

17-5 Effects of Consumption Taxes on Real Exchange Rates and Trade Balances

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Abstract

This paper examines the effects of border-adjusted consumption taxes (mainly value added taxes or VATs) in a sample of 34 advanced economies from 1970 through 2015. We find that the real exchange rate tends to rise by the full amount of any consumption tax increase, with little effect on the current account balance and modest offsetting effects on the trade and income balances. Case studies suggest that adjustment comes initially through prices. We note that the border-adjusted cash flow tax of the House Republicans differs in important ways from consumption taxes used in our study, which raises the possibility of a slower adjustment process with temporarily larger trade effects.

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INTRODUCTION

As the United States considers moving to a destination-based cash flow tax, there is growing concern about the impact of the proposed border adjustment on trade.¹ Border adjustment on sales taxes, which tax imports and exempt exports, is a common way of taxing only goods consumed in a country. Most countries perform such border adjustments on value added taxes (VATs). US states effectively border-adjust sales taxes, which apply to all goods consumed in a state, irrespective of where they are produced.

Economic models imply that border adjustment does not affect trade patterns or the trade balance because the real exchange rate (RER) adjusts. But many producers and market participants fear that border adjustment will be protectionist, raising costs and disrupting supply chains. A critical question thus is: Does border adjustment generate an offsetting movement in the real exchange rate or does it work like a tax and export subsidy and raise the trade balance?

We attempt to answer this question by examining the experiences of countries that have implemented VATs and other border-adjusted consumption taxes.² We do it in three ways. First, we examine movements in the RER, the trade balance, and other variables around the dates that countries first implemented a VAT. Second, we use cross-country time-series regressions to examine long-run correlations between consumption tax rates, the RER, and various measures of external balance, while controlling for other variables that would be expected to move the exchange rate and trade. Finally, we consider a handful of case studies.

Overall, our results support the basic theoretical conclusion that RER movements fully offset border-adjusted consumption taxes, including the VAT. Our results also suggest that a large share of the movement in the RER comes via consumer prices. In particular, increases in VAT rates temporarily increase inflation, which permanently changes the RER. There is little evidence of any significant effect of border-adjusted consumption taxes on the current account balance, although there may be different effects on the components of the current account. Most of the adjustment occurs within three years.

The destination-based cash flow tax proposed by the House Republicans³ differs in important ways from border-adjusted consumption taxes used in other countries. In particular, under the border-adjusted cash flow tax (CFT), tax rates vary depending on the firms' labor cost share and international exposure. This key difference implies that the channel of RER adjustment is likely to be different. As Auerbach et al. (2017) note, a VAT requires an increase in consumer prices relative to wages, which may explain the adjustment pattern seen in the data. In contrast, because labor costs can be deducted, a CFT does not

1. "Destination-based" refers to the tax being levied based on the location of the consumer. By taxing imports and exempting exports, border adjustment enables a tax to focus on consumers within a country.

2. The paper focuses on VATs in the event study and on consumption taxes, nearly all of which are border adjusted, more broadly in the regression analysis.

3. *A Better Way: Our Vision for a Confident America—Tax*, June 24, 2016, https://abetterway.speaker.gov/_assets/pdf/ABetterWay-Tax-PolicyPaper.pdf.

require a change in consumer prices relative to wages, so any adjustment may be more likely to come through the nominal exchange rate. The House proposal would tax gross cash flow at 20 percent, which implies a 25 percent tax rate on cash flow net of the tax, and would require a 25 percent RER appreciation in equilibrium.

Although appreciation of the nominal exchange rate would facilitate domestic economic adjustment, it might disrupt the global financial system given the dollar's dominant role in finance. Alternatively, the special role of the dollar could mean that the nominal exchange rate responds only partially to trade pressures, especially if other countries resist the corresponding depreciation of their currencies. Limits on dollar appreciation force adjustment to come through US prices and wages. It would take time for prices and wages to reach a new equilibrium, because wages are set in advance through contracts and the Federal Reserve may not accommodate the full shift. Whether adjustment eventually comes through a 25 percent appreciation or a 25 percent increase in wages and prices or some combination of the two, these adjustments are large, and much larger than the events studied in this paper.

When a VAT is increased, domestic prices often go up almost one for one. As a result, exporters and importers remain indifferent between domestic and foreign markets because the increase in the tax is offset by the increase in the domestic price. In contrast, when a CFT is implemented, the price pressures will vary across industries and even across firms within industries unless the nominal exchange rate adjusts quickly. In the absence of nominal exchange rate adjustment, the result is likely to be a temporary stimulus to domestic production and an improvement in the trade balance.

WHY SHOULD THE REAL EXCHANGE RATE ADJUST TO VALUE ADDED TAXES?

Consider a country implementing a VAT or final sales tax on goods sold domestically. Imports face the tax but exports do not. The process of adjustment depends on the extent to which the tax leads to higher consumer prices. We consider two extreme cases, one in which consumer prices rise by the full amount of the tax, and the other in which consumer prices do not rise at all.

When consumer prices rise by the full amount of the tax, the nominal exchange rate does not need to adjust. The price of exports, which are not taxed, does not rise, and they continue to be sold in foreign markets at the same local price as before. The price of imports, which are taxed, rises by the same amount as domestically produced goods. Assuming that the tax revenue is transferred back to consumers, perhaps through a reduction in other taxes, consumers maintain their total consumption spending.⁴ Moreover, consumers don't have to switch between imports and domestic products because their prices have risen

4. As our focus is on the border adjustment, the relevant comparison is the same tax system, with or without border adjustment. Shifting from a corporate tax to a consumer tax, as proposed in the House blueprint, would likely affect saving and investment. A tax increase designed to reduce the fiscal deficit would also have real effects because consumers would have lower after-tax real incomes.

equally. The trade balance is thus not affected. The RER, which is the exchange rate–adjusted ratio of consumer prices at home to consumer prices abroad, rises by the full amount of the tax.

When consumer prices do not change—because of monetary policy aimed at maintaining stable prices and/or reductions in other business taxes that lower the local cost of production—the nominal exchange rate must appreciate. If it did not, firms would have a strong incentive to increase exports because they would be able to sell them abroad at the same price as at home and avoid paying the tax. Imports, on the other hand, would face the tax but would not cost any less than before. The increased supply of exports and reduced demand for imports would create an imbalance in the foreign exchange market, which would push up the value of the domestic currency. An appreciation exactly equal to the tax rate rebalances the foreign exchange market and keeps exports and imports, and thus the trade balance, unchanged.

A country's trade balance is equal to the gap between domestic saving and domestic investment. If the government returns consumption tax revenues to households, its saving does not rise and households have the same after-tax real income as before. Consumption taxes do not affect the after-tax return on saving or the cost of capital, so there is no reason to expect any change to private saving or investment. Thus, with full RER offset and a constant fiscal balance, border-adjusted consumption taxes should not affect saving, investment, or the trade balance (Feldstein and Krugman 1990).

A uniform VAT rate on consumption is important because it prevents distortions. If the tax is levied more heavily on some products, then there will be an incentive to shift away from those goods. In practice, most countries exclude some services, such as education, government, and health, as well as basic foodstuffs. Doing so is problematic because it encourages a shift toward these generally nontraded goods.⁵ Another distortion arises because tourists should pay the tax rate of their home country but in practice pay the tax rate of the country they are visiting. When these tax rates differ, demand shifts toward the country with the lower tax rate.

Exempt sectors and tourism tend to represent a sizable share of consumption. The VAT revenue ratio measures the extent to which the tax covers all goods and services. It is defined as actual VAT revenue divided by revenue that would be collected if all consumption were taxed at the VAT rate. It equals 1 if the VAT is broad based and properly administered. It is less than 1 if some sectors are untaxed or if collection is uneven. It can exceed 1 if some export rebates are absent or if a country has a tourism surplus.

As shown in table 1, even among OECD countries, VAT revenue ratios are well below 1, averaging just 0.55, and have remained roughly unchanged over the last decade.

The difference between a VAT and a border-adjusted CFT is that price adjustment is more complex under a CFT. To the extent that the nominal exchange rate does not appreciate quickly and fully, prices of imports and goods with imported content are likely to rise substantially. It is less clear what happens to

5. The exceptions also generate incentives for tax fraud by mis-invoicing some taxable goods as nontaxable. They may also push some transactions into the informal economy.

other goods. To fully adjust to the tax, both prices and wages have to rise. Given labor contracts, adjustment could take longer than with a VAT.

In contrast, if adjustment comes through the nominal exchange rate appreciation it could neutralize the border-adjusted CFT more rapidly. Given the dollar's status as the world's premier reserve currency and a major target of pegged exchange rates, it is not clear how far or fast adjustment would proceed through this channel.

PREVIOUS STUDIES ON THE ECONOMIC EFFECTS OF CONSUMER TAXES

A few studies examine the effect of VATs on trade flows, employment, and prices. Desai and Hines (2005) use data from 168 countries for 1950–2000 and find that countries with a VAT export 10 percent less and have lower overall openness than countries without a VAT. They also find that subsidiaries of US multinationals in VAT countries tend to export less. They argue that exports are lower because VATs tend to be higher on traded goods than nontraded goods (as shown by the relatively low VAT revenue ratios reported above), which pushes production and consumption into nontradables. Incomplete VAT rebates to exporters compounds the shift of resources toward nontradables.

Nicholson (2010) uses panel data from 12 years, 29 industries, and 146 countries to examine the effect of VAT and US corporate income tax on US competitiveness. Like Desai and Hines, he finds that VATs tend to reduce trade, both imports and exports, and that the effects differ across sectors. He also finds that VATs in developing countries tend to affect US exports but not imports and interprets this finding as evidence that VAT may be disproportionately applied to goods entering a country, acting as a barrier to trade. He also explores the relationship between the US corporate income tax and foreign VATs in a cross section gravity model. The results show reduced US exports and expanded US imports in country-industries where corporate taxes are highest and VATs are present, offering some evidence that border adjustments in other countries coupled with existing US corporate income tax hurt US competitiveness.

The study most closely related to the proposed border adjustment on a cash flow tax is by De Mooij and Keen (2012), who examine the economic effects of shifting taxation away from labor and toward consumption. They show that such fiscal devaluations have large short-term positive effects on employment and trade balances, especially in eurozone countries. Because each euro member's currency is determined by the group, no single member can appreciate to offset these events. Effects on noneuro countries are slightly smaller and not as statistically significant, although positive short-run effects remain.

A larger body of literature focuses on the price effects of implementing a VAT.⁶ The studies find that in countries where a VAT replaces sales taxes there are no price effects; in contrast, in countries where the share of revenues from consumption taxes increases, there tends to be a one-time increase in prices. Studies

6. See Zodrow et al. (2010) for a summary. Benedek et al. (2015) find similar results.

that examine rises in VAT rates find that prices tend to rise almost one for one with VAT rates. Overall, the results are consistent with a full one-time offset of VAT in the price level.

Methodology and Data

We take two approaches. First we look at the effects of a new VAT on prices, real exchange rates, and trade balances, both on average across countries and on a few specific cases. The advantage of this approach is that these are big events, often with large increases in the tax and the associated border adjustment. The disadvantage is that other taxes are being phased out, some of which may be border adjusted. The VAT is often part of a larger reform package, which may confound exchange rates and trade balances. In addition, in many cases a VAT is implemented in response to a fiscal crisis.

The second approach is a more comprehensive econometric analysis, which focuses on fluctuations in consumer taxes over time and across countries. The advantage of this approach is that it allows us to control for other factors that affect exchange rates and trade balances. The disadvantage is that factors besides policy changes, such as changes in consumption of taxable goods, may cause fluctuations in the goods and services tax share of consumption. To minimize the effect of cyclical changes in consumption, which may fall more heavily on highly taxed goods, we focus on long-run relationships in the data.

Most of the data are from 34 OECD countries.⁷ Data on current account balances and net international investment positions are from the External Wealth of Nations dataset.⁸ Missing data are filled in from the International Monetary Fund's (IMF) *World Economic Outlook* database where available. We exclude a few observations from transition economies in Eastern Europe before 1995 out of concern about the reliability of the initial posttransition data. We also exclude Luxembourg because its role as a financial center and electronic commerce hub distorts its measured consumption tax rate.⁹

The data are annual from 1970 through 2015. Data for many countries are missing in the first half of this sample; 2015 data are missing for a few countries.

In principle, the RER depends on relative consumption tax rates at home and abroad. For the regression analysis, we use bilateral RERs based on consumption deflators between each country and a fixed partner country and measure the relative consumption tax rates as the ratio $(1 + \text{home tax rate}) / (1 + \text{partner tax rate})$. Control variables are also expressed relative to partner country values. The partner countries are either the United States or Germany. For the external balance regressions, we use only the home tax rate, but the results are not affected much if we compare external balances against a partner country and use the ratio of

7. OECD Annual National Accounts and Revenue Statistics databases.

8. The dataset is available at www.imf.org/external/pubs/ft/wp/2006/data/update/wp0669.zip.

9. Despite no tax increase, upward trends in the effective consumption tax rate and the goods and services trade balance have been strong in Luxembourg since 1992. Financial services provided to other EU countries pay VAT on inputs but do not receive a rebate. In addition, exports of electronic services, telecommunications, and broadcasting services are subject to VAT in Luxembourg (OECD 2014a).

tax rates. For the case studies, we focus on behavior in the country implementing a pronounced change and measure the exchange rate as the trade-weighted RER.¹⁰ The primary measure of the trade balance (BAL) is the current account balance (CAB). However, we also examine the goods and services trade balance (GSB) and the difference between the CAB and the GSB, which is the balance on income and transfers (INC). All balance measures are expressed as percents of nominal GDP.

Goods and services tax revenue (GSREV) are taxes on goods and services transactions, including VAT, sales taxes, excise taxes, and tariffs.¹¹ All of these taxes are border adjusted, so that imports incur the tax and exports do not.¹² Household consumption (CONS) is in nominal terms.

WHAT HAPPENS AFTER A VAT IS ADOPTED?

Analyzing the effect of introducing a VAT with border adjustment depends on what taxes are being replaced and whether the total tax burden is rising or falling. If other types of sales taxes that are also border adjusted are replaced, the effect on the RER will be minimal. In contrast, if corporate or income taxes are replaced, one would expect the effects to show up in the exchange rate.

Table 2 lists the OECD countries and the year VAT was adopted, the VAT rate, and the taxes that were replaced. In most cases, VATs were introduced to replace other more distortionary turnover taxes. The problem with a sales tax that applies to all goods is that it taxes intermediates twice—once when they are sold and again when the final good in which they are an input is sold. Like VATs, they are largely border adjusted, because imports face the tax but exports do not. However, the border adjustment is incomplete, because rebates are not provided on sales taxes paid on intermediates of exported goods.

After VATs were introduced, most countries recorded an increase in the share of tax revenue from goods and services taxes—in part because VATs require fewer exceptions and can be charged more broadly and at a higher rate, without the distortions a sales tax creates.

Figure 1 shows the movement of exchange rates, prices, and trade balances in countries around the time VATs were imposed. Panel A shows results for the maximum number of countries that have data for four years before and after implementation in each series. Panel B shows results for 10 countries that have data in all series. The upper left charts in panels A and B show the change in the tax rate—measured using OECD data on goods and services taxes as a share of consumption. On average, the share of goods and services taxes in consumption increased by 1.5 percentage points when the VAT was implemented. In New Zealand, Poland, Portugal, and Spain, which also reduced income taxes, the increase was above 3 percentage points. To the extent that some of the taxes in the measure may not have been border adjusted—for example, turn-

10. Data on trade-weighted exchange rates are from the World Bank's *World Development Indicators*.

11. In these countries tariff rates are low and stable, and taxes on exports are uniformly zero.

12. It is possible that some of the non-VAT taxes are not rebated on exports, but we believe such nonadjusted taxes are a tiny share of revenues.

over taxes charged on intermediates to exports—one would still expect to see some evidence of exchange rate appreciation around the time the VAT was implemented if the border adjustment works.

The remaining charts in panels A and B show average movements in the inflation rate, the trade-weighted real exchange rate, the dollar real exchange rate, the current account relative to GDP, and the goods and services trade balance relative to GDP, for a balanced sample of countries.¹³ There is strong evidence that inflation increased and the RER appreciated following VAT implementation.

While the current account generally improved throughout the period, it does not appear to have been associated with VAT implementation, as the upward trend precedes the introduction of VAT. Importantly, the goods and services trade balance to GDP stabilized at the time of VAT implementation.

REGRESSION ANALYSIS

We next use the full panel dataset to estimate the effect of changes in the effective consumption tax rate (GSREV/CONS) on RERs and external balances. We ran panel unit root tests on all measures of RER, BAL/GDP, and GSREV/CONS. We reject that these series are nonstationary in every country. However, we also reject that these series are stationary in every country. Plots of these data display trending behavior of GSREV/CONS in some countries and RER and BAL/GDP in a few countries.

Given the apparent mixture of stationary and nonstationary data, we analyze the data using both cointegration and conventional frameworks. The results are rarely sensitive to the choice of framework. The estimated equations are shown below, where Y denotes either the real exchange rate (RER) or the external balance (BAL/GDP).

Cointegration framework:

$$\Delta Y_{it} = \beta \{Y_{it-1} - \alpha (\text{GSREV/CONS})_{it-1} - \Lambda \text{Controls}_{it-1}\} + \text{country effects} + \text{year effects} \quad (1)$$

$$+ \Gamma (\Delta Y_{it-1}, \Delta(\text{GSREV/CONS})_{it+1}, \Delta(\text{GSREV/CONS})_{it}, \Delta(\text{GSREV/CONS})_{it-1}, \Delta \text{Controls}_{it})$$

Conventional framework:

$$Y_{it} = \alpha (\text{GSREV/CONS})_{it} + \Lambda \text{Controls}_{it} + \beta Y_{it-1} + \Gamma (\Delta Y_{it-1}, \Delta(\text{GSREV/CONS})_{it}, \Delta \text{Controls}_{it}) + \text{country effects} + \text{year effects} \quad (2)$$

Equation (1) is estimated by a dynamic fixed effects algorithm. The coefficient α represents the long-run effect of the consumption tax rate and β represents the speed of adjustment to the long-run relationship. Equation (2) is estimated by ordinary least squares (OLS). The long-run effect is given by $\alpha/(1-\beta)$.

A notable difference between the two frameworks is the inclusion of additional dynamic terms on the tax rate variable in equation (1). In particular, the lead difference term controls for possible short-run endo-

13. Countries with average inflation rates above 10 percent in the four years before the VAT was implemented were excluded from the inflation graph.

generosity of the consumption tax rate to either the real exchange rate or the external balance. For example, a cyclical boom may push up RER and push down BAL/GDP at the same time that it increases GSREV/CONS because tax rates may be higher on cyclically sensitive goods. We want to exclude such a transitory correlation and focus on the long-run changes in GSREV/CONS, which we assume are driven by policy choices and not economic shocks.

We view the cointegration results as more conservative than the conventional results because the conventional framework may find spuriously significant results when the data are truly nonstationary. There are strong economic grounds for arguing that these data should be stationary, but if a series is not long enough, it may behave like a nonstationary series.

In the simple theoretical model discussed above, the RER should rise in proportion to any increase in the border-adjusted tax rate on consumption (GSREV/CONS), implying that $\alpha = 1$ in equation (1) and $\alpha/(1-\beta) = 1$ in equation (2). The same model implies that GSREV/CONS should have no effect on the external balance, so that $\alpha = 0$ in equation (1) and $\alpha/(1-\beta) = 0$ in equation (2).

Control variables include general government revenues (percent of GDP); general government fiscal balance (percent of GDP); purchasing power parity (PPP)–adjusted per capita income (log ratio to US per capita income); and net international investment position (percent of GDP).

Real Exchange Rates

Table 3 presents our basic results for the effect of consumption taxes on RERs using the cointegration framework. The top half displays results using the RER against the United States and the bottom half displays results using the RER against Germany. Because the RER responds to factors both at home and abroad, the explanatory variables are expressed as differences between the home country value of the variable and the partner country value.¹⁴ The partner country, either the United States or Germany, is excluded from the regressions. All regressions include a full set of country fixed effects to control for differences across countries that are stable over time.¹⁵

The table displays long-run coefficients on all variables that were included in the cointegrating vector. We do not display the short-run coefficients or the estimated country and year fixed effects. The bottom row displays the error correction coefficients, which capture the speed of adjustment to long-run equilibrium, about 20 percent per year. These coefficients are always highly significant, suggesting that the data are either cointegrated or stationary.

14. In principle, we could have specified the regressions using each country's trade-weighted real exchange rate, but doing so would have required us to construct country-specific trade-weighted measures of the foreign explanatory variables.

15. Country fixed effects are required in these regressions because the real exchange rates are indexes set to 100 in 2010 and thus contain no information on absolute price differences across countries.

Column 1 displays results with a full set of control variables and year effects. Column 2 shows results with all control variables but no year effects. Columns 3 and 4 show results dropping the fiscal balance, the variable with the largest number of missing observations. The change in the estimated consumption tax effect (the first row) reflects the additional observations and not the omission of the fiscal variable.¹⁶ Finally, columns 5 and 6 display results using only the consumption tax rate and country and year effects.

The first row of each half of the table displays the estimated effect of the consumption tax rate on the real exchange rate. With the United States as partner country, the average value is 1.7. With Germany as partner country, the average value is 0.7. The overall average is 1.2.

The large differences in the estimates across specifications probably reflect the fact that real exchange rates are far more volatile than consumption tax rates. For the typical country and year, the real exchange rate against the United States appreciates or depreciates by 11 percent, whereas the consumption tax rate (relative to the United States) rises or falls only 1 percent.¹⁷ We have a slight preference for the results shown in column 3 because this specification uses a large number of control variables while retaining most of the available observations. However, the other specifications also provide a useful sense of the considerable uncertainty surrounding any one estimate.

Statistical significance is conventionally measured as a two-tailed test of deviations from 0 in either direction. The asterisks next to the coefficient estimates denote this conventional measure of significance at the traditional 1, 5, and 10 percent levels. However, we are particularly concerned about the hypothesis of full exchange rate offset of consumption taxes, $\alpha = 1$. Thus, two rows at the end each half of the table display one-tailed tests of the hypotheses that $\alpha = 0$ and $\alpha = 1$. We reject $\alpha = 0$ in favor of $\alpha > 0$ in four of six regressions against the United States and one of six regressions against Germany. We never reject $\alpha = 1$ in favor of $\alpha < 1$. In other words, the results are consistent with a one-for-one real exchange rate adjustment in response to changes in the VAT in the long run.

One measure of the short-run response of RER to GSREV/CONS is the sum of the estimated coefficients on the lead, contemporaneous, and lagged changes in GSREV/CONS. The average value of this sum for the regressions in table 3 is 0.44, implying that the real exchange rate moves by 44 percent of any change in relative consumption tax rates by the year after the tax rate changes.

Table 4 displays results based on the conventional framework. The results are broadly similar to those of table 3. The average long-run effect of the consumption tax rate on the real exchange rate is 1.3 and the average short-run effect (the sum of the coefficients on the contemporaneous level and change in GSREV/

16. The coefficient on the consumption tax rate is virtually unchanged by dropping the fiscal variable in column 1 and restricting the regression to the same 892 observations. This is also true in the bottom half of the table.

17. We define "typical" as one standard deviation in the annual change of a variable. Typical RER movements against Germany are smaller (7 percent) because many countries in the sample are either in a currency union with Germany or target their exchange rates with Germany.

CONS) is 0.40. The one-tailed tests of $\alpha/(1-\beta) = 0$ are significant (in favor of $\alpha/(1-\beta) > 0$) at the 10 percent level in 10 of 12 regressions and the tests of $\alpha/(1-\beta) = 1$ are never significant.

The results broadly support the hypothesis of full exchange rate offset of changes in consumption tax rates. However, the results depend greatly on which country (the United States or Germany) is the partner country. The existence of fixed exchange rates between some countries may imply a different pattern of dynamic adjustment relative to floating exchange rates. For this reason, we also ran equation (2) separately on (a) euro area countries plus Denmark starting in 1999 and (b) non-euro-area countries excluding Denmark.¹⁸ For the former countries (about one-quarter of the full sample), we use Germany as the partner country and for the latter countries (about one-half of the full sample) we use the United States. About one-quarter of the sample is lost owing to pre-1999 years for euro members and late joiners to the euro area.

For the non-euro-area countries, the results are similar to the full sample results, with average long-run tax rate coefficients that are never significantly different from those of the top half of table 4 and that have an average value of 1.3. For the euro area countries, the coefficients vary considerably across specifications with large standard errors, raising the likelihood of too small of a sample for the number of parameters being estimated. The coefficients are never significantly different from those of the bottom half of table 4 but the average value of the coefficients is somewhat lower, at 0.5.

Trade Balances

Table 5 displays our basic results for external balances in the cointegration framework. The top displays results for the current account balance; the middle displays results for the goods and services trade balance; and the bottom displays results for the difference between the first two: the balance on income and transfers. In each case, a country's external balance refers to its trade with the rest of the world and we therefore do not need to specify the explanatory variables as differences between values in the home and partner countries.

The estimated effects of the consumption tax rate on the current account are all close to 0 and only one is significantly different from 0. The goods and services trade balance coefficients are uniformly higher and three out of six are significantly positive. The income and transfers coefficients are all negative and four out of six are statistically significant. The short-run effects, measured as the sum of coefficients on the changes in consumption tax rates, are about two-thirds of the long-run effects for goods and services trade and half of the long-run effects for income and transfers. Thus, most of any long-run change in the external balance happens by the year after the tax rate changes. The error correction coefficients are a bit larger than the

18. Denmark has maintained a tightly fixed exchange rate against the euro since 1999. We include Greece, which joined at the beginning of 2001 but exclude countries that joined the euro area after 2001.

coefficients for the RER, with a long-run adjustment speed of about 20 to 25 percent per year; they are always highly significant.

Table 6 displays analogous results using the conventional framework. Although the overall pattern is similar to that of table 5, the coefficient values are uniformly lower for the current account and the goods and services trade balance. None of the current account coefficients is significantly different from zero. Two of the goods and services coefficients are significantly positive. The results for income and transfers are nearly identical to those of table 5, with four of six significantly negative. Put simply, the results are consistent with changes in the VAT having no significant effect on the current account in the long run.

Overall, the results in tables 5 and 6 suggest that consumption taxes have little effect on the current account balance, but they tend to lower net income and transfer payments and to raise net goods and services exports. We conjecture that by raising the real exchange rate, consumption taxes reduce the value of income received from foreign investments and transfers relative to the value of payments to foreigners on their investments and to outgoing transfers from domestic residents. The higher RER also reduces the net international investment position of domestic residents and thus reduces their real wealth. This reduced wealth may increase saving and thus spur an increase in net exports. Based on a typical coefficient of 0.2 for the trade balance and -0.2 for the income and transfers balance, a 10 percentage point increase in the consumption tax rate—which is an order of magnitude larger than the typical yearly movement and larger than any yearly change in our sample—would be expected to raise the trade balance by 2 percent of GDP and reduce the income and transfers balance by an equal amount, leaving the current account unchanged.

FOUR CASE STUDIES

The results presented above are broadly consistent with full exchange rate offset, but there are potential concerns with both methodologies. The event study suffers from confounding effects from the type of tax reform. The regression analysis allows us to control for other factors, but the coefficients are not precisely estimated. As a final attempt to understand the effect of border adjustment, we examine the consequences of a VAT introduction or increases in four countries where one would most expect to see adjustment and that are relevant for the United States.

New Zealand

New Zealand is the cleanest example in our sample. It implemented a 10 percent value added tax in October 1986, which was raised to 12.5 percent in 1989 and 15 percent in 2010 (Benge, Pallot, and Slack 2013). The tax is uniquely broad-based: It applies to government transactions and excludes only residential rents and financial services, reflected in the VAT revenue ratio of nearly 1 (table 1). As the VAT largely

replaced corporate and income taxes, there was a notable adjustment in the share of goods and services taxes in consumption. The border adjustment, therefore, was new.

Much of the initial adjustment happened via inflation. Inflation (measured relative to the same quarter the previous year) averaged 11 percent during the first three quarters of 1986, then jumped to 18 percent in the four quarters after the tax was introduced (table 7). Put differently, the 10 percent tax was accommodated by a one-time increase in the rate of inflation of 7 percent. The jump in prices mirrors the expansion in the share of goods and services taxes in consumption, which rose from 12 percent in 1985 (the year before the VAT was implemented) to 20 percent in 1987 (the first full year of the tax). These results are consistent with evidence reported in Zodrow et al. (2010) that rising VAT rates contribute to a one-time increase in prices. The price increase fed into the RER, which appreciated by 15 percent between 1986 and 1987 (figure 2).

The case of New Zealand offers evidence that the broad-based VAT was associated with a one-time real appreciation that offset the tax. The evidence suggests that the initial mechanism for the adjustment was via prices. Indeed, the real exchange rate jumped by more than the consumption tax rate, although the effect likely reflected the financial market's positive assessment of the entire package of reforms, which improved the fiscal outlook and relaxed many domestic regulations.

Figure 2 also shows the current account balance in New Zealand around the time of implementing the VAT. Overall, there was some increase in the current account balance over the period, but it started doing so before the change occurred. The shift from income to consumption taxes would be expected to increase saving, which would improve the current account over time.

Australia

In July 2000 Australia introduced a 10 percent VAT, which largely replaced other indirect sales taxes. Despite flat or decreasing total revenue in GDP, the share of goods and services taxes in consumption increased by nearly 2 percent.

The overall impact should have been lower than in New Zealand, since the shift to border-adjusted taxes was smaller. The period was associated with rising inflation in the short run. The jump in the inflation rate of 3 percentage points (table 7) closely matched the increase in the consumption tax rate. The real exchange rate, however, did not appreciate at the time VAT was adopted. In addition, the current account to GDP ratio temporarily increased, suggesting that the border adjustment may have temporarily fed into the trade balance. Over the next two years it reversed, with no medium run change in the current account (figure 2).

Canada

Canada introduced a 7 percent VAT in 1991, which was later reduced to 5 percent in the mid-2000s. The tax largely replaced a sales tax on manufacturers that had been in place since 1924. The manufacturer's tax cascaded through the value chain and was regressive, subjecting it to complaints and a series of reports suggesting reform from as early as the 1930s (Bird and Gendron 2009).

The new VAT was combined with provincial sales taxes, which were turned into VATs, some immediately. The share of goods and services taxes in consumption was flat, but including provincial taxes, which were added on top, the overall increase was larger. In addition, the tax was applied to a much broader base than the previous manufacturer's tax and was border adjusted to a greater extent than the manufacturer's tax. Still, given the conversion of sales taxes, we expect only a small change in prices and the exchange rate.

The tax had a small and immediate effect on prices and the real exchange rate (figure 2). The current account balance as a share of GDP remained unchanged.

The price change is apparent immediately in quarterly data (table 7). Although the increase was relatively modest, the conservative government that enacted the tax lost the next election. Sullivan (2011) writes, "The Canadian experience confirms every politician's instinct that supporting a VAT is career suicide." But, he also calls the case for the VAT "compelling," as it solved Canada's budget problems without increasing the size of government. Despite the next government campaigning to remove the tax and sweeping the election, the VAT remains in place to this day.

China

In 1994, China implemented a 17 percent VAT on goods, with a reduced rate of 13 percent on staples. The VAT applied only to goods, with a separate business tax covering services. It deviated from a broad-based VAT in several other respects as well: For example, some capital expenditures were not deductible, and input rebates for exports varied by sector (Yan 2011).

The tax replaced a cascading turnover tax and allowed for lower corporate income taxes. The turnover tax did not allow deduction of taxes paid on intermediates, which meant that taxes cascaded up the value chain. The VAT raised significant revenue, accounting for over 40 percent of total tax revenue when it was implemented.

China also began pegging the yuan to the dollar in 1994. As a result, the nominal exchange rate could not adjust to the VAT. The VAT was implemented during a period of high inflation. Nevertheless, a sharp one-time increase in prices after VAT implementation is visible. The rate of inflation jumped from 17 to 22 percent in the first quarter VAT was applied (table 7). The price change facilitated a real exchange rate appreciation. In contrast, the current account remained relatively stable in the years after the VAT was

implemented. The experience of China is also consistent with the real exchange rate adjusting to offset the border adjustment in the tax.

CONCLUSIONS

This paper largely supports the theoretical assertion that a country's real exchange rate rises in proportion to any increase in its border-adjusted consumption taxes, with little effect on the current account balance. However, the border-adjusted cash flow tax being considered in the United States differs in important ways from the consumption taxes we examine, raising the possibility of a slower and more complicated adjustment.

Real Exchange Rates

The event study and case studies generally find evidence of a positive effect of border-adjusted consumption taxes on the real exchange rate. Much of the adjustment comes through consumer prices. In some cases, the nominal exchange rate also appreciated and the RER appreciated by even more than the increased tax rate. This excess adjustment probably reflects other reforms that accompanied VAT increases that financial markets viewed positively.

The regressions support the hypothesis of full exchange rate offset ($\alpha = 1$) significantly more than the hypothesis of no exchange rate offset ($\alpha = 0$). One-tailed tests that the offset is greater than 0 are significant in five of 12 cases at the 10 percent level in the cointegration framework and 10 of 12 cases in the conventional framework. One-tailed tests that the offset is less than 1 are never significant.

The degree of offset is not precisely estimated. Point estimates range from 0.5 to 3.1. This imprecision almost certainly reflects the dominant role of factors other than consumption taxes, including factors not readily observable, in exchange rate behavior. Exchange rates are highly volatile, and economists have had scant success in explaining them.

External Balances

The event study and case studies find no evidence of any strong effect of border-adjusted consumption taxes on the current account balance. In some cases, the current account increased moderately around the time of a VAT increase, but many VAT increases were associated with increases in the fiscal balance, which would restrain demand for imports.

The regressions find some evidence for a moderate effect of consumption tax rates on the components of the current account balance: the goods and services trade balance and the income and transfers balance. Median point estimates are around 0.2 for trade and -0.2 for income and transfers. One possible explanation is that the consumption tax has a small positive effect on the goods and services balance that is offset

by a small negative effect on the investment income balance, reflecting the decline in profits on foreign investment caused by the real exchange rate appreciation. Goods and services and investment income are typically the two largest components of the current account.

Implications for the Destination-Based Cash Flow Tax

In the long run, changes in policy are accommodated by changes in the real exchange rate, exactly as theory predicts. The event study and the case study analysis reveal that adjustment to the new equilibrium is complete within about two years, with much of the adjustment happening immediately through prices. The regression analysis finds somewhat slower adjustment, although more than half of adjustment seems to occur within three years. To the extent that bold tax reform is a rare event that takes place every 30 years or so, a three-year adjustment is not too worrisome.

Three important caveats are worth noting. First, the United States is a large country that controls the world's reserve currency. While movement in the nominal exchange rate could immediately offset the border adjustment of the cash flow tax, the extent to which dollar movements reflect trade relative to financial flows may be quite small in practice. In addition, the dollar's special role in global trade and finance, and the fact that a number of countries' exchange rates are tied to the dollar, could mute this channel.

Second, the proposed border-adjusted CFT is different from a VAT or sales tax, for which prices do most of the adjustment. In the absence of rapid exchange rate appreciation, adjustment requires increases in both prices and wages, which would likely take longer and be more complex. If wages are slow to adjust, there would likely be real effects on employment and trade in the short run. There is also a question of the extent to which the Federal Reserve would accommodate the change.

Third, the size of the proposed CFT is larger than other taxes. Most other countries have raised border-adjusted consumption taxes in small steps, requiring only small price increases or exchange rate appreciations. The shift to the destination-based CFT, as proposed in the House blueprint, would require a 25 percent appreciation or a 25 percent increase in wages and prices. The magnitude of the change is far outside our sample and could create additional concerns for the global financial system and for consumer price and wage inflation.

If the exchange rate does not immediately adjust, or adjusts only partially, real trade effects are likely. During the adjustment period, exporting and import-competing firms would benefit, while retailers and firms using imported inputs would suffer.

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Table 1 VAT rates and VAT revenue ratios

Country	Standard VAT		
	rate, 2012 (percent)	VAT revenue ratio, 2000	VAT revenue ratio, 2012
Australia	10	n.a.	0.47
Austria	20	0.61	0.59
Belgium	21	0.5	0.48
Canada	5	0.5	0.48
Chile	19	0.64	0.64
Czech Republic	20	0.42	0.57
Denmark	25	0.6	0.59
Estonia	20	0.72	0.7
Finland	23	0.61	0.56
France	19.6	0.5	0.48
Germany	19	0.6	0.55
Greece	23	0.49	0.37
Hungary	27	0.52	0.52
Iceland	25.5	0.59	0.45
Ireland	23	0.62	0.45
Israel	16	0.62	0.64
Italy	21	0.43	0.38
Japan	5	0.68	0.69
Korea	10	0.59	0.69
Luxembourg	15	0.76	1.13
Mexico	16	0.28	0.31
Netherlands	19	0.57	0.53
New Zealand	15	0.99	0.96
Norway	25	0.67	0.57
Poland	23	0.42	0.42
Portugal	23	0.6	0.47
Slovak Republic	20	0.44	0.43
Slovenia	20	0.67	0.58
Spain	18	0.52	0.41
Sweden	25	0.52	0.56
Switzerland	8	0.74	0.71
Turkey	18	0.45	0.4
United Kingdom	20	0.47	0.44
<i>Average</i>	18.7	0.57	0.55

n.a. = not available

Note: VAT revenue ratio is actual VAT revenue divided by revenue that would be collected if all consumption were taxed at VAT rate.

Source: OECD (2014b).

Table 2 VAT implementation dates and rates

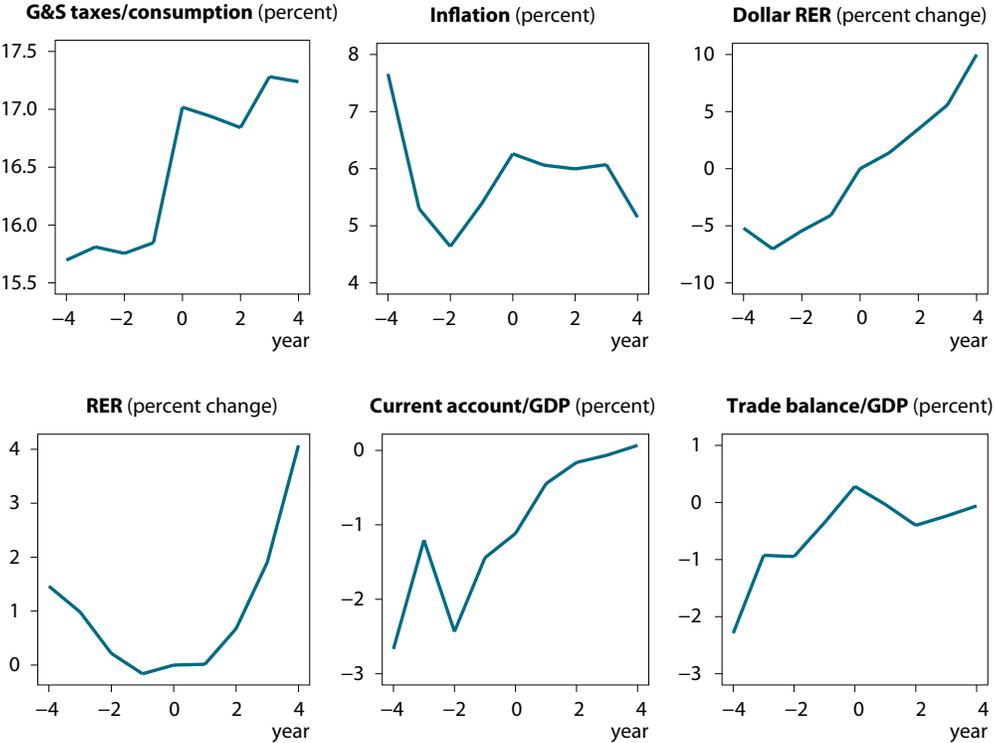
Country	Year implemented	VAT rate	Taxes replaced
Australia	2000	10% goods and services tax (VAT)	State indirect taxes and income taxes
Austria	1973	16% VAT, reduced rate 8%	Cascade turnover tax
Belgium	1971	Four-rate VAT: standard 18%, 6%, 14%, 25%	Cascade turnover tax
Canada	1991	7% goods and services tax (VAT)	Manufacturers' sales tax (MST)
Switzerland	1995	6.5% VAT	Sales tax on goods
Chile	1975	20% VAT	Cascade sales tax, other indirect taxes
Czech Republic	1993	23% VAT, reduced rate 5%	Turnover tax
Germany	1968	10% VAT, reduced rate 5%	Cascade turnover tax
Denmark	1967	10% VAT	Wholesale tax
Spain	1986	Three-rate VAT: standard 12%, 6%, 33%	Cascade sales tax, other indirect taxes
Estonia	1992	10% VAT	Turnover tax
Finland	1994	22% VAT	Turnover tax
France	1968	16.66% VAT	Earlier VAT
United Kingdom	1974	10% VAT	Purchase tax and selective employment tax
Greece	1987	Four-rate VAT: standard 16%, 3%, 6%, 36%	Stamp duties, business turnover tax
Hungary	1988	Multiple-rate VAT: top rate 25%	Turnover tax
Ireland	1972	Four-rate VAT: 5.26%, 11.11%, 16.37%, 30.26%	Wholesale and turnover tax
Iceland	1990	24.5% VAT	—
Israel	1976	8% VAT	None
Italy	1973	12% VAT	—
Japan	1989	3% Consumption tax (VAT)	Other indirect and excise taxes
Korea	1977	10% VAT	Cascade turnover tax, other indirect taxes
Latvia	1995	18% VAT	Turnover tax
Luxembourg	1971	8% VAT, reduced rate 4%	—
Mexico	1980	10% VAT	—
Netherlands	1969	12% VAT, reduced rate 4%	Cascade turnover tax
Norway	1969	20% VAT	General sales tax
New Zealand	1986	10% VAT	Income tax
Poland	1993	22% VAT, reduced rate 7%	Turnover tax
Portugal	1986	Three-rate VAT: standard 16%, 8%, 30%	Tax on transactions and other indirect taxes
Slovak Republic	1993	23% VAT, reduced rate 5%	Turnover taxes
Slovenia	1999	20% VAT, reduced rate 8.5%	—
Sweden	1969	10% VAT	Retail sales tax
Turkey	1985	10% VAT	Other indirect taxes

— = no information available

Sources: National sources and OECD reports.

Figure 1 Changes in exchange rates, prices, and trade balances following implementation of VAT

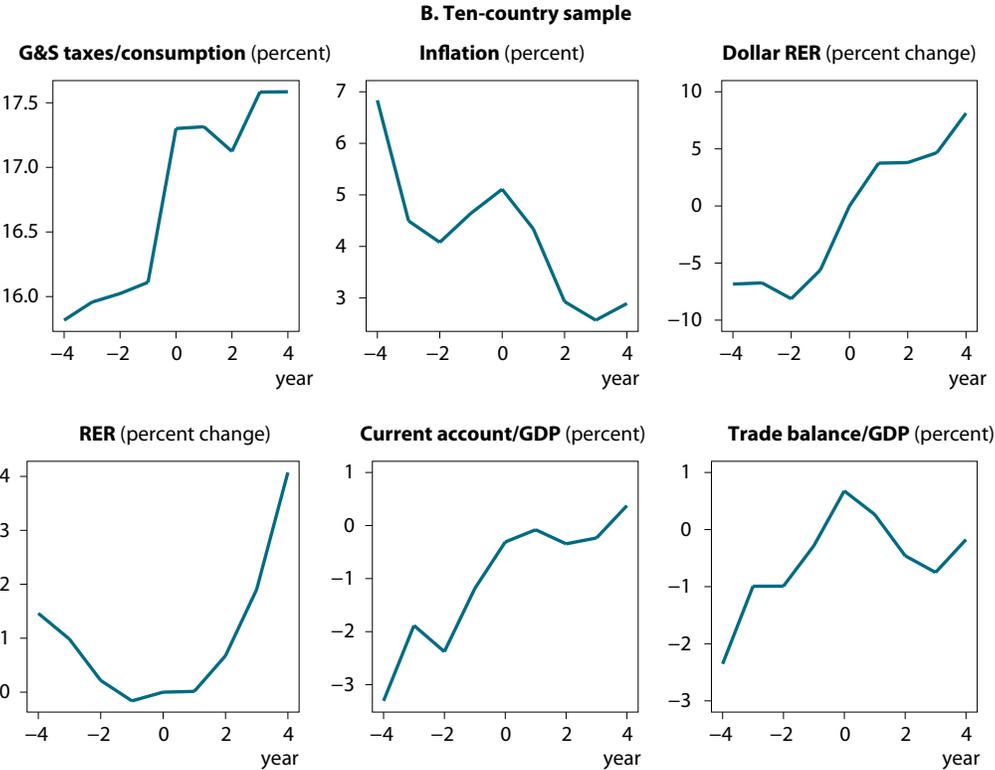
A. All countries for which data were available



Notes: Graphs are based on all countries for which data were available: 12 for goods and services (G&S) tax revenue as a share of consumption, 14 for inflation, 14 for the real dollar exchange rate, 10 for the trade-weighted real exchange rate (RER), 14 for the current account as a share of GDP, and 12 for the trade balance as a share of GDP.

(figure continues)

Figure 1 Changes in exchange rates, prices, and trade balances following implementation of VAT (continued)



Note: The sample consists of Australia, Canada, Finland, Greece, Iceland, Japan, New Zealand, Portugal, Switzerland, and Spain. The inflation graph excludes countries with average inflation above 10 percent during the four years before tax reform.

Source: Authors' calculations using data described in text.

Table 3 Cointegrating regression of real exchange rate on consumption tax rate, 1970–2015 annual, equation (1), long-run cointegration coefficients

Partner: United States	1	2	3	4	5	6
Goods & services tax rate	3.11*** (1.07)	2.17* (1.26)	1.16 (0.79)	0.70 (0.90)	0.75 (0.74)	2.04** (0.81)
Fiscal balance	1.10** (0.50)	2.58*** (0.51)				
Government revenue	-1.05 (0.69)	0.58 (0.82)	0.11 (0.55)	1.76*** (0.62)		
Relative per capita income	0.41*** (0.10)	0.51*** (0.12)	0.30*** (0.09)	0.57*** (0.11)		
Net investment position	-0.06* (0.03)	-0.08** (0.04)	-0.03 (0.03)	-0.03 (0.04)		
Error correction	-0.19*** (0.02)	-0.22*** (0.02)	-0.17*** (0.02)	-0.20*** (0.02)	-0.17*** (0.02)	-0.17*** (0.01)
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.69	0.28	0.67	0.24	0.61	0.16
Observations	892	892	1120	1120	1164	1164
$\alpha > 0$	***	**	*			***
$\alpha < 1$						
Partner: Germany	1	2	3	4	5	6
Goods & services tax rate	0.83 (1.15)	0.73 (1.00)	1.04 (0.64)	0.48 (0.57)	0.61 (0.61)	0.61 (0.61)
Fiscal balance	0.94** (0.43)	0.15 (0.32)				
Government revenue	-1.76*** (0.67)	-1.72*** (0.55)	-0.02 (0.42)	-0.09 (0.33)		
Relative per capita income	0.54*** (0.11)	0.57*** (0.06)	0.22*** (0.07)	0.32*** (0.04)		
Net investment position	-0.03 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.05** (0.02)		
Error correction	-0.21*** (0.02)	-0.24*** (0.02)	-0.18*** (0.02)	-0.21*** (0.02)	-0.17*** (0.02)	-0.18*** (0.02)
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.45	0.33	0.45	0.25	0.37	0.13
Observations	689	689	1120	1120	1164	1164
$\alpha > 0$			*			
$\alpha < 1$						

* p<.10, ** p<.05, *** p<.01

Source: Authors' calculations using data described in text.

Table 4 Ordinary least squares (OLS) regression of real exchange rate on consumption tax rate, 1970-2015 annual, equation (2), estimated long-run effects

Partner: United States	1	2	3	4	5	6
Goods & services tax rate	3.14*** (1.08)	2.29* (1.25)	1.59** (0.74)	1.15 (0.81)	0.87 (0.66)	1.37* (0.76)
Fiscal balance	1.19* (0.71)	2.75*** (0.73)				
Government revenue	-1.19 (1.18)	0.40 (1.12)	0.15 (0.72)	1.59*** (0.50)		
Relative per capita income	0.44*** (0.12)	0.48** (0.21)	0.33** (0.14)	0.57*** (0.21)		
Net investment position	-0.06 (0.06)	-0.09 (0.07)	-0.02 (0.05)	-0.04 (0.05)		
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.92	0.82	0.92	0.82	0.90	0.77
Observations	905	905	1134	1134	1208	1208
$\alpha / (1-\beta) > 0$	***	**	**	*	*	**
$\alpha / (1-\beta) < 1$						
Partner: Germany	1	2	3	4	5	6
Goods & services tax rate	0.94 (1.39)	0.70 (1.09)	1.47** (0.65)	0.87 (0.54)	0.80 (0.62)	0.84 (0.59)
Fiscal balance	1.07 (0.68)	0.23 (0.48)				
Government revenue	-1.88* (1.11)	-1.72* (1.00)	-0.01 (0.54)	-0.15 (0.50)		
Relative per capita income	0.52*** (0.12)	0.57*** (0.08)	0.24** (0.10)	0.33*** (0.07)		
Net investment position	-0.02 (0.04)	-0.02 (0.03)	-0.01 (0.04)	-0.04 (0.04)		
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.87	0.85	0.85	0.8	0.82	0.76
Observations	700	700	1134	1134	1208	1208
$\alpha / (1-\beta) > 0$			**	*	*	*
$\alpha / (1-\beta) < 1$						

* p<.10, ** p<.05, *** p<.01

Source: Authors' calculations using data described in text.

Table 5 Cointegrating regression of external balances on consumption tax rate, 1970–2015 annual, equation (1), long-run cointegration coefficients

Current account	1	2	3	4	5	6
Goods & services tax rate	0.19 (0.22)	0.2 (0.23)	0.21 (0.16)	0.33** (0.16)	-0.10 (0.14)	0.19 (0.13)
Fiscal balance	0.00 (0.11)	-0.07 (0.11)				
Government revenue	-0.35** (0.15)	-0.22 (0.15)	-0.25** (0.12)	-0.07 (0.10)		
Relative per capita income	0.06*** (0.02)	0.08*** (0.02)	0.05** (0.02)	0.07*** (0.02)		
Net investment position	-0.01 (0.01)	-0.02** (0.01)	-0.01* (0.01)	-0.02** (0.01)		
Error correction	-0.26*** (0.03)	-0.25*** (0.02)	-0.25*** (0.02)	-0.24*** (0.02)	-0.23*** (0.02)	-0.23*** (0.02)
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.30	0.22	0.29	0.23	0.23	0.13
Observations	944	944	1162	1162	1205	1205
Goods & services trade balance	1	2	3	4	5	6
Goods & services tax rate	0.31 (0.19)	0.26 (0.19)	0.54*** (0.17)	0.63*** (0.18)	0.15 (0.16)	0.46*** (0.16)
Fiscal balance	-0.02 (0.10)	-0.07 (0.09)				
Government revenue	-0.17 (0.13)	-0.11 (0.12)	-0.32** (0.13)	-0.09 (0.11)		
Relative per capita income	0.07*** (0.02)	0.09*** (0.02)	0.10*** (0.02)	0.13*** (0.02)		
Net investment position	-0.02*** (0.01)	-0.03*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)		
Error correction	-0.25*** (0.02)	-0.25*** (0.02)	-0.20*** (0.02)	-0.19*** (0.02)	-0.18*** (0.02)	-0.17*** (0.02)
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.31	0.25	0.29	0.23	0.21	0.11
Observations	946	946	1179	1179	1242	1242

(table continues)

Table 5 Cointegrating regression of external balances on consumption tax rate, 1970–2015 annual, equation (1), long-run cointegration coefficients (continued)

Income and transfers	1	2	3	4	5	6
Goods & services tax rate	-0.12 (0.11)	-0.06 (0.11)	-0.35** (0.14)	-0.29** (0.13)	-0.27* (0.14)	-0.23* (0.12)
Fiscal balance	0.03 (0.05)	0.01 (0.05)				
Government revenue	-0.15** (0.07)	-0.09 (0.07)	0.06 (0.11)	0.01 (0.09)		
Relative per capita income	-0.02 (0.01)	-0.01 (0.01)	-0.05*** (0.02)	-0.04*** (0.02)		
Net investment position	0.02*** 0.00	0.02*** 0.00	0.01 (0.01)	0.01 (0.01)		
Error correction	-0.29*** (0.03)	-0.29*** (0.03)	-0.15*** (0.02)	-0.16*** (0.02)	-0.13*** (0.02)	-0.14*** (0.02)
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.35	0.30	0.28	0.23	0.12	0.08
Observations	944	944	1162	1162	1205	1205

* p<.10, ** p<.05, *** p<.01

Source: Authors' calculations using data described in text.

Table 6 Ordinary least squares regression of external balances on consumption tax rate, 1970-2015 annual, equation (2), estimated long-run effects

Current account	1	2	3	4	5	6
Goods & services tax rate	-0.01 (0.26)	-0.16 (0.28)	0.06 (0.16)	0.08 (0.17)	-0.20 (0.19)	0.04 (0.18)
Fiscal balance	0.00 (0.10)	-0.07 (0.13)				
Government revenue	-0.44** (0.17)	-0.32* (0.17)	-0.30** (0.13)	-0.07 (0.13)		
Relative per capita income	0.06*** (0.02)	0.09*** (0.02)	0.04* (0.02)	0.08*** (0.02)		
Net investment position	-0.01 (0.01)	-0.02 (0.01)	-0.01* (0.01)	-0.02** (0.01)		
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.68	0.65	0.7	0.66	0.67	0.62
Observations	958	958	1177	1177	1251	1251
Goods & services trade balance	1	2	3	4	5	6
Goods & services tax rate	0.01 (0.24)	-0.11 (0.25)	0.31* (0.16)	0.32* (0.18)	-0.04 (0.23)	0.24 (0.21)
Fiscal balance	-0.02 (0.12)	-0.06 (0.12)				
Government revenue	-0.29 (0.18)	-0.22 (0.17)	-0.40** (0.16)	-0.10 (0.13)		
Relative per capita income	0.08*** (0.02)	0.10*** (0.02)	0.10** (0.04)	0.13*** (0.02)		
Net investment position	-0.03*** (0.01)	-0.03*** (0.01)	-0.04*** (0.01)	-0.05*** (0.01)		
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.72	0.69	0.79	0.77	0.77	0.73
Observations	959	959	1193	1193	1291	1291

(table continues)

Table 6 Ordinary least squares regression of external balances on consumption tax rate, 1970-2015 annual, equation (2), estimated long-run effects (continued)

Income and transfers	1	2	3	4	5	6
Goods & services tax rate	-0.02 (0.10)	-0.05 (0.12)	-0.27** (0.12)	-0.23** (0.10)	-0.23** (0.10)	-0.23* (0.11)
Fiscal balance	0.04 (0.06)	0.01 (0.06)				
Government revenue	-0.13 (0.09)	-0.07 (0.07)	0.06 (0.12)	0.01 (0.07)		
Relative per capita income	-0.02 (0.01)	-0.01 (0.01)	-0.05 (0.03)	-0.04 (0.03)		
Net investment position	0.02*** 0.00	0.02*** (0.01)	0.01 (0.01)	0.01 (0.01)		
Year effects	Yes	No	Yes	No	Yes	No
R-squared	0.71	0.69	0.81	0.8	0.77	0.76
Observations	957	957	1176	1176	1250	1250

* p<.10, ** p<.05, *** p<.01

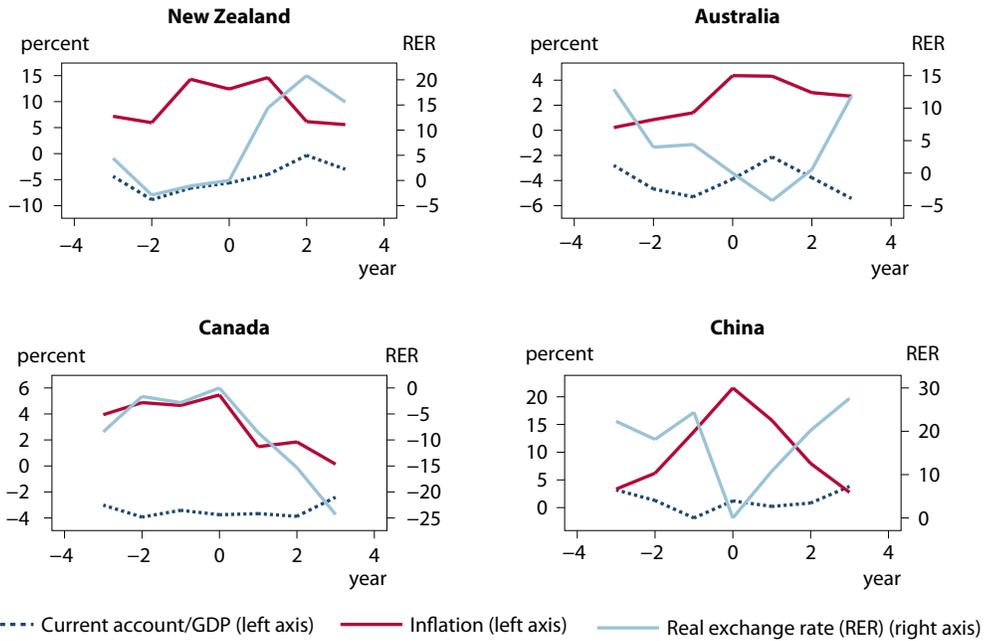
Source: Authors' calculations using data described in text.

Table 7 Inflation around VAT change, four-quarter price change (percent)

Quarter	New Zealand	Australia	China	Canada	Average
Q3	12.96	1.92	13.90	4.61	8.35
Q2	10.42	2.80	16.10	4.15	8.37
Q1	11.03	3.08	17.13	4.95	9.05
Q0	18.24	6.11	22.23	6.44	13.26
Q1	18.29	5.79	21.87	6.21	13.04
Q2	18.94	6.03	25.70	5.81	14.12
Q3	16.95	6.13	26.90	4.09	13.52
Q4	9.59	2.47	22.60	1.58	9.06
Q5	8.98	3.15	19.97	1.37	8.37
Q6	6.35	2.98	14.80	1.20	6.33

Sources: Data for Australia, New Zealand, and China are from OECD. Data for Canada are from Statistics Canada via Haver Analytics.

Figure 2 Implementation of VAT, by country



Source: Authors' calculations using data described in text.