



Decoupling economic activity and transport growth: the state of play in New Zealand

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ABSTRACT

The government's December 2002 *New Zealand Transport Strategy* states that "in the long run, economic development and transport growth need not be directly related". That is, it suggests that in the long run, there may be some 'decoupling' of economic growth and transport growth. Whilst there has been some research conducted on decoupling overseas, and in Europe in particular, there is a gap in the existing body of knowledge in this area in New Zealand. This paper aims to 'start the ball rolling' on decoupling issues amongst the New Zealand research community.

This paper comprises two key sections. First we examine the international literature on decoupling in order to gain an understanding of how this issue has been addressed overseas. The key conclusions from the literature review are that decoupling is poorly defined and that quantitative analysis surrounding the topic is scant. We then move on to analyse some possible measures of decoupling in New Zealand. Whilst the results are interesting, they highlight the need to clearly define decoupling before attempting to develop measures to accurately monitor it. The concept of decoupling is easy to grasp, but difficult to measure in practice. We conclude the paper by suggesting one possible definition and monitoring measure of decoupling.

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1. INTRODUCTION

In recent years, there has been growing interest both in New Zealand and overseas in the links between transport and the economy. In most developed countries, there has traditionally been a strong positive relationship between economic growth and transport growth. However, transport activity leads to negative side-effects or externalities such as air pollution and congestion.

Given that economic growth increases the welfare of a country, and these negative externalities reduce welfare, policymakers are considering how a country can experience economic growth without facing the negative side effects of transport growth. Breaking or weakening the link between economic growth and transport growth is known as 'decoupling'.

The issue of decoupling has recently been raised by the New Zealand government. The government released its New Zealand Transport Strategy (NZTS) in December 2002. The NZTS outlines the government's vision for the development of the New Zealand transport system to 2010. The NZTS's overall goal is to "achieve an affordable, integrated, safe, responsive and sustainable transport system by 2010" (New Zealand government, 2002, p. 4).

While the NZTS contains a broad range of objectives related to economic, environmental and social issues, from an economic research point of view one comment in particular warrants attention:

In the long run economic development and transport growth need not be directly related...[and the government's] approach will minimise the extent of transport growth necessary to achieve economic development goals, and in particular minimise transport-related energy consumption (New Zealand government, 2002, p. 10).

This suggests that in the long run there will be some degree of decoupling of economic activity and transport growth. However, there is little in the NZTS to indicate why decoupling is desirable, how it might occur and what impact policies to achieve decoupling might have on the economy.

The purposes of this paper are threefold:

1. To provide interested parties with a primer on decoupling via a review of existing overseas literature on the subject.
2. To examine some possible measures of the relationship between economic activity and transport in New Zealand.
3. To highlight gaps in the decoupling research agenda and to suggest some possible ways to advance thinking on the topic.

It is hoped that our paper will spark debate on decoupling amongst the transport research community in New Zealand and Australia, as to date there has been little research conducted on the topic at all in the Australasian region. It is important to note that we do not purport to have all of the answers to the questions that arise from examining decoupling more closely. However, we believe that this paper will serve a useful purpose in introducing the topic area and raising some of the problems that are associated with defining and measuring decoupling.

The paper is set out as follows. Section 2 provides some broad definitions of decoupling and suggest two key reasons why it is a policy objective. Section 3 examines the overseas literature on decoupling. Section 4 takes an initial look at possible indicators of decoupling in New Zealand. Given the problems that this entails, section 5 provides an alternative definition of decoupling. Finally, some conclusions and research suggestions are made in section 6.

2. WHAT IS DECOUPLING AND WHY IS IT A POLICY OBJECTIVE?

2.1 ECONOMIC DEVELOPMENT, TRANSPORT AND EXTERNALITIES

In most developed countries, there has traditionally been a strong relationship between economic growth and transport activity growth. The provision of physical infrastructure (roads, railways, ports, airports, etc) is generally agreed to be of vital importance to economic development (SACTRA, 1999). However, it is also generally accepted that as transport increases, so too do its undesirable side effects – air pollution, noise pollution, CO₂ emissions, contaminated water run-off, congestion and stress. It should be noted that there are also positive externalities arising from some forms of transport growth, such as improved social interaction for isolated areas.

In recent years, there has been considerable interest in the links between transport and the economy, prompted mainly by policymakers in the EU. If transport growth and economic growth are strongly related, but transport growth leads to significant negative side-effects, the question that many researchers and policymakers are trying to address is how can a country experience economic growth without facing the negative side-effects of transport growth?

The seemingly simple answer to this question is to have economic activity growing faster than transport activity, thus breaking/weakening the link between economic growth and transport growth and its side effects. Breaking or weakening this link has come to be known as 'decoupling' economic growth and transport growth.

There are two broad types of decoupling (Belgian Presidency of the Council of the European Union, 2001, p. 70; OECD, 2002, p. 5). Decoupling occurs when GDP growth is higher than transport growth. If transport growth is positive, then this could be defined as *relative* decoupling – that is, transport is still increasing with economic growth, but at a slower rate: the link has been weakened. If transport growth is negative, this could be defined as *absolute* decoupling – the link has been broken.

2.2 ENVIRONMENTAL AND ECONOMIC ARGUMENTS FOR DECOUPLING

At a general level there are two reasons why a government may want to decouple transport and economic growth.

1. It may want to reduce the level or growth in negative externalities (pollution, congestion, etc) associated with transport growth without dampening economic growth. This is the environmental argument for decoupling.
2. It is striving for productivity gains across the economy. Economic growth (or development) can be achieved by reducing the amount of transport required per unit of output generated by the economy. If less inputs are used to produce a

given level of output, a productivity gain is generated. This increases GDP. Therefore even in the hypothetical case where there were no externalities from transport activity, a government may still wish to decouple. This is the efficiency argument for decoupling.

The relative importance of the productivity or environmental reasons for stating decoupling as a goal is a political issue, and is likely to depend on the set of preferences displayed by society. However, the two motivations overlap – by achieving decoupling, productivity gains and hence economic development will take place, and the growth in negative externalities from transport will ease. The NZTS's statements noted in section 1 above indicate that decoupling has been adopted as a policy goal for both environmental and efficiency reasons.

2.3 THE IMPORTANCE OF DEFINING 'TRANSPORT' CLEARLY

As a concept, decoupling is not too difficult to grasp. However, look a little deeper and it becomes clear that definitional issues are vital when it comes to working out exactly what a government is trying to achieve. One key point relates to stating clearly what 'transport' is when we refer to decoupling economic growth and transport growth.

There is a large distinction between the use of transport in the *production* of goods and services, and the use of transport by households as a *consumption* good. The distinction between transport as an input to production and transport as a consumption good is important for decoupling policies, as is the interaction between the two forms of transport.

2.3.1 Production transport

This involves activity related to the production of goods and services and essential household sector activities. Broadly, production transport includes the transport activity used to get raw materials to the production location, the transport required to transform raw materials into final goods, plus the transport activity used to get these goods to their final destination. If a monetary value can be placed on the output of an economic activity, then any transport required in the activity could be defined as production transport. In addition, certain elements of households' daily operations could be classified as productive transport. This covers activities such as the trip to work and shopping for essentials such as food and clothing. Without these activities the productive capacity of the economy would be lower.

2.3.2 Consumption transport

We can define consumption transport to cover the use of transport by individuals, households and tourists for non-essential purposes (including leisure).¹ Consumption transport refers to the use of transport by households and tourists – and provides households and tourists with utility (or satisfaction). Much of this transport – trips in self-driven cars – is not a product or service purchased at market prices or captured in the national accounts.

¹ The phrases 'consumption transport' and 'leisure transport' are to a large extent interchangeable.

Note that we have, for now, defined tourists' transport as consumption transport. However, given that tourists' demand for transport is externally driven and that it has a major impact on the level of New Zealand's production transport, it is a different form of consumption transport to that of domestic households.

We do not know the relative sizes of production and consumption transport in New Zealand. This is in part due to a lack of adequate quantitative measures of transport activity.

2.3.3 The interaction between production and consumption transport

As an input (and hence a cost) to production, firms have an incentive to minimise their use of transport. As a consumption good, households like to consume more of it as their incomes increase. This creates an immediate dichotomy. If firms reduce their use of transport via improved productivity, GDP (or national income) will increase.² On its own, this represents decoupling in the production sector. However, households treat transport as a 'normal good' – their consumption of transport for leisure purposes increases as incomes rise.³ Therefore reducing transport use in the production sector will generally lead to an increase in consumption transport. The net effect on overall transport activity is ambiguous.

This has implications for the development of decoupling policies. A policy that resulted in firms reducing their use of transport could in fact increase households' consumption of transport as a leisure good. Obviously, this may not be an effective policy.

Policies that affect consumption transport will also have an impact on production transport. For example, if policies are introduced that restrict leisure transport, then the producers of goods and services that are consumed by households and tourists on trips associated with leisure travel may suffer as demand falls. On the other hand, such policies may cause consumers to substitute other goods and services for transport activity – for example, they might spend more time in the garden instead of going on a day trip to the beach and might therefore spend more on gardening products.

It is clear that the direct and indirect linkages between production transport, leisure transport and economic activity comprise a complex set of relationships. In order to determine which policy levers are available to policymakers and how they would affect the interactions between production transport, consumption transport and economic growth, it is important to:

1. Define the various types of transport activity to a disaggregated level.
2. Examine the drivers of each type of transport.
3. Consider how these drivers will change in the future.

² GDP = Total output (sales) less intermediate consumption (goods or services used to produce the final product).

³ The treatment of transport as a normal good should be treated with a degree of caution. Certainly from a starting point of low income and low transport usage, an increase in income will lead to increased transport activity. However, it is probably true that there is an upper bound to households' use of transport – once they earn a certain level of income, they are probably consuming as much transport as they desire. That is, the marginal increase in transport activity that results from increased income decreases as income increases. It is also likely that the type of transport activity will change as incomes increase – more air travel may occur instead of road trips.

These three points are the focus of our current research activities, although we do not report on them in this paper as the results are still preliminary and are being considered by the Ministry of Transport before being released in the public domain.

3. WHAT'S BEEN DONE OVERSEAS?

3.1 OVERVIEW

Research into decoupling is a fairly recent development. Most of the papers have been written in the past four years, and there appears to have been little interaction between researchers. That is, there has been limited serious debate on the relative merits of each paper's policy suggestions.

The geographical sources of decoupling research are also limited. We did not find a great deal of literature from the US, Canada, Australia, Chile or Argentina. Two contacts from Canada suggest that "there is no work on decoupling in North America, to my knowledge" (Gilbert, pers. comm, 2002) and that "I am not directly aware of other North American decoupling work" (Zielinski, pers. comm, 2002). These thoughts were confirmed by a contact at the OECD, who suggests that "decoupling is not an issue in any region except Europe, thus, the absence of literature on the topic" (Wiederkehr, pers. comm, 2002). However, the OECD has initiated a project on decoupling under the auspices of the OECD Environment Policy Committee's Working Group. The Australian Department of Transport and Regional Services is similarly unaware of any research on decoupling in Australia (Board, pers. comm, 2002).

The majority of literature in the area of decoupling and sustainable transport has been conducted in Europe. Some possible reasons why this might be the case include:

- The increased political presence of 'green' political movements in Europe.
- The higher opportunity cost of land in Europe means that transport infrastructure policy and decisions require more in depth studies than in other countries where land is at less of a premium.
- The continuing integration of Europe has led to calls for a co-ordinated policy approach to transport policies in the future.

We do not report here on the literature that focuses on the negative impacts of transport growth on the environment. There is a vast amount of international literature available on the harmful externalities associated with increasing transport activity, and there is a broad consensus that transport growth is indeed 'coupled' with environmental damage. We are more interested in the *economic* aspect of this issue: the aim of the literature review is to concentrate on issues surrounding the decoupling of economic growth and transport growth, not just decoupling transport growth and environmental degradation.

Much of the literature surrounds possible policy approaches to achieve decoupling economic growth and transport growth. The starting point for most papers was on how to achieve decoupling, rather than stating what problem they are trying to address. They simply attempt to decouple transport (however it is defined) and economic growth. This may seem a subtle point but it is critical to the development of policy. The reason for trying to decouple will fundamentally determine which range of policy tools that should be used. In addition, many papers tend to gloss over the

exact meaning of decoupling. In particular, with 'transport growth' not being well defined the meaning of decoupling is vague. The lack of concrete definitions for the key terms in the decoupling literature makes the policy conclusions difficult to assess.

At this stage, it appears that there hasn't been substantial quantitative research into the issue, in terms of developing indicators of decoupling. It is generally assumed by researchers (rather than shown or proven) that breaking the link between transport and economic growth is a desirable policy aim. There isn't a great deal of literature discussing *why* having transport growth growing at the same pace as or faster than economic growth is necessarily a 'bad' thing. Rather, it is usually assumed that since transport has a number of negative externalities associated with it, it is desirable to reduce transport growth while keeping economic growth steady.

3.2 CAUSES OF INCREASED TRANSPORT ACTIVITY

Before we can start to identify viable policies to decoupling in New Zealand, it is necessary to understand the key drivers of transport growth. That is, we need to consider why has transport growth been so high overseas, and do the same drivers apply to the transport situation in New Zealand?

The literature pinpoints a number of reasons why transport activity has been growing rapidly in recent decades:

1. Globalisation and trade liberalisation have increased the number of international exchanges of goods, and consequently lifted the transport embodied in these goods.
2. Related to increased globalisation, there has been an ever-larger division of labour occurring in recent years. That is, countries are becoming more and more specialised in the production of certain goods, and tend to import those goods in which they do not specialise. So the ever-increasing distances between production and consumption have contributed to high transport growth.
3. In addition, changing production techniques, such as the widespread use of Just-In-Time delivery, have caused a change in transport activities. Instead of large, infrequent deliveries of goods, many firms now reduce their storage costs and instead use more frequent, smaller deliveries.
4. From a consumer's point of view, transport is often treated as a 'normal' good. When a consumer's income increases, their demand for normal goods increases.
5. Regional development policies have gained in importance. These policies often have an export-oriented flavour or involve investment in transport infrastructure between regions and population centres.
6. The deregulation of transport markets that has occurred has led to a decrease in the cost of transport, thus making it more attractive to consumers and producers.
7. A growing national population requires more goods and services for consumption purposes. This necessarily increases the amount of transport activity in an economy as more goods are moved around and into/out of a country.
8. Social and demographic changes have led to more women in the workplace, so rather than there being only one adult per household travelling to work daily, many households have two.
9. Modern life is simply more complex and frenetic, compared to, say, the 1970s. As a result, the number of household-based transport trips has increased.⁴

⁴ We thank an anonymous referee for this comment.

10. Walking and cycling have become relatively less popular, as consumers prefer to drive to work or for leisure purposes.

These factors explain why transport activity (and hence the negative externalities associated with transport) has grown rapidly in Europe (and within New Zealand, see section 4), and hence why decoupling has become such a hot topic.

3.3 DATA AND MEASUREMENT ISSUES

A number of themes emerge from the European literature regarding quantitative analysis of transport issues and decoupling:

1. It is generally accepted that there is a strong correlation between transport activity and economic activity. However, this does not mean that economic growth causes transport growth, or that transport growth causes economic growth. Quantitative techniques struggle to isolate causation effects between the two variables.
2. In a similar vein, further analysis needs to be conducted (particularly on road traffic) to determine how much of current transport activity is due to derived demand in production processes and how much is due to the preferences of individuals to use cars for work and leisure. Some studies suggest that transport activity is almost entirely determined by the amount of goods and services that are demanded in an economy (derived demand), while others focus much more on the use of transport by households.
3. Current cost benefit analysis techniques do not adequately incorporate environmental and social costs and benefits. It is suggested that CBAs need to place less weight on time savings from transport infrastructure investment, and more weight on noise and air pollution. ,
4. More research needs to be done to model the forward and backward linkages of transport and the economy. That is, we need to determine how the impacts of a change in transport policy on one sector flow on to affect other sectors in the economy. General equilibrium modelling is suggested as the best way to do this.

Overall, the literature on quantitative aspects of the relationships between economic growth and transport provided a lot more questions than answers when it came to assessing possible decoupling policies. Despite the lack of quantitative assessment, a huge number of policy options were identified in the literature.

3.4 POLICY SUGGESTIONS

To summarise the multitude of policies suggested in the European literature that could achieve decoupling, it is useful to split them into four broad categories:

- (i) Demand side policies for freight transport.
- (ii) Demand side policies for passenger transport.
- (iii) Supply side policies for freight transport.
- (iv) Supply side policies for passenger transport.

The demand side policies focus on limiting overall transport demand. The supply side measures concentrate more on technological advances that help decrease the undesirable impacts of increased transport growth, and encouraging modal switches. Naturally, many of these policies will be intertwined, and are unlikely to operate in isolation.

Many of the policies suggested focus on reducing road transport, and private car use, in particular. This is not surprising, as it is the motor car that is responsible for a large proportion of the negative externalities associated with transport. However, it is important to remember that decoupling generally refers not to breaking the link between car use and economic growth, but to breaking the link between transport as a whole and economic growth. This again highlights the importance of defining at an early stage exactly what you wish to decouple.

It is not our intention at this stage to suggest which policies would be most appropriate for New Zealand. There is a complex set of economic, political, societal, cultural and environmental issues that need to be considered before policymakers can determine the policy mix to be implemented. Rather we simply provide a summary of the broad decoupling policy options that have been or are being considered overseas.

3.4.1 Demand side policies for freight transport

Demand side policies suggested in the literature include:

- Policies to achieve a **dematerialisation of the economy**. These are aimed at reducing the amount of materials used in the production process, thereby reducing the need for freight transport. Suggested dematerialisation policies (Schleicher-Tappeser, Hey and Stein, 1998) include:
 - Increasing the information available (via labelling for example) to consumers regarding the amount of materials used in the production of different types of goods. If consumers' preferences are for goods with a lower transport content, buyers' preferences will send signals to producers to encourage them to dematerialise.
 - (ii) Encouraging producers to reduce the amount of waste they produce by making them pay for the cost of waste treatment.
- **Increasing the cost of road freight transport** (and hopefully reducing demand, depending on the elasticity of demand). Direct emissions taxes could be introduced for freight vehicles. This may encourage modal shifts that are less damaging in an environmental sense (Koopman, 1995; Litman, 1999).
- Encouraging freight transport users to **reschedule their trips** in order to avoid congestion at certain places at certain times of day. Road pricing could be introduced. This would mean that freight transport users would be charged depending on the marginal time costs imposed on other drivers (Koopman, 1995).
- A straight price increase, via **higher fuel taxes**. This could bring about a shift in freight transport modes towards more energy-efficient modes (primarily water and rail). In addition, such an increase would create disincentives for firms to use empty and partly loaded trucks, and may encourage the use of more energy-efficient vehicles (Bleijenberg, 1995).

3.4.2 Demand side policies for passenger transport

Policies suggested to limit the demand for transport from households include:

- In order to make other modes of passenger transport more attractive relative to road transport, it has been suggested that there should be a **thorough**

examination of the rights and obligations of transport users (CEC, 2001). This would involve determining air passengers' rights when they are inconvenienced due to overbooking, delays and flight cancellations, and examining the rights of passengers on the road and rail public transport systems. The aim would be to see where passengers' rights could be improved, thereby making non-private car transport options more attractive.

- Supporting the **redensification of urban areas** via urban planning (Banister, 2000). Redensification policies are aimed at reducing the need for short car trips, which account for a large proportion of total passenger kilometres. In redensified cities, workplaces, shops and recreation facilities would all be within walking or cycling distance.
- Directly **limiting the number of private car users** on the road system by introducing legislation to discourage those who aren't driving from starting (for example raising the legal driving age or making the driving test more difficult). Another option would be to encourage those who are currently driving to stop using private cars (Dupuy, 1999).
- **Telecommuting and videoconferencing** are thought to have some potential for decreasing passenger transport, by decreasing the amount of transport used to get to the workplace and decreasing business travel respectively (ECMT, 2000). Although no policy options to encourage these work practices were specified, the use of policy to provide appropriate incentives is a possibility.
- To reduce the amount of passenger travel from leisure purposes, some overseas local governments have tried to **discourage stand-alone retail developments** (USDT, 2001).
- Improving the quality of the networks for the non-motorised alternatives to car transport, and in particular **upgrading bicycling and pedestrian infrastructure**, has been used overseas to encourage commuters to cycle or walk to work.

3.4.3 Supply side policies for freight transport

Supply side policies generally focus on encouraging modal shifts and developing superior technology to reduce some forms of negative externalities arising from transport. In regards to freight transport, these policies include:

- **Revitalising the railways.** By doing so, the use of rail transport could become more attractive for freight purposes (CEC, 2001). Measures to safeguard the quality of rail services and users' rights (including making providers pay compensation for delays or failures to meet their service obligations) have also been suggested.
- Creating a '**motorway of the seas**' - that is, promoting shipping – as another option for freight transport (CEC, 2001).
- Developing **freight integration techniques** designed to link the non-road modes of freight transport. Again the aim is to incentivise the use of alternatives to road freight (CEC, 2001).
- Increasing the incentives for research and development into **cleaner vehicle technologies**. The exact form of these incentives was not specified, but is likely to involve tax breaks, and public-private research collaborations for example.

- Encouraging the **establishment of local production ‘clusters’** is also suggested, in order to go some way into reversing the trend of deterritorialisation that has occurred due to globalisation and trade liberalisation (Schleicher-Tappeser, Hey and Stein, 1998; Banister and Berechman, 2001).

3.4.4 Supply side policies for passenger transport

These policies often focus on encouraging consumers away from using private motorised transport towards public transport. The suggested policy options include:

- Incentivising **research and development into hydrogen-powered cars** which are primarily for urban use (USDT, 2001; Banister, 2000).
- Using **public information campaigns** to inform the public of the negative consequences of their choice to drive private cars, and to highlight the attractiveness of the alternatives (USDT, 2001).
- **Improving the comfort, convenience and accessibility of public transport stations and bus stops** to encourage the use of public transport rather than private cars.
- Gaining a **better understanding of consumers’ transport preferences** via customer surveys. The results could provide policymakers with some guidelines regarding what factors sway consumers towards/away from private car use (Litman, 1999).

This section has summarised some potential policy options considered overseas for achieving decoupling, however it may be defined. It is possible that some of these policies could be implemented in New Zealand in the future if decoupling remains a policy objective. At this stage, no analysis has been completed to determine what might be the effects of various policies on transport activity and economic growth in New Zealand. While this is likely to form a major part of future research plans, we suggest that a lot more work needs to be done before the relative costs and benefits of alternative policies are assessed.

With this in mind, it is useful to first provide an analytical basis for government intervention on decoupling issues. That is, using readily available data, can we provide any indications of changes over time in the relationship between transport and economic activity in New Zealand?

4. AN INITIAL LOOK AT DECOUPLING MEASURES IN NEW ZEALAND

Our economy is unavoidably linked with our ability to transport people, livestock, agricultural, pastoral and manufactured products both within the country and overseas (Statistics New Zealand, 2000, p. 3).

The decoupling goal in the NZTS appears to be contrary to the implication of the comment from Statistics New Zealand above. It seems that there is little consensus on the relationship between economic growth and transport in New Zealand. In this section we look at recent trends in transport and economic activity in New Zealand. We compare movements in each using various measures of both transport and economic activity. We also take a brief look at how transport is linked to economic

activity in New Zealand. Whilst these don't provide us with a clear and definitive answer to the question of whether or not there has been any decoupling in New Zealand in recent years, they do at least highlight some data measurement issues.

Looking at the reasons behind strong transport growth noted in section 3.2, we can see that New Zealand is not particularly different to the rest of the world:

1. Successive New Zealand governments have been strong supporters of the trade liberalisation/globalisation process. Due to New Zealand's limited domestic market, New Zealand exporters need to look overseas to find increased market openings. Encouraging the removal of trade barriers on a unilateral, bilateral and multilateral basis has created more opportunities for New Zealand firms operating in world markets.
2. New Zealand has had a growing population, and increasing income per capita.
3. The transport system in New Zealand has been deregulated considerably since the early 1980s (see Bollard, Lattimore and Silverstone, 1996, p. 25 for a chronology of the reforms in the transport sector). This has led, on average, to a drop in the real cost of transport over time.
4. There has been an increasing participation of females in the New Zealand labour force.
5. Regional development policies have become more prominent in recent years as government bodies such as the Ministry of Economic Development and Industry New Zealand have sought to encourage economic growth and innovation at the regional level.

This suggests that at an aggregate level, New Zealand is similar to most developed countries when it comes to determining why transport activity has been growing strongly. In addition, the New Zealand economy remains heavily reliant on bulky commodity exports, which require a large amount of transportation.

In the following analysis, we generally compare growth rates in transport and economic activity by looking at how the ratio of transport to economic activity has changed over time. If the ratio decreases, this indicates that transport has grown at a slower rate than economic activity, indicating some degree of decoupling under the definition in Section 2.

There are many reasons why the ratios may have changed including relative price changes, demographics, income changes, economic structural changes, modal switches, productivity and efficiency gains, changes in capacity utilisation, and deregulation. We do not attempt to explain the changes in the ratios here, leaving this analysis for further work.^{5,6}

⁵ The issue of how demographics and/or structural change might affect the relationship between transport growth and economic growth in particular warrants further attention. Like many developed countries, New Zealand is projected to see its population age significantly over the next few decades. The labour force is projected to shrink from around 2023, which is likely to see growth in the number of work related trips ease. This alone may to a degree of decoupling in the future. In addition, the focus of the production in New Zealand has moved, and is likely to continue moving, away from the primary sectors towards more service-based sectors. Again, this will see the composition of transport activity change. Hence it may be that even with no government intervention, the link between economic growth and transport growth may weaken.

The preliminary examination of the readily available New Zealand data suggests some decoupling has occurred at the modal level. However, more work needs to be done to construct an overall transport index to evaluate whether decoupling has occurred in general.

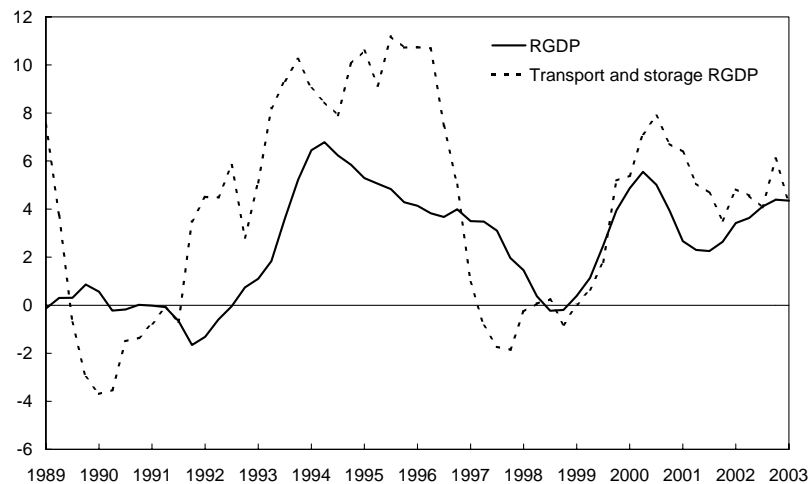
4.1 GROSS DOMESTIC PRODUCT

4.1.1 What does the data show?

We begin by looking at the trends in transport and economic figures published by Statistics New Zealand. The first of these includes the official measure of New Zealand's gross domestic product (GDP). We first need to consider whether to look at nominal or real GDP (RGDP). There have been large movements in the price of transport services relative to movements in other prices in the economy. General prices have been rising faster than transport prices, causing a decline in the relative price of transport. A problem with looking at nominal GDP is that it includes these price changes. We really need a measure of the 'real' or 'volume' change. The word 'real' in this context means after adjustment for inflation. Statistics New Zealand publishes RGDP by industry on a quarterly basis. Figure 1 shows the relationship between annual average growth in RGDP for the economy as a whole and annual average growth in the transport and storage industry (TRGDP) over the last 15 years.

Figure 1 Real economic and transport growth

Annual average percent change



Source: Statistics New Zealand

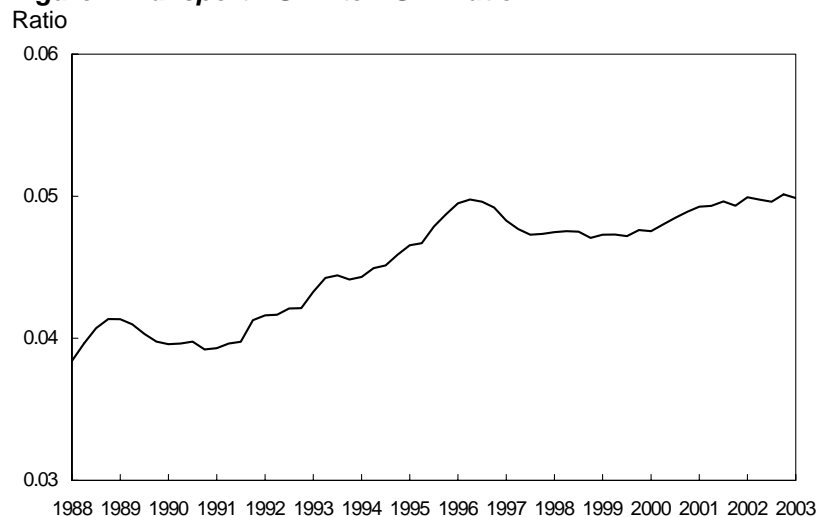
⁶ A referee of a draft version of this paper noted that the Government's Vehicle Fleet Emission Control Strategy asserts that fuel consumption and emissions levels will ease within New Zealand and internationally due to technological breakthroughs and a general upgrade of the vehicle fleet. This will therefore reduce the negative pollution externalities related to increasing motorised transport activity. The referee suggests that much of the environmental argument for decoupling will thus disappear. We largely agree with this statement, although the negative externalities related to transport go beyond pollution alone. Congestion times, for example, are unlikely to be affected by these changes. The referee's comments highlight the importance of stating early in any policy discussions the exact reason for wanting to achieve decoupling. They also provide support for our belief that research needs to be conducted into what might happen to decoupling measures in the future in the absence of any policy interventions.

This chart shows that growth in the transport and storage industry tends to rise and fall with overall economic growth. These series are positively correlated with a correlation coefficient of 0.67. This signifies that the two series are linked in a linear fashion but does not necessarily imply any cause-and-effect relationship.

The rates of growth of RGDP and TRGDP differ over this period. The average annual growth rate for RGDP from the June 1988 quarter to the March 2003 quarter was 2.5%, whereas TRGDP grew much faster, averaging 4.4% per annum. Based on these figures, New Zealand does not appear to have experienced decoupling over the last 15 years. In fact, on this evidence the degree of coupling between transport and economic growth in New Zealand has increased.

Another way of expressing this is by looking at the ratio of TRGDP to overall RGDP. Figure 2 shows that this ratio (also known as the transport intensity of GDP) has increased over the last 15 years.

Figure 2 Transport RGDP to RGDP ratio



Source: Statistics New Zealand, NZIER

4.1.2 Problems with the GDP data

An obvious problem with the data above is the relatively short time period. Unfortunately, this is the longest period for which consistent data that includes recent quarters is available. Data released earlier by Statistics New Zealand covered the period from 1977 to 2000. Similar trends were found in this data. Average annual growth in RGDP from the September 1978 quarter to the June 2000 quarter was 2.1%, while TRGDP grew by 3.7% over the same period.

Some limitations of using GDP in transport intensity calculations are discussed in Stead (2001). These centred on the possibility of GDP increasing as a result of negative externalities from transport. For example, the negative impacts of air pollution in cities do not show up in GDP figures, whereas the activity generated because the pollution leads to higher clean-up costs, the need for more health services, etc, will actually increase GDP.

There is also a problem with using transport GDP as the numerator in the ratio. GDP is a value-added concept. That means it is not strictly a measure of output, rather it is a measure of output less inputs. In the jargon, GDP is equal to gross output minus intermediate consumption. The fact that GDP is not strictly an output measure could have serious implications on the interpretation of movements in transport intensity ratios.

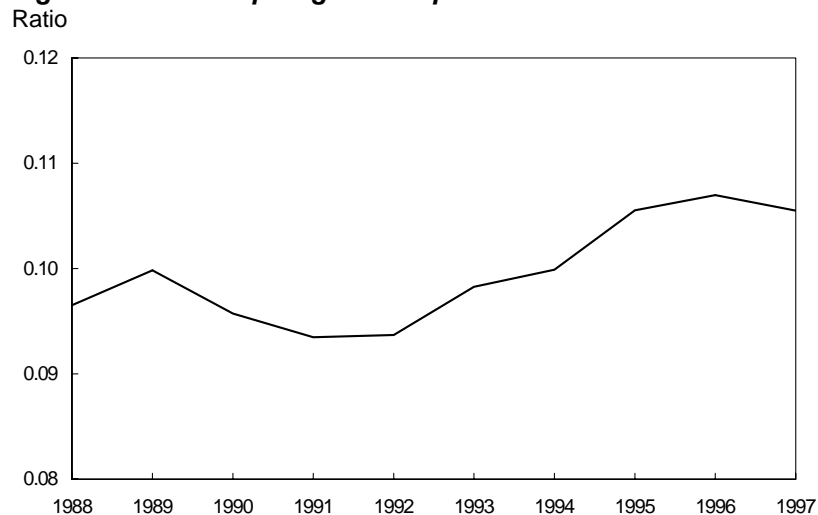
To illustrate, consider the case where the transport sector becomes more efficient. That is, it uses less inputs to produce the same output. In other words, transport GDP increases. If all other sectors remain constant, overall GDP would rise but by a smaller percentage than GDP in the transport sector. In this case, the ratio of transport GDP to overall GDP would rise, suggesting transport intensity rose despite the transport sector becoming more efficient. This apparent contradiction is a direct result of transport GDP not being a strict output measure of the transport sector.

4.2 USING GROSS OUTPUT OF THE TRANSPORT SECTOR

4.2.1 What does the data show?

A better ratio to consider is real gross output of the transport sector to real GDP. This avoids the possibility of a contradiction as described above. Figure 3 shows that this ratio has generally increased over the period 1988 to 1997. Unfortunately gross output data for later years is not yet available from Statistics New Zealand. However, over the period for which we have data, the real transport gross output to RGDP ratio suggests each dollar of GDP now embodies a greater transport component. That is, decoupling does not appear to have occurred.

Figure 3 Real transport gross output to RGDP ratio



Source: Statistics New Zealand, NZIER

4.2.2 Classification and household problems

As with other indicators of transport intensity, there are problems with the transport gross output to GDP ratio. We discuss three of these here. The first two relate to the way industries are classified in Statistics New Zealand's national accounts and the third relates to the treatment of households.

1. Companies are classified in the national accounts by their main purpose. So for example, a large wholesaler who has a delivery truck would be classified as a wholesaler. This means that the transport industry in the national accounts shows less activity than the true level of transport activity. This may not be a serious problem if the proportion of transport activity that was undertaken by the transport industry remains roughly constant. But this may not be the case.
2. The transport/total output ratio will move when the company performing a transport activity changes and this change causes the activity to be included or excluded from the transport industry. Consider the wholesaler example above. Suppose that the wholesaler decided to outsource the delivery part of the business to a transport company. Suppose also that the same number of trips is made by the transport company as was made when the wholesaler owned a truck. In this case, the transport industry in the national accounts would show an increase, while the overall amount of transport activity would be unchanged.
3. A bigger problem than the two listed above is that the industry data does not include private car transport and the like. The transport industry is just that, an industry that supplies transport services. Individuals using their cars do not pay a transport company in the process and therefore their transportation is not included in the national accounts. (The fuel individuals buy will be included in the national accounts but in another industry).

These problems and those noted in section 4.1.2 leave us needing better measures of transport activity to analyse how transport intensity has changed over recent years.

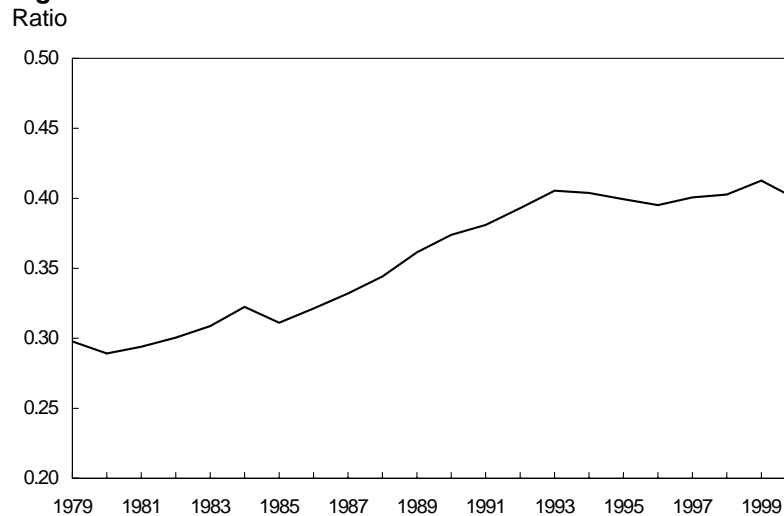
4.3 ROAD TRANSPORT INTENSITY

While decoupling focuses on weakening the link between economic growth and transport as a whole, it is fair to say that much of the focus of decoupling policies are likely to be directed at road transport. The aim will be to reduce the road transport intensity of GDP. A measure of road transport activity is the number of vehicle kilometres travelled (VKT). Total VKT to real GDP ratio is a better measure of road transport intensity than using industry data from the national accounts. This is because VKT includes all road travel irrespective of what industry classification the company doing the travelling is, or if the traveller is in a private car.

Figure 4 shows that the total VKT to RGDP ratio has increased from 1979 to 2000.⁷ This is the result of total VKT growing at an average annual rate of 3.6%, faster than the 2.2% average growth in RGDP over this period. Despite the rise over the entire period, there has been a clear break in the trend around 1993. The ratio has remained around 0.40 since then, as VKT growth continued at 3.6% and growth in RGDP lifted to around the same rate. This indicator suggests that the degree of coupling between transport and economic growth rose from the late 1970s to the early 1990s, and since then the degree of coupling has remained about the same.

⁷ 2000 is the latest year for which VKT by vehicle type is available.

Figure 4 Total VKT to RGDP ratio



Source: Statistics New Zealand, Ministry for the Environment, NZIER

VKT data is also available by vehicle type. By looking at the ratios of VKT by type against RGDP, we found that the cars VKT:RGDP ratio has shown a very similar pattern to that shown in Figure 4. This is not surprising, given that car VKT account for around 75% of total VKT. The ratio of light vehicle VKT and RGDP rose from 1979 to the early 1990s, and has held steady since then. The same pattern is demonstrated by the ratio of heavy vehicle VKT to RGDP. The only transport type to have displayed a clear decoupling with RGDP is motorbikes and mopeds. The ratio of motorbike and moped VKT to RGDP has fallen steadily since 1984. This is likely to be a result of the mass uptake of motorbike and moped use in response to the oil price shocks of the 1970s, which has gradually rescinded over the past 20 years.

4.4 RAIL TRANSPORT INTENSITY

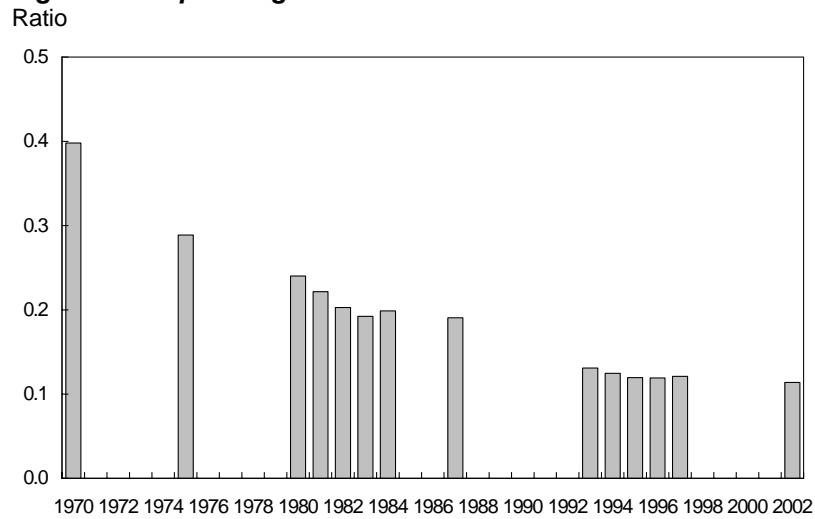
We have also looked at the rail transport sector to see if there are any signs of decoupling occurring in that mode.

4.4.1 Rail passenger intensity

One measure of rail passenger transport activity is the number of passengers carried (Rail PC). Rail PC to real GDP ratio is a better measure of rail passenger transport intensity than using industry data from the national accounts. However, using Rail PC alone does not give us any idea of the distances travelled by each passenger. Hence a better measure would be a ratio of passenger kilometres to RGDP.

We had difficulties obtaining a consistent time series of Rail PC. However, the limited data that we did find showed that the Rail PC to RGDP ratio decreased steadily between 1970 and 1993. This is a result of Rail PC almost halving while RGDP grew by an average annual rate of 2.2% over this period. This indicator suggests that there was considerable decoupling of rail passenger transport and economic growth over the 1970-1993 period. Since 1993 the ratio has held steady, indicating that the decoupling trend may have halted.

Figure 5 Rail passengers to RGDP ratio

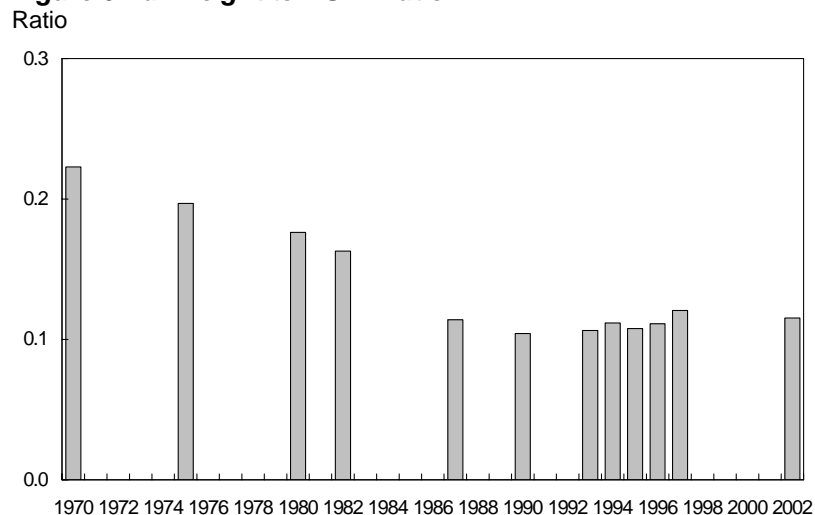


Source: Statistics New Zealand, NZIER

4.4.2 Rail freight intensity

A measure of rail freight transport intensity is the ratio of tonnes of rail freight to real GDP. Given that this tells us nothing about how far the freight travels, a better measure would be a ratio of tonne kilometres to RGDP. However, we did not have this data readily available, and had to instead use an infrequent series sourced from Statistics New Zealand's annual yearbooks.

Figure 6 Rail freight to RGDP ratio



Source: Statistics New Zealand, NZIER

Figure 6 shows that the rail freight to RGDP ratio has declined between 1970 to 1990. This is a result of rail freight decreasing by 42% while RGDP grew by an average annual rate of 2.2% over this period. This indicator suggests that there has been considerable decoupling of rail freight and economic growth over this period. However, the decoupling halted between 1990 and 2002, as rail freight returned to positive growth. This suggests that there has been a degree of modal shift away from

road freight towards rail freight since New Zealand Rail was corporatised and then privatised in 1993 and 1996 respectively.

4.5 TRANSPORT ENERGY INTENSITY

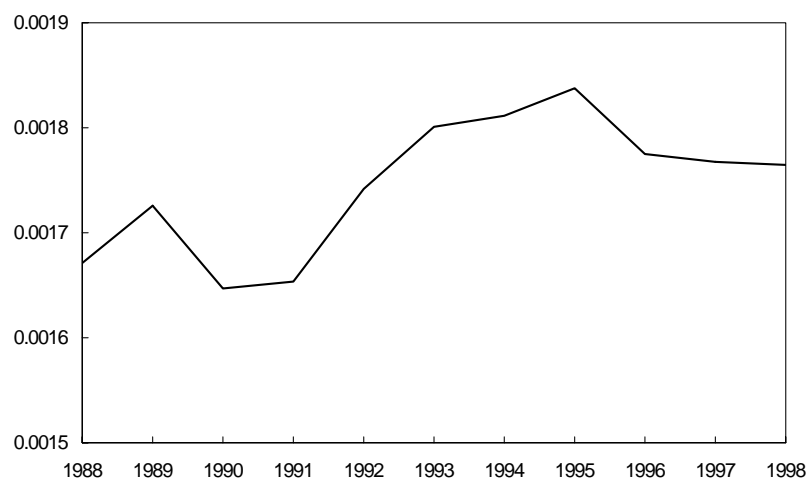
One aim of this paper is to look at whether a decoupling of transport and economic growth has occurred in New Zealand. That is, has economic growth been faster than transport growth? The initial look at the data above shows that the answer to this question depends on what indicator you look at.

As discussed in section 2.2, decoupling transport from economic growth may be desirable for a number of reasons, one of which is the desire to reduce energy use and hence emissions. We can look at the use of energy by transport to RGDP ratio to see if transport energy intensity has changed over time.

Figure 7 shows that the transport energy to RGDP ratio increased from 1988 to 1998. This is the result of transport energy use growing at an average annual rate of 2.7%, faster than the 2.2% average growth in RGDP over this period. However, this ratio has not increased uniformly. It declined in 1990 and in each of the three years to 1998. The decline in the last three years is a result of both a slowing in transport energy growth and growth in RGDP being above its average for the period. This indicator suggests that the degree of coupling between transport energy use and economic growth rose from the late 1980s to the mid 1990s, and since then a degree of decoupling has taken place – that is, the economy is now creating more GDP per unit of energy used in the transport sector.

Figure 7 Transport energy to RGDP ratio

Ratio



Source: Statistics New Zealand, Ministry for the Environment, NZIER

4.6 SUMMARY OF INITIAL DATA EXAMINATION

This preliminary examination of the readily available New Zealand data suggests that there is some evidence of decoupling having occurred in the New Zealand economy at a modal level. However, the data sources used were not ideal, and therefore it is difficult to draw any firm conclusions for this analysis. The key lessons learnt from this initial look at the data in New Zealand are:

1. More work needs to be done on a conceptual level to determine exactly what we mean when we talk about decoupling.
2. Existing New Zealand data sources do not provide sufficient information to derive an overall measure of whether decoupling has occurred over time.

Therefore it is clear that more research is required to construct an overall picture of the degree of decoupling that has taken place in the New Zealand economy (see section 5).

5. AN ALTERNATIVE DEFINITION OF DECOUPLING

A striking observation from the literature review was the lack of a clear and consistent definition of transport growth. Many indicators are used, such as passenger kilometres, freight kilometres, and vehicle kilometres travelled. Stead (2001) noted that until a universally accepted set of indicators is developed, monitoring progress on changing transport intensity (or decoupling) will be difficult. We agree with Stead's sentiment. While there is broad agreement on the concept of decoupling (i.e. the goal is to weaken the link between transport activity and economic activity), a consistent method of measuring decoupling has yet to be developed. In this section we suggest a measure of decoupling that could be used for future analysis, even if current data limitations mean that it cannot be used immediately.

It is clear from the NZTS that decoupling is not solely an economic objective. The assessment of any decoupling policies must take into account their potential impacts on the environment and on social factors such as mobility and equity.

Ideally, a measure of decoupling would require:

- A measure of welfare – consisting of economic, environmental and social aspects. Some form of socially and environmentally adjusted GDP would be preferable (i.e. a 'triple bottom line' GDP measure).
- A measure of mass movement (MMM) for the transport involved in moving people and goods in New Zealand. This MMM would be a volume measure that takes into account both the distance and weight of freight movements, and the distance and number of passenger movements. Note that ideally a mass movement indicator would cover all modes of travel, from walking to air travel.

By examining the trend in the ratio between the welfare and transport measures, we could get an impression of whether decoupling has occurred in the past, and also use it to monitor future changes.

$$\text{Decoupling ratio} = \frac{\text{MMM}}{\text{Triple bottom line GDP}}$$

Note that this ratio would capture both the efficiency and environmental aspects of decoupling (see 2.2). Increased productivity (i.e. higher GDP per unit of transport activity) would lift the economic component of the welfare measure in the denominator. Decreased negative externalities (lower pollution, congestion, etc) per

unit of transport activity would also lift the denominator. Both of these effects would decrease the ratio, indicating a higher degree of decoupling.⁸

Unfortunately there is no single available data source for either of the welfare or mass movement measures in New Zealand.⁹ Hence it may be necessary to develop some proxies for these measures. This forms part of our future research into decoupling issues.

6. CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The topic of decoupling transport growth and economic growth has received little attention in New Zealand. The purpose of this paper is to provide interested readers with an introduction to the issues surrounding decoupling, and to hopefully spark discussion and debate in the research community. Decoupling is virgin territory as far as Australasian research goes, yet given the attention that it the subject is now attracting in Europe, it is likely to gain more consideration in coming years. Certainly in New Zealand at least, there is growing interest in how the national transport infrastructure should be developed so as to best serve the needs of society.

The key conclusions from our research so far are as follows:

1. The broad concept of decoupling and the reasons why it is a policy objective are relatively easy to grasp. Both the efficiency and environmental arguments behind decoupling aim to increase the welfare of society.
2. Much of the international literature on the subject tends to ignore the difficulties of defining precisely what decoupling means.
3. The lack of accurate definition renders quantitative studies of decoupling progress difficult and inconclusive.
4. Exacerbating the definitional problem is a lack of consistent and long run time series on the key variables needed for decoupling measurement.
5. Without an adequate analytical base, the assessment of policy options to achieve decoupling is likely to be highly judgemental and incomplete.

These conclusions may look rather gloomy, but it must be remembered that research into decoupling is very much still in its infancy, particularly in Australasia. As the number of interested decoupling researchers increases over time, there is likely to be rapid progress towards getting a better grip on these issues.

⁸ The measure that we suggest is similar to the measure of transport intensity that was first addressed numerically by Peake and Hope (1994). By adding together both passenger and freight mobility into a single index expressed in terms of tonne miles, SACTRA (1999, Section 3.2.3) notes that one can obtain a measure of gross mass movement. Transport intensity is then the ratio of gross mass movement to GDP. The aim of policies in this context is to decrease the transport intensity of GDP – that is, to lower the transport content of output. However, we would argue that a socially and environmentally adjusted GDP would be a better numerator, at least theoretically.

⁹ A large amount of research has been carried out overseas into socially and environmentally adjusted measures of GDP (often called Indexes of Sustainable Economic Welfare). A convenient summary of the issues, plus some interesting international examples can be found at http://www.foe.co.uk/campaigns/sustainable_development/progress

We suggest that decoupling research in Australasia should focus on:

- Tying down exactly what the reason(s) is (are) behind listing decoupling as a policy goal.
- Stating clearly how progress towards this goal should be monitored – defining a suitable quantitative measure of decoupling trends.
- Developing the appropriate variables necessary to calculate this measure, and ensuring that they cover a period of time that is sufficient to allow researchers to conduct trend analysis.
- Considering what might happen to this measure of decoupling in the future under a scenario of no policy intervention, in order to determine whether or not the link between transport activity and economic growth is likely to decouple itself due to technological, demographic or structural change.
- Examining the policy measures suggested overseas and considering which of them are appropriate in an Australasian context, given our respective economic structures.
- Assessing what the impact of these policies might be on key economic, social and environmental indicators such as GDP, employment, sectoral performance, mobility, access, pollution, congestion, etc.

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