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The Intertemporal Substitution and Income Effects of GST Rate Increases: Evidence from New Zealand

David Cashin

University of Michigan

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[1] Cashin: Department of Economics, University of Michigan, 611 Tappan Street, Ann Arbor, MI 48109-1220, email: cashin@umich.edu, phone: (734) 764-2355, fax: (734) 764-2769. I would like to thank Matt Benge, David White, Iris Claus, Graeme Buckley, Bob Buckle, Steve Cantwell, Chris Jones, and seminar participants at New Zealand's Inland Revenue Department, Victoria University of Wellington, and The Australian National University for helpful comments and suggestions. I would also like to thank Geoff Leggett, Brandon Sloan, and Andrew McLaren for providing research support. Finally, special thanks to the International Tax Policy Forum for generously funding this study and Victoria University of Wellington's Center for Accounting, Governance, and Taxation Research for hosting me during my stay in New Zealand.

Abstract

Increases in consumption tax rates are an important political issue in New Zealand and around the world, as governments have become increasingly reliant upon them as a source of revenue. And while economic theory is generally favorable towards consumption taxation, increases in consumption tax rates have the potential to induce short-term macroeconomic volatility as a result of intertemporal substitution, as well as depress household consumption due to income effects. This study quantifies these effects using retail sales data from New Zealand and three separate increases in the country's Goods and Services Tax (GST) as event studies. I find that increases in the GST rate are associated with a statistically and economically significant amount of intertemporal substitution in the month just prior to and the quarter following implementation, though the response is likely to be greatly reduced when households are overleveraged or expect prices to decline in the future. The results also suggest that intertemporal substitution is driven largely by the durability or storability of a good, rather than a positive intertemporal elasticity of substitution. Over a longer period of time, I find that uncompensated increases in consumption tax rates depress retail sales in proportion to the increase in the overall price level, while compensated rate increases have no discernible impact on total retail sales.

Key words: Goods and Services Tax, Consumption Taxation, Intertemporal Substitution, Consumer Behavior

JEL classification: H24 H31 D12

1. Introduction

Increases in consumption tax rates are a major political issue in New Zealand and around much of the developed world. Governments have become increasingly reliant on indirect taxes as a source of revenue, often as part of an effort to sustain unfunded, or pay-as-you-go, pension systems, rather than resorting to the more politically sensitive decision to cut benefits or raise payroll taxes. And while economic theory is generally favorable towards consumption taxation (e.g. Auerbach et al., 1983), increases in consumption tax rates have the potential to induce short-term macroeconomic disruptions around the time of the tax change as a result of intertemporal substitution, as well as depress household consumption in the long-run as a result of income effects.

Specifically, an increase in the consumption tax rate should result in an increase in price levels. As these rate increases are inevitably announced prior to being implemented, households have an incentive to accelerate purchases to avoid higher prices in the future. As documented by Cashin and Unayama (2011), this incentive is especially strong for durable and storable non-durable goods and services, for which the timing of purchase and consumption do not necessarily coincide, but less so for non-storable non-durable goods and services, for which intertemporal substitution should be governed solely by the intertemporal elasticity of substitution (IES) in consumption. As a result of these incentives, one would expect to observe an increase in sales in the period between announcement of the rate increase and its implementation, and a decline thereafter. This is the intertemporal substitution effect. In addition, if a consumption tax rate increase is uncompensated – that is, if the rate increase is not offset by a reduction in income tax rates or an increase in benefits which allows the household to consume the same bundle it consumed prior to the tax change – it has the potential to reduce household consumption in the long-run.[2] If this occurs, one would expect to observe a decline in sales independent of the intertemporal substitution effects.

Cashin and Unayama (2011) examine these effects using Japan's April 1997 Value Added Tax (VAT) rate increase from three to five percent as a case study, finding that the rate increase was responsible for a significant amount of intertemporal substitution, largely among durable and storable non-durable goods and services, but did not lead to significant reductions in

[2] An uncompensated rate increase will not necessarily reduce household consumption. Households could, for example, increase their lifetime labor supply, or alternatively, draw down on a buffer stock of savings.

household spending over a longer time period as has been previously speculated, perhaps because the rate increase was part of a staggered reform package that was intended to be revenue-neutral (i.e. compensated).

In this paper, I use monthly and quarterly Retail Trade Survey data from New Zealand to quantify the intertemporal substitution and income effects of rate increases in the country's Goods and Services Tax (GST). While estimating these effects for a second country is interesting in and of itself, New Zealand's experience with GST is of additional value because there are three separate rate increases – the October 1986 implementation of GST at a flat rate of 10 percent, the July 1989 rate increase from 10 to 12.5 percent, and the October 2010 rate increase from 12.5 to 15 percent – to examine. Furthermore, the GST implementation and October 2010 rate increase were intended to be compensated, while the July 1989 rate increase was widely viewed as being uncompensated, and thus one might expect to observe heterogeneity in the income effects associated with the rate increases. In addition, the length of time between the passage of legislation and implementation varied for the rate increases, which could potentially affect the magnitude and timing of intertemporal substitution. Finally, the July 1989 and October 2010 rate increases were of similar magnitudes, but economic circumstances around the time the tax rates were changed differed markedly, which provides an opportunity to determine what factors other than the size of the rate increase drive the intertemporal substitution response.

Using seasonally-adjusted monthly Retail Trade Survey data, I find that households engaged in a significant amount of intertemporal substitution prior to both the October 1986 GST implementation and the July 1989 rate increase. Despite the fact that the period between announcement and implementation was much greater for the October 1986 GST implementation than it was for the July 1989 rate increase, nearly all intertemporal substitution for both events occurred in the month prior to the rate change, with sales in September 1986 21 percent higher than they would have been in the absence of a rate increase, and sales in June 1989 11 percent higher. Furthermore, the vast majority of intertemporal substitution was driven by increased outlays on durable goods and services, and industry-specific intertemporal substitution responses suggest that most of the non-durable intertemporal substitution was due to purchases of storable non-durable goods such as liquor. These findings indicate that intertemporal substitution is driven largely by the durability or storability of a good, as opposed to a positive IES. Related to

this point, the results suggest that the timing of announcement is of little consequence in minimizing revenue losses sustained by governments as a result of pre-announcement. Because nearly all intertemporal substitution occurs in the month prior to the rate increase, and some delay between announcement and implementation is inevitable, there is little benefit to minimizing the amount of time between the two events. Following both the GST implementation and the July 1989 rate increase, two rate hikes which differed in magnitude, the intertemporal substitution effects died out within three months, suggesting that households do not plan purchases more than a few months in advance.

Surprisingly, the October 2010 GST rate increase elicited a muted intertemporal substitution response compared to the July 1989 episode, despite the fact that the rate changes were similar in magnitude and the October 2010 rate increase was compensated. Several possible explanations for the heterogeneity in the two responses are addressed, with liquidity/borrowing constraints and increases over time in the frequency and depth of retailer discounting as two plausible culprits.[3]

Deflated and seasonally-adjusted quarterly Retail Trade Survey data is used to quantify the income effects associated with the GST rate increases. While the samples that generate these estimates are likely too small to make inferences, the results suggest that the July 1989 GST rate increase, which was uncompensated, reduced retail sales by over two percent in the quarters following its announcement. Given that full forward shifting of the rate increase implied a 2.3 percent increase in prices, the equal and opposite movements in sales and prices indicate first that the average household did not expect the rate increase to benefit it in the form of increased government transfers, and second, that households did not initially increase their labor supply or draw down on a buffer stock of savings to maintain consumption at its prior level. Quarterly retail sales increased slightly (0.34 percent) and fell slightly (0.60 percent) following announcement of the compensated 1986 GST implementation and 2010 rate increases, respectively.[4] Since (Slutsky) compensated rate increases should lead to an unambiguous increase in household consumption, the results suggest either that the rate increases were not truly compensated in the present value sense, or that the estimation strategy used covers an

[3] I also plan to examine whether households were not borrowing constrained, but rather inclined to pay down debt rather than take advantage of the intertemporal substitution incentives offered by the 2010 rate increase. This would be a rational response if households in debt expected interest rates to increase in the future.

[4] I also find that while total retail sales remain largely unchanged, durable retail sales declined, while non-durable retail sales increased, a result also observed in Cashin and Unayama (2011). I plan to investigate this issue further.

insufficient number of periods to capture consumption increases.[5] The decline in retail sales following announcement of the 2010 rate increase is consistent with the claims of some experts that the compensation provided to the lower and middle income classes was less generous than the government suggested it would be. Unfortunately, given that the data is aggregate retail sales data, I am unable to conduct a distributional analysis to elucidate further on this issue.

The remainder of the paper is organized as follows. Section 2 presents some basic theoretical predictions regarding the intertemporal substitution and income effects resulting from increases in GST rates. Section 3 provides background on GST in New Zealand and details on the October 1986 GST implementation, July 1989 rate increase, and the October 2010 rate increase. Section 4 provides an overview of the design and content of the Retail Trade Survey. Section 5 introduces the empirical methodology used to identify the intertemporal substitution and income effects. Section 6 presents the results. Section 7 discusses the implications of the results, and Section 8 concludes.

2. Theoretical Framework

2.1. Heterogeneity in Intertemporal Substitution Across Goods and Services

The magnitude of intertemporal substitution observed between announcement and implementation of a consumption tax rate increase should depend not only on how sensitive a household's consumption is to anticipated price changes (summarized by the IES), but also on the types of goods being purchased and consumed. In particular, the more durable is a good or service, the greater is the incentive to engage in intertemporal substitution, as household's can purchase a good in a relatively low price period and continue to derive a service flow from that same good during a relatively high price period. To demonstrate, suppose that a household solves the following two-period optimization problem:

$$\max_{I_0, I_1} \frac{I_0^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} + \frac{[(1-\delta)I_0 + I_1]^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \qquad s.t.\ 1)\ I_0 + S_0 = Y_0$$

$$2)\ (1+\tau)I_1 = Y_1 + S_0$$

where

[5] This could be true given that reductions in income tax rates should minimize the disincentive to save.

I_t: Investment in good *I* in period *t*

σ: IES

δ: Depreciation rate of good *I* between period 0 and period 1

S_0: Savings in period 0

Y_t: Income in period t

τ: Tax rate on good I in period 1

The household chooses how much to invest in good I in periods 0 and 1 in order to maximize its lifetime utility subject to a budget constraint. In period 0, the household knows that a consumption tax will be imposed in period 1 at a rate τ, and can adjust its behavior accordingly. What separates this problem from a standard optimization problem with iso-elastic utility is that good I may possess durability. That is, it may not fully depreciate between periods 0 and 1. In other words, it may be the case that $0 < \delta < 1$. Solving the household's problem for period 0 investment in good I yields

$$I_0 = \frac{Y_0 + Y_1}{1 + (1+\tau)\left(\left(\left(\frac{1}{1+\tau}\right) - (1-\delta)\right)^{\sigma} - (1-\delta)\right)} \qquad (1),$$

where

$$I_0 = \frac{Y_0 + Y_1}{1 + (1+\tau)^{1-\sigma}} \qquad (2)$$

if $\delta = 1$. From (2), one observes that the magnitude of intertemporal substitution for non-durable goods depends only on the IES. The larger is the IES, the greater is period 0 investment in good I when a consumption tax is applied in period 1. On the other hand, when $\delta < 1$, (1) makes clear that the magnitude of intertemporal substitution depends not only on the IES (positively), but also on good $I's$ depreciation rate (negatively). In fact, even if the IES is zero, intertemporal substitution of durable goods should be evident in period 0. Furthermore, if the

IES is positive, there is a positive interaction between the durability of the good and the IES. For a given IES, the more durable is the good (i.e. the lower its depreciation rate), the greater will be the magnitude of intertemporal substitution.

In addition to differences in the intertemporal substitution response between durables and non-durables, one would also expect to observe a greater amount of intertemporal substitution among storable non-durable goods and services than non-storable non-durable goods and services. Storable goods, such as laundry detergent, depreciate very slowly over time or not at all if not used, but unlike durable goods, are consumed fully with use. As a result, these goods can be stockpiled during relatively low price periods for consumption during high price periods. Again, a two-period optimization problem can be used to demonstrate that the magnitude of intertemporal substitution should increase the more storable is the good (i.e. the lower is the cost of storage):

$$\max_{I_0, X_0, I_1} \frac{[I_0 - X_0]^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} + \frac{[I_1 + X_0]^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \qquad s.t.\ 1)\ I_0 + aX_0 + \frac{b}{2}X_0^2 + S_0 = Y_0$$

$$2)\ (1+\tau)I_1 = Y_1 + S_0$$

where

I_t: Investment in good I in period t

X_0: Amount of good I purchased in period 0 for consumption in period 1

σ: IES

a: Linear storage cost parameter

b: Quadratic storage cost parameter

S_0: Savings in period 0

Y_t: Income in period t

τ: Tax rate on good I in period 1

The household again chooses how much to invest in good I in periods 0 and 1 to maximize lifetime utility subject to a budget constraint. In addition, the household can choose to store some of the good purchased in period 0 for consumption in period 1 at a cost, which is

assumed to be increasing and convex in the amount stored, X_0. For simplicity, it is assumed that the stored good does not depreciate from period 0 to period 1, though this would not fundamentally alter the results. Solving the household's problem for period 0 investment in good I yields

$$I_0 = \frac{Y_0 + Y_1}{1 + (1+\tau)^{1-\sigma}} + \frac{\tau - a}{b} + \frac{(\tau - a)^2}{2b[1 + (1+\tau)^{1-\sigma}]} \qquad (3)$$

where I_0 reduces to (2) if the good is not storable (i.e. $b \to \infty$). In the case of storable non-durable goods, intertemporal substitution depends not only on the IES, but also on the storage cost parameters, a and b. Specifically, the magnitude of intertemporal substitution is decreasing in these two parameters. As was the case with durable goods, even if the IES is zero, intertemporal substitution should be present in period 0. For a more thorough treatment of intertemporal substitution among storable non-durable goods, see Hendel and Nevo (2004, 2006).

2.1. Compensated and Uncompensated Consumption Tax Rate Increases and Their Implications for Household Consumption Levels

Consumption tax rate increases can be either compensated or uncompensated. A (Slutsky) compensated increase in the consumption tax rate compensates households such that they are just able to afford the consumption bundle that maximized utility prior to the tax change. Compensated consumption tax rate increases often take the form of reductions in income tax rates, increases in income tax exemption levels, increases in benefits to offset the price increases that accompany a consumption tax rate hike, new social spending, or a combination of these. Uncompensated increases in the consumption tax rate, on the other hand, are not offset by a reduction in income tax liability or increases in benefits, though even an uncompensated increase may in a sense compensate households, as discussed below.

Figure 1A depicts optimal consumption bundles prior to and following announcement of an uncompensated tax rate increase in the final period of a two-period model, where the revenue from the rate increase is not rebated to households in a lump sum fashion. Prior to announcement of the rate increase, the price of consumption in period 0 is the foregone interest

earned from deferring consumption, and thus the slope of the budget line is $-\frac{1}{1+r}$. Under this scenario, the optimal consumption bundle is (C_1, C_0). Following announcement of the rate increase, the slope of the budget line becomes steeper, as the relative price of period 0 consumption has declined. The new utility maximizing consumption bundle is given by (C_1', C_0'). Total consumption and welfare following announcement are lower than they otherwise would have been, as evidenced by the fact that the bundle (C_1', C_0') lies inside the original budget set.

By how much should one expect total consumption to fall following announcement? Since the period between announcement and implementation of the consumption tax rate increase is in general far shorter than the period following implementation, an upper bound for the percentage decline in total consumption would be the percentage increase in the price level resulting from the consumption tax rate increase. Such an increase would be consistent with an infinitesimally short period between announcement and implementation, an IES of zero, no labor supply response to the increase in the price level, and no drawdown on a buffer stock of savings.

In a traditional general equilibrium framework, however, the revenue from an uncompensated consumption tax rate increase will be rebated in a lump sum fashion to households. This scenario is depicted in Figure 1B. As was the case for the uncompensated consumption tax rate increase with no lump sum rebate, the budget line becomes steeper, with a slope of $-\frac{1+\tau_{c1}}{1+r}$. The lump sum rebate, however, pushes the budget line outwards. The new utility maximizing bundle, (C_1^R, C_0^R), will lie at the intersection of the original budget line and the income expansion path under the new prices $(1 + \tau_{C1}, 1)$. Under this scenario, total consumption may not fall at all, though welfare will due to the distortion caused by the change in price levels. This places a lower bound on the decline in total consumption resulting from an uncompensated tax rate increase.

Figure 2 depicts a third scenario, a (Slutsky) compensated consumption tax rate increase. In this example, an income tax regime is replaced by a consumption tax regime, with the assumption that the consumption tax rate in period 1 exceeds the real rate of return. Under this scenario, total consumption (and welfare) increases under the new tax regime, since the utility maximizing consumption bundle, (C_1', C_0'), was not attainable under the original budget set. As a result, provided that the rate increase is truly compensated in the Slutsky-sense, the total consumption response should be weakly positive.

3. GST in New Zealand[6]

3.1. The October 1986 GST Implementation

GST was imposed in New Zealand on October 1, 1986 at a flat rate of ten percent on most goods and services. It coincided with the repeal of the Wholesale Sales Tax (WST), which had been levied at the manufacturing stage on a select number of goods (mostly durables) at various rates ranging from 10 to 50 percent, with a standard rate of 20 percent.[7] Relative to the Value Added Taxes (VAT) that were in place in other countries at this time, New Zealand's GST was notable for its broad tax base, which covered 87 percent of consumption. Major exemptions were limited to financial services, existing housing sold by unregistered persons, residential rent, sales of secondhand goods by unregistered traders, sales of donated goods and services by nonprofit organizations, and fundraising activities.

The introduction of GST coincided with a period of major economic reforms undertaken by the ruling Labor Party, whose general goal was economic liberalization.[8] In regards to tax policy, the goal of reform was to increase revenue, reduce high average and marginal tax rates, broaden the tax base, and in so doing, remove or reduce the economic distortions that result from narrow tax bases with high rates. The broad conceptual design for GST was laid out in the November 1984 Budget speech, with a target date of April 1, 1986 set for implementation. However, in June 1985, it was announced that GST introduction would be delayed by at least six months. In August 1985, the government released the Statement on Taxation and Benefit Reform, which officially set October 1, 1986 as the date of implementation for GST, which would be levied at a rate of ten percent and replace the WST. In addition, the Statement laid out additional reforms of income tax, corporate tax, and benefits. For these reasons, I consider August 1985 to constitute "announcement", which will be important for the income effect

[6] The factual content in Section 2 is largely derived from Douglas (2007), Dickson (2007), Stephens (2007), Stephens (1993), Harding (2010), and the "New Zealand Economic Chronology" statements published annually in the *Reserve Bank Bulletin*. Much of the information regarding the October 2010 rate increase stems from conversations with New Zealand Treasury and Inland Revenue Department officials.

[7] See Appendix Table A.1 for a list of the various WST rates and the goods to which they applied. See Appendix Table A.2 for a list of goods that were exempt from the WST.

[8] In addition to changes in tax policy, other major economic reforms included a shift from import licenses to tariffs, the floating of the exchange rate, privatization of state-owned enterprises, deregulation of the financial, agricultural, transport, and retail sectors, and the elimination of export incentives to manufacturers and supplementary minimum prices for farmers.

estimation, as the Life Cycle Permanent Income Hypothesis (LCPIH) predicts that any income effect associated with a tax change should become evident immediately following announcement. In April 1986, in an effort to mitigate price disruptions upon introduction of GST, all WST rates that exceeded 20 percent were reduced to the standard rate. In July 1986, the government reconfirmed that the GST would be implemented in October as planned.[9] Finally, on October 1, 1986, GST took effect, an event I refer to as "implementation".

The introduction of GST coincided with a host of other tax and benefit reforms designed to increase economic efficiency and offset the additional burden imposed by the GST. In particular, the number of income tax brackets was reduced from five to three, with a reduction in the top marginal tax rate from 66 to 48 percent, while several personal tax expenditures were eliminated. Furthermore, the government set out to ensure that the most vulnerable groups were not made any worse off by GST introduction. Specifically, upon introduction of GST, the government increased all benefits, including superannuation (pension), by five percent, which was the government's estimate of the simultaneous price impact of repeal of the WST and introduction of GST. Family Support was also introduced for those households not on benefit, which included a payment of $36 per week for the first child, $16 per week for additional children, and a guaranteed minimum income of $294 per week for families with at least one child.[10]

The government intended for the tax reforms to leave the average household no worse off than it was prior to the tax changes, and Stephens (2007) claims that the reforms were perceived to be fair. However, the changes may have favored high income households over the less well off. For one, the price impact of GST introduction appears to have exceeded the government's estimates, an issue we return to below. Furthermore, as Stephens (2007) concedes, only higher income households enjoyed large reductions in personal income tax rates. However, given that I rely on aggregate data, I cannot explore the distributional consequences further. Thus, one would expect that GST implementation, coupled with income tax and benefit reforms, would likely not have a significant impact on average retail sales in the long-run.

[9] As a robustness check, I will also allow for July 1986 to constitute "announcement" of GST implementation.
[10] The government also reformed the corporate tax system, closing loopholes, aligning the corporate income tax rate with the top personal income tax rate at 48 percent, introducing a Fringe Benefits Tax, and switching from a classical tax system to an imputation system in order to remove the distortion caused by the double taxation of dividends.

In order for households to accelerate purchases prior to implementation of the GST, it must be the case that they were aware of the impending rate increase, and furthermore, that they expected the rate increase to lead to an increase in price levels. Stephens (2007), Douglas (2007), and Dickson (2007) all note that the public was bombarded with a public relations campaign in the lead up to GST imposition, so it seems safe to assume that public awareness was high. Price expectations are a more complex issue, especially given that goods subject to the standard rate of WST technically experienced a rate reduction. The standard assumption, and working assumption throughout this paper, is that households expected to bear the entire burden of the rate increase in the form of higher prices. Carroll et al. (forthcoming) find that full forward shifting of consumption tax rate increases is the norm across most countries, which the authors suspect is due largely to factor price, and namely wage, rigidities. This appears to have been the New Zealand government's belief as well, as the Statement on Taxation and Benefit Reform predicted that the simultaneous replacement of WST with GST would lead to a one-time increase in the average price level of 5-5.5 percent.[11]

Table 1 provides estimates of the impact of GST implementation on overall price levels and for specific goods in the quarter of implementation. To generate these estimates, the percentage change in the price level on the previous quarter was regressed on flexible time trend polynomials, quarter dummies (if seasonality was present), and a dummy specific to the quarter of implementation. The time trend polynomial allows for a moving average in quarter-to-quarter price changes, while the 1986 Q4 dummy should capture any deviation above and beyond the average change, which I attribute to GST implementation. Overall price levels increased by 6.53 percent as a result of GST implementation, which exceeds the government's prediction of 5-5.5 percent, but is in line with previous estimates (see Dickson, 2007). For goods such as food that were not previously subject to the WST, GST was fully shifted forward. On the other hand, goods that were previously subject to WST, such as floor coverings, experienced price increases, despite the fact that the WST rate that was being replaced exceeded the new GST rate. This is consistent with Dickson's (2007) claim that at the time of implementation, margins were widened as GST was generally applied to the pre-existing WST inclusive prices, and likely

[11] In addition to these explanations, New Zealand is a small open economy which imports most of its consumption goods (33 percent of GDP in 1986, as opposed to about 11 percent in the United States around the same time period). Provided there exists a world price for these goods, GST would need to be passed onto New Zealand consumers in order for importers to be willing to sell the goods in New Zealand.

accounts for the fact that the overall impact of GST implementation on price levels exceeded the government's prediction.

Identification of the income effect resulting from GST implementation and the tax reforms that coincided with it relies on the assumption that there was not a significant change in other factors that affect household expenditure during our estimation period. The October 1987 global stock market crash was responsible for a sharp decline in both the New Zealand share market and the New Zealand dollar. Furthermore, the crash was blamed for the prolonged economic malaise that followed. As a result, the income effect estimation does not include 1987 Q4 or any subsequent periods.[12]

3.2. The July 1989 GST Rate Increase

On July 1, 1989, the GST rate rose from 10 percent to 12.5 percent. The prospect of an increase in the GST rate was first broached in December 1987, but it was not until March 1989 that the rate increase was formally passed. I consider this event to constitute "announcement" of the rate increase. Thus, relative to GST implementation, households were aware of the rate increase for a shorter period than was the case in 1985-1986.

The 1989 rate increase was primarily intended as a revenue-raising measure. That is, it was widely perceived as being uncompensated. Unlike in 1986, benefits were not immediately adjusted to compensate households for the increase in the price level, nor was the additional revenue intended to fund new social programs. Instead, the additional revenue was intended to plug a $1 billion hole in government accounts. Because the rate increase was uncompensated, and perhaps also because of tight monetary controls that were in place at the time to rein in inflation, Bollard (1992) and Stephens (1993) claim that the rate increase delayed economic recovery from the October 1987 stock market crash, an event which was blamed for the protracted economic downturn in New Zealand.

Full forward shifting of the July 1989 rate increase would have implied a price increase of 2.3 percent on goods and services that were subject to GST. The best available data regarding price expectations is the Reserve Bank of New Zealand's (RBNZ) Survey of Expectations, a quarterly survey of New Zealand business managers, which asks the question "What quarterly

[12] I will likely add more information on macroeconomic trends over this time period, monetary policy, international terms of trade, as well as excise tax changes.

percentage change do you expect in the Consumer Price Index for the [next quarter]?"[13] The mean response in 1989 Q2 for 1989 Q3 was 2.3 percent, which is consistent with full pass through. However, taking first differences, and assuming that any deviation in inflation expectations between 1989 Q2 and 1989 Q3 is due to the GST rate increase, the survey respondents expected the GST rate increase to result in a price increase of only one percent. It is not possible to determine whether respondents factored inflation independent of that caused by the GST rate increase into their 1989 Q3 expectations, but it does seem safe to assume that the expectation was that consumers would bear a significant portion of the rate increase at the very least. As shown in Table 1, the estimated price impact of the 1989 GST rate increase was 2.31 percent, again implying that consumers bore the full burden of the rate increase.

3.3. The October 2010 GST Rate Increase

On October 1, 2010, the GST rate increased from 12.5 to 15 percent. The prospect of a rate increase was first discussed by the Victoria University Tax Working Group (TWG). The TWG was set up by Victoria University with the support of the government to consider a broad range of medium-term policy options for the New Zealand tax system. The group's final report, which was released in January 2010, called for an increase in the GST rate from 12.5 to 15 percent. Following the release of the report, Prime Minister John Key announced that the government was carefully considering an increase in the GST rate to 15 percent, and on May 21, 2010, the rate increase was formally passed. Like the two previous rate increases, I consider the passage of legislation to constitute "announcement".

As was the case for the 1986 GST implementation before it, the 2010 rate increase coincided with a host of other tax and benefit reforms intended to compensate families for the rate increase. In particular, all personal income tax rates were reduced, while benefits, superannuation, and Working for Families payments were increased by 2.02 percent.[14] Despite the government's intentions, however, some experts are skeptical as to whether lower and middle class households were sufficiently compensated for the rate increase. If this were true, total consumption may not have risen as a result of the tax mix switch.

[13] The survey is not available prior to 1987 Q3, and as a result we cannot gauge expectations around the time of GST implementation.

[14] Additional changes included alignment of the top personal and trust tax rate at 33 percent, a reduction in the company tax rate from 30 percent to 28 percent, and changes in depreciation allowances.

Full pass through of the October 2010 rate increase would imply a price increase of 2.22 percent on goods and services subject to GST. Given that GST covers nearly 90 percent of household consumption, the benefit increase of 2.02 percent upon implementation suggests that the government's expectation was that consumers would bear the full burden of the rate increase in the form of higher prices. Data from the 2010 Q3 Survey of Expectations shows that business managers expected the 2010 Q4 price levels to jump by only 1.6 percent on the previous quarter, less than would be the case under full forward shifting. Taking first-differences of quarterly price expectations implies that managers expected the GST hike to lead to a one percent increase in the price level, which is similar to the 1989 case. Table 1 shows that the actual price impact of the 2010 rate increase was just under two percent. Again, this finding is consistent with full forward shifting.

4. Data[15]

The data used for this analysis is Statistics New Zealand's Retail Trade Survey (RTS), which collects monthly sales data from businesses undertaking retail activities or specified service activities. The retail sector is defined as those businesses primarily selling goods and services to final consumers. In addition to expenditures by households, final consumption includes expenditures by non-private households living in hotels, boarding houses, etc.; businesses, clubs, trusts, and other purchasers outside the household sector; and overseas residents visiting New Zealand. Specifically, the RTS collects sales data from businesses that fall under the Australia New Zealand Standard Indusrial Classification divisions of Retail Trade, Accommodation, and Personal Services, which can be found in Appendix Table A.3.[16] Of the roughly 50,000 retail outlets in New Zealand, the RTS uses a postal questionnaire to collect sales figures from approximately 3,500 enterprises operating between 9,000 and 10,000 geographic

[15] Section 3 content is derived from the following sources: "Information About the Retail Trade Survey", available at http://www2.stats.govt.nz/domino/external/omni/omni.nsf/outputs/retail+trade+survey; "Retail Trade Survey: Implementation of New Survey Design", located at http://www2.stats.govt.nz/domino/external/pasfull/pasfull.nsf/web/Hot+Off+The+Press+Retail+Trade+Survey+-+Survey+design+Information+Paper+Information+Paper?open; Statistics New Zealand (2010). *Implementing ANZSIC 2006 in the Retail Trade Survey.* Wellington: Statistics New Zealand; and Graham, Philippa (2001). "Seasonal Adjustment within Statistics New Zealand". Wellington: Statistics New Zealand.

[16] The RTS does not include expenditures on property and dwelling rents, purchase of houses, property maintenance services, electricity and gas, public transport (local and overseas), medical services, leisure and recreational services, insurance services, and enterprises that do not meet the significance criteria in terms of GST turnover (i.e. enterprises with turnover not exceeding $30,000 NZD).

units (retail outlets), while GST returns are used to obtain sales figures for 37,000 smaller enterprises in order to minimize their compliance costs. Selection into the sample is based on an enterprise's industry, which is chosen based on their predominant activity, and size, with the probability of selection increasing in size, and large retailers facing a 100 percent chance of selection. To ensure the sample accurately depicts the current population distribution, selected businesses within an industry are weighted according to their size. Furthermore, businesses can be reweighted from month to month as their size changes, or if they are reclassified as belonging to another industry. In addition, new businesses enter the sample over time, while businesses that cease operation are removed. Nevertheless, 99 percent of the sample remains the same from one month to the next, and the sample reselection methodology does not significantly impact sales movements.

Monthly current price sales figures are then compiled for each industry. While the current price data does not remove the effects of price movements over time, it does exclude GST. Sales for each industry are then seasonally-adjusted using the U.S. Census Bureau's X-12-ARIMA program (X-11-ARIMA prior to August 1998). Quarterly constant price data is also available. Prior to September 1995, it was generated by summing the seasonally-adjusted monthly data, and then using quarterly retail trade deflators to put the data into constant prices. Since then, a reverse approach has been used, whereby the quarterly current price data is first deflated, and then seasonally-adjusted, which Stats NZ claims removes residual seasonality introduced by the deflators. The monthly current price sales figures are used to estimate the intertemporal substitution effects resulting from the GST rate increases, while the quarterly constant price figures are used to estimate the income effects. Monthly data is used to estimate the intertemporal substitution effects because these effects are likely heavily concentrated in the months just before and after a rate increase, and thus quarterly data will have difficulty capturing these effects. The downside to using the monthly data to identify the intertemporal substitution effects is that it is in current prices, but the empirical methodology described below should mitigate the effects of price changes from month to month.

Two separate RTS series are used for the analysis. Intertemporal substitution and income effect estimates for the October 1986 GST implementation and the July 1989 rate increase are derived from the RET series, which was available from April 1976 to March 1990, while estimates for the October 2010 rate increase are derived from the most recent RTT series,

available from May 1995 through December 2010. The series differ slightly in their classification of industries, as recent samples are designed to reflect the changing composition of New Zealand's retail sector. In the RTT series, an enterprise is placed into its respective industry based on the ANZSIC06 classification scheme laid out in Appendix Table A.3. Appendix Table A.4 provides the classification scheme for the earlier RET series, and it should be noted that the category "Automotive, Fuel, and Repairs", which includes both durable and non-durable goods, was separated into three industries beginning in May 1982: motor vehicles and other transport equipment, petrol stations, and repair of motor vehicles and motor cycles.

As mentioned above, the magnitude of the intertemporal substitution response should be larger for both durable and storable non-durable goods and services. Unfortunately, given the RTS industry classifications, in most cases it is not possible to separate storable non-durables from non-storable non-durables, since, for example, storables such as laundry detergent and non-storables such as fresh fruit are both sold at a supermarket. As a result, each industry is placed into either the "Durable" or "Non-durable" category. Appendix Table A.5 provides a list of the industries that comprise the "Durable" and "Non-durable" categories for both the RET and RTT series.

Table 2 provides summary statistics for the four datasets used in the analysis, while Figures 3A and 3B plot monthly current price and quarterly constant price seasonally-adjusted retail sales for the RET series. Figures 4A and 4B do the same for the RTT series. For the RET series, note that there are fewer observations for the durable and non-durable categories than there are for the total category. This is due to the fact that the category "Automotive, Fuel, and Repairs" was not separated until May 1982. In regards to the RTT series, the quarterly constant price data is only available from 2003 Q3, when a survey redesign took place. Also note the large spike in retail sales prior to both the October 1986 GST implementation and July 1989 rate increase, which suggest significant amounts of intertemporal substitution prior to those events. Conversely, there appears to be little change in retail sales prior to the October 2010 rate increase.

5. Empirical Methodology

5.1. Baseline Model

The empirical strategy employed for this study largely mirrors that used in Cashin and Unayama (2011). Based on the standard LCPIH with a taste shifter, retail sales can be written in a simple form. The logarithm of retail sales in year y and period t are expressed as follows:

$$E_{y,\mathrm{t}} = \delta_t + T_{y,\mathrm{t}} + B_{y,\mathrm{t}}$$

where δ_t is a seasonal effect, $T_{y,t}$ is a tax effect, and $B_{y,t}$ is an effect for all other factors that determine expenditure independent of the tax change and season (e.g. price movements).[17] Consistent with the LCPIH, tax effects are allowed for only after "announcement" has occurred, where "announcement" is defined to be the period in which legislation was formally passed.

The tax effect can be further decomposed into the period-specific intertemporal substitution effect, $\gamma_{y,t}$, and the income effect, α, which is assumed to be constant over time. That is,

$$T_{y,\mathrm{t}} = \alpha + \gamma_{\mathrm{y,t}} \quad \text{following announcement}$$

5.2. Identifying the intertemporal substitution effect

This section considers identification of the intertemporal substitution effects. The main idea of the identification strategy is the following: by taking first differences of monthly retail sales data, we can cancel out the income effect in all months save the month in which the income effect first appears, since the income effect is assumed to be constant once it has appeared. Formally, taking the first difference of monthly retail sales yields

$$E_{y,\mathrm{m}} - E_{y,\mathrm{m-1}} = \delta_m - \delta_{m-1} + T_{y,\mathrm{m}} - T_{y,\mathrm{m-1}} + B_{y,\mathrm{m}} - B_{y,\mathrm{m-1}}$$

Since the RTS data used for this analysis is seasonally-adjusted, we can rearrange the above expression as

[17] For estimation of the intertemporal substitution effects, the period t is one month, while for estimation of the income effects, period t is one quarter.

$$\tilde{E}_{y,m} - \tilde{E}_{y,m-1} = (E_{y,\mathrm{m}} - E_{y,\mathrm{m}-1}) - (\delta_m - \delta_{m-1}) = T_{y,\mathrm{m}} - T_{y,\mathrm{m}-1} + B_{y,\mathrm{m}} - B_{y,\mathrm{m}-1}$$

Suppose $B_{y,m}$ follows either of the two conditions listed below:

1) There is no change in $B_{y,m}$ from one period to the next.
2) $B_{y,m}$ follows a linear trend.

Under condition (1), the term $B_{y,m} - B_{y,m-1}$ cancels out, while under condition (2), the term $B_{y,m} - B_{y,m-1}$ yields a constant, c. More generally, if there is little change in $B_{y,m}$ other than the linear trend, the first differences can be approximated as

$$\tilde{E}_{y,m} - \tilde{E}_{y,m-1} \approx c + \gamma_{y,m} - \gamma_{y,m-1} + \alpha I,$$

where *I* is an indicator function that takes on a value of 1 in the month when the income effect appears and zero in others. Accordingly, the empirical specification is as follows:

$$\Delta\tilde{E}_{y,m} = c + \Delta\tilde{T}_{\mathrm{y},m} + \Delta u_{y,m}$$

where $\tilde{T}_{y,m}$ is a coefficient associated with an indicator function that takes on a value of 1 in month m of year y, and $u_{y,m}$ represents unobservables affecting expenditure in month m of year y.

Figure 5 graphically depicts identification of the monthly tax effects using the above first differenced specification. The top figure presents seasonally-adjusted retail sales, where the rate increase causes a deviation in spending from the trend level, E^*, in periods $y, m-1$ and y, m, with the tax effects in the two periods given by $T_{y,m-1}$ and $T_{y.m}$, respectively. Once we take first differences (depicted in the bottom figure), in order to identify the coefficient $T_{y,m}$, we must also difference out the coefficient for the previous month, $T_{y,m-1}$.

To keep the empirical specification as parsimonious as possible, a decision must be made on which months to allow for intertemporal substitution effects. To do so, the following approach was used. The logarithm of seasonally-adjusted monthly retail sales for each of the

three categories was regressed on a flexible time trend polynomial, which should remove long-term economic trends. The residuals from these regressions were then plotted over time. The months which allow for tax effects are the months between announcement and implementation for which there is a clear upward trend in retail sales (including at least the final month prior to implementation), and the months including and following implementation for which sales remain below the long-term trend (including at least the month of implementation and the two subsequent months). Appendix Table A.6 lists the months used to estimate the intertemporal substitution effects for each rate increase and sales category. Not surprisingly, the number of months required to capture the intertemporal substitution effects for durables exceeds that of non-durables.

One might worry that this approach misses intertemporal substitution that occurs in months following announcement but prior to the final few months before implementation, perhaps because it is hidden by removal of the trend. This possibility cannot be ruled out, but plots of the lower frequency quarterly retail sales data suggest there was little to no intertemporal substitution during the periods immediately following announcement.

With the specification above, the period-specific intertemporal substitution effects before and after the tax changes can be identified. If the income effect appeared in a month *m* immediately following announcement, but prior to the months for which coefficients for the tax effect are included, the coefficients $\tilde{T}_{y,m}$ will capture the period-specific intertemporal substitution effects. If the income effect instead appeared in the same month in which a coefficient for the tax effect is first included, that coefficient would capture both the period-specific intertemporal substitution effect as well as the income effect, while the coefficients for subsequent months would capture only the intertemporal substitution effect. Given this possibility, it seems reasonable to believe the coefficients for the months prior to the rate increase provide a lower bound on the intertemporal substitution effects associated with a GST rate increase. That is, the coefficients represent a lower bound on the percentage change in household spending in the months leading up to the GST rate increases that would not have been observed had a rate increase not been implemented.

5.3. Identifying the Income Effect

To identify the income effects associated with the GST rate increases, a log-level specification for deflated and seasonally-adjusted quarterly retail sales data is used. The basic identification strategy is the following: choose a time interval that begins in the quarter following announcement and extends for a period beyond implementation that is long enough for all intertemporal substitution to have occurred. Provided this is the case, the pre-tax change and post-tax change intertemporal substitution effects will cancel out. Additionally, so long as there are no other significant changes in factors affecting retail sales relative to the quarter of announcement (i.e.$B_{y,q}$), any deviation in sales during this time interval from sales in the quarter of announcement are attributed to the income effect.

The assumption that all intertemporal substitution occured during the time interval of interest can be tested using the results from the intertemporal substitution effect analysis. To minimize the potential change in $B_{y,q}$ relative to the "announcement" date, the estimation period must cease prior to other major events which had the potential to significantly impact retail sales. For example, 1987 Q3 is the final quarter used for estimation of the income effect resulting from GST implementation, since the stockmarket crash of 1987 Q4 likely depressed retail sales, and it is not possible to disentangle the impact of the crash from the impact of GST on sales.

The following empirical specification will allow for identification of the income effect associated with the GST rate increases and any coinciding tax reforms:

$$\tilde{E}_{y,q} = \tilde{E}_{\mathrm{a}} + \boldsymbol{B_o} + T_{pa} + \epsilon_{y,q},$$

where $\tilde{E}_{y,q}$ is the logarithm of deflated and seasonally-adjusted quarterly retail sales in quarter q of year y, $\tilde{E}_a$ is the logarithm of deflated and seasonally-adjusted quarterly retail sales in the quarter of announcement (the omitted quarter), $\boldsymbol{B_o}$ is a vector of coefficients associated with indicator functions that take on a value of 1 in years or quarters which were neither the quarter of announcement nor the quarters being used to estimate the income effect, T_{pa} is a coefficient for an indicator function that takes on a value of 1 in each quarter q following announcement and up to a specified number of quarters following implementation, and $\epsilon_{y,q}$ accounts for unobservables affecting expenditures in each quarter q of year y.

To clarify how the empirical specification above is able to identify the income effect associated with a rate increase, the baseline specification for GST implementation is given as an example. Year indicators are included for 1976 to 1984 and 1988 to 1990. Year-quarter specific dummies are included for 1985 Q1, 1985 Q2, and 1987 Q4. An indicator is also included for 1985 Q4-1987 Q3, the period of interest. Thus, the omitted time period is 1985 Q3, which coincided with "announcement" of GST implementation. This time period becomes the constant in the specification above, and the coefficient associated with the 1985 Q4-1987 Q3 indicator provides average percentage deviations in retail sales in those periods relative to 1985 Q3.

Provided the aforementioned assumptions hold, T_{pa}, the coefficient of interest, will yield the average change in quarterly spending resulting from a GST rate increase and any coinciding tax and benefit reforms.

5.4 Standard Error Corrections

Household decisions regarding period-specific outlays on durable and non-durable goods and services are not necessarily made independent of one another. As a result, one might expect contemporaneous correlation between the error terms for durable and non-durable retail sales in both the intertemporal substitution (first-difference) and income (level) effect estimates. Indeed, in several of the specifications, independence of the residuals from the durable and non-durable equations is rejected. In addition, classical measurement error in the retail sales data will yield negative serial correlation in the first-difference specification, and this holds true for the first-differenced aggregate retail sales figures used in this study. Finally, given that most firms in the Retail Trade Survey samples remain in the sample from one month to the next, one might worry about serial correlation in the error terms for the log-level specification due to firm-specific fixed effects. This appears to be less of an issue than is serial correlation in the first-differenced specification.

Where evidence of these problems exists, the following corrections are made:

1) If independence of the residuals from the durable and non-durable regressions is rejected, but there is no evidence of serial correlation, a seemingly unrelated regression is used.

2) If we cannot reject independence of the residuals from the durable and non-durable equations, but there is evidence of serial correlation, Cochrane-Orcutt AR(1) regression estimates are generated.
3) If independence of the residuals from the durable and non-durable equations is rejected, and there is evidence of first-order serial correlation, generalized least squares estimates that control for contemporaneous correlation and first-order autocorrelation specific to the durable and non-durable equations are used.
4) Otherwise, estimates are derived from ordinary least squares regressions.

5.5 Robustness Checks and a Note on the Income Effect Estimation

Recall that the specification to identify the intertemporal substitution effects allows for a linear trend in$B_{y,m}$. If this trend is not linear, the intertemporal substitution estimates could be biased upwards or downwards depending on whether the trend in $B_{y,m}$ in the period in which intertemporal substitution occurs is greater than or less than the linear trend estimate (as given by the constant in our baseline specification). As a result, an additional specification for identifying the intertemporal substitution effects includes year dummies, which allows for year-specific linear trends in$B_{y,m}$.

In regards to the income effect estimation, a major concern for our empirical model is what constitutes "announcement". As mentioned above, the LCPIH predicts that the income effect will appear when a rate increase is announced. However, in practice, it is difficult to determine the timing of announcement since there is heterogeneity of information and/or awareness. As discussed in Section 3, I consider final passage of the GST rate increases to constitute "announcement". However, other dates could be considered. For example, in July 1986, the government reconfirmed that the GST implementation set for October 1986 would go through as planned. As a robustness check, I will carry out the income effect estimation for other dates that could have potentially been considered "announcement" dates.

There is also a tradeoff inherent in the number of quarters following a GST rate increase that are used to estimate the income effect. On the one hand, including more quarters yields an income effect result that is closer to the true long run income effect. On the other hand, inclusion of more quarters makes it more likely that $B_{y,q}$ changes significantly relative to the quarter of

announcement, which will bias the income effect result. For this reason, where possible, income effect estimates are generated using a varying a number of quarters following a rate increase.

In addition to the difficulty of determining the "announcement" date, there is a growing literature that suggests the income effects associated with tax changes are absent until the tax change is implemented. Watanabe et al. (2001) examine the spending responses of Japanese households to more than 40 changes in national income tax, local income tax, consumption tax, and social security contributions that occurred between 1975 and 1998. The authors find that over 80 percent of Japanese households respond to tax changes at the time of implementation, as opposed to the time of announcement, and conclude that most Japanese households follow a "near-rational" decision rule, in which the costs of obtaining and processing information associated with a policy announcement outweigh the benefits from improved consumption smoothing.[18] Recent work by Mertens and Ravn (2010) using U.S. quarterly GDP data further supports this finding.[19] If this were true in the New Zealand case, the income effect estimates will be biased towards zero, and the bias will increase in the number of quarters between announcement and implementation.

6. Results

6.1 Descriptive Results

Figure 6A plots the residuals from a regression of the logarithm of seasonally-adjusted current price monthly retail sales on a flexible time trend polynomial for the months surrounding the October 1986 GST implementation. The time trend polynomial should capture long-term economic trends, so the residuals are interpreted as the percentage deviation in retail sales from the detrended average. The plots strongly suggest that the prospect of GST implementation induced households to engage in a significant amount of intertemporal substitution prior to implementation, as total retail sales in September 1986 were more than 20 percent above the detrended average, with durable retail sales over 30 percent above average in that same month. Non-durable retail sales also appear to have significantly exceeded trend, though the magnitude

[18] The authors define "announcement" as the date which the Liberal Democratic Party (LDP) Tax Committee submits a proposal report to the government. This is followed by Cabinet approval of the proposal, which is then followed by Diet approval. They consider submission of the report to be "announcement" because Cabinet and Diet approval are virtually guaranteed following the Tax Committee's submission.

[19] Previous work by Poterba (1988), Parker (1999), and Souleles (1999, 2002) also finds that U.S. household spending does not respond to anticipated tax changes until the tax change is implemented.

of intertemporal substitution is much smaller than for durables. The plots also suggest that nearly all of the pre-rate increase intertemporal substitution occurred in the month just prior to implementation, while the intertemporal substitution effects following implementation died out within three months of implementation.

Figure 6B plots the percentage deviation in deflated and seasonally-adjusted quarterly retail sales for the quarters 1985 Q4 – 1987 Q4 relative to 1985 Q3, the quarter of announcement. Other than the spike and trough in sales resulting from intertemporal substitution around the time of implementation, retail sales in quarters following announcement remain quite similar to sales in the quarter of announcement, suggesting that GST implementation had no impact on retail sales over a longer period of time. It is perhaps worthy to note, however, that while there was no change in overall retail sales, the composition of sales does appear to have changed, with retail sales of durable goods falling below their level at the time of announcement, while sales of non-durables exceed their announcement level, a phenomenon that was also observed in Cashin and Unayama (2011).

Figure 7A plots the percentage deviation in seasonally-adjusted current price monthly retail sales from the detrended average in the months surrounding the July 1989 GST rate increase. A pattern quite similar to what was observed around the time of GST implementation emerges, with a concentrated buildup in retail sales the month prior to implementation, followed by a sharp fall in sales in the month of implementation, and a return to trend over the course of the next three months. As discussed above, the 1989 rate increase was expected to lead to a price increase of roughly one-half the size of the 1986 GST implementation. What is noticeable in these plots is that the June 1989 intertemporal substitution response also appears to have been approximately one-half the size of the September 1986 response.

Figure 7B provides the percentage deviation in constant price quarterly retail sales from sales in 1989 Q1, the quarter of announcement. Unlike the 1986 GST implementation, these plots suggest that the July 1989 GST rate increase depressed retail sales over a longer time period. The trough in sales in the quarter of implementation exceeds the spike in the prior quarter, and sales remain below the 1989 Q1 level over the next two quarters. This is true for both durable and non-durable sales, though non-durable sales in March 1989 were uncharacteristically high (for a reason not yet determined), which could bias the result downwards.

Figure 8A plots the percentage deviation in current price monthly retail sales from the detrended average for the months leading up to and immediately following the October 2010 GST rate increase. What is striking about these plots is how muted the intertemporal substitution response appears to be in the month prior to implementation. Even durable retail sales, which were more than 30 percent above trend in the month prior to GST implementation, and more than 15 percent above trend in the month prior to the 1989 rate increase, jumped only slightly in September 2010. Furthermore, non-durable retail sales actually fell throughout the period between announcement and implementation, and then jumped in the month of implementation, the opposite of what one would otherwise expect to observe.[20]

6.2. Regression Results

The regression results confirm what was observed in the plots discussed in Section 5.1. Table 3 presents the percentage change in monthly retail sales that would not have been observed had the GST rate increases not been implemented. Specification (1) allows for a linear trend in $B_{y,m}$, while specification (2) includes year indicators which allow for year-specific linear trends in $B_{y,m}$. Table 4 lists the RTS industries from the RET and RTT series, and highlights those for which a significant amount of intertemporal substitution was observed in the month prior to the rate increase. Table 5 tests the null hypothesis that all intertemporal substitution occurred within the months for which intertemporal substitution effects were allowed. That is, it tests the null hypothesis that the positive pre-rate increase and negative post-rate increase intertemporal substitution effects sum to zero, a key assumption for identification of the income effects. Finally, Table 6 provides various estimates of the income effect associated with each GST rate change (and other simultaneous tax and benefit reforms) in terms of the average percentage deviation in quarterly retail sales relative to the quarter of "announcement".

As seen in Table 3, most intertemporal substitution prior to GST implementation took place in September 1986. Under specification (1), I find that total retail sales in that month were 21 percent higher than they would have been in the absence of a rate increase, due largely to a drastic increase in outlays on durable goods and services, which were 31 percent higher than they

[20] A plot of the percentage deviation in retail sales relative to 2010 Q1 has not yet been generated, as I am waiting for 2011 Q1 data to become available before doing so. The 2011 Q1 data will likely be misleading, however, given the negative impact of the February 2011 Christchurch earthquake on retail sales.

otherwise would have been.[21] As shown in Table 4, every RTS industry assigned to the durable category experienced a significant increase in retail sales in September 1986. Non-durable sales were also significantly above trend in September 1986, six percent higher than they otherwise would have been. As expected, the non-durable RTS industries that experienced significant increases in retail sales in September – liquor and licensed accommodations, petrol stations, and supermarkets and groceries – were those selling goods characterized by storability. Oddly, sales in the "chemist" category, which covered storable items such as pharmaceutical supplies, cosmetics, and toiletries, did not increase significantly in September 1986. Cashin and Unayama (2011) show that outlays on these types of goods increased significantly prior to the 1997 VAT rate increase in Japan.

The larger is the intertemporal substitution response to an increase in the rate of GST, the larger are the revenue losses sustained by the government as a result of pre-announcement. The results imply that retail sales were 548 million NZD higher in the two months preceding GST implementation than they would have been had a rate increase not been implemented. If one uses the government's conservative assumption that GST implementation would result in an increase in the price level of five percent, this would suggest that the government lost at least 27.4 million NZD of revenue as a result of pre-announcement, which amounts to XX percent of fiscal year 1987 GST revenue.[22]

As discussed above, one of the key assumptions for identification of the income effects is that all intertemporal substitution occurred within the period used to estimate the income effect. Table 5 tests whether this assumption is violated by adding up the estimated intertemporal substitution effects prior to and following the rate increases to see whether the sum differs significantly from zero. For all three events, we cannot reject the null hypothesis that all intertemporal substitution occurred within the months immediately preceding and following the GST rate hikes, which strengthens the claim that the estimates in Table 6 capture the income effects resulting from the rate increases.

Ttotal retail sales were not affected following announcement of the October 1986 GST implementation, which was intended to be compensated. Under the baseline specification, I find

[21] Estimates using specification (2) do not differ markedly from those generated by the more restrictive baseline specification.

[22] I have yet to receive numbers from New Zealand's Inland Revenue Department with historical fiscal year revenue, so I cannot calculate the percentages.

that the 1986 tax reform was responsible for average quarterly retail sales that were 0.34 percent higher than in the period of announcement, which is not significantly different from zero. Alternative specifications, which use fewer quarters following implementation and allow for the possibility that "announcement" actually coincided with the government's reconfirmation of GST implementation in 1986 Q3, yield similar results.

Interestingly, despite the stability in total retail sales, durable retail sales fell by 1.5 percent following announcement, while non-durable retail sales increased by a significant 2.6 percent under the baseline specification. One must view these results with some suspicion, however, as the decline in durable sales and increase in non-durable sales are greatly reduced under the alternative specification that defines 1986 Q3 as the quarter of announcement.

Moving on to the July 1989 GST rate increase, Table 3 shows that retail sales in June 1989 were nearly eleven percent higher than they would have been, again largely as a result of a sizeable increase in spending on durable goods and services, which were 5 and 16 percent higher in May and June 1989 than they would have been in the absence of a rate increase. Retail sales in nearly every industry assigned to the durable category increased significantly in June 1989 save the "motor vehicle repair" and "other stores" industries, which included jewelers, watch dealers, music shops, etc. Non-durable retail sales also exhibited significant increases in retail sales in June 1989, exceeding trend by nearly five percent. Unlike the 1986 GST implementation, however, only petrol sales increased by a significant amount prior to the July 1989 rate increase. Liquor and grocery sales also increased in June 1989, but there was a great deal of variability in sales of these goods around this time, so their increase was not statistically significant. The regression results further confirm that the intertemporal substitution response to the July 1989 rate increase was roughly half the size of the response to the October 1986 GST implementation.

The total increase in retail sales in the two months prior to the July 1989 rate increase that would not have been observed in its absence was 277 million NZD. Assuming full forward shifting of the rate increase, which implied an increase in the price level of 2.27 percent, pre-announcement resulted in a revenue loss to the government of 7.5 million NZD, or XX percent of fiscal year 1989 GST revenue.

Recall that the GST rate increase in 1989 was uncompensated, so there is potential for a negative income effect, and thus a decline in retail sales. Indeed, that is what is observed, as

average quarterly retail sales fell by over two percent following announcement of the rate hike, a result that is robust to estimation periods that differ in the number of quarters used following implementation, though it is not statistically significant. And whereas durable sales declined and non-durable sales increased following announcement of the compensated 1986 GST implementation, both durable and non-durable sales decreased by similar magnitudes following announcement of the July 1989 rate increase.

Finally, as suggested in the plots discussed in Section 6.1, the October 2010 rate increase provides a stark contrast to the July 1989 rate increase with regards to intertemporal substitution. Retail sales in September 2010 were only 1.43 percent higher than they would have been in the absence of a rate increase, due to a significant, though moderate, increase in durable retail sales of four percent. As seen in Table 4, unlike the initial GST rate increases, the only two industries assigned to the durable category that exhibited significant increases in retail sales in September were the "electrical and electronic goods" and "furniture" industries. Meanwhile, non-durable retail sales were actually below trend in September 2010, and significantly above trend in October 2010.

Average quarterly retail sales fell slightly following announcement of the (compensated) rate increase, as sales in 2010 Q3 and Q4 were 0.6 percent lower than in 2010 Q2. Furthermore, like the compensated rate increase in 1986, durable retail sales fell by a greater magnitude than non-durable retail sales.

7. Discussion

7.1. Heterogeneity of the 1989 and 2010 Intertemporal Substitution Responses

This section attempts to interpret and rationalize the results presented above. Perhaps the most puzzling result is the muted intertemporal substitution response prior to the October 2010 GST rate increase, a result made more surprising by the fact that the 2010 rate increase was compensated and was nearly identical in size to the uncompensated 1989 rate increase, which did induce a significant amount of intertemporal substitution among both durable and non-durable goods and services. These disparate findings beg the question of what factors are responsible for the heterogeneity in the intertemporal substitution responses. There are several potential explanations, some of which can be evaluated to an extent and some for which I can only speculate.

The first explanation that I investigate is whether a wealth shock and the ensuing adjustment in durable stocks provide a plausible explanation for the difference in the 1989 and 2010 intertemporal substitution responses. As theory predicts, and the results above confirm, intertemporal substitution is largely driven by increased outlays on durable goods and services. In September 2010, durable retail sales were a modest 4 percent above trend, as opposed to 16 percent in June 1989. One explanation for this lack of a response may have been the negative wealth shock that resulted from the recession that began in New Zealand in late 2008, accompanied by the tendency of durable stocks to adjust slowly to these shocks. On the heels of the global financial crisis, New Zealand fell into a recession in late 2008 as the result of drought, falling home prices, and high petrol prices (Bollard, 2009). In fact, data from the RBNZ show that household wealth as a percentage of disposable income fell by over ten percent from 2007 to 2008, the largest decrease in the 30 years for which data is available.

A frictionless LCPIH model would predict that households immediately adjust their durables stock downward in response to this reduction in wealth. However, as Caballero (1990, 1993) highlights, households are slow to adjust their durable stocks due to adjustment costs such as secondary market imperfections. As a result, following a negative wealth shock such as the 2008 recession, one might expect households to reduce their durable stock not by selling off their stock of durables and purchasing cheaper versions of the goods that made up the durable stock prior to the shock, but rather by holding onto the existing stock and postponing purchases of new goods. In fact, anecdotal evidence suggests this was the case in New Zealand, as the average age of cars and vans on the road in New Zealand hit an all time high of 13 years in 2011, which was attributed to the recession (Stock, 2011). Figure 4B provides further evidence of this phenomenon, as durable retail sales began to decline markedly after peaking in 2007. Provided the wealth shock brought on by the 2008 recession induced a large proportion of households to gradually deplete their durable stock, one would expect that a relatively small proportion of households were in a position to take advantage of the intertemporal substitution incentives offered by the prospective rate increase.

Working against this explanation, however, is the fact that prior to the 1989 GST rate increase, New Zealand households were faced with a negative wealth shock of a similar magnitude to the 2008 recession. The stock market crash of October 1987 arguably had a deeper and more prolonged impact on New Zealand than any other developed economy. As the RBNZ

data cited above shows, household wealth as a percentage of disposable income fell by eight percent from 1986 to 1987, by another three percent the following year, and by nearly two percent from 1988 to 1989. Furthermore, Figure 3B exhibits the same gradual decline in durable retail sales following the crash that was observed following the 2008 recession. Thus, the argument that a negative wealth shock followed by a delayed adjustment in durable stocks was responsible for the heterogeneity in the intertemporal substitution responses is not completely convincing, and is even less convincing given that durable retail sales again began to rise in 2009, suggesting any delayed adjustment of the durable stock was complete.

Another potential line of reasoning for the heterogeneity in the 1989 and 2010 intertemporal substitution responses is that households expected retailers to largely absorb the October 2010 GST rate increase. Indeed, the Warehouse, a discount store similar to Wal-Mart and the largest department store retailer operating in New Zealand, announced that it did not intend to increase prices when the 2010 rate increase took effect (McKentee, 2010). However, other anecdotal evidence, remarks by government officials, the level of compensation provided to households for the rate increase, and surveys of price expectations suggest that consumers expected to bear a substantial portion of the burden imposed by the rate increase. In addition to its discussion of Warehouse's pricing strategy, the McKentee article also mentions that several other retailers intended to increase their prices by no more or less than the 2.2 percent price increase implied by the GST rate increase, explaining that profit margins were too thin not to increase prices, but that competition was too fierce to increase prices by more than that amount. The words and actions of government officials also suggest that full forward-shifting was to be expected. An August 2010 speech by RBNZ Governor Alan Bollard, and a subsequent September 2010 RBNZ monetary policy statement make clear that the Bank expected the GST rate increase to coincide with a one-off spike in inflation. Finally, as discussed above, the government's decision to compensate beneficiaries with a 2.02 percent increase in benefits at the time of the GST rate increase, along with the fact that inflation expectations in 2010 Q3 for 2010 Q4 spiked, and then subsequently fell for quarters following 2010 Q4, lead me to conclude that backward shifting of the GST rate increase is not a compelling argument for the differences in the 1989 and 2010 intertemporal substitution responses.

A third argument for heterogeneity in the intertemporal substitution responses is the impact of liquidity/borrowing constraints. If households lack liquid assets and find it difficult to

borrow against future earnings, their consumption behavior should deviate from the predictions of the frictionless LCPIH in the sense that they will underreact to an anticipated price increase such as that brought on by a hike in the GST rate. In fact, Vissing-Jorgensen (2002) finds that the IES differs significantly for households that hold assets and those that do not, and further that the IES does not differ signicantly from zero for households without assets.

Figure 9A presents a time series of household savings relative to disposable income. While this measure does not perfectly capture liquid assets, one can argue that it serves as a useful proxy. Note that household savings were positive in 1989, but negative throughout the previous decade, including 2010, which suggests that it was easier for households to bring forward purchases in 1989 than 2010 by simply drawing down savings. Even without liquid assets available, however, it is possible that the GST rate increase was large enough to provide the incentive for households to borrow against future earnings through credit card purchases. However, Figure 9B, which presents a RBNZ time series of credit limits in New Zealand, and Figure 9C, which presents credit card usage as a percentage of total electronic card transaction values, suggest that households have been credit constrained over the past few years. In Figure 9B, August 2008 marked an abrupt reduction in New Zealanders' total credit limit, which has yet to recover, while Figure 9C shows that credit card usage has declined markedly since its 2007 peak. As a result, it seems plausible that the combination of New Zealand's negative savings rate in the years leading up to and including 2010 and the credit crunch over the prior few years contributed to the muted intertemporal substitution response prior to the October 2010 rate increase.

However, other statistics suggest that in general, New Zealand households are much less borrowing constrained today than they were in the past. For example, Bollard et al. (2006) note that New Zealand households have increasingly 'cashed in' on rising home prices over the past decade by resorting to Housing Equity Withdrawals (HEW) to fund consumption. This would imply that despite the fact that household savings rates in New Zealand are negative, and financing consumption through credit card use has recently become more difficult, a large proportion of New Zealand households can still borrow with relative ease.

But it may no longer be in their interest to do so. Figure 10 provides the annual percentage change in home prices, as well as the market value of the housing stock, from 1990 to 2010. Figure 11 presents household debt as a percentage of disposable income over the same

time period. What is immediately apparent from the two figures is the substantial increase in both the value of the housing stock and the level of household debt through 2007. After 2007, however, home prices leveled off, and then fell sharply in 2009. Perhaps not surprisingly, this period also coincided with what appears to be the beginning of deleveraging by households.

The argument for the muted intertemporal substitution response in September 2010 then goes as follows. Prior to 2007, households consumed as if their home prices would continue to appreciate into the foreseeable future, borrowing against the equity generated by their homes to finance current consumption. When home prices fell, households realized they were overleveraged, and devoted their resources to paying down debt. If the interest charged on a household's debt is great enough, the rational response is to continue paying down debt rather than take advantage of the intertemporal substitution incentives offered by the 2010 GST rate increase. The decline in the dissavings rate, credit card usage, and household debt after 2007 all suggest that debt repayment played a role in the muted intertemporal substitution response.

Finally, two other potential explanations exist for which I can only speculate, as data to evaluate these claims is not available to my knowledge. First, both the September 2010 RBNZ Monetary Policy Statement and a statement from New Zealand's ASB Bank regarding the potential impact of a GST rate increase emphasize that the frequency and depth of retailer discounting have increased over time, and therefore it might not be in a consumer's interest to make pre-GST rate increase purchases if the goods they plan to buy will be marked down by a greater percentage in the future. Second, the rise of e-commerce allows consumers to avoid the GST system entirely by ordering goods such as electronics, books, movies, and music offshore. Both arguments seem plausible, and the first, in particular, strikes me as a strong disincentive to bring forward purchases prior to the GST rate increase, especially given that persistent inflation is less of a problem in New Zealand today than it was throughout the 1980's.

7.2. Implications of the Results for Tax Policy and Consumer Preferences

The intertemporal substitution results provide several implications for tax policy and consumer preferences. First, the fact that intertemporal substitution for all three events was heavily concentrated in the month just prior to the rate increase, despite differences in the time interval between announcement and implementation, implies that intertemporal substitution is largely a function of the durability and storability associated with a good or service rather than a

positive IES, which would instead imply an increase in consumption throughout the entire period between announcement and implementation. The finding also leads one to wonder whether previous studies that have found a positive IES using non-durable expenditure are instead capturing storability. Related to this point, because nearly all intertemporal substitution occurs in the month prior to a rate increase, and some delay between announcement and implementation is inevitable, a government is unlikely to be able to time announcement to minimize revenue losses. That is, providing a minimal time interval between announcement and implementation will not reduce revenue losses sustained as a result of pre-announcement. Finally, since the post-rate increase intertemporal substitution effects died out within three months of implementation for three rate increases of varying sizes, this suggests that households do not plan purchases more than three or four months in advance.

The income effect estimates provide some additional insights into consumer behavior, whether and when the revenue from the uncompensated rate increase was redistributed, and whether the compensated rate changes were truly compensated in the Slutsky sense. As mentioned earlier, an uncompensated increase in the GST rate that is rebated lump sum to households should not cause a percentage decline in retail sales that is equal and opposite to the percentage increase in the price level. On the other hand, this behavior could be observed for an uncompensated rate increase for which revenue is not transferred back to households, the IES is zero, and the period between announcement and implementation relative to the estimation period after is short. Given that the July 1989 rate increase was associated with a decline in retail sales equal and opposite to the increase in the price level, the implication is that the revenue generated by the rate increase was not rebated to households or that there was a lag in redistribution of the revenue to households (and also that Ricardian equivalence does not hold). The results further suggest that households did not initially increase their labor supply or draw down from a buffer stock of savings to maintain consumption at or near its level prior to the rate increase.

The fact that retail sales did not increase following the compensated rate increases suggests one of two things. First, the GST rate increases were not truly compensated in the present value sense. Since Slutsky-compensated changes in relative prices yield an unambiguous increase in household welfare, consumption should increase as a result of the change, and thus retail sales should increase in the long run following announcement. A second possibility is that the compensated GST rate increases did improve welfare and consumption, but that the

estimation period following announcement is too short to capture the effect. This could be true given that compensation in the form of reductions in personal income tax rates mitigate the savings distortion associated with the taxation of the return to savings. As a result, if savings increased immediately after the change, consumption would not initially increase, but would do so over the long run.

8. Conclusion

The increasing reliance of governments on consumption taxation as a source of revenue begs the question "What is the macroeconomic impact of increases in consumption tax rates?" Using retail sales data from New Zealand surrounding the October 1986 GST implementation, July 1989 GST rate increase, and October 2010 GST rate increase to quantify the impact, the preceding analysis demonstrates that anticipation of higher prices in the future resulting from a consumption tax rate increase induces a statistically and economically significant amount of intertemporal substitution in the month immediately prior to and the quarter immediately following implementation, though this response is likely to be mitigated when households are overleveraged or expect prices to decline in the future. Furthermore, while the revenue losses sustained by governments as a result of intertemporal substitution are not negligible in absolute terms, they comprise a small share of total tax revenue, and in any case, the results suggest that there is little that governments can do to minimize the amount of revenue that is lost from announcing consumption tax rate increases prior to their implementation.

Over a longer time frame, the New Zealand experience suggests that uncompensated increases in consumption tax rates depress retail sales in proportion to the increase in the price level, which provides evidence against Ricardian equivalence. Compensated rate increases, on the other hand, had little discernible impact on total retail sales. In particular, the fall in retail sales resulting from the October 2010 GST rate increase seems to lend some credence to the claims of some experts that compensation for the most recent tax change was inadequate. The results further indicate that in addition to greater volatility in sales around the time of the rate increase, industries specializing in the sale of durable goods may also suffer a decline in sales over a longer time frame.

Because this analysis utilized aggregate retail sales data, there is little to be said regarding the distributional consequences of uncompensated and compensated increases in consumption

tax rates. An empirical analysis of the distributional consequences of such changes is a promising area for future research. Finally, an attempt should be made to quantify the welfare costs of such changes using the results from this exercise and Cashin and Unayama (2011), which I leave for future work.

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Figure 1A. Uncompensated consumption tax rate increase with no lump-sum rebate

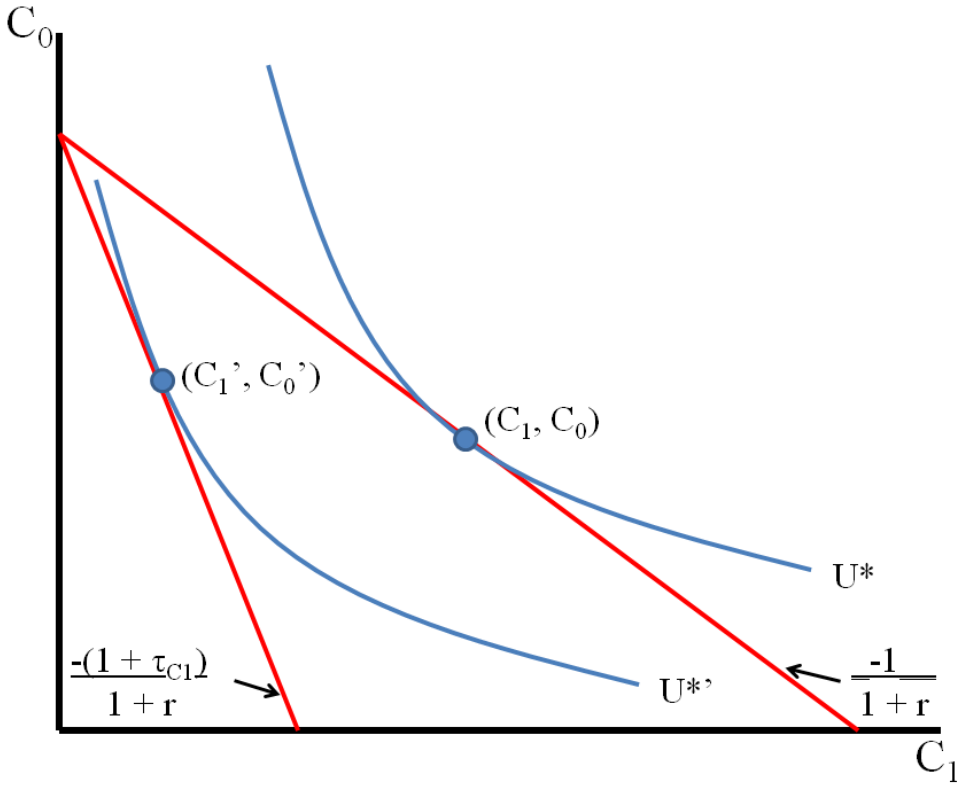


Figure 1B. Uncompensated consumption tax rate increase with lump-sum rebate

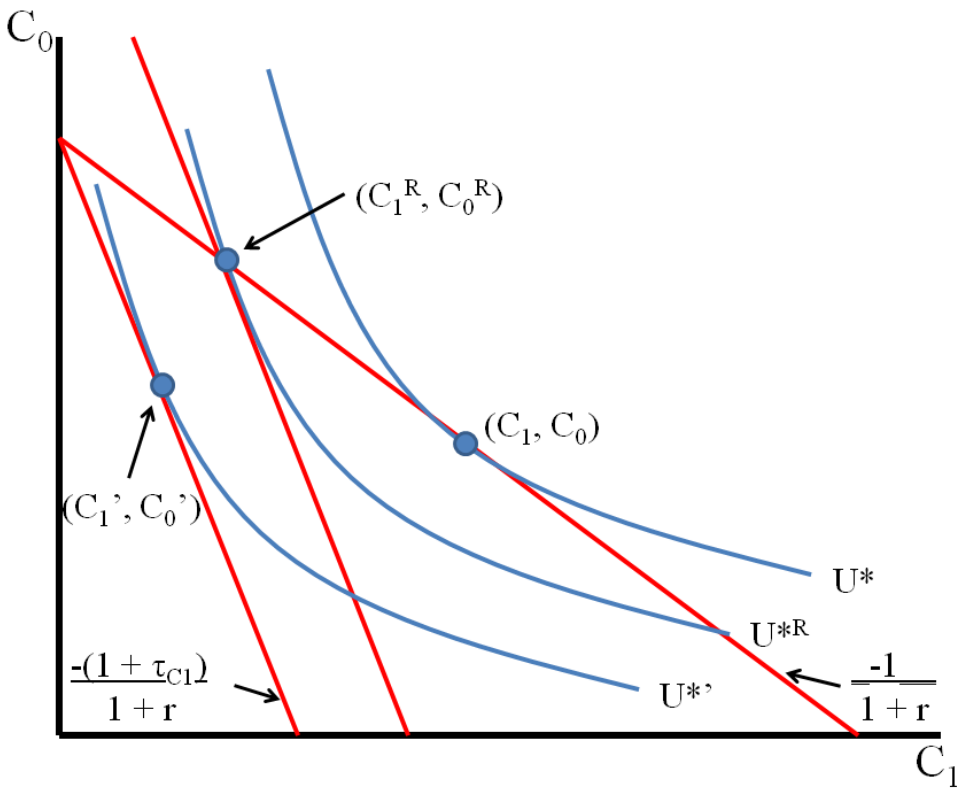


Figure 2. Compensated consumption tax rate increase

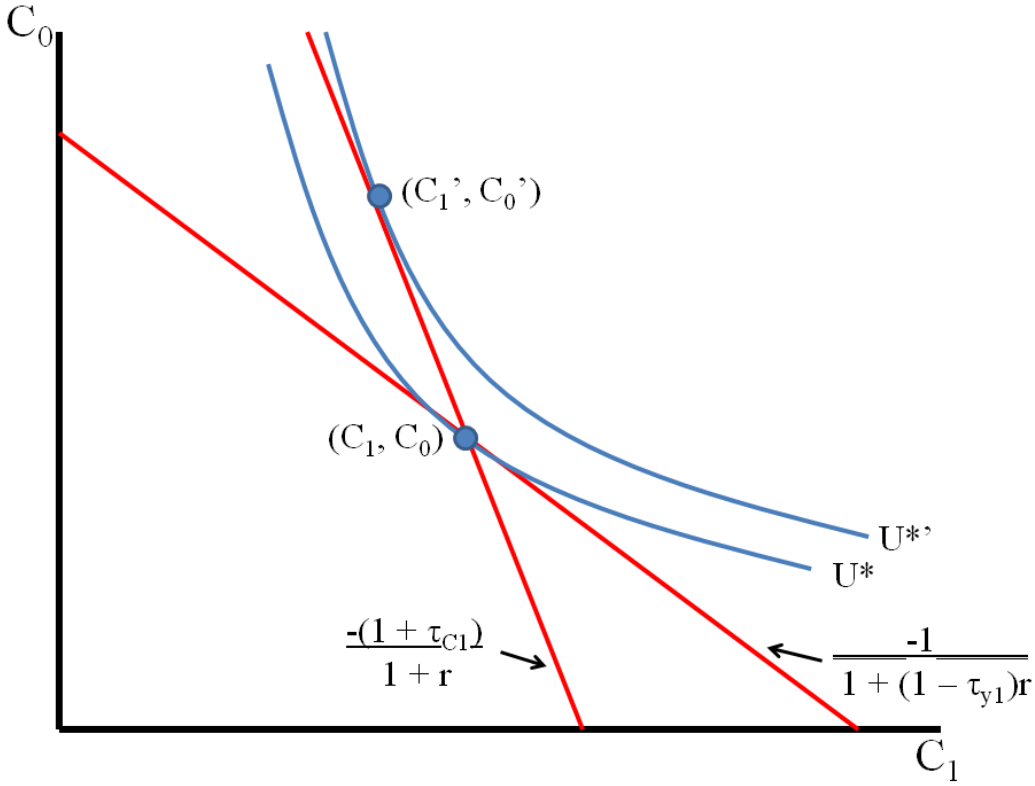


Figure 3A. RET seasonally-adjusted monthly retail sales

Nominal dollars (excludes GST)

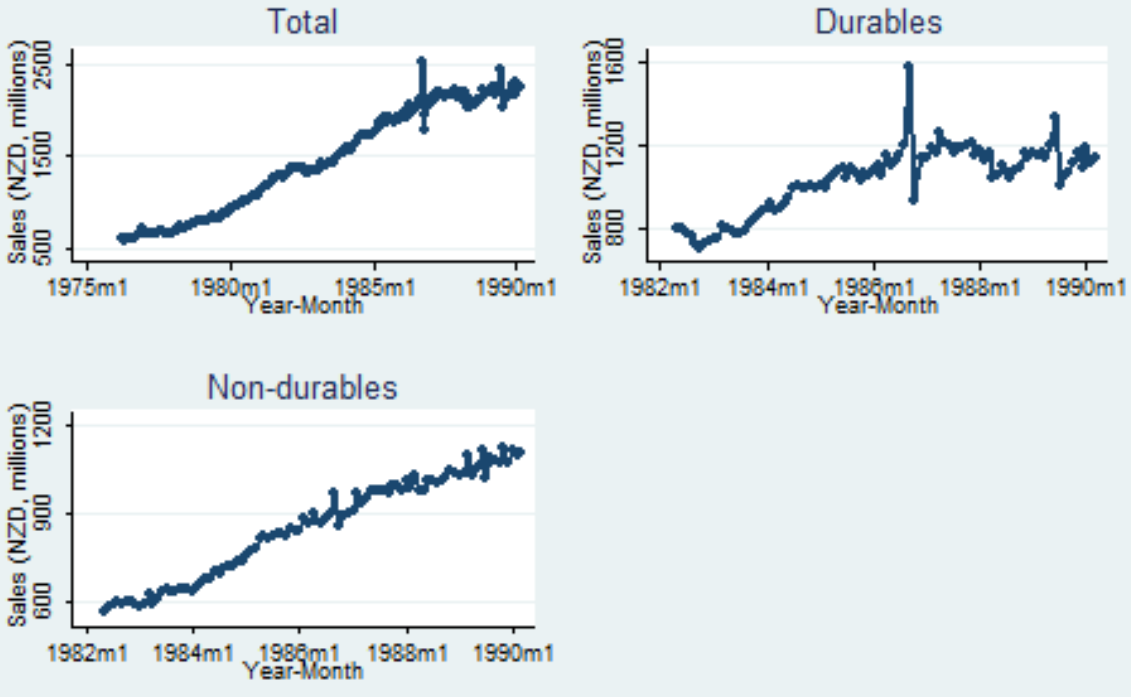


Figure 3B. RET seasonally-adjusted quarterly retail sales

1980 Q4 dollars (excludes GST)

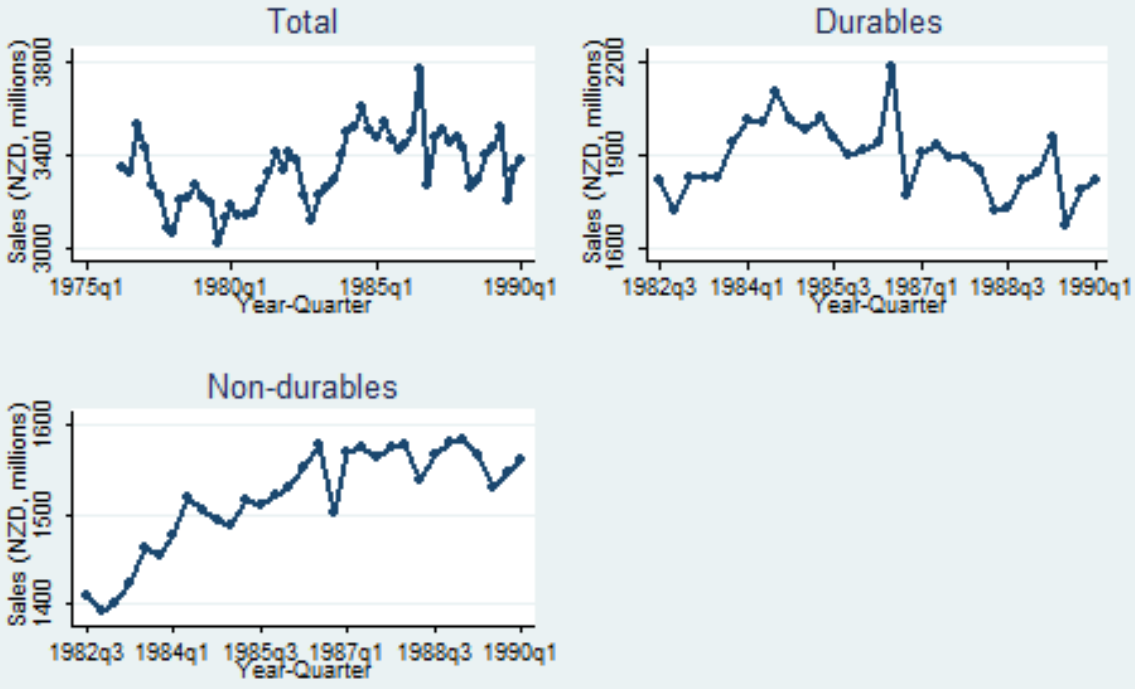


Figure 4A. RTT seasonally-adjusted monthly retail sales

Nominal dollars (excludes GST)

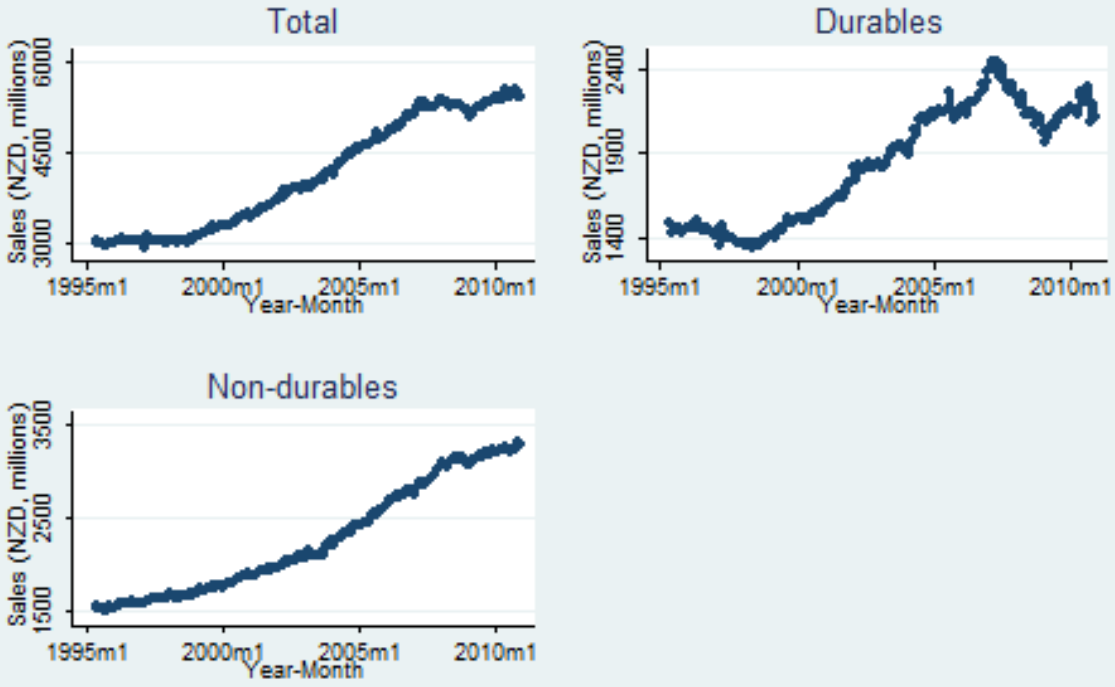


Figure 4B. RTT seasonally-adjusted quarterly retail sales

1995 Q3 dollars (excludes GST)

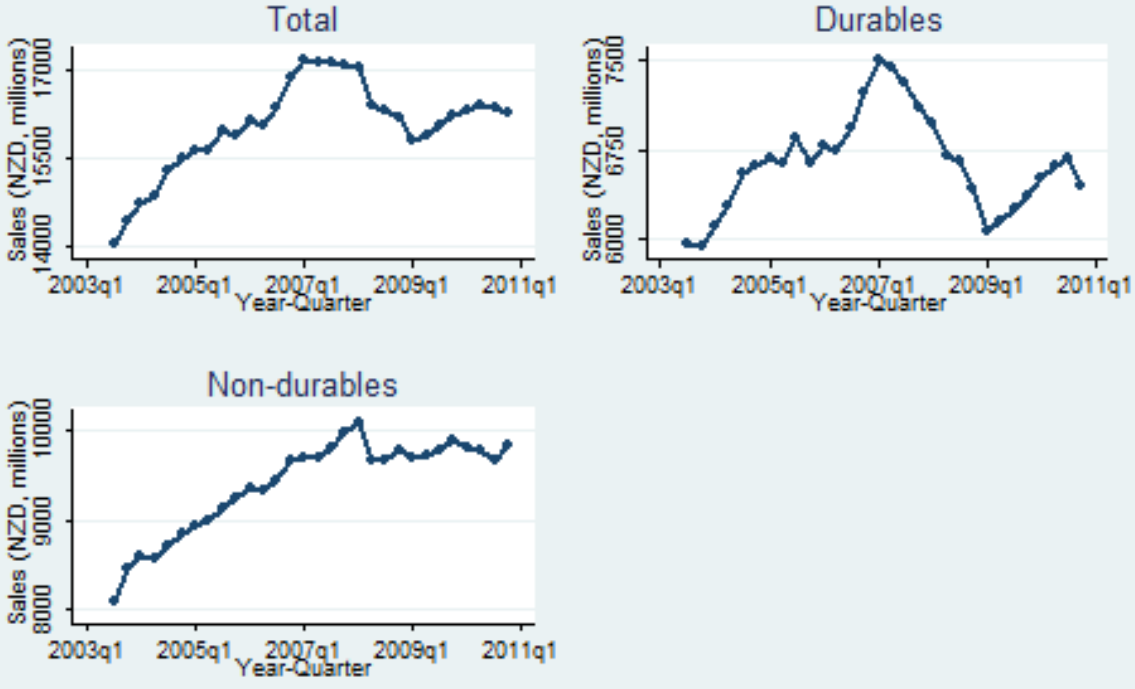
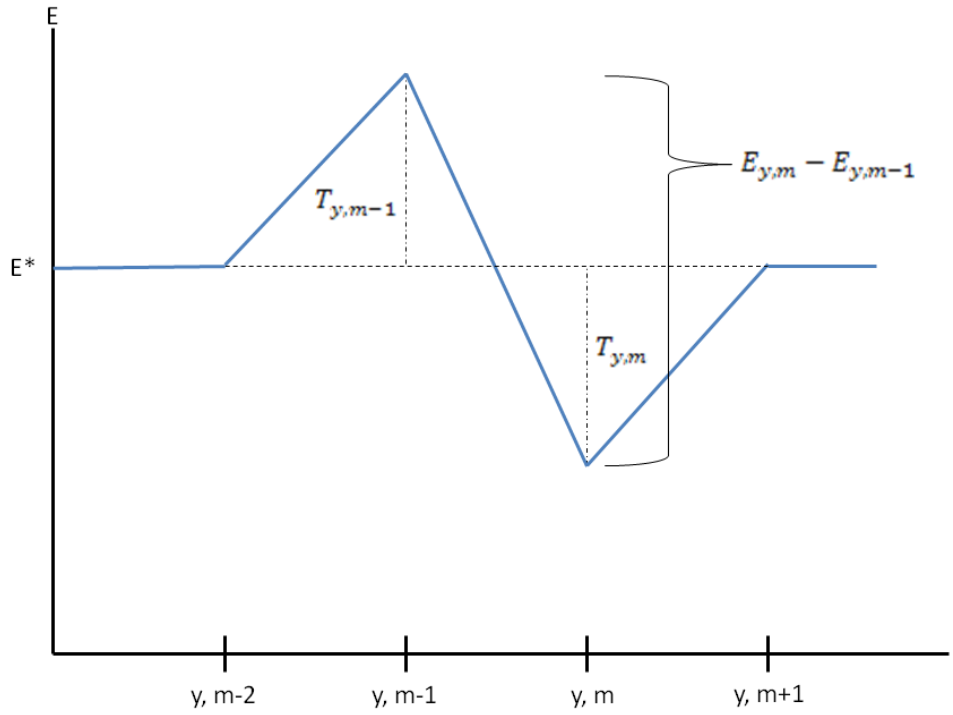


Figure 5. Identifying the intertemporal substitution effects of a GST rate increase on retail sales using a first-differenced specification



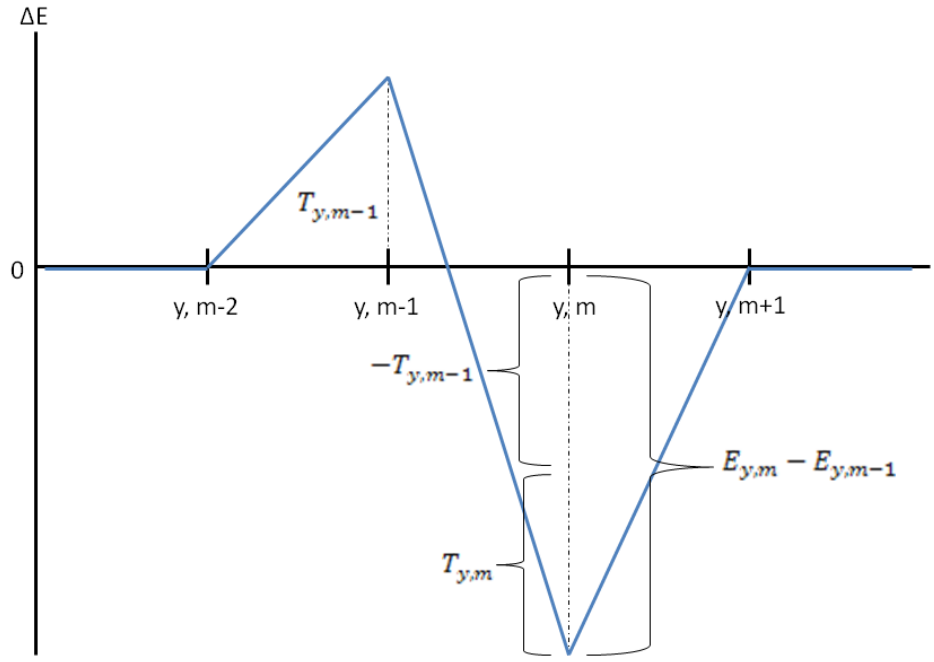
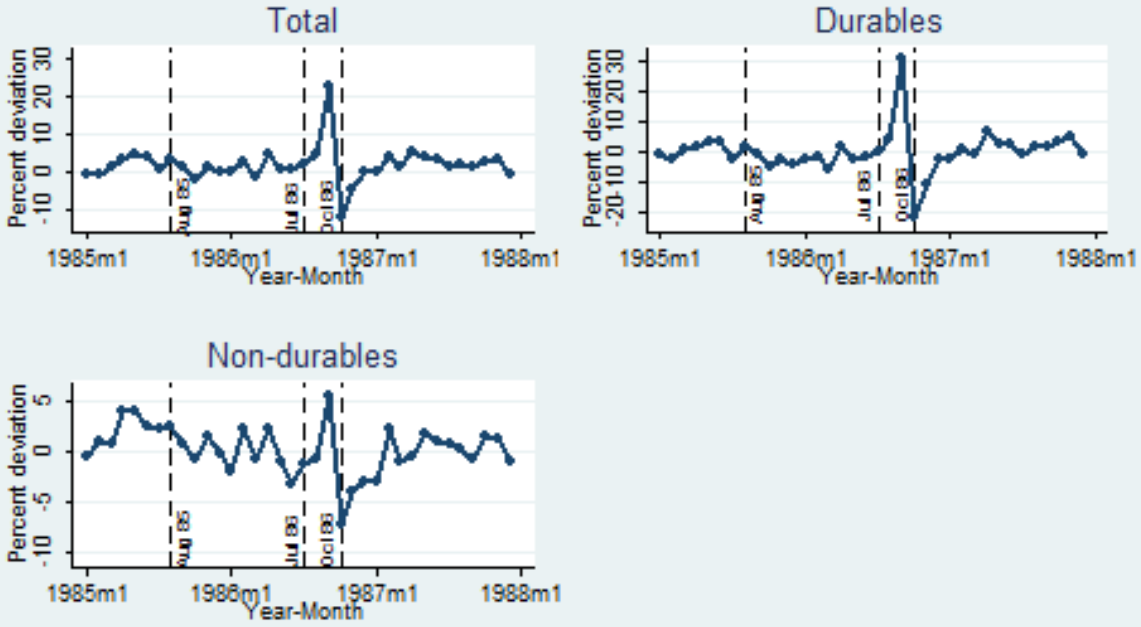
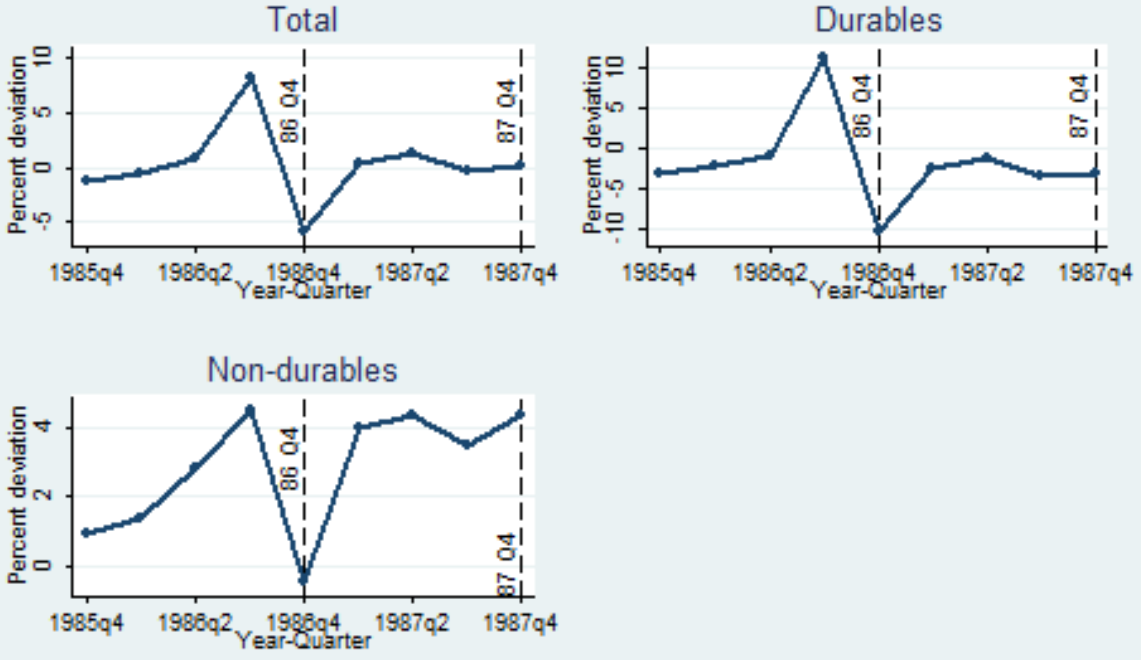


Figure 6A. Percent deviation from detrended average



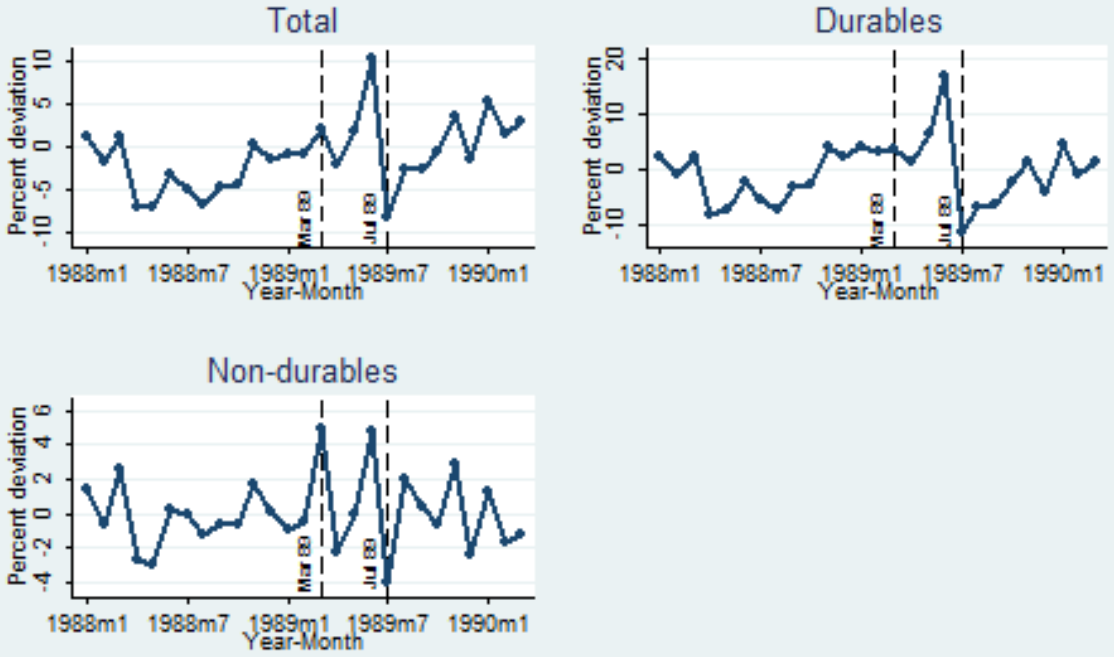
Aug 85: Statement on Taxation and Benefit Reform (announcement)
Jul 86: October implementation date reconfirmed
Oct 86: GST Implementation

Figure 6B. Percent deviation from 1985 Q3 retail sales



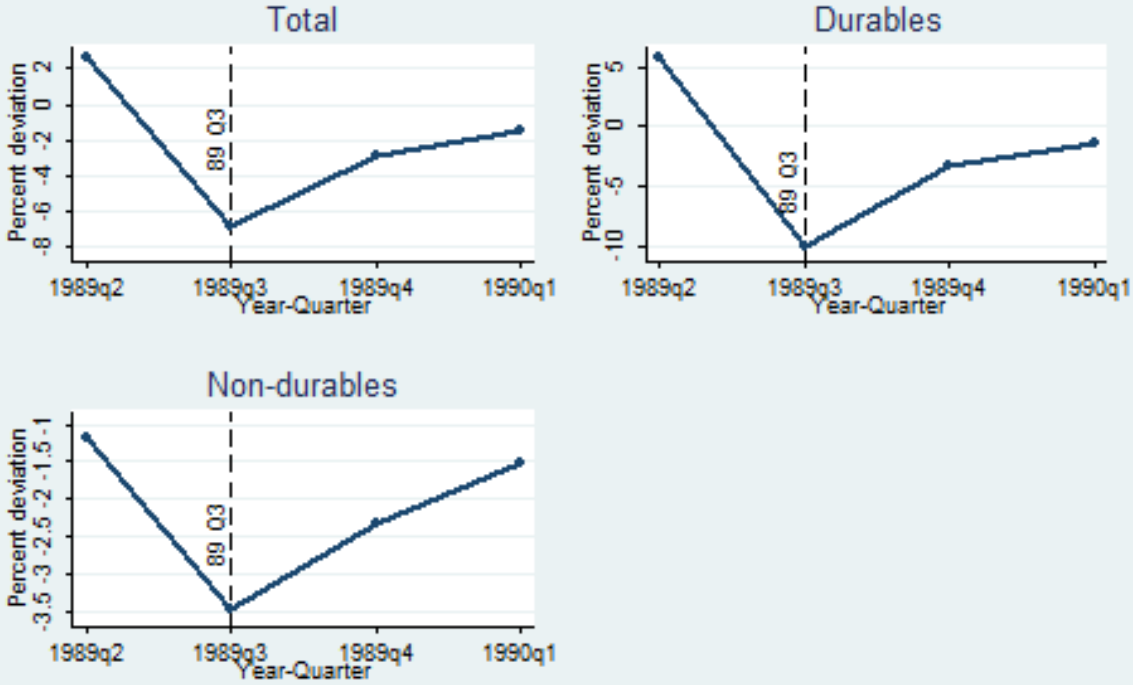
86 Q4: GST implementation
87 Q4: Stock market crash

Figure 7A. Percent deviation from detrended average



Mar 89: GST rate increase passed (announcement)
Jul 89: GST rate increased

Figure 7B. Percent deviation from 1989 Q1 retail sales



89 Q3: GST rate increase implemented

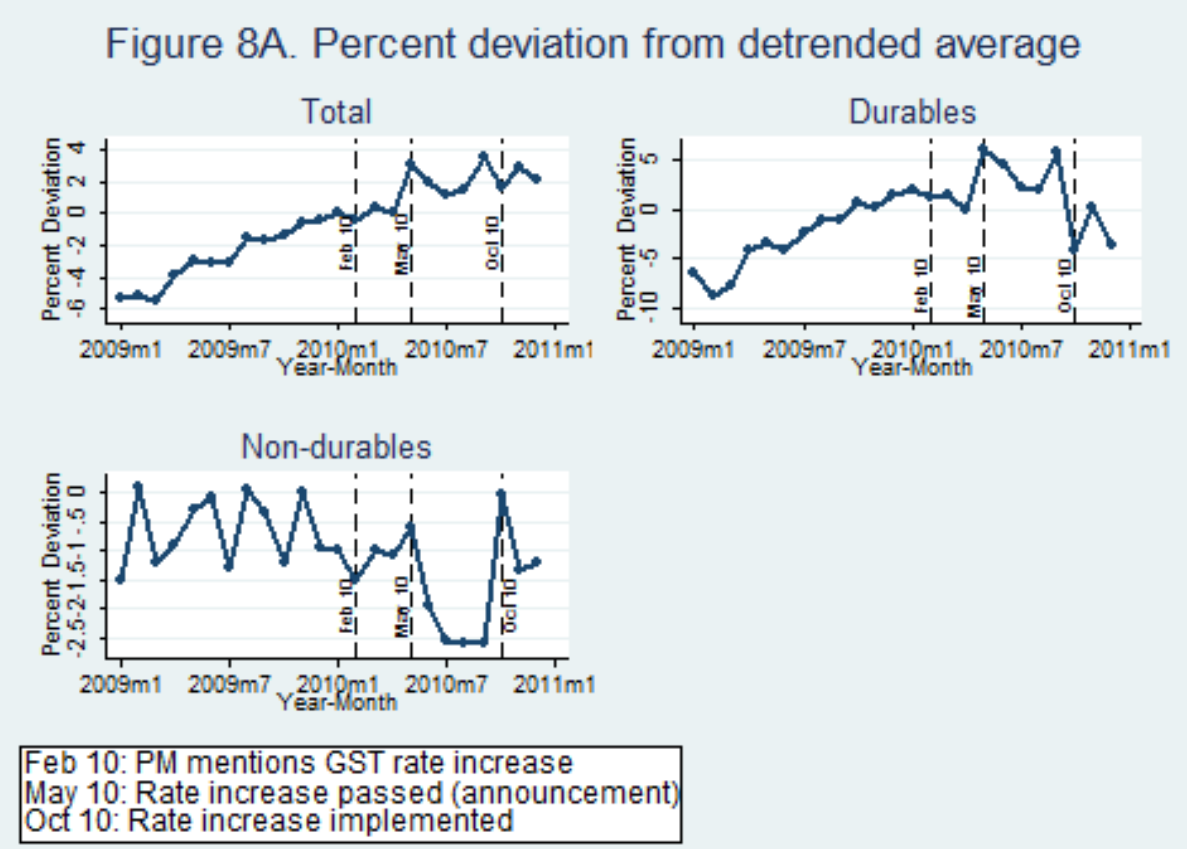
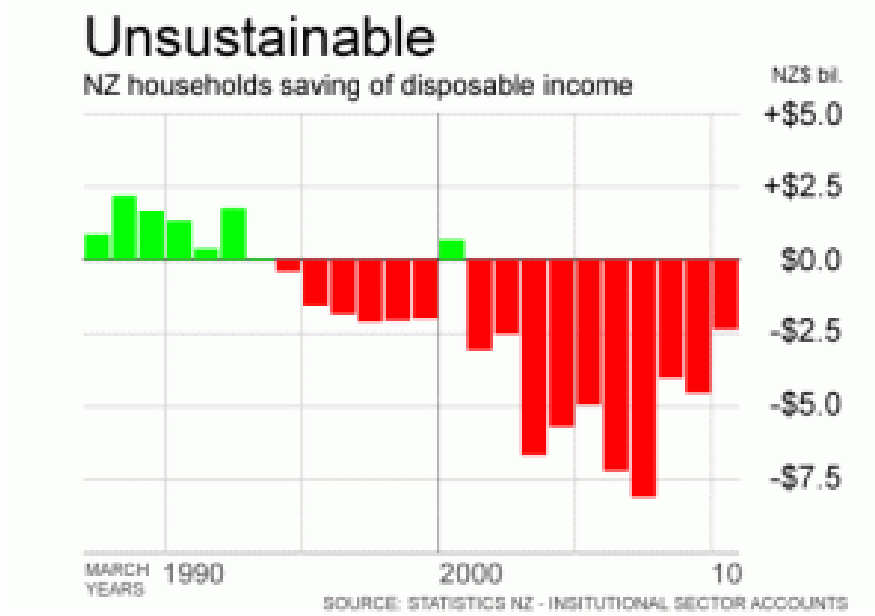


Figure 9A. Household Savings in New Zealand



Source: Tarrant, Alex. (2010, December 16). "Kiwis still spending more than they earn, although dissavings are declining, new Stats NZ measure shows". Retrieved from http://www.interest.co.nz/news/51732/kiwis-still-spending-more-they-earn-although-dis-savings-are-declining-new-stats-nz-measure-shows

Figure 9B. Total credit limit

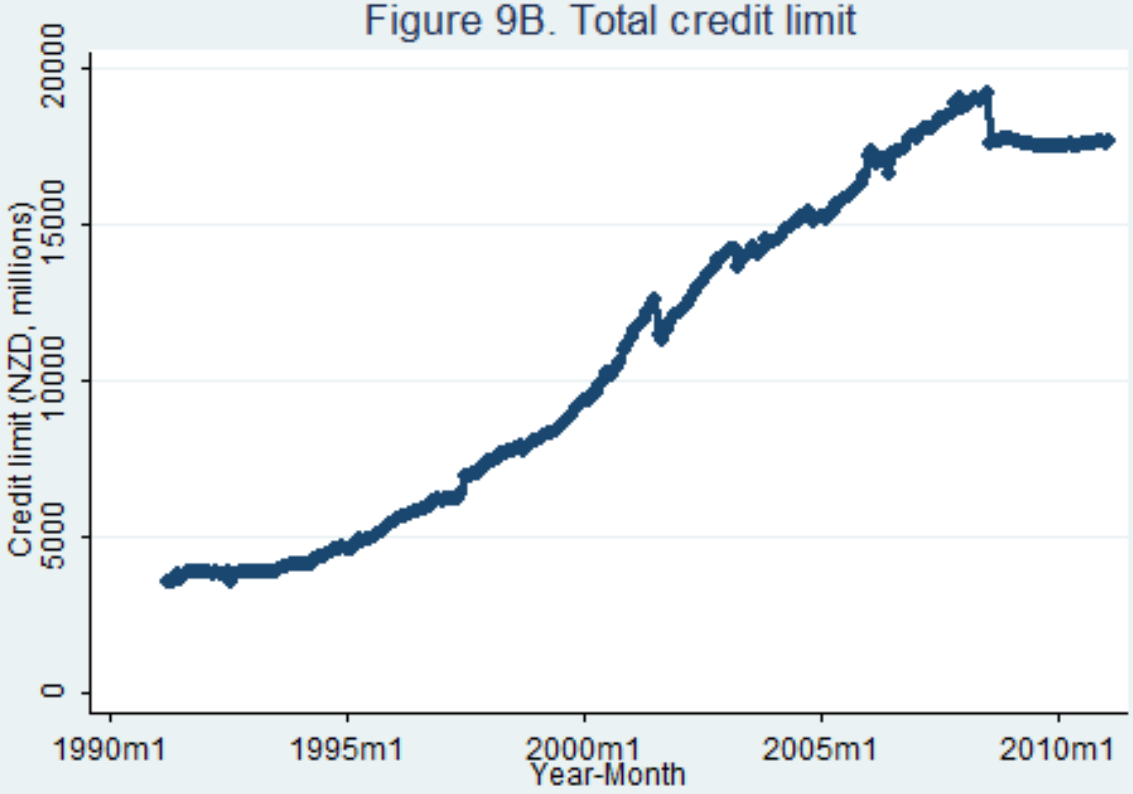
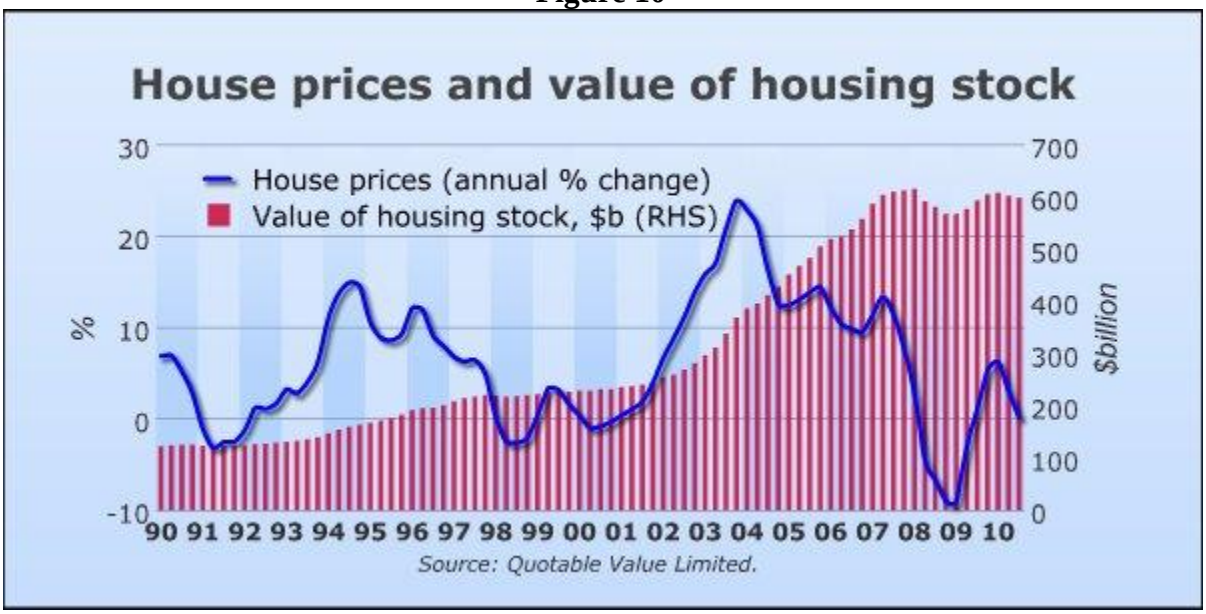


Figure 9C. Credit card usage as a percentage of total electronic card transaction value

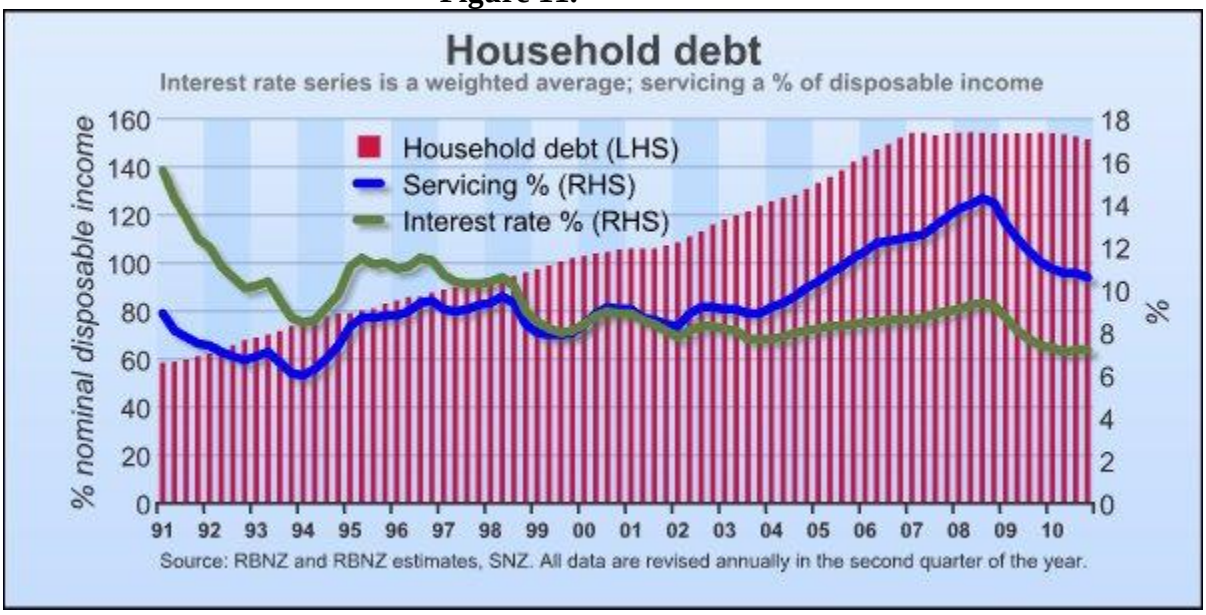
Seasonally adjusted

Figure 10



Source: Reserve Bank of New Zealand's "Key Graphs", obtained at
http://www.rbnz.govt.nz/keygraphs/Fig5.html

Figure 11.



Source: Reserve Bank of New Zealand's "Key Graphs", obtained at
http://www.rbnz.govt.nz/keygraphs/Fig5.html

Table 1. Estimated Impact of GST Rate Increases on Price Levels			
	Rate Increase		
Category	**1986 Q4**	**1989 Q3**	**2010 Q4**
Overall	6.53	2.31	1.99
Food	9.95	5.65	1.25
Alcohol & Tobacco	9.90	3.09	0.74
Footwear	5.88	1.84	0.23
Vehicles	6.03	1.29	0.11
Floor coverings	8.35	0.77	1.62
Household textiles	10.57	1.76	5.51
Clothing	8.80	1.66	-0.38
Furniture	N/A	N/A	2.99
Household appliances	N/A	N/A	1.21

The above table provides estimates of the percentage increase in price levels resulting from increases in GST rates. To generate the estimates, the percentage change in price level on the previous quarter was regressed on a flexible time trend polynomial, quarter dummies (if seasonality was present), and an indicator for the quarters in which the GST rate increase occurred. The time trend polynomial allows for a moving average in price changes, while the indicator functions capture any deviation from the average, which I attribute to the GST rate increase.

Table 2. Retail Trade Survey Summary Statistics						
Data Series	**Category**	**Obs.**	**Mean***	**Std. Dev.**	**Min**	**Max**
RET Monthly Current Price	Total	168	1,443	576	579	2,532
April 1976 - March 1990	Durable	95	1,030	160	708	1,567
	Non-durable	95	851	172	566	1,121
RET Quarterly Constant Price	Total	56	3,333	153	3,015	3,760
1976 Q2 - 1990 Q1	Durable	31	1,886	116	1,667	2,181
Base period: 1980 Q4	Non-durable	31	1,518	57	1,391	1,584
RTT Monthly Current Price	Total	188	4,098	912	2,927	5,532
May 1995 - December 2010	Durable	188	1,832	340	1,347	2,449
	Non-durable	188	2,267	592	1,501	3,323
RTT Quarterly Constant Price	Total	30	16,034	797	14,041	17,192
2003 Q3 - 2010 Q4	Durable	30	6,636	409	5,957	7,488
Base period: 1995 Q3	Non-durable	30	9,398	522	8,073	10,092

*Millions of New Zealand dollars

Table 3. Percentage Deviation in Retail Sales from Trend*							
		Total		Durable		Non-durable	
Event	**Period**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
GST Implementation October 1986	Aug-86	3.22	3.03	4.33	4.08		
		(2.15)	(2.07)	(2.65)	(2.57)		
	Sep-86	**20.90**	**20.43**	**30.61**	**29.98**	**6.18**	**5.95**
		(2.34)	**(2.22)**	**(3.11)**	**(2.99)**	**(1.83)**	**(1.81)**
	Oct-86	**-14.50**	**-15.17**	**-21.62**	**-22.59**	**-6.99**	**-7.37**
		(2.54)	**(2.47)**	**(3.36)**	**(3.30)**	**(1.92)**	**(1.93)**
	Nov-86	**-7.38**	**-8.24**	**-10.59**	**-11.92**	**-3.93**	**-4.47**
		(2.54)	**(2.55)**	**(3.38)**	**(3.42)**	**(2.06)**	**(2.14)**
	Dec-86	-2.70	-3.87	-2.31	-3.96	**-3.60**	**-4.32**
		(2.34)	(2.44)	(3.14)	(3.33)	**(1.92)**	**(2.08)**
	Jan-87	-2.86	-3.37	-2.52	-3.52	**-3.23**	**-3.63**
		(2.15)	(2.18)	(2.82)	(2.86)	**(1.82)**	**(1.88)**
Rate Increase July 1989	May-89	1.86	1.49	**5.24**	**5.16**		
		(2.15)	(2.05)	**(2.65)**	**(2.54)**		
	Jun-89	**10.53**	**10.64**	**15.74**	**15.74**	**4.71**	**4.72**
		(2.34)	**(2.16)**	**(3.08)**	**(2.89)**	**(1.65)**	**(1.60)**
	Jul-89	**-8.66**	**-8.82**	**-12.20**	**-12.19**	**-4.58**	**-4.56**
		(2.54)	**(2.36)**	**(3.32)**	**(3.11)**	**(1.65)**	**(1.60)**
	Aug-89	-3.08	-2.87	**-8.04**	**-7.94**		
		(2.54)	(2.36)	**(3.19)**	**(3.01)**		
	Sep-89	**-4.01**	**-4.10**	**-6.66**	**-6.66**		
		(2.34)	**(2.16)**	**(2.95)**	**(2.78)**		
	Oct-89	-1.58	-1.13	-1.12	-1.08		
		(2.15)	(2.05)	(2.65)	(2.54)		
Rate Increase October 2010	Sep-10	1.43	1.72	**3.82**	**3.81**	-0.25	0.27
		(1.05)	(1.08)	**(1.85)**	**(1.93)**	(1.09)	(1.15)
	Oct-10	-0.99	-0.52	**-5.89**	**-5.90**	**2.17**	**3.00**
		(1.25)	(1.30)	**(2.20)**	**(2.33)**	**(1.28)**	**(1.38)**
	Nov-10	-0.14	0.56	-1.44	-1.46	0.68	1.91
		(1.49)	(1.63)	(2.63)	(2.93)	(1.53)	(1.73)
	Dec-10	-1.56	-0.66	**-4.99**	-5.01	0.63	2.21
		(1.68)	(1.90)	**(2.96)**	(3.42)	(1.71)	(2.02)

*Figures in bold indicate significance at the ten percent level. Standard errors are listed in parentheses.
Notes: The figures above are derived from a regression of the first difference of the logarithm of current price monthly retail sales on first-differenced year-month indicators for specification (1), and both year dummies and first-differenced year-month indicators for specification (2). The coefficients associated with the year-month indicators are interpreted as the intertemporal substitution effects resulting from the GST rate increases.

Regressions for total retail sales correct for first-order serial correlation. Regressions for durable and non-durable retail sales in the RET series correct for both contemporaneous correlation between the durable and non-durable equations, and first-order serial correlation in each of the equations. All regressions from the RTT series correct for only first-order serial correlation.

Table 4. Retail Trade Survey Industries that Experienced a Significant Increase in Retail Sales the Month Prior to a GST Rate Increase*	
RET Series (May 1982-March 1990)	
Durable	**Non-durable**
Clothing and textiles	Butcher
Department store	Chemist (Pharmaceuticals)
Footwear	**Liquor & lic. accommodation**
Furniture	Other food
Hardware	***Petrol stations***
Household appliances	Restaurants and takeaways
Motor vehicles	**Supermarket and groceries**
Motor vehicle repair	Unlicensed accommodations
Other stores	
RTT Series (May 1995-December 2010)	
Durable	**Non-durable**
Clothing, footwear, and personal accessories	Accommodation
Department store	Food and beverage services
Electrical and electronic goods	Fuel
Furniture	Liquor
Hardware	Pharmaceutical and other stores
Motor vehicle and parts	Specialized food
Non-store and commission-based	Supermarket and groceries
Recreational goods	

*****Industries from the RET and RTT series that are listed in **bold** text experienced a significant increase (at the ten percent level) in retail sales in September 1986 and September 2010, respectively, while industries from the RET series listed in *italics* experienced a significant increase in retail sales in June 1989. Industries from the RET series listed in both **bold** and *italics* experienced a significant increase in retail sales in both September 1986 and June 1989.

Table 5. F-tests of Null Hypotheses That All Intertemporal Substitution Occurred Within Specified Period									
	Total			**Durable**			**Non-durable**		
Event	**Test**	**Sum***	**p-value**	**Test**	**Sum**	**p-value**	**Test**	**Sum**	**p-value**
GST Implementation October 1986	$\sum_{1986,8}^{1987,1} T_{y,m} = 0$	18.3	0.90	$\sum_{1986,8}^{1987,1} T_{y,m} = 0$	70.4	0.58	$\sum_{1986,9}^{1987,1} T_{y,m} = 0$	**-100.4**	**0.07**
Rate Increase July 1989	$\sum_{m=5}^{m=10} T_{1989,m} = 0$	-87.4	0.53	$\sum_{m=5}^{m=10} T_{1989,m} = 0$	-33.0	0.79	$\sum_{m=6}^{m=7} T_{1989,m} = 0$	4.2	0.85
Rate Increase October 2010	$\sum_{m=9}^{m=12} T_{2010,m} = 0$	-18.2	0.93	$\sum_{m=9}^{m=12} T_{2010,m} = 0$	-169.1	0.30	$\sum_{m=9}^{m=12} T_{2010,m} = 0$	150.2	0.19

*Millions of New Zealand Dollars

Notes: Figures in bold denote significance at the ten percent level. The figures above are derived from F-tests for which the null hypothesis is that the coefficients, which are associated with year-month indicators from a regression of first-differenced retail sales on first-differenced year-month indicators, sum to zero. That is, all intertemporal substitution occurred within the months for which we conduct the F-test. Standard errors for these regressions were calculated in the same manner as described in the "Notes" section for Table 3 above.

Table 6. Average Percentage Change In Quarterly Retail Sales Since "Announcement"*					
Event	**Announcement**	**Test**	**Total**	**Durable**	**Non-durable**
GST Implementation October 1986	1985 Q3	1985 Q4 - 1987 Q3	0.34	-1.49	**2.60**
			(3.35)	(4.12)	**(1.37)**
		1985 Q4 - 1987 Q2	0.44	-1.22	**2.48**
			(3.41)	(4.14)	**(1.37)**
		1985 Q4 - 1987 Q1	0.30	-1.23	2.17
			(3.49)	(4.18)	(1.32)
	1986 Q3	1986 Q3 - 1987 Q3	-0.04	-0.43	0.33
			(3.46)	(4.34)	(1.37)
		1986 Q3 - 1987 Q2	0.22	0.10	0.25
			(3.57)	(4.40)	(1.39)
		1986 Q3 - 1987 Q1	0.14	0.27	-0.17
			(3.74)	(4.55)	(1.41)
GST Rate Increase July 1989	1989 Q1	1989 Q2 - 1990 Q1	-2.17	-2.28	-2.12
			(3.43)	(4.39)	(1.29)
		1989 Q2 - 1989 Q4	-2.40	-2.56	**-2.32**
			(3.59)	(4.53)	**(1.33)**
GST Rate Increase October 2010	2010 Q2	2010 Q3 - 2010 Q4	-0.60	-0.93	-0.39
			(2.15)	(2.71)	(1.65)

*Figures in bold indicate significance at the ten percent level. Standard errors are listed in parentheses.
Notes: The coefficients above are derived from a regression of the logarithm of current price quarterly retail sales on an indicator that takes on a value of 1 in the quarters following "announcement" up to a specified number of quarters following implementation. Year dummies or year and quarter-specific indicators control for sales in periods that are of no concern, and the omitted time period is the quarter of "announcement". Thus, the coefficients of interest capture the average percentage deviation in quarterly retail sales following "announcement". Under our identification assumptions, these coefficients yield the income effect of the GST rate increase. The coefficients for "total" retail sales are derived from an Ordinary Least Squares regression, while the coefficients for "durables" and "non-durables" are derived from a Seemingly Unrelated Regression allowing for contemporaneous correlation between the residuals of the durable and non-durable equations.

Appendix

Table A.1. Wholesale Sales Tax Rates Prior to Repeal

Selected goods and their rate of sales tax (December 1984)

Ad valorem rates	
10%	aircraft, heavy motor vehicles (gross weight over 3.5 tonnes) household utensils, lawn mowers, soap and other cleaners, toothpaste, most industrial machinery, computers, boats, caravans.
20%	standard rate applied to all goods unless exempted or subject to other rates — e.g. ice cream, tyres, stationery, toys, motor cycles, motor vehicle parts, grease and petroleum products, records and tapes, cosmetics.
30%	watches, photographic equipment, projectors, radios, TVs and stereos, motorcars (not exceeding 1350 cc), commercial motor vehicles of up to 3.5 tonnes gross weight.
33%	motorcars (over 1350 cc)
40%	jewellery, office machinery, copying equipment, perfume, cigarettes and other tobacco products, film.
50%	smokers' lighters, cameras, binoculars
Specific Rates	
$2.15 per litre	fortified wines
$1.32 per litre	table wines
$2.40 per litre	bitters and spirits less than 23% alcohol
$5.01 per litre	gin, vodka, schnapps
$7.47 per litre	whisky, brandy and other spirits
7.2c per litre	diesel oil (not including marine diesel oil), jet fuel
5.8c per litre	marine diesel oil
8.0c per litre	kerosene, home heating oil
5.0c per litre	other oils not subject to other rates of tax
$2.51 per gigajoule	natural gas
6.86c per litre	liquified petroleum gas

Source: Scott, Claudia and Howard Davis, 1985. "The Gist of GST: A Briefing on the Goods and Services Tax", The Institute of Policy Studies, Studies in Taxation Policy, April.

Table A.2. Goods and End Users Exempt from the Wholesale Sales Tax	
Exempt goods	Animals Second-hand goods Food Clothing Building materials Medication Education material Ambulances Lifesaving apparatuses Fire engines Firefighting equipment Articles suited for impaired persons Goods used in funerals Religious goods Literature and printed books Craft goods Prizes and medals won overseas Child safety seats Certain imported goods
End user exemptions	Hospitals Education boards Government departments Charities

Source: New Zealand Inland Revenue Department

Table A.3.

ANZSIC06 Retail Trade Survey industries and ANZSIC06 class codes and descriptions

ANZSIC06 RTS industry		ANZSIC06 class code and description	
G1110	Motor vehicle and parts	G391100	Car retailing
		G391200	Motor cycle retailing
		G391300	Trailer and other motor vehicle retailing
		G392100	Motor vehicle parts retailing
		G392200	Tyre retailing
G1120	Fuel	G400000	Fuel retailing
G1210	Supermarket and grocery stores	G411000	Supermarket and grocery stores
G1221	Specialised food	G412100	Fresh meat, fish, and poultry retailing
		G412200	Fruit and vegetable retailing
		G412900	Other specialised food retailing
G1222	Liquor	G412300	Liquor retailing
G1311	Furniture, floor coverings, houseware, textiles	G421100	Furniture retailing
		G421200	Floor coverings retailing
		G421300	Houseware retailing
		G421400	Manchester and other textile goods retailing
G1312	Electrical and electronic goods	G422100	Electrical, electronic, and gas appliance retailing
		G422200	Computer and computer peripheral retailing
		G422900	Other electrical and electronic goods retailing
G1313	Hardware, building, and garden supplies	G423100	Hardware and building supplies retailing
		G423200	Garden supplies retailing
G1321	Recreational goods	G424100	Sport and camping equipment retailing
		G424200	Entertainment media retailing
		G424300	Toy and game retailing
		G424400	Newspaper and book retailing
		G424500	Marine equipment retailing
G1322	Clothing, footwear, and accessories	G425100	Clothing retailing
		G425200	Footwear retailing
		G425300	Watch and jewellery retailing
		G425900	Other personal accessory retailing
G1330	Department stores	G426000	Department stores
G1340	Pharmaceutical and other store-based retailing	G427100	Pharmaceutical, cosmetic, and toiletry retailing
		G427200	Stationery goods retailing
		G427300	Antique and used goods retailing
		G427400	Flower retailing
		G427900	Other store-based retailing nec
G1350	Non-store and commission based retailing	G431000	Non-store retailing
		G432000	Retail commission-based buying / selling
H2110	Accommodation	H440000	Accommodation
H2120	Food and beverage services	H451100	Cafes and restaurants
		H451200	Takeaway food services
		H451300	Catering services
		H452000	Pubs, taverns, and bars
		H453000	Clubs (hospitality)

Source: Statistics New Zealand (2010). *Implementing ANZSIC 2006 in the Retail Trade Survey.* Wellington: Statistics New Zealand.

Table A.4. ANZSIC Industry Classification for RET Series

Storetype	Groups
Butcher	• Butchers • Delicatessen
Supermarket/Grocer	• Grocers • Dairies • Supermarkets
Other Food	• Fish Shops • Groceries and Other Food nec • Greengrocers and Fruiterers
Footwear	• Shoe Shops
Clothing and Textiles	• Textiles and General Softgoods • Wearing Apparel • Clothing Accessory Shops nec
Furniture	• Furniture, Soft Furnishings and Floor Coverings
Household Appliances	• Household Appliance, Radio and Television Stores
Hardware	• Paint and Wallpaper Shops • Hardware
Chemist	• Pharmaceutical Supplies, Cosmetics and Toiletries
Department and General	• Department Stores • General Stores
Automotive, Fuel and Repairs	• Motor Vehicles and Motor Cycles (inc parts and accessories) • Other Transport Vehicles nec • Petrol Stations • Repair of Motor Vehicles and Motor Cycles
Restaurants and Takeaways	• Takeaway Food Stores • Tea Rooms, Coffee Houses, Cafeterias, and Unlicensed Restaurants • Licensed Restaurants and Cabarets
Alcohol, (including licensed accommodation)	• Licensed Taverns and Chartered Clubs • Alcoholic Beverages • Licensed Hotels and Motels
Accommodation	• Unlicensed Motels • Private Hotels, Boarding Houses, Guest Houses, Hostels

	• Motor Camps, Caravan Parks, Cabins • Other Accommodation nec
Other Stores	• Agricultural and Gardening Supplies • Pet Shops • Printer Paper Products • Tobacconists • Photographic and Optical Goods Dealers • Watch and Clock Dealers and Jewellers • Music Stores • Sports Goods Dealers • Toys, Novelties, Souvenirs • Art Dealers • Second Hand Dealers

Source: Statistics New Zealand

Appendix Table A.5. **Assignment of RTS industries to "durable" and "non-durable" categories**	
RET Series (May 1982-March 1990)	
Durable	**Non-durable**
Clothing and textiles	Butcher
Department store	Chemist (Pharmaceuticals)
Footwear	Liquor & lic. accommodation
Furniture	Other food
Hardware	Petrol stations
Household appliances	Restaurants and takeaways
Motor vehicles	Supermarket and groceries
Motor vehicle repair	Unlicensed accommodations
Other stores	
RTT Series (May 1995-December 2010)	
Durable	**Non-durable**
Clothing, footwear, and personal accessories	Accommodation
Department store	Food and beverage services
Electrical and electronic goods	Fuel
Furniture	Liquor
Hardware	Pharmaceutical and other stores
Motor vehicle and parts	Specialized food
Non-store and commission-based	Supermarket and groceries
Recreational goods	

Table A.6. Months Allowing for Tax Effects in Intertemporal Substitution Estimation			
	GST Rate Increase		
Category	**October 1986**	**July 1989**	**October 2010**
Total	Aug 1986 - Jan 1987	May 1989 – Oct 1989	Sep 2010 – Dec 2010
Durable	Aug 1986 - Jan 1987	May 1989 – Oct 1989	Sep 2010 – Dec 2010
Non-durable	Sep 1986 - Jan 1987	Jun 1989 – Jul 1989	Sep 2010 – Dec 2010