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# Using a temporary indirect tax cut as a fiscal stimulus: evidence from the UK

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# Using a Temporary Indirect Tax Cut as a Fiscal Stimulus: Evidence from the UK\*

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This paper evaluates a novel form of fiscal stimulus: a temporary cut in the rate of Value Added Tax (VAT). In December 2008, the UK cut the standard rate of VAT by 2.5 percentage points for 13 months in an effort to stimulate spending. We estimate the effect of the cut on prices and spending using alternative strategies for identifying the counter-factual. Although firms initially passed through the VAT cut by lowering their prices, at least part of the pass through of the VAT cut was reversed after only a few months. Despite this early reversal, the cut raised the volume of retail sales by around 1% which on its own generates a 0.4% increase in total expenditure. The cut raised retail sales by encouraging consumers to bring forward their purchases and we find a significant fall in sales after the VAT cut ended. Thus an indirect tax cut stimulates significant intertemporal substitution in purchases.

**Keywords:** fiscal stimulus, passthrough, consumption

**JEL Classification Numbers:** H24, H31, E21, E62

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# 1 Introduction

Since the onset of the global financial crisis, governments around the world have implemented a variety of fiscal stimuli in efforts to aid growth. Most forms of stimulus, such as tax rebates and increases in public expenditure, have been used in previous recessions. But in late 2008 the UK government implemented a fiscal stimulus that had never been used in the UK or abroad - it made a *temporary* cut in its rate of Value Added Tax (VAT).<sup>1</sup> In December 2008 the UK Government lowered its standard VAT rate by 2.5 percentage points (from 17.5% to 15%) for a period of 13 months. The aim was to boost expenditure and it was the UK Government's 'main lever' for tackling the financial crisis. Around 150 countries levy VAT, including every OECD member except the U.S. Hence, if effective, a temporary VAT cut could become a widely used form of fiscal stimulus. This paper is the first ex-post evaluation of the UK's temporary VAT cut.

In testimony to the US Congress Joint Economic Committee Lawrence Summers (2008) argued that an effective fiscal stimulus should be 'timely, temporary and targeted'. The temporary VAT cut possessed the first two of these qualities. It began just one week after it was announced and so had the potential to stimulate purchases almost immediately. By way of comparison, tax rebates can take months to implement and, in any case, are impracticable in countries like the UK where only a small proportion of people file tax returns. The VAT cut was also clearly temporary - it only lasted for 13 months and it was not seen as a threat to the country's fiscal stability. On the other hand, a VAT cut is not targeted at a particular group of consumers (such as those most likely to spend the cut).<sup>2</sup>

A temporary VAT cut works by placing VAT goods on 'sale' for the length of the cut. This induces an income effect, a within period substitution effect and intertemporal substitution effects. The income effect arises because consumers save on their regular shopping and so may purchase more goods. If consumers are forward-looking, this income effect is likely to be small for a temporary price cut. Further, we expect the possibilities for within period substitution between goods subject to VAT and those not subject to VAT are likely to be small. The more important effect is likely to be that the temporary nature of the cut may persuade consumers to bring purchases forward so as to pay the lower VAT rate. In this way, a VAT cut in a recession may raise the trough in spending by taking some purchases from the future. Ideally, by the time the VAT cut ends, the recovery is underway. Such a substitution effect can happen in two ways. If consumers bring forward *consumption*, this is a classic intertemporal substitution effect. If consumers bring forward *purchases* of storable

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<sup>1</sup>There have been instances where Governments have lowered VAT and then raised the rate back, but these short-lived cuts were not *intended* to be temporary.

<sup>2</sup>While the VAT is often thought to be regressive, many necessities are either zero-rated, exempt or only attract VAT at the reduced rate and so households with high expenditure spend relatively more on VAT goods. More affluent households may be more affected by the cut (Crossley, Phillips and Wakefield, 2009).

goods, but do not alter their consumption plans, this is an arbitrage effect.

To evaluate the effectiveness of the cut we pose three questions: i) did firms pass-through the cut by lowering their prices, ii) were consumers aware of the cut, iii) did consumers increase their purchases? In answering these questions the key challenge we face is to construct the counter-factual evolution of prices and purchases had the VAT cut not taken place. Our solution is to use alternative strategies to estimate the counter-factual: (i) the evolution of prices and purchases on non-VAT goods and (ii) the evolution of prices and purchases in other OECD countries. Each strategy rests on a different assumption, as we discuss further below. We examine a range of outcome data: aggregate expenditure data, retail sales data, price data, and survey data on consumer sentiment.

We find that businesses initially lowered their prices and we cannot reject full pass-through of the tax cut to consumers. Similarly, at the start of the VAT cut we find a fall in the proportion of prices that end in ‘99 which suggests that firms did apply the VAT cut. However, we find that after only a few months, prices of VAT goods began to rise and the initial cut was partly reversed. At the same time, the proportion of prices ending in ‘99 rose again suggesting active repricing.

Turning to consumers, we find a sharp rise in sentiment toward major purchases in December 2008, which suggests that consumers were at least aware of the cut. We do not find any significant rise in purchases measured in aggregate expenditure data over 2009 in the national accounts data. However, using data on retail sales, there is evidence of an increase of around 1% in retail sales. There is a sharp drop in retail sales in January 2010 (when the VAT cut ended) which suggests that the rise was due to arbitrage, where consumers shifted purchases forward. Our results are consistent with the handful of papers that have examined other changes in indirect taxes, in particular Cashin and Unayama (2011) and Cashin (2012), which have tended to find that the income effects are small (at best) and the substitution effects are significant. Our results from retail sales are broadly in line with the predictions made by the government on the effect of the VAT cut, although we view the mechanism as being through a substitution effect not an income effect.

The rest of this paper is structured as follows. Section 2 provides a brief background to the UK’s temporary VAT cut. Section 3 discusses the likely effects of the cut given consumer theory, the effects of other indirect tax changes, and evidence from surveys that were carried out during the cut. Our empirical results are presented in sections 4-6. Section 4 measures pass-through from the cut. Section 5 shows how the cut affected consumer sentiment. Section 6 estimates the effect of the VAT cut on household purchases. Section 7 concludes.

## 2 The temporary VAT cut

*“But to prevent the recession deepening, we also need to take action to put money into the economy immediately...To deliver a much-needed extra injection of spending into the economy right now. I therefore propose to cut VAT from 17.5 to 15 per cent until the end of next year... It will make goods and services cheaper and, by encouraging spending, will help stimulate growth.”* Chancellor Alistair Darling, 24th November 2008, HM Treasury (2008a)

On 24th November 2008 the UK Government announced that the standard rate of Value Added Tax (VAT) would be cut from 17.5% to 15% for 13 months. The cut began just one week later on 1st December. VAT on goods which were subject to the lower rate of 5% did not change, and excise duties on goods such as alcohol and tobacco were lifted to prevent these goods from becoming cheaper. The Government described the cut as the ‘main lever for the fiscal action’ (HM Treasury (2008b) (page 23)). The Government’s total discretionary stimulus package was worth around £25bln over 2008/09 and 2009/10 (Chote et al., 2009). The VAT cut was by far the single most expensive policy, at an estimated cost of £12.4bln (HM Treasury, 2008b).

The aim of the cut was to raise consumer spending and tackle the recession which began in the second quarter of 2008. On the likely effect of the VAT cut, the Government assumed that “approximately half of the increase in real purchasing power translates into an increased volume of spending, with the remainder used by households to bolster their finances” (HM Treasury (2008b) (page 19)). The 2.5 percentage point cut translated into a 2.1% fall in prices ( $2.5/117.5$ ) for goods subject to the standard rate of VAT, and around 56% of expenditure by households attracts VAT.<sup>3</sup> This implies that the Government expected the VAT cut to boost consumption by around 0.5%. The Government believed that this increase would arise from an income effect.

On 1st January 2010 the rate of VAT rose back to 17.5%. Then in late June 2010, the Government preannounced a permanent rise in VAT to 20% to begin on 4th January 2011.

## 3 Anticipated effects

### 3.1 Pass-through

The UK Government assumed that ‘due to the competitive nature of the UK retail sector, especially during the coming downturn, the majority of the VAT rate cut will be passed

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<sup>3</sup>ONS (2011a).

through to consumer prices, but that prices will be reduced progressively rather than immediately' (HM Treasury, 2008b (page 18)). However, the theory of tax incidence identifies several factors that can influence pass-through. In competitive markets the degree of shifting will depend on the elasticities of demand and supply, with greater pass-through (from a price cut) where there is elastic demand and inelastic supply. In an imperfectly competitive market, firms may over-shift the tax cut. Another factor is menu costs, which may slow down or reduce pass-through.<sup>4</sup>

Two papers have estimated the pass-through from the temporary VAT cut, but both were published before the cut ended. Pike et al. (2009) concluded that the VAT cut (and rise in excise duties) had lowered annual CPI inflation in December 2008 by around 0.5 percentage points. That corresponds to pass-through of around 38% which is relatively low. Their estimate comes from assuming that any reduction in the price of a VAT good, of between 1.4% and 2.9% between November and December 2008, was due to the cut. Of course we cannot be sure that all price falls between 1.4% and 2.9% were in fact due to the cut, or equally that changes outside these bounds did not include the VAT cut. Interestingly, Pike et al. (2009) note that by February 2009 around 50% of VAT prices had risen back to at least their level in November 2008. In Section 4 we determine whether this was simply due to a widespread rise in costs, or because some firms chose to reverse the VAT cut early.

In contrast to the results of Pike et al. (2009), Chirakijja et al. (2009) found evidence of 'substantial and rapid pass through' from the cut. Although their pass-through estimates ranged between 66%-75% they could never reject the hypothesis that the VAT cut was immediately passed through in full and stayed in place for at least seven months (when their sample ended). Their estimates come from comparing inflation in non-VAT goods to inflation in VAT goods. We improve this estimation strategy and compare it with alternatives.<sup>5</sup>

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<sup>4</sup>HM Treasury (2008c) estimated that the total cost to firms (of the VAT cut and its reversal) was around £300 million (net present value in 2008). A survey of firms, by ORC (2010), found that the median time for compliance was only 2.5 hours with this time spent on tasks such as familiarization, additional bookkeeping, system changes and additional pricing costs.

<sup>5</sup>There are also several pieces of survey evidence that relate to the VAT cut. In December 2008, the ONS found that 66% of firms (where they had collected prices) had passed on the cut (Pike et al. (2009)). By mid 2009, a survey by ORC (2010) found that 78% had passed on the cut and 77% had passed on the cut in full. There was some variation among industries, ranging from 87% pass-through in 'wholesale, retail and motor vehicles' to 52% in 'accommodation and food services'. Among those firms who had not passed on the cut, 36% said that the savings had little or no impact on their business and a further 30% did not know how the savings had been used. The Agents' Summary of Business Conditions, published by the Bank of England, offer some further insights. In their January 2009 report, agents commented that the VAT cut had been 'widely, but not universally implemented', with the exceptions typically being smaller stores. Interestingly, their April 2009 report noted that 'a number of retailers had restored prices of VAT-able goods to the pricing points that had prevailed prior to the VAT cut', which coincides with the findings of Pike et al. (2009). On the reversal, their January 2010 report (based on discussions in late 2009) found that 83% of businesses planned to pass through at least part of the reversal of the VAT cut, with 46% planning to pass it through in full. By April 2010, contacts reported that the VAT rise had been passed through by the majority who were planning to do so.



Only a handful of papers have measured firms' responses to other indirect tax changes.<sup>6</sup> They have tended to focus on a small number of goods and their results suggest that there is no 'normal' rate of pass-through that we should expect. Besley and Rosen (1999) measured pass-through from sales taxes using variation in sales tax rates across states in the US. They compared 12 retail commodities across 155 cities between 1982-1990 and found large variation in pass-through rates, and even found some evidence of 'over-shifting' the sales taxes onto consumers, suggesting instances of imperfect competition. They also found that prices responded quite quickly to tax changes - the mean lag was only around one quarter. Porteba (1996) used the same approach but focused on clothing and compared two different sample periods - the depression and the post-war period. He could never reject the hypothesis of complete shifting which is consistent with perfect competition. However, he found there was less shifting during the depression (1925-39) than during the post-war period (1947-77), which may be relevant to our analysis of a VAT cut in a recession.

Most tax changes are small which makes it difficult to identify how the tax was shifted, but Carbonnier (2007) examined two very large changes in VAT in France. In 1987 the VAT rate on car sales was cut from 33.33% to 18.6%, and then in 1999 the VAT rate on housing repair services was cut from 20.6% to 5.5%. Carbonnier finds that both taxes were under-shifted: 77% of the VAT cut on housing repair services was passed to consumers and only 57% of the cut on car sales.

Carare and Danninger (2008) were the first to examine a VAT change that applied to *all* goods. In 2007, the standard VAT rate in Germany rose from 16% to 19%. The authors found that total pass-through was around 73% with no evidence of any delay. A key difference to the UK's VAT cut was that the German VAT rise was announced 13 months in advance. Firms used this period to gradually 'phase-in' the price increases so that when the VAT rate rose the increase in core inflation was 'more modest than expected'. Interestingly, this early pass-through was faster for durable goods and for items in less competitive markets.

Lastly, Doyle and Samphantharak (2006) are the only authors to have considered a *temporary* tax change. In 2000, Indiana and Illinois suspended their 5% sales taxes on gasoline for 120 days and 6 months respectively.<sup>7</sup> Despite the cut being temporary and the good itself having inelastic demand, they found that 70% of the tax cut was still passed through to consumers.

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<sup>6</sup>We exclude studies on the introduction of VAT (as cited in Carroll et al. (2010)), as VAT is often replacing other consumption taxes, and this can muddy the pass-through results.

<sup>7</sup>Unlike other items, sales taxes on gasoline must be included in the posted price.

## 3.2 Purchases

The aim of the temporary VAT cut was to raise the volume of goods purchased. Ideally, the cut works in two ways (Crossley, Low and Wakefield, 2009). First, there is an income effect because it is cheaper to purchase the same bundle of goods, and this saving can be spent. In 2007/08 the average household paid £2,107 in VAT (expressed in 2008/09 prices)<sup>8</sup>, which would imply a one-time saving of approximately £326.<sup>9</sup> Second, there is a substitution effect because the temporary nature of the cut encourages consumers to bring their purchases forward.<sup>10</sup> These purchases may be consumed immediately (a classic inter-temporal substitution in consumption) or hoarded for later consumption (an arbitrage effect). In either case, substitution effects may lead to a dip in purchases after the VAT cut ends.

The strength of both income and substitution effects will depend on salience, uncertainty and deflationary expectations. If consumers are not aware of the VAT cut, they are unlikely to react. A high degree of income uncertainty or the expectation that prices will fall further may also dissuade consumers from raising their purchases. These are particularly real risks during a recession. In addition, we would expect the income effect of a transitory price change to be small for those consumers who have long planning horizons. The income effect will be even smaller if individuals anticipate that future tax liabilities have changed. On the other hand, if consumers are credit constrained, the additional cash-on-hand will ease the constraint and translate into greater purchases. The strength of the substitution effect may also vary with the type of good. We would expect a larger effect for durables and other storable goods (because of the potential for arbitrage) and for luxury goods (which have higher inter-temporal substitution elasticities - see Browning and Crossley (2000)). Finally, note that uncertainty (particularly in combination with irreversibility) and storage costs will lead arbitrage to happen late in the period of the cut, whereas an inter-temporal substitution effect in consumption should apply throughout the period of lower prices.

A number of papers have made predictions about the effect of the VAT cut on consumer spending. The Government's assumptions imply that they were expecting the cut to boost consumer spending by around 0.5% (HM Treasury, 2008b). In March 2009, *Fiscal Studies* published three papers that contained predictions ranging from a rise of less than 1% by the fourth quarter of 2009 to a rise of 1.25% over the whole 13 month period. All three papers predicted that these increases would come almost entirely from substitution effects, with little or no income effect. At the top end, Crossley et al. (2009) predicted that consumption spending would be 1.25% higher than without the cut. They assumed full pass-through and an elasticity of substitution (EIS) equal to 1.0. Their value of the EIS came from the upper

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<sup>8</sup>ONS (2011b).

<sup>9</sup>  $\frac{2,107 (0.15 - 0.175)}{0.175} \frac{13}{12}$ .

<sup>10</sup>We do not expect there to have been a significant *intratemporal* substitution effect because there are few VAT goods that are substitutes for non-VAT goods.

end of the range of micro estimates surveyed by Attanasio and Wakefield (2008). Crossley et al. (2009) reasoned that most VAT goods are luxuries (which have higher elasticities of inter-temporal substitution) and most VAT goods are storable (so that some arbitrage in timing of spending should be expected on top of the inter-temporal substitution in consumption). Blundell (2009) also assumed an EIS of 1.0 but expected slightly lower pass-through (75%), and so predicted a 1% rise in consumption spending. Lastly, Barrell and Weale (2009) forecast that the VAT cut would boost consumption by less than 1% by the fourth quarter of 2009. Their prediction was informed by examining 9 permanent VAT changes in EU member countries, where they found that consumption spending only tended to react in the quarter immediately preceding or following the change.<sup>11</sup> There are very few empirical studies that measure how consumption reacts to indirect tax changes. The few that do exist, which we discuss below, tend to find a small income effect (if any) and a significant but short-lived inter-temporal substitution effect which is stronger for durable goods. That said, there are several important differences between the tax changes studied in these papers and the temporary VAT cut. Most notably almost all study cuts that were announced as permanent.

Carare and Danninger (2008) studied the VAT rise in Germany at the start of 2007 (from 16% to 19%). Although they focused primarily on measuring pass-through, they observed that aggregate consumption spending was 2.2% higher in the last quarter of 2006 (in annualized terms) than over the same period of the previous year. Moreover, growth was strongest in cars and other durables. Following the VAT rise, consumption spending fell by 0.5% in the first quarter of 2007. This pattern points towards a substitution effect where consumers brought their purchases forward (from Q1 2007 to Q4 2006) to secure the lower VAT rate.

Cashin and Unayama (2011) examined the VAT rise in Japan in 1997 (from 3% to 5%). They found that the income effect was negligible, but this may be because the change was part of a package that was intended to be revenue neutral (i.e. the rise was compensated). They did however find a substitution effect, but it was short-lived, and only increased consumption spending in the quarter before the VAT rise. They estimate that in these three months the cut boosted consumption spending by 0.61%, 3.24% and 8.85% respectively. Three quarters of the increase was due to greater outlays on durable goods and on storable non-durable goods. Cashin and Unayama posit that the short-lived nature of the substitution effect may be because consumers did not find earlier announcements credible and so only responded when the Budget (containing the rise) had completed its final passage. In a subsequent

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<sup>11</sup>Several qualitative surveys were conducted during the VAT cut. The results suggest that only a small fraction of households responded to the cut. For example, a BBC survey found that only 23% of respondents had spent money they would not otherwise have spent because of the cut. A survey by PWC found that only 8% of respondents had raised their spending as a result of the VAT cut. Lastly, a survey by ORC (2010) found that only 20% of businesses agreed (or strongly agreed) that the VAT cut had had a positive impact on sales.

paper, Cashin and Unayama (2012) found larger responses to the VAT rise by households who had more time (to shop) and more space (to store goods), which is further evidence that households were engaged in short-run arbitrage.

Lastly, Cashin (2012) studied three separate increases in New Zealand's rate of VAT (in 1986, 1989 and 2010). Only one of the three increases was not compensated (by other policies) and in this instance there is tentative evidence of an income effect, with retail sales being 2% lower in the quarters following the announcement of the VAT rise. Cashin finds significant substitution effects for the first two rate changes, but the effects are short-lived, and primarily boost retail sales in the month prior to the VAT hikes (by 21% and 11% respectively). This is despite the first rise being confirmed long before it was implemented. Once again the majority of the substitution effect was driven by increased purchases of durable goods and on storable non-durables. Following the VAT rises, the dip in retail sales from the substitution effects is gone within three months, implying that households only shifted their purchases over a short period. Again, the evidence points to a key role for short-term arbitrage in the substitution effects (changes in the timing of purchases, rather than in the timing of consumption). For the most recent hike, in October 2010, the substitution effect is more muted, with purchases of only two categories of durable goods showing a significant rise ('furniture' and 'electrical and electronic goods'). Cashin posits that the muted response may be due to borrowing constraints, a drop in wealth following the onset of the crisis, or a promise by some producers not to pass on the rise. The first two reasons are relevant for our analysis of the temporary VAT cut.

The three studies discussed above would predict that the temporary VAT cut had a small income effect and a significant but short-lived substitution effect (due mostly to short-term arbitrage). However, the income effect may have been even smaller because the VAT cut was only temporary whereas the studies above all considered permanent changes. Also, VAT applies to a smaller proportion of goods in the UK, which may have dampened both the income and substitution effects. According to the OECD (2011), in 2008 the VAT revenue ratio (which measures the proportion of total expenditure on which VAT is collected) was 98% for New Zealand, 67% for Japan, 55% for Germany but only 46% for the UK (the 4th lowest in the OECD).

US sales tax holidays offer further insight on the effect of tax changes. These holidays are periods (normally a weekend) over which a state exempts the sale of selected goods from sales tax. The most commonly exempted goods are school supplies, clothing and computers. Despite 18 states holding sales tax holidays in 2012<sup>12</sup>, there has been little analysis of such holidays, with two exceptions. Agarwal et al. (2013) found that consumption was 'extremely responsive' to these short-term price changes, but that the increase in demand was primarily

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<sup>12</sup>[http://www.taxadmin.org/fta/rate/sales\\_holiday\\_2012.html](http://www.taxadmin.org/fta/rate/sales_holiday_2012.html)

due to an income effect and found no evidence of intertemporal substitution. Cole (2009) studied nine sale tax holidays for computers in 2007 and found that there was an income effect for desktops but a timing or substitution effect for laptops. He found that pass-through varied by product too - desktop sellers overshifted the sales tax holiday (i.e. lowered their pre-tax prices) but laptop sellers did not change their prices. Comparing the sales tax holidays to the temporary VAT cut, we might expect a smaller effect from the latter because there are fewer opportunities for cross-border shopping in the UK, and the cut was not announced in advance which prevented consumers from delaying purchases. However, two factors work in the opposite direction. First, VAT is always included in the posted price of a good unlike a sales tax and Chetty et al. (2009) found that consumers react significantly more to tax changes that are included in the posted price. Second, most sales tax holidays feature price caps, whereby an exempted item will still attract sales tax if its price exceeds the cap.

## 4 Pass-through

Between November and December 2008 annual CPI inflation fell by 1 percentage point. This would equate to pass-through of approximately 77%.<sup>13</sup> Of course many other factors may have affected inflation in December. These include the spikes in food and energy prices that occurred just prior to the financial crisis. We need a strategy for estimating how inflation would have evolved, counter-factually, without the VAT cut. In the handful of empirical studies that were discussed in Section 3 the most commonly used strategies are to base the counter-factual estimate on ‘inflation in other areas’ (that weren’t affected by the tax change) or ‘inflation in other items’ (that didn’t attract the tax). Besley and Rosen (1999) and Porteba (1996) both used other US states to identify the incidence of sales taxes. Similarly, Doyle and Samphantharak (2006) used neighboring states when they looked at the temporary suspension of the gasoline sales tax in Illinois and Indiana. Carbonnier (2007) used inflation in other items to control for the cut in VAT on cars and housing repairs, while Carare and Danninger (2008) used inflation in non-VAT goods when they studied the rise in Germany’s VAT. We use both of these strategies - inflation in other areas (other OECD countries) and inflation in other items (non-VAT goods). The underlying assumption is that inflation in these “controls” (areas or goods) would have moved in line with inflation in VAT goods had the cut not taken place (i.e. they must share a common trend). We must also assume that inflation in each control wasn’t affected by the VAT cut.

We measure pass-through using the Consumer Price Index (CPI) which aims to capture the average price level for a typical basket of items bought in the UK.<sup>14</sup> The CPI is a

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<sup>13</sup>Pike et al. (2009) estimate that full pass-through (of the VAT cut) would lower annual CPI inflation by 1.3 percentage points (this includes the rise in excise taxes).

<sup>14</sup>An alternative measure of inflation is the Retail Prices Index (RPI) but we prefer the CPI for two

monthly series published by the ONS and is based on approximately 180,000 prices for almost 700 different items. The prices are combined using expenditure weights which are updated annually. As noted above, the 2.5 percentage point cut in the initial rate of 17.5% translates into a 2.1 percent reduction in prices ( $2.5/1.175$ ) on the 56% of consumer purchases that were affected. Pike et al. (2009) estimate that if the VAT cut was passed through in full it would have lowered CPI inflation by 1.3 percentage points (the VAT cut would take off 1.5 percentage points but the rise in excise duties would add back 0.2 percentage points).<sup>15</sup>

## 4.1 Inflation in VAT vs. non-VAT goods

Our first strategy for estimating pass-through compares inflation in VAT and non-VAT goods. Only the standard rate of VAT was lowered, and so we apply the non-VAT label to any category that attracts the reduced VAT rate as well as the handful of categories on which excise taxes are levied. The CPI is disaggregated into 85 categories, split into VAT and non-VAT goods using HMRC guidelines.<sup>16</sup> The result is 42 VAT categories and 42 non-VAT categories.

Figure 1 shows inflation in the VAT and non-VAT categories, alongside total CPI inflation.<sup>17</sup> The two shaded areas indicate when the standard VAT rate was 15% and 20% respectively (everywhere else it was 17.5%). Between November and December 2008 inflation in ‘VAT goods’ fell 1.5 percentage points, which is close to complete pass-through of 2.1 percentage points. Almost half of that fall was reversed in February 2009 when inflation in VAT goods rose by 0.65 percentage points.<sup>18</sup> This may be because some firms unwound the cut or because there was simply a rise in some other type of inflationary pressure. To disentangle these causes we use inflation in non-VAT goods to control for other types of inflationary pressure. However, Figure 1 casts doubt on the usefulness of the simplest version of this strategy. The identifying assumption is that inflation in VAT and non-VAT goods would have evolved similarly in the absence of the VAT cut. Figure 1 makes clear that inflation in

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reasons. First, the RPI includes mortgage interest payments and inflation in this component fell sharply over late 2008 and early 2009 and this may confound our estimates of pass-through. Second, CPI is constructed in line with Eurostat guidelines and so is more comparable with inflation in other countries.

<sup>15</sup>The ONS went to considerable efforts to ensure that prices were measured accurately when the VAT cut was introduced. For example, retailers were asked whether they had passed on the cut to avoid missing price reductions that were only made at the till. Pike et al. (2009) estimated that because some prices are only measured quarterly, the ONS likely overestimated the annual inflation rate in December 2008, but only by 0.02 percentage points. They conclude that because of steps taken by the ONS, the reduction in the quality of inflation indicators is likely to have been negligible.

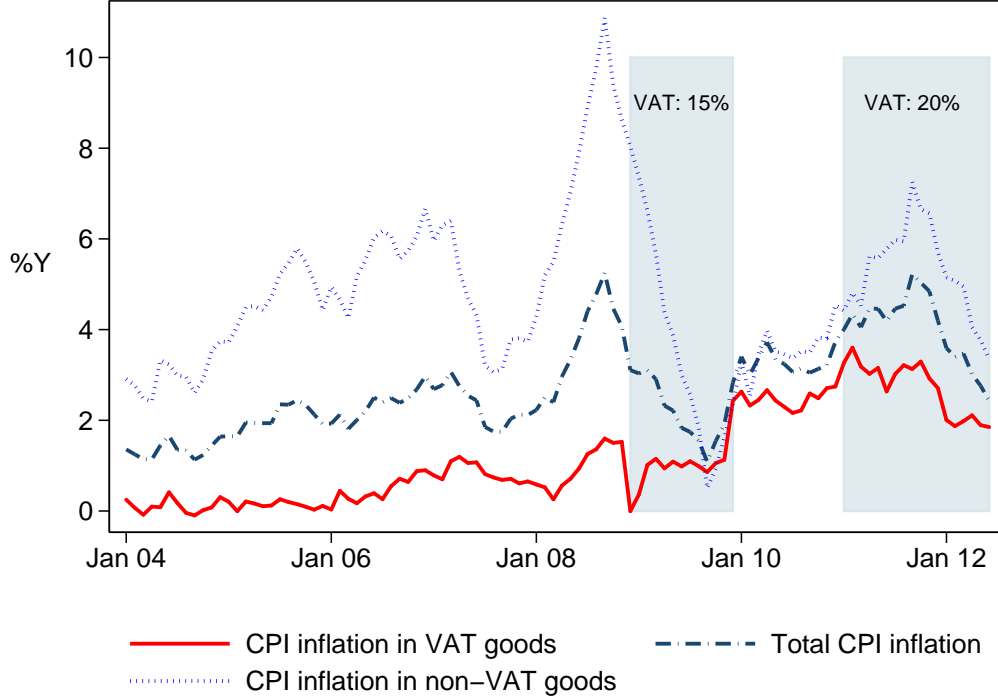
<sup>16</sup> <http://www.hmrc.gov.uk/vat/forms-rates/rates/goods-services.htm>. Only one category is excluded, second-hand cars, because its VAT status is variable.

<sup>17</sup>The VAT and non-VAT series were aggregated by taking a geometric mean using the 2009 expenditure weights.

<sup>18</sup>The sharp rise in ‘VAT inflation’ in December 2009 is purely a base effect, and due to the fall in inflation one year earlier.

these two broad categories was very different in the period prior to the VAT cut. Inflation in non-VAT goods is more volatile than inflation in VAT goods. This is primarily because most food is zero rated and most energy supplies only attract the reduced rate of VAT which makes the non-VAT series more sensitive to commodity price shocks.

Figure 1: CPI inflation in VAT and non-VAT goods



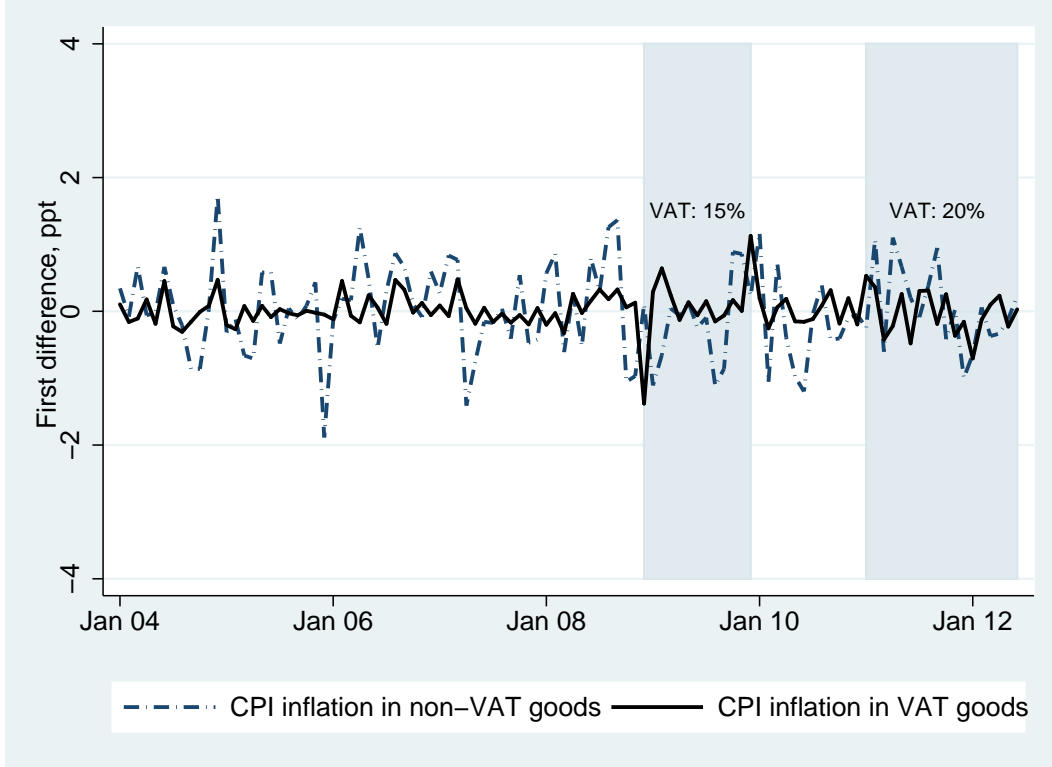
We therefore estimate pass-through using the following augmented difference-in-difference specification:

$$Inflation_{i,t} = \beta_0 + \beta_1 VAT_i + \beta_2 VAT_i \times Cut_t + \beta_3 Cut_t + \beta_{4i} CrudeOil_{t-k} + \varepsilon_{i,t} \quad (1)$$

where  $Inflation_{i,t}$  is annual inflation in category  $i$  in period  $t$ ,  $VAT_i$  is a dummy to indicate a VAT category,  $Cut_t$  is a dummy applying to all categories for the 13 months of the VAT cut and  $CrudeOil_t$  is annual inflation in imported and domestically produced crude oil from the Producer Price Index (PPI). This variable significantly improves the validity of our common trends assumption. We allow the coefficient on crude oil to differ for each category. The coefficient  $\beta_2$  gives our estimate of pass-through from the VAT cut (in percentage points), while  $\beta_3$  picks up other changes in inflation that affected all categories of goods at the same time as the VAT cut. We estimate the equation using fixed effects with

robust standard errors.<sup>19</sup> Categories are weighted according to their aggregate budget share to prevent categories with small expenditure weights exerting large effects on the coefficients. Figure 2 shows the change in inflation for VAT and non-VAT goods after we have removed the effects of commodity price movements. Although the non-VAT series is still more volatile than its VAT counterpart, there is no clear violation of the common trends assumption over the period prior to the VAT cut.

Figure 2: First difference in CPI inflation for VAT and non-VAT goods  
(after removing the effects of commodity price movements)



The regression results are shown in Table 1. In column 1 the  $Cut_t$  dummy is set equal to one for the full length of the VAT cut, and so is labeled  $Dec08 - Nov09$ . We exclude December 2009 because *annual* inflation in this month should not have been affected by the cut (because the cut was in place one year earlier). The coefficient on  $VAT \times Dec08 - Nov09$  is not significant which suggests either that the VAT cut was not passed through or that it was not in place for the entire period. In columns 2 to 5 we restrict our attention to the start of the cut and test for temporary pass-through by adding in shorter time dummies (e.g.  $VAT \times Dec08 - Jan09$ ). Column 2 shows that in December there was a significant fall of 2.92 percentage points in VAT inflation, and we cannot reject 100% pass-through in this month (see the final two rows of the table). Columns 3 to 5 show that as we extend the period of

<sup>19</sup>The  $VAT_i$  variable is incorporated into the fixed effect.



the cut, the fall in inflation becomes smaller and less significant.

These results are consistent with at least part of the VAT cut being reversed early. To test for reversal *after* the VAT cut ended, column 6 includes interactions of *VAT* with dummies for the quarters in 2010. There is no significant rise in VAT inflation over the start of 2010, reinforcing our finding that the reversal occurred before the official end date. There is however a rise in VAT inflation over the second half of 2010: this may reflect early pass-through of the subsequent (and permanent) VAT *rise*, which was announced in late June 2010 and began in January 2011. This is consistent with the evidence in Carare and Danninger (2008) for Germany that firms begin to pass-through a permanent VAT change after the announcement and in advance of the implementation.

Table 1: Pass-through of VAT cut  
(*difference-in-differences, comparing annual inflation  
in VAT goods with non-VAT goods*)

<i>Annual Inflation</i>	Entire period	1 month	2 months	3 months	4 months	2 months
<i>Pass-through</i>						
VAT * Dec08-Nov09	-0.10 (0.96)					
VAT * Dec08		-2.92*** (0.96)				
VAT * Dec08-Jan09			-2.30** (1.03)			-2.29** (1.07)
VAT * Dec08-Feb09				-1.61 (1.08)		
VAT * Dec08-Mar09					-1.22 (1.18)	
<i>Reversal</i>						
VAT * Jan10-Mar10						0.54 (1.04)
VAT * Apr10-Jun10						1.85 (1.36)
VAT * Jul10-Sep10						2.70* (1.55)
VAT * Oct10-Dec10						3.70** (1.84)
Observations	7980	7980	7980	7980	7980	9072
No. months (max)	95	95	95	95	95	108
No. groups	84	84	84	84	84	84
R squared within	0.54	0.54	0.54	0.54	0.54	0.50
Estimate of initial pass-through from VAT cut (%)	4.6	137.2	108.3	75.7	57.4	107.5
Test for 100% pass-through (-2.128) (pvalue)	0.037	0.413	0.864	0.632	0.445	0.882

Notes:

- i) Fixed effects with robust standard errors reported in parentheses
- ii) Inflation in each item is weighted by aggregate expenditure
- iii) Sample period is Jan 2002 to Nov 2009 (Dec 2010 for eq.6)
- iv) Also included is inflation in crude oil from the PPI at lags 0,6 and 12 and period dummies.
- v) \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

## 4.2 Inflation in the UK vs. other OECD countries

An alternative approach to estimating pass-through compares inflation in the UK with inflation in other OECD countries. We use a collection of OECD countries (the top 15 by GDP per capita) and estimate the following difference-in-difference specification:

$$Inflation_{i,t} = \beta_0 + \beta_1 UK_i + \beta_2 UK_i \times Cut_t + \beta_3 Cut_t + \beta_4 Trend_t + \varepsilon_{i,t} \quad (2)$$

where  $Inflation_{i,t}$  is now annual CPI inflation excluding food and energy for country  $i$  in period  $t$ ,  $UK_i$  is a dummy for the UK,  $Cut_t$  is a dummy for all countries during the VAT cut, and  $Trend_t$  is a linear trend. The coefficient  $\beta_2$  gives the change in inflation during the VAT cut that was unique to the UK, which is our estimate of pass-through. The coefficient  $\beta_3$  picks up other changes in inflation that were common to all OECD countries. Once again, we use fixed effects with robust standard errors. We have monthly data on inflation in 14 of the top 15 OECD countries.<sup>20</sup> We drop Ireland as they experienced a VAT change in 2008. The identifying assumption is that, in the absence of the VAT cut, inflation in the UK would have evolved similarly to inflation in these other countries.

The regression results are displayed in Table 2. Column 1 shows that over the *entire* VAT cut, inflation in the UK was *not* significantly lower, when compared to inflation in other OECD countries. However, the remaining columns show that over shorter periods UK inflation *was* significantly lower. Full pass-through would correspond to a fall of around 1.353 percentage points in this measure of inflation.<sup>21</sup> The final two lines of the table show that we can reject the null of full pass-through from February 2009 onwards (at the 1% level) and so, once again, it appears that at least part of the VAT cut was reversed early. Thus, this finding seems robust to our choice of identification strategy.

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<sup>20</sup>Monthly inflation data is not available for Australia.

<sup>21</sup>We estimate that approximately 64% of CPI excluding food and energy attracts VAT at the standard rate (excluding goods which also attract excise taxes).

Table 2: Effective duration of the VAT cut  
(*difference-in-differences, comparing annual inflation  
in the UK with other OECD countries*)

<i>Annual Inflation</i>	Entire period	1 month	2 months	3 months	4 months	5 months	6 months
<i>Pass-through</i>							
UK * Dec08-Nov09	-0.39 (0.30)						
UK * Dec08		-0.90*** (0.21)					
UK * Dec08-Jan09			-0.93*** (0.17)				
UK * Dec08-Feb09				-0.81*** (0.15)			
UK * Dec08-Mar09					-0.71*** (0.15)		
UK * Dec08-Apr09						-0.69*** (0.16)	
UK * Dec08-May09							-0.63*** (0.18)
Observations	1391	1391	1391	1391	1391	1391	1391
No. months (max)	107	107	107	107	107	107	107
No. groups	13	13	13	13	13	13	13
R squared within	0.10	0.09	0.09	0.10	0.10	0.10	0.10
Estimate of pass-through from VAT cut (%)	29.1	66.8	68.6	59.7	52.3	51.3	46.6
Test for 100% pass-through (-1.353) (p-value)	0.008	0.057	0.026	0.004	0.001	0.001	0.002

Notes:

i) Fixed effects with robust standard errors reported in parentheses

ii) Sample period is Jan 2001 to Nov 2009

iii) Also included is a trend for each country, and period dummies

iv) \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

A recent paper by Conley and Taber (2011) notes that standard inference procedures may not be reliable in difference-in-difference settings, such as this one, where the number of policy changes is small (we only have one). Conley and Taber's solution is to use the controls to estimate the distribution of the treatment effect which can then be used to construct confidence intervals. We have applied their methods to our data, where the controls are OECD countries. The 95% Conley-Taber confidence interval around our original estimate (for pass-through between December 2008 and January 2009) is -1.35 to -0.06. While this interval does not include zero, it still includes a large range of estimates for the extent of pass-through.

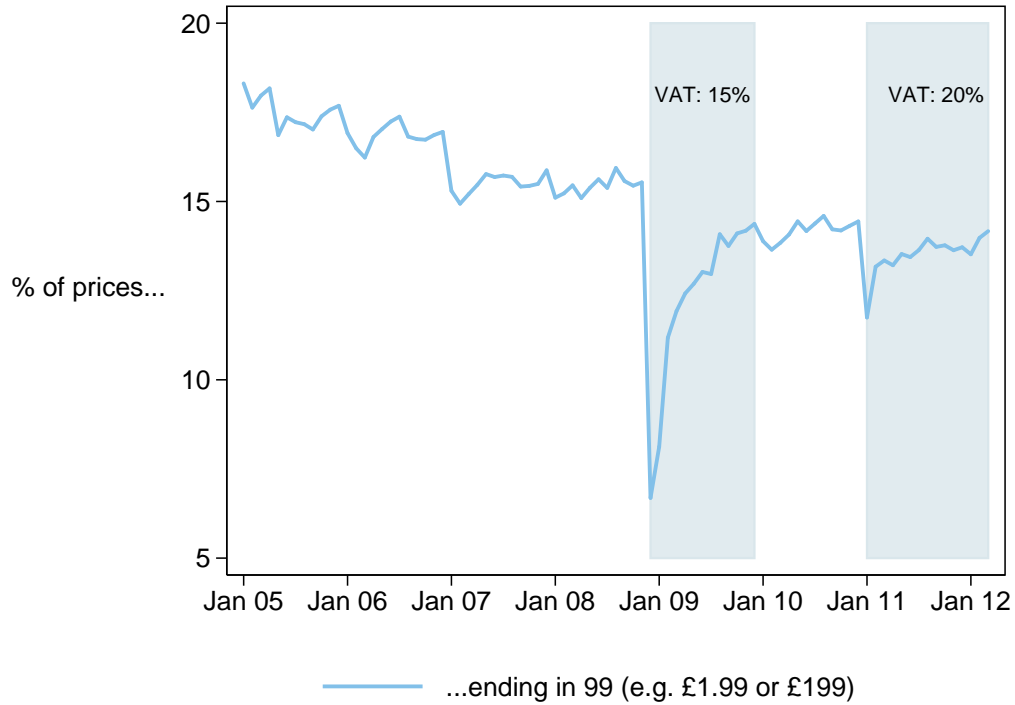
### 4.3 Evidence of re-pricing

'Price points' (or price endings) refers to the last two digits on a price and there is a tendency among businesses to favor certain price points (Schindler, 2006). The literature has posited a variety of reasons for this tendency, including: i) consumers are more likely to think that the product is on sale or that its price has not been increased recently; ii) consumers ignore or give insufficient weight to the right-most digits of a price; iii) firms expect consumers to react in these ways. If firms passed on the VAT cut, and lowered their prices by 2.1%, we would

expect to see a fall in the fraction of goods at popular price points (e.g. an item that was £16.99 would become £16.63). When the VAT cut was reversed the original price ending would be restored. Although prices may change for other reasons, these changes should not affect the *distribution* of price endings.

To explore how price points changed during the VAT cut we use a unique database from the ONS which contains the price of almost every good that is used to create their estimate of CPI. Our sample, which starts in 2005, contains over 9 million prices. The number of collected prices for a given item does vary from month to month, but we have no reason to suspect that this would bias our results in a particular direction. Figure 3 below shows the proportion of prices (on VAT and non-VAT goods) that end in 99 (e.g. £1.99 and £799). Prior to the VAT cut, the proportion of ‘99 prices is declining at a gradual pace. But in December 2008 when the VAT cut began, this proportion drops by more than half, from over 15% to less than 7%. This suggests that firms did apply the VAT cut. However, we find that after only a few months, the proportion of prices that end in 99 had risen again. This suggests active repricing and the reversal of the VAT cut. It is not clear from this analysis why prices were reversed, but an attraction to certain price points may have been a contributing factor. Alternatively, repricing to price points may have afforded an opportunity to reverse the cut. There is a much smaller drop in the proportion of ‘99 prices in January 2011 when VAT was raised to 20%. Further research would be needed to determine whether this was because firms had a longer period to adjust their prices after the announcement (6 months rather than 1 week) or because fewer firms passed on the VAT change.

Figure 3: Prices ending in '99



## 5 Salience and sentiment

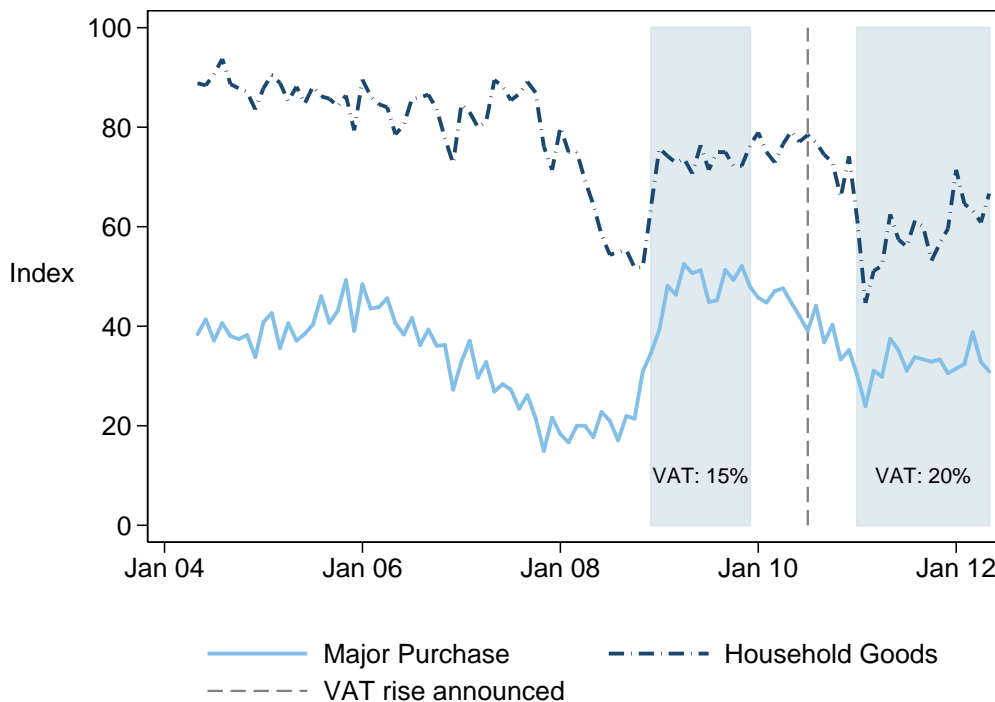
Any increase in consumption spending observed during the period of the VAT cut can only be credibly attributed to the policy if consumers were aware of the temporary VAT cut, and it was salient to their purchase decisions. The cut was small (at 2.1%) and the most frequently purchased items, foodstuffs, are mostly zero-rated. Also, some businesses only passed on the reduction at the till, and left their shelf prices unchanged. In December 2008 the ONS found that 43% of local shops had changed their prices only at the till (Pike et al., 2009). To assess whether the VAT cut was salient for consumers we look at sentiment towards major purchases in a survey of consumer confidence: The Nationwide consumer confidence survey. Chirakijja et al. (2010) looked at a shorter series from this survey and concluded that it contained evidence that the VAT cut was salient for UK consumers.

The Nationwide consumer confidence survey ran from May 2004 to May 2012 and was a monthly survey based on interviews with around 1,000 people. The survey contained two separate questions on sentiment toward expenditure - one relating to major purchases (which included cars and houses) and one relating only to household goods. This separation is extremely useful as it prevents us from conflating the effects of the VAT cut with the car scrappage scheme. The car scrappage scheme started in May 2009 and should have boosted

sentiment toward major purchases but not toward household goods.

The figure below shows that sentiment toward purchasing household goods rose sharply in December 2008, exactly coinciding with the VAT cut. This suggests that consumers were aware of the VAT cut and thought it would improve spending conditions. The Major Purchase series started to rise a little earlier (in November) and may be picking up the start of the (short-lived) recovery in the housing market. Interestingly, the Household Goods series never dropped when the VAT cut finished in January 2010. It only fell back in January 2011 when VAT rose to 20%. One reason for the series staying elevated over 2010 may have been an early awareness that VAT would need to rise further in the near future. Even as far back as November 2008, newspapers reported that the Treasury had wanted to raise VAT back to 18-20% when the VAT cut finished.<sup>22 23</sup>

Figure 4: Sentiment toward making a major purchase (Nationwide survey)



## 6 Purchases

We now turn to whether consumers raised their purchases in response to the VAT cut. That was certainly the aim of the policy, but it was put in place during the largest contraction in

<sup>22</sup><http://news.bbc.co.uk/1/hi/business/7749074.stm>.

<sup>23</sup>There is a second survey on consumer confidence (The European Commission's consumer confidence indicator) which shows qualitatively similar results. Details available on request.

output since the Great Depression. In the 12 months leading up to the VAT cut (2007Q4 to 2008Q4) aggregate expenditure by households ('aggregate consumption') fell by 5.1%. Again, the key difficulty lies in estimating how purchases would have evolved had the fiscal stimulus not been in place. Previous papers have assumed that any deviation from trend could be attributed to the policy change. Both Cashin and Unayama (2011) and Cashin (2012) used this "difference-from-trend" approach when they evaluated indirect tax changes in Japan and New Zealand. We begin by replicating this approach. Then, following our analysis of pass-through, we adopt difference-in-difference specifications with our two alternative control groups - purchases of non-VAT goods and retail sales in other OECD countries. These estimates allow purchases to depart from trend due to factors other than the VAT cut, but assumes those factors affected non-VAT goods / other OECD countries in the same way.

There are a number of potentially important confounding factors. The first is the large cut in the Bank Rate by the Bank of England (BoE) over the first half of the VAT cut, which could have raised expenditure. Between September 2008 and March 2009, the BoE lowered its Bank Rate from 5% to 0.5% - the largest reduction in its history.<sup>24</sup> However, effective interest rates (paid on mortgages and credit cards) did not fall nearly as far.<sup>25</sup> For this reason we think it unlikely that the loosening in monetary policy had a significant impact on expenditure levels over 2009. A second factor that may have affected spending during the cut was the car scrappage scheme, which ran from May 2009 to March 2010. The scheme offered a £1,000 subsidy to the price for about 15% of new cars (a trade-in of a 10 year old car was required) and this could contaminate our estimate the impact of the VAT cut.<sup>26</sup> Therefore, where possible we also look at measures of purchases that exclude cars. A third factor that may have raised spending was a (short-lived) recovery in the housing market that emerged over 2009. The BoE Agents' Summary of Business Conditions for January 2010 noted widespread reports of growth in 'big-ticket items' at the end of 2009, such as white-ware and home furnishings. Some retailers attributed this to consumers anticipating the end of the VAT cut but others felt it reflected a pickup in housing market activity.<sup>27</sup> Where possible, we separate purchases of durables from other types of goods. The final event which may disrupt our analysis is the announcement, in late June 2010, that VAT would rise to 20% on 4th January 2011. Consumers may have cut back their purchases following this announcement which could lead us to overstate the payback from any substitution effect associated with the VAT cut.

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<sup>24</sup>The BoE also began Quantitative Easing in March 2009 and by end 2009 had made £200bln of asset purchases.

<sup>25</sup>See Crossley, Low and O'Dea (2013).

<sup>26</sup>Dealers were supposed to match this £1000 subsidy with an additional £1000 discount of their own. It is difficult to test whether such discounts were in fact additional.

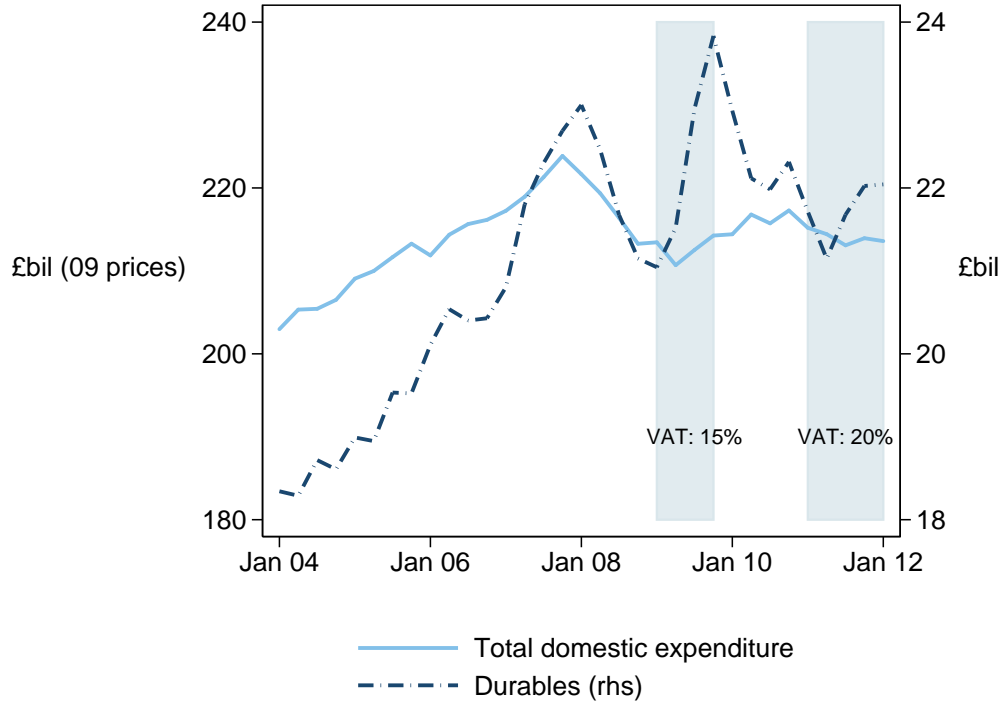
<sup>27</sup><http://www.bankofengland.co.uk/publications/Documents/agentssummary/agsum10jan.pdf>

## 6.1 Aggregate Expenditure Data

We begin by looking for the effect of the VAT cut at the aggregate level using Total Domestic Expenditure (TDE) and its components.<sup>28</sup> The TDE series and its components are based mostly on data from the Retail Sales Inquiry and the Living Costs and Food Survey, though they also draw on administrative data from HMRC as well as other survey data. This aggregate level data set contains purchases of different types of good (i.e. durable, semi-durable, non-durable and services). As mentioned, durables and (to a lesser extent) semi-durables are easier to store and are more likely to be luxuries, so we may see larger substitution effects for these types of goods. The main limitation of the data is that it is only available on a quarterly basis.

Figure 5 below shows TDE as well as expenditure on durable goods.<sup>29</sup> The figure shows that TDE fell sharply over 2008 following the onset of the financial crisis. This decline ended in 2009, which roughly coincides with the start of the VAT cut, and expenditure then continued to grow slowly through 2009 and 2010, before falling back in 2011. There was however, a large rise in purchases of durable goods over 2009 and then a decline over most of 2010 after the VAT cut ended. Purchases of durables makes up approximately 10% of TDE.

Figure 5: Total domestic expenditure and purchases of durables



<sup>28</sup>This is consumption as measured in the national accounts. Total Domestic Expenditure captures all expenditure in the UK, and includes spending by tourists but excludes spending by UK residents abroad.

<sup>29</sup>Both series have been converted to volumes (purchases) and seasonally adjusted.



In 2009, 2 million new cars were bought. Of these, 300,000 benefited from a £1000 government subsidy through the car scrappage scheme, giving an average value of £150 across all new cars bought. All new cars additionally benefited from the reduction of 2.5% through the VAT cut which, with the average pre-VAT price of a new car at about £10000, meant the average value of the VAT cut was about £250. The presence of the scrappage scheme may confound our estimates of the effect of the VAT cut. We therefore construct a series for durables excluding cars. We also consider semi-durables, which is predominantly clothing, but only makes up approximately 11% of TDE.

In Table 3, we regress TDE and its components on a time dummy for 2009. We assume a simple linear trend but allow the trend to change with the onset of the financial crisis (2008Q1, the first quarter in which TDE contracted). There is no sign of a significant rise in TDE or in any of its components (only a fall of 0.7% in non-durables).

Table 3: Effect of the VAT cut on total domestic expenditure and its components

	Total dom. expenditure	Durables	Durables ex cars	Semi-durables	Non-durables	Services
2009	0.0001 (0.003)	0.0168 (0.014)	-0.0094 (0.012)	-0.0046 (0.012)	-0.0069* (0.004)	0.0007 (0.004)
Trend	0.0088*** (0.001)	0.0199*** (0.004)	0.0264*** (0.004)	0.0221*** (0.003)	0.0044*** (0.002)	0.0053*** (0.001)
Fin. crisis - trend	-0.0120*** (0.003)	-0.0224* (0.012)	-0.0222*** (0.006)	-0.0141*** (0.005)	-0.0098*** (0.003)	-0.0100** (0.004)
Observations	53	53	53	53	53	53
R Squared	0.60	0.30	0.53	0.52	0.18	0.30

Notes:

i) Estimated in first-differences of logs with robust standard errors

ii) Sample period is 1997Q1 to 2010Q2

iii) Standard errors reported in parentheses

iv) \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

A breakdown of TDE is available for over 100 different categories of goods. By labeling each category as non-VAT or VAT we have also estimated a difference-in-difference specification using ‘non-VAT’ goods as the control groups. We again find that purchases of VAT goods over 2009 is not significantly different from the counterfactual.<sup>30</sup> These results suggest that the VAT cut did not raise purchases on a large enough number of goods and over a long enough period to enable a precise effect to be estimated at the aggregate level on quarterly data. This does not rule out short-lived effects or those confined to a few goods, or that the effects may be more precisely estimated with other data. We explore these possibilities in the next section.

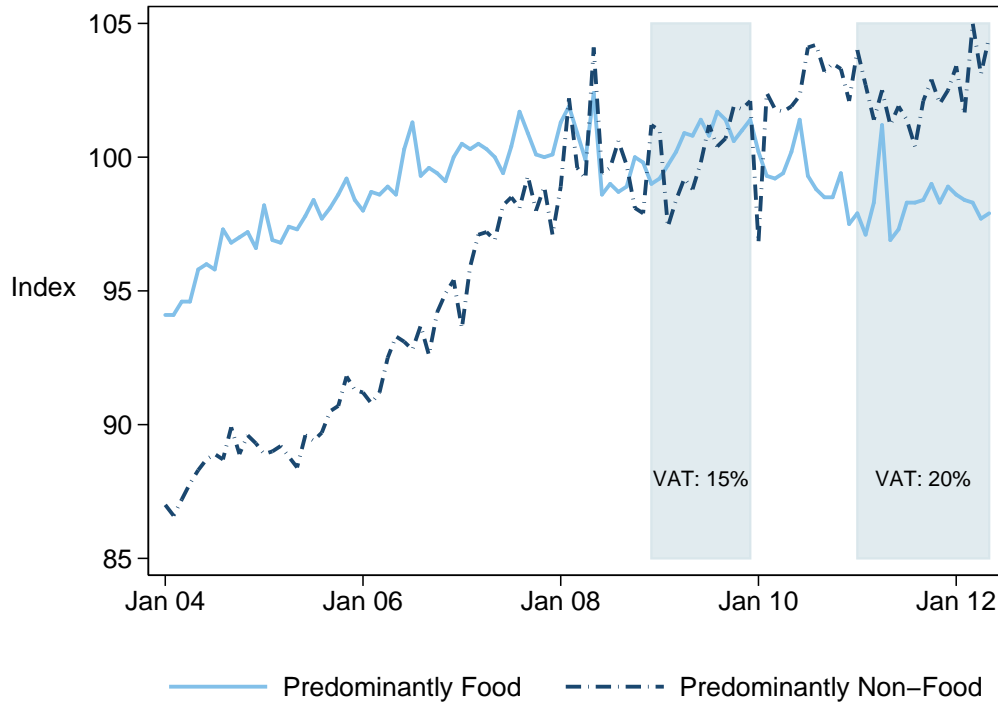
<sup>30</sup>Details are available on request.

## 6.2 Retail Sales

We now narrow our focus to retail sales which make up approximately 34% of aggregate expenditure (Anagboso and McLaren, 2009). Our data come from the Retail Sales Inquiry (RSI) which is a monthly survey of approximately 5,000 retailers. The survey excludes cars (Dolling et al., 2005) and it has the advantage of being available at a higher frequency than the aggregate expenditure data. Figure 6 below shows the two main components of retail sales - Predominantly Food and Predominantly Non-food (44.9% and 49.8% respectively).<sup>31</sup>

<sup>32</sup> At the start of the cut there is a large rise in the ‘predominantly non-food’ series. The idea that this is due to the VAT cut is made more likely by the absence of a rise in the Predominantly Food series (most food is zero-rated). After the VAT cut ends (in January 2010) there is a large dip in the Predominantly Non-food series with no matching dip in Predominantly Food. This points toward the VAT cut producing a short-lived substitution effect, whereby consumers moved purchases forward from the start of 2010 into 2009.

Figure 6: The two main components of retail sales



To quantify these observations we begin with the difference-from-trend specification. Specifically, we regress retail sales and its components on a range of time dummies and

<sup>31</sup>The percentages come from Anagboso and McLaren (2009). The remaining 5.3% is ‘non-store retailing and repair’.

<sup>32</sup>Both series have been converted to volumes (purchases) and seasonally adjusted.

allow for a simple linear trend. Table 4 shows that total retail sales (excluding automotive fuel) rose 1.2% above its trend over the period of the VAT cut. This comes entirely from Predominantly Non-food sales. In particular, Household Goods (which make up around 10% of retail sales) rose 2.9% above its trend. By redefining dummies for shorter periods, we find that the rise comes primarily at the start of the VAT cut period, which is consistent with our previous finding that pass-through was greatest in the first few months. In January 2010, when the VAT cut ended, there are significant falls in retail sales. There are no further falls or rebounds in February, which is consistent with short-run arbitrage.

The change to the overall price level due to the VAT cut was around 1.3%, and so the 1.2% increase in total sales gives an elasticity of approximately 1. Since retail sales makes up 34% of aggregate expenditure, these estimates imply that aggregate expenditure increased 0.4% in response to the VAT cut, although other components of aggregate expenditure may have also changed.

Table 4: Effect of the VAT cut on retail sales and its components  
(*difference from trend*)

	Total sales	Predominantly non-food	Household goods	Predominantly food
2008 Dec - 2009 Dec	0.012*** (0.001)	0.021** (0.009)	0.029*** (0.007)	0.002 (0.008)
2010 Jan	-0.024*** (0.001)	-0.044*** (0.009)	-0.123*** (0.007)	-0.001 (0.008)
Trend	0.003*** (0.001)	0.004*** (0.001)	0.004*** (0.002)	0.002*** (0.001)
Fin. crisis - trend	-0.002 (0.002)	-0.003 (0.004)	-0.008** (0.004)	-0.002 (0.002)
Observations	162	162	162	162
R Squared	0.22	0.24	0.43	0.05

Notes:

- i) Total sales excludes automotive fuel
- ii) Estimated in first-differences of logs with robust standard errors
- iii) Sample period is Jan 1997 to Jun 2010
- iv) Standard errors reported in parentheses
- v) \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Turning next to difference-in-difference specifications, we first consider the effect of the VAT on categories of expenditure that are largely subject to VAT (predominantly nonfood, and household goods, which is a subset of the former) using the predominantly food category (which is largely zero-rated) as a control. The results, in Table 5, show again a 2-3 percent increase in these categories of retail sales during the period of the VAT cut, implying a 1 percent increase in retail purchases overall.

Table 5: Retail Sales Effects of the VAT cut  
*(difference-in-differences, comparing  
VAT goods with non-VAT goods)*

	Nonfood - Food	Household goods - Food
2008 Dec - 2009 Dec	0.020 (0.017)	0.027*** (0.001)
2010 Jan	-0.044** (0.017)	-0.123*** (0.001)
Trend	0.002 (0.001)	0.002 (0.002)
Fin. crisis - trend	-0.001 (0.003)	-0.006 (0.004)
2008 May	0.016*** (0.005)	0.005*** (0.000)
Observations	162	162
R Squared	0.18	0.37

Notes:

- i) Total sales excludes automotive fuel
- ii) Estimated in first-differences of logs with robust standard errors
- iii) Sample period is Jan 1997 to Jun 2010
- iv) Standard errors reported in parentheses
- v) \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

An alternative approach is to estimate a counter-factual path for retail sales in the UK using retail sales in other OECD countries. As noted above, this approach rests on the assumption that no other events (aside from the VAT cut) affected retail sales in the UK but not elsewhere at the exact time of the VAT cut. The assumption holds in so far that the financial crisis was a global phenomenon and was the main factor influencing retail sales, but the assumption may fail because the severity of the crisis (and Government responses) differed widely across countries.

Our data set consists of monthly retail sales in the top 15 OECD countries (by GDP per capita).<sup>33</sup> We use these countries to estimate the following difference-in-difference specification:

$$RetailSales_{i,t} = \beta_0 + \beta_1 UK_i + \beta_2 UK_i \times Cut_t + \beta_3 Cut_t + \beta_4 Trend_t + \varepsilon_{i,t} \quad (3)$$

<sup>33</sup>Retail sales data was not available for Australia on a monthly basis. Once again we exclude Ireland which experienced a VAT change in 2008.

where  $RetailSales_{i,t}$  is the monthly index of retail sales in country  $i$  in period  $t$ ,  $UK$  is a dummy for the UK,  $Cut_t$  is a dummy (for all countries) for the period of the VAT cut and  $Trend_t$  is a linear trend. The coefficient  $\beta_2$  picks up the impact of the VAT cut on UK retail sales, while the coefficient  $\beta_3$  captures changes in retail sales that were common to all OECD countries. The equation was estimated using fixed effects with robust standard errors.

The regression results are shown below in Table 6. The specifications differ by whether we allow for a change in the trend at the start of the financial crisis, and whether that change is allowed to differ among the countries.<sup>34</sup> The results suggest that the VAT cut boosted retail purchases by 1% (from the coefficient on  $UK \times Dec08 - Dec09$ ). This is consistent with our estimates above and would translate into aggregate expenditure rising 0.4% if other components were unchanged. The boost to purchases appears to come almost entirely in the first half of the VAT cut, which is consistent with our earlier result that at least part of the cut was reversed early. There is a large fall back (2%) in UK retail sales in January 2010 when the VAT cut officially ended. Finally we note that the effects report here do not contradict our estimates using TDE and its subcomponents. The effects in retail sales data are more precisely estimated.<sup>35</sup>

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<sup>34</sup>We choose February 2008 as the start of the crisis as this was the middle of the first quarter in which total domestic expenditure contracted.

<sup>35</sup>For a more conservative approach to inference we construct a Conley-Taber confidence interval, using the same approach as described in sub-section 4.2. Namely, we estimate the finite sample distribution of  $\beta_2$  for the last equation in Table 5 using our OECD control countries. The 95% Conley-Taber confidence interval is wide and ranges from -0.3% to 3.3%.

Table 6: Effect of the VAT cut on retail sales  
(*difference-in-differences, comparing retail sales in  
the UK with sales in other OECD countries*)

	(1)	(2)	(3)	(4)	(5)
<i>Effect of VAT cut</i>					
UK * Dec08-Dec09	0.011** (0.004)	0.011** (0.004)			0.011** (0.004)
UK * Dec08-Jun09			0.011*** (0.002)		
UK * Jul09-Dec09				-0.003 (0.002)	
<i>Effect of VAT cut reversal</i>					
UK * Jan10	-0.021*** (0.002)	-0.021*** (0.002)	-0.026*** (0.003)	-0.028*** (0.003)	-0.021*** (0.002)
Observations	1325	1325	1325	1325	1325
No. months (max)	102	102	102	102	102
No. groups	13	13	13	13	13
R squared within	0.01	0.01	0.02	0.02	0.02
Financial crisis trend	None	Group	Individual	Individual	Individual

Notes:

- i) Estimated in first-differences of logs with robust standard errors. Additional controls are period dummies.
- ii) Standard errors reported in parentheses
- iii) \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$
- iv) Sample period: Jan 2002 to Jun 2010

## 7 Conclusions

In this paper we reported the first ex-post evaluation of a temporary VAT cut. In late 2008, the UK Government announced an almost immediate, but temporary cut to VAT. The standard VAT rate was cut by 2.5 percentage points for 13 months. The aim was to stimulate consumer spending. This type of fiscal stimulus had never been used either in or outside the UK, but it has the potential to become a widely used tool, with around 150 countries now levying VAT. The appealing features of a temporary VAT cut are that it can be implemented quickly and it incentivizes consumers to bring forward purchases, stimulated aggregate demand. If consumers bring forward *consumption*, this is a classic intertemporal substitution effect. If consumers bring forward *purchases* of storable goods, but do not alter their consumption plans, this is an arbitrage effect. Uncertainty or storage costs will lead arbitrage to happen late in the period of the cut, whereas an inter-temporal substitution effect in consumption should apply throughout the period of lower prices.

The efficacy of a VAT cut as a fiscal stimulus depends on the extent to which firms pass through the price cut to consumers, and the extent to which consumers respond to the consequent price changes. On the first question, we found that although firms initially passed through the lower VAT rate (we cannot reject complete pass-through), they subsequently reversed at least part of the cut after around two months. Thus while prices did respond to the VAT cut, they did not follow the time path of the VAT. This raises interesting questions about consumers anticipation of the path of prices. Our data do not speak directly to this question and we leave it to future research.

Turning to the response of consumer purchases to the VAT cut, we find that the VAT cut boosted retail sales by about 1%, with a particularly marked increase in sales of household goods. Retail sales make up around 34% of aggregate expenditure and so this implies an increase in aggregate expenditure of 0.4%.<sup>36</sup> We find a significant increase in purchases only in the first half of the period of the VAT cut. This coincides with the part of the period in which we estimate prices to be lower than they would have been in the absence of the VAT cut. Finally, we also found a drop in retail sales in January 2010, when the temporary VAT cut expired.

Comparing our results to the Government's aim which was for a 0.5% increase in aggregate consumption, we conclude that the effect of the cut was slightly smaller than they had hoped. The impact of the cut might have been larger if the VAT cut had been passed through for a longer period: the size of the effects are striking given the limited pass through we observe. Our key conclusion is that cutting prices temporarily can lead to intertemporal substitution which provides an important fiscal mechanism for stimulating expenditure.

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<sup>36</sup>The national accounts data are consistent with a wider range of effects than the retail sales data.

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