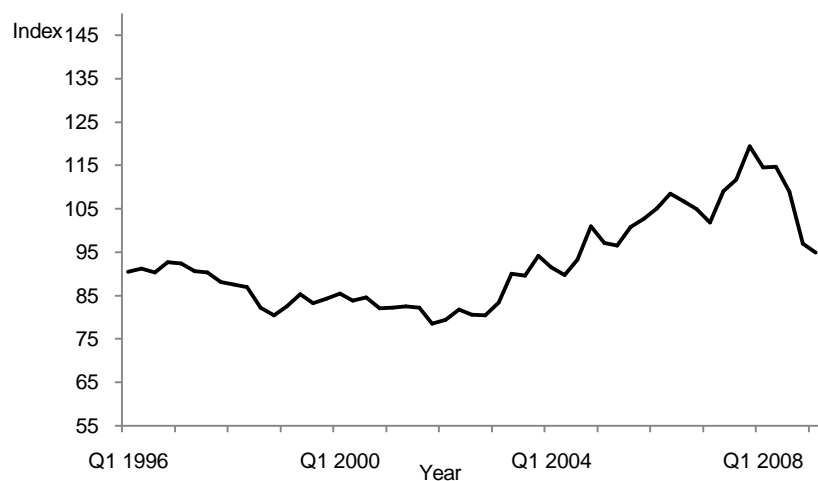
Canada

Figure 5　Canada's Trade Weighted Index, Real, Broad Q1 1996 to Q1 2009. Base = 1990. Source: Bank of Canada.

Figure 6　Left hand axis: Canada's terms of trade (solid line). Base = 2002. Right hand axis: Canada's trade openness (dashed line) Q1 1996 to Q1 2009. Source: CANSIM – Statistics Canada and Thomson Financial.
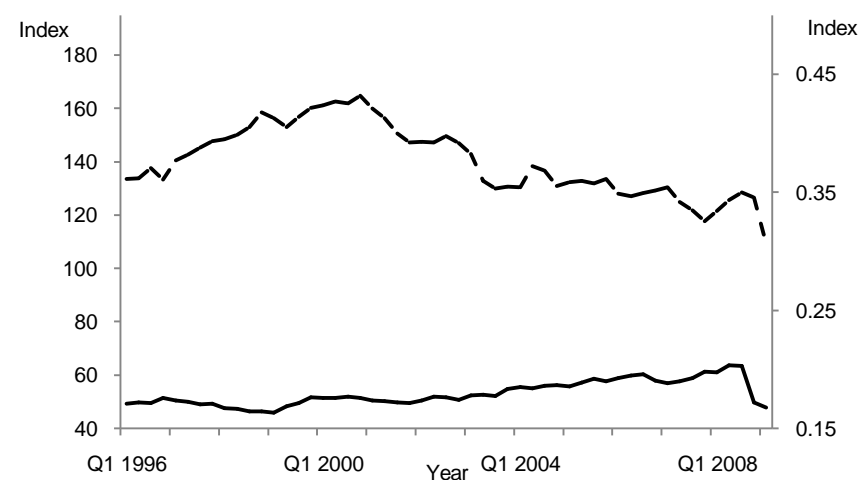

Figure 7　Canada and the US's interest rate differential Q1 1996 to Q1 2009. Source: CANSIM – Statistics Canada and US Federal Reserve.
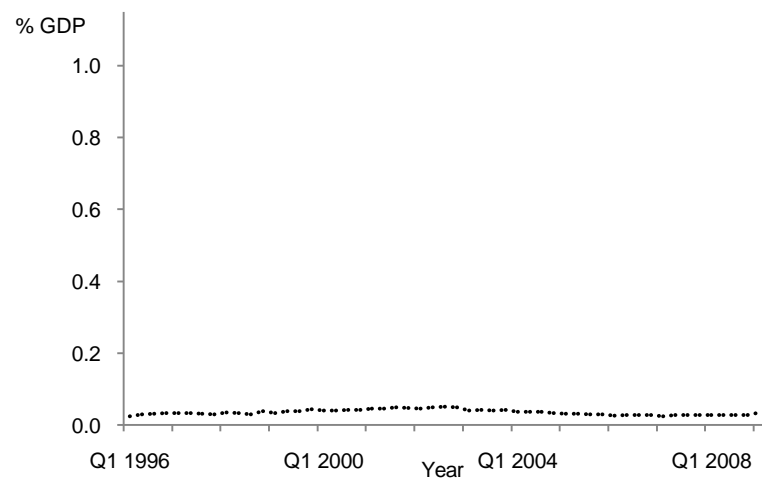
Figure 8　Canada's international reserves as a proportion of GDP Q1 1996 to Q1 2009. Source: CANSIM – Statistics Canada.
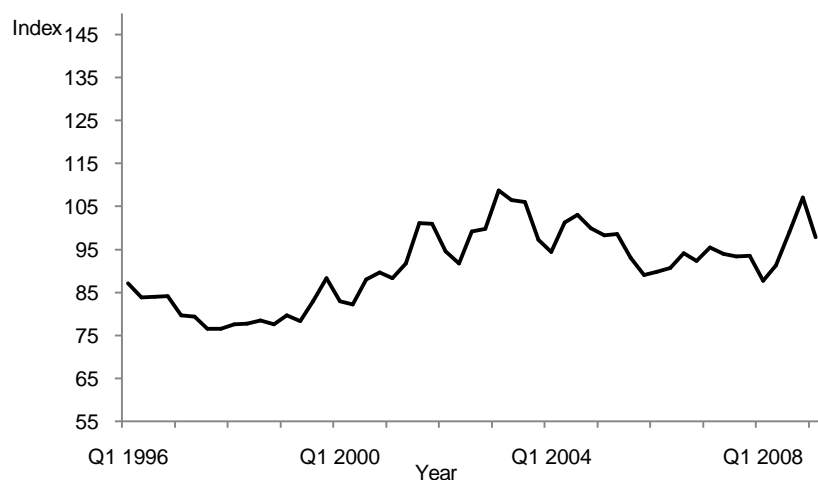
Chile

Figure 9 Chile's Real Observed Exchange Rate Q1 1996 to Q1 2009. Base = 1986. Source: Bank of Chile.

Figure 10 Left hand axis: Chile's terms of trade (solid line). Base = 2003. Right hand axis: Chile's trade openness (dashed line) Q1 1996 to Q1 2009. Source: Bank of Chile.
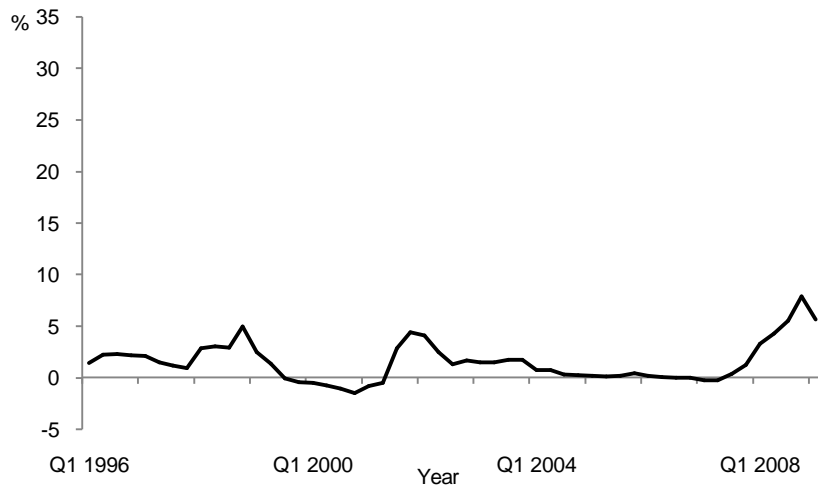
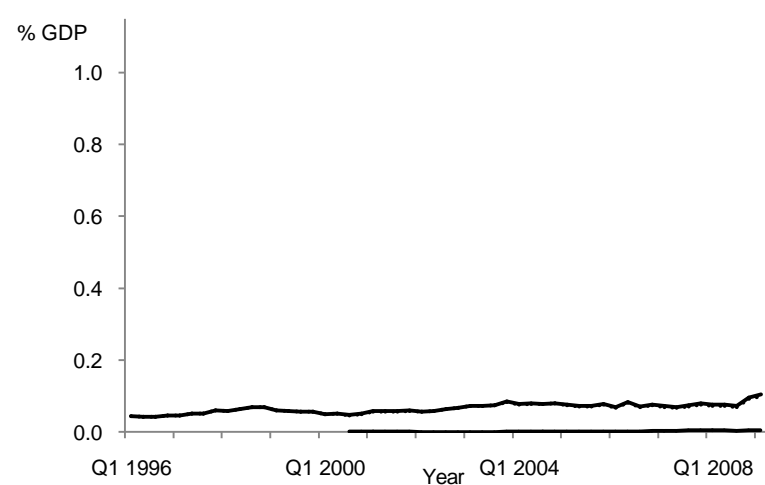**Figure 11** Chile and the US's interest rate differential Q1 1996 to Q1 2009. Source: Bank of Chile and US Federal Reserve.

Figure 12 Chile's international reserves as a proportion of GDP (dotted line), revenue funds as a proportion of GDP (dashed line) and combined value as a proportion of GDP (solid line) Q1 1996 to Q1 2009. Source: Bank of Chile and Ministry of Finance.
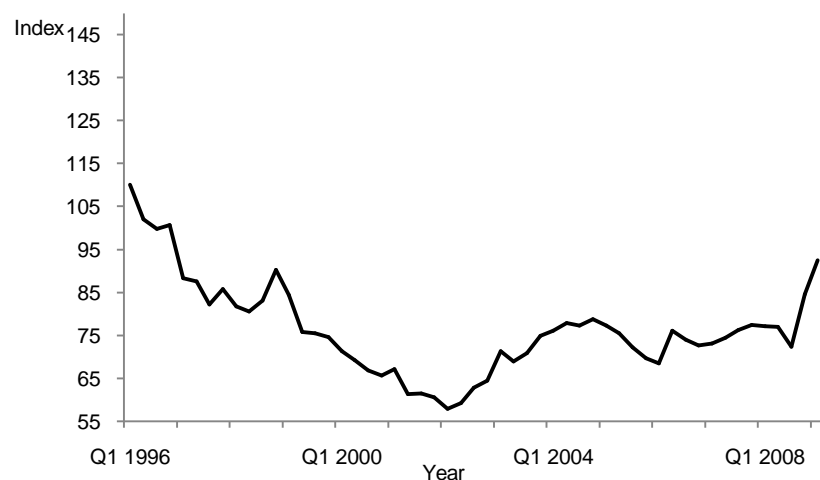
Mexico

Figure 13   Mexico's Exchange Rate Real Index Q1 1996 to Q1 2009. Base = 1990. Source: Banco de Mexico.

Figure 14   Left hand axis: Mexico's terms of trade (solid line). Base = 1980. Right hand axis: Mexico's trade openness (dashed line) Q1 1996 to Q1 2009. Source: Banco de Mexico and OECD.

Figure 15   Mexico and the US's interest rate differential Q1 1996 to Q1 2009. Source: Banco de Mexico and US Federal Reserve.

Figure 16   Mexico's international reserves as a proportion of GDP (dotted line), revenue funds as a proportion of GDP (dashed line) and combined value as a proportion of GDP (solid line) Q1 1996 to Q1 2009. Source: Banco de Mexico and Ministry of Finance.
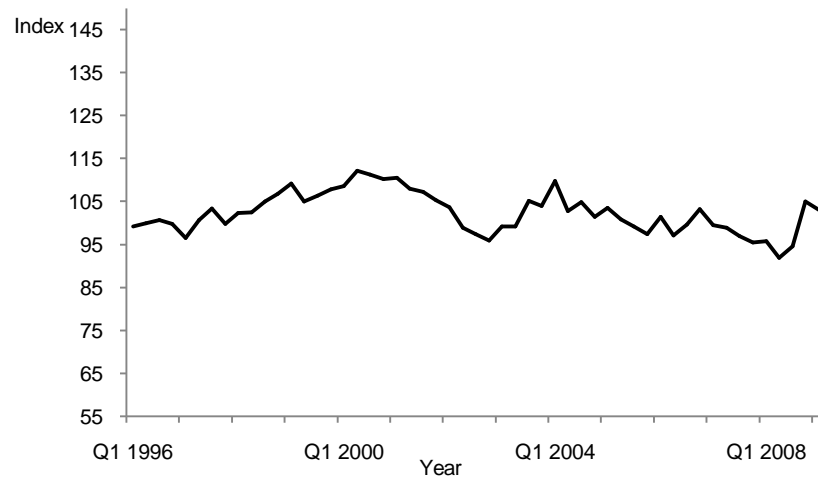
Norway

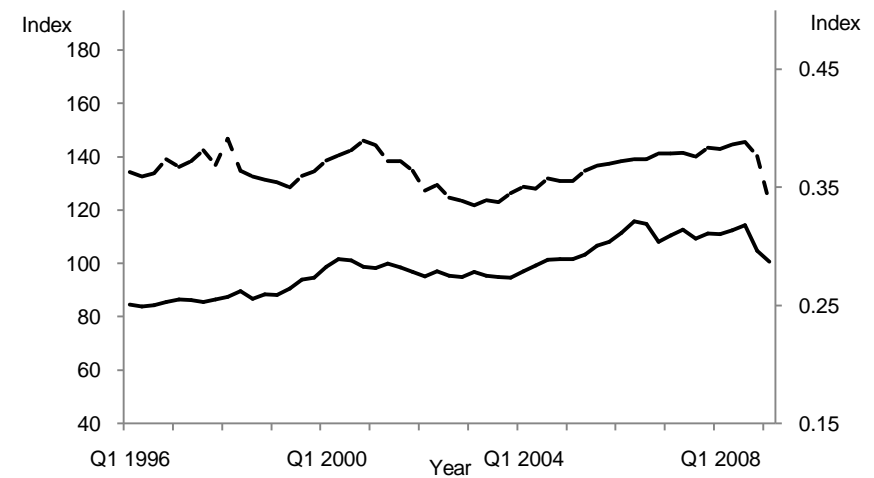Figure 17 Norway's Trade Weighted Index Q1 1996 to Q1 2009. Base = 1990. Source: Norges Bank.

Figure 18 Left hand axis: Norway's terms of trade (solid line). Base = 2000. Right hand axis: Norway's trade openness (dashed line) Q1 1996 to Q1 2009. Source: Statistics Norway.
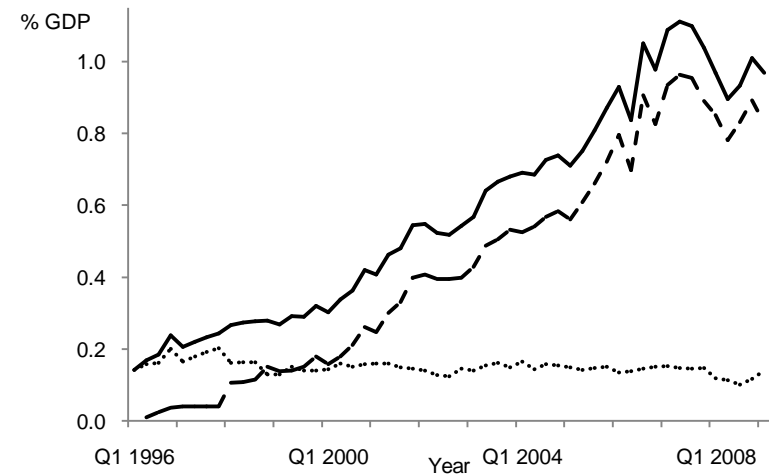

Figure 19 Norway and the US's interest rate differential Q1 1996 to Q1 2009. Source: Norges Bank and US Federal Reserve.

Figure 20 Norway's international reserves as a proportion of GDP (dotted line), revenue funds as a proportion of GDP (dashed line) and combined value as a proportion of GDP (solid line) Q1 1996 to Q1 2009. Source: Norges Bank.
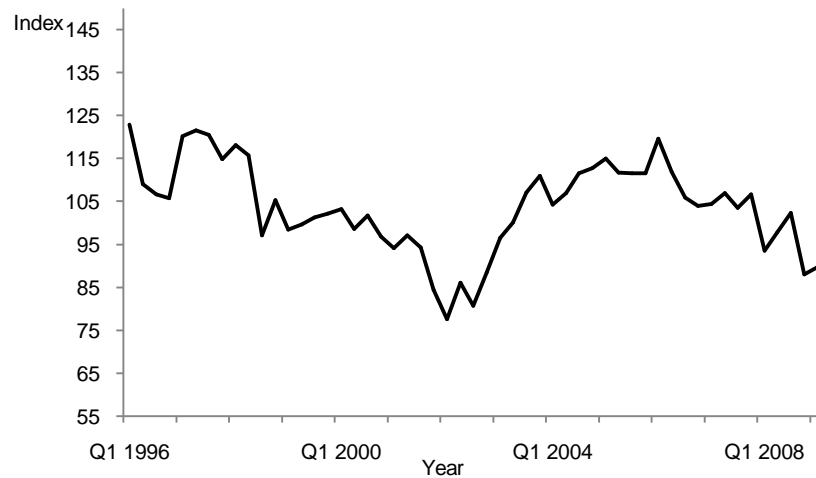
South Africa

Figure 21 South Africa's Real Effective Exchange Rate Q1 1996 to Q1 2009. Base = 2000. Source: South African Reserve Bank.
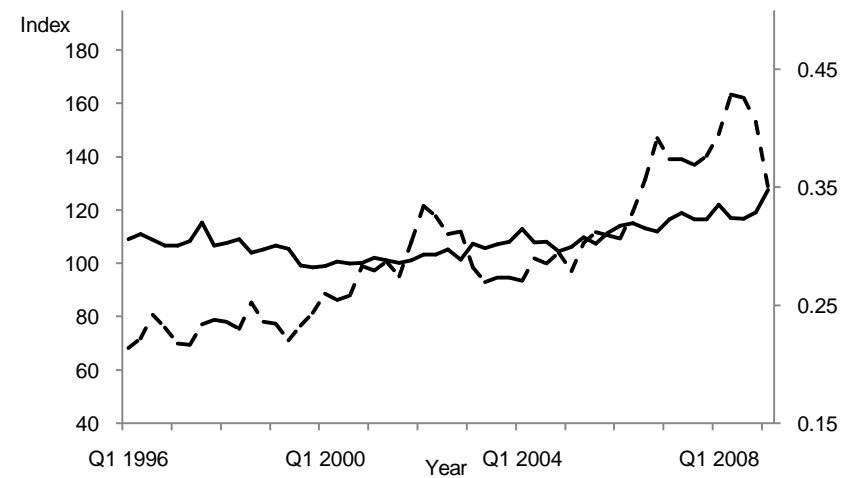

Figure 22 Left hand axis: South Africa's terms of trade (solid line). Base = 2000. Right hand axis: South Africa's trade openness (dashed line) Q1 1996 to Q1 2009. Source: South African Reserve Bank and Statistics South Africa.
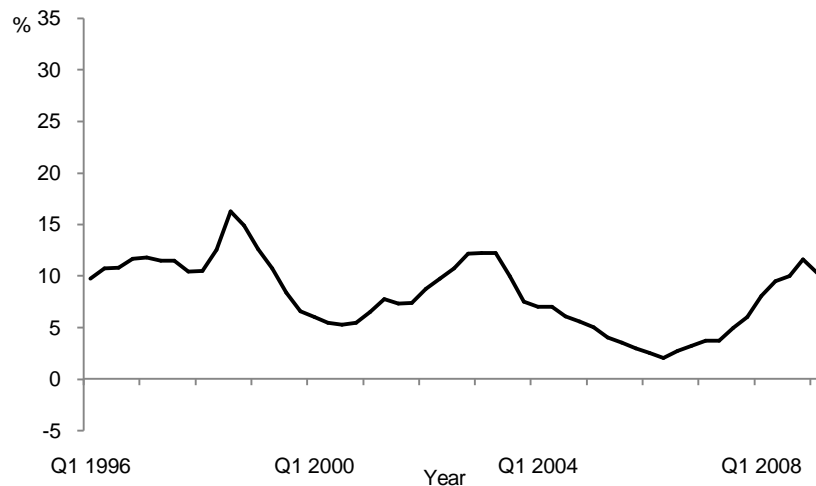

Figure 23 South Africa and the US's interest rate differential Q1 1996 to Q1 2009. Source: South African Reserve Bank and US Federal Reserve.
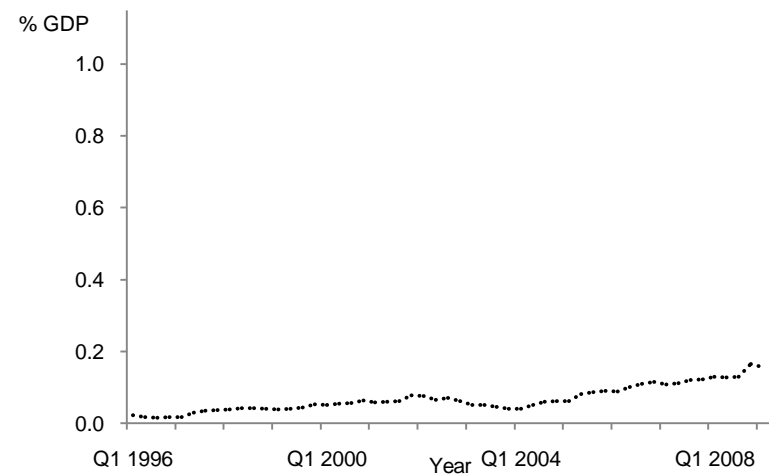

Figure 24 South Africa's international reserves as a proportion of GDP Q1 1996 to Q1 2009. Source: South African Reserve Bank.