Durable spending, relative prices and consumption

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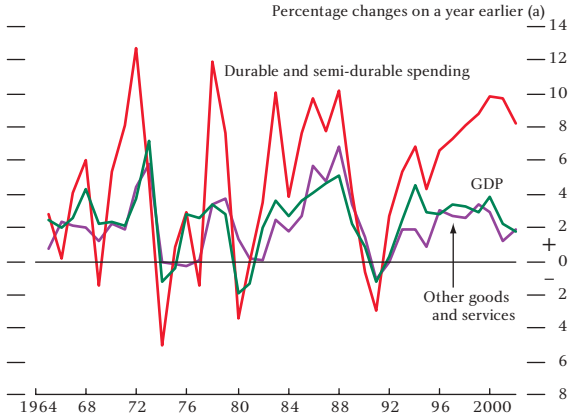
In real terms, the growth of durable spending has substantially outpaced that of spending on other goods and services since the mid-1990s. But that gap largely reflects the effects of falling relative prices: nominal spending on durables and on non-durables has grown at similar rates during that period. This article uses a simple framework to assess the behaviour of the real and nominal ratio of durables to non-durable spending in the long run. It also considers the current position of the ratios in more detail and provides some assessment of how we might expect them to have evolved given prevailing cyclical factors.

Durable goods and consumption

Real annual consumption growth has averaged about 3.7% between 1998 Q1 and 2003 Q3—well above real average annual GDP growth of about 2.6% during that period.(2) Chart 1 shows that the buoyancy of consumer spending can be entirely accounted for by strong growth in durable and semi-durable goods expenditure (henceforth referred to as 'durable spending' unless otherwise specified). Since 1998 Q1 the annual growth rate of that spending has averaged 8.5%. In contrast, the growth of spending on other goods and services (which constitutes about three quarters of total consumer expenditure) has been much weaker, averaging 2.1% a year during that period.

Chart 1
Consumption and GDP



(a) Annual data.

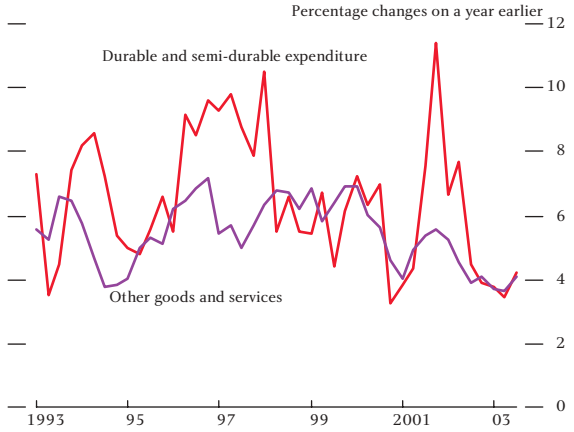
Chart 1 also shows that durable spending is volatile: it fluctuates more procyclically than non-durable spending. Periods of high GDP growth are accompanied by strong growth of durable spending relative to non-durable spending. And during recessions, durable expenditure typically falls back more sharply. This is consistent with economic theory which implies that households' purchases of durable goods could react more to economic news than households' demand for other goods and services. This is because durable goods provide a flow of services which households consume over a number of periods and those goods are typically purchased by households rather than rented. So, for example, given a perceived improvement in economic conditions (such as an increase in expected future income) households might seek to build up their stocks of those goods and therefore temporarily drive up their purchases of those goods relative to spending on other non-durable goods and services.

An initial analysis might therefore wholly attribute the relative strength of durable spending in recent years to positive cyclical factors, which have caused households to increase their relative demand for durable goods. But the persistence of the strength of durable spending is puzzling. The gap between the annual growth rates of durable and non-durable expenditure has exceeded 4 percentage points in every quarter since 1998 Q3. That is unlikely to reflect short-run factors. Moreover,

(1) The author would specifically like to thank the Household Expenditure branch at the ONS for providing additional data used in the analysis contained in this article.
(2) Note that the analysis in this article is based on ONS National Accounts data published in the ONS Quarterly National Accounts (QNA) release on 23 December 2003. More recently, and prior to publication of this article, Q4 GDP and consumption data, as well as back revisions to those data were published in the UK Output, Income and Expenditure (OIE) release on 25 February 2004. However, this article does not use the information in that release, as disaggregated consumption data on durables, semi-durables and other consumption expenditure were not published. (Typically those data are only published at the QNA stage of the data cycle.)

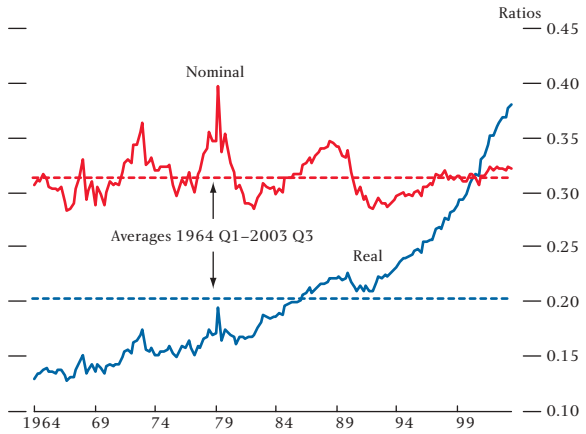
the strength of durable spending is largely a 'real'-only phenomenon. In nominal terms, since 1998 Q1 the annual growth rate of durable spending has averaged 5.9%—above, but not exceptionally higher than, the 5.4% average annual growth of spending on other goods and services (see Chart 2).

Chart 2
Nominal consumption



So a falling relative price of durable to non-durable goods and services must have contributed to the stronger relative growth of real durable spending. The falling relative price is not just a recent phenomenon: it has trended downwards since 1964, the earliest point for which disaggregated consumption data were published. That is reflected in the real ratio of durable spending to other consumption expenditure, which has risen during that period while the nominal ratio has remained relatively flat (see Chart 3). The real ratio is now well above its average, unlike the nominal ratio which is currently close to its average.

Chart 3
Ratio of durable and semi-durable spending to that on other goods and services

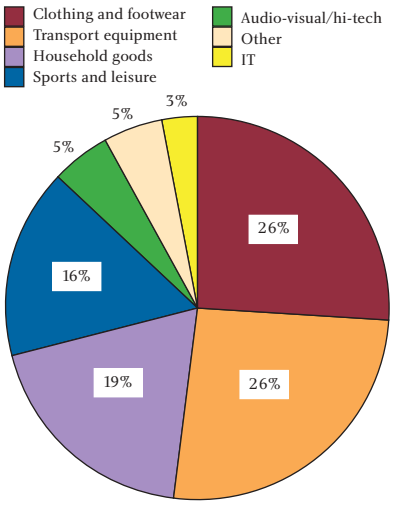


In order to assess any possible imbalances in durable spending relative to spending on other goods and services, it is necessary therefore to consider both the real and the nominal ratio of durable to non-durable spending. This article considers the behaviour of these ratios in long-run equilibrium. In the next section we outline the components of durable spending in more detail. Then we use consumer theory, and an application of the method recently used in the *Bulletin* to characterise the long-run equilibrium business investment to GDP ratio, to produce similar estimates for the ratio of durable to non-durable expenditure.(1) The article concludes by discussing the recent evolution of durable to non-durable spending and providing some assessment of where we might have expected those ratios to be given the prevailing cyclical factors.

The components of durable spending

Unlike most consumption goods, which provide a service for a limited time, durable and semi-durable goods can be used repeatedly or continuously and, on the ONS definition, typically for more than one year. Together, durable and semi-durable expenditure account for about 25% of total consumer spending (in roughly equal proportions). Within 'durables only', transport equipment (mainly vehicles) is the single largest component, followed by household goods (home furnishings, carpets, household appliances etc), and IT/audio-visual goods. The main components of semi-durable goods are clothing and footwear, followed by sports and leisure equipment. Chart 4 shows the current-price expenditure breakdown of durable and semi-durable goods in 2002. It is useful to note that in the National Accounts the purchase of new housing does not form part of durable consumption. Instead, housing

Chart 4
Expenditure composition of durable and semi-durable goods in 2002



(1) See Ellis and Groth (2003).

is treated as an asset; additions to the housing stock therefore form part of whole-economy investment. However, consumption of housing services is captured within the consumption data, as rents and imputed rents from owner-occupied housing form part of services spending.

Modelling durable goods spending

The decision by a consumer to purchase a durable good is similar to that of a firm that invests in a unit of capital. The firm will assess the cost of purchasing an additional unit of capital relative to the present value of expected future income that it will generate. The consumer's decision can be characterised as assessing the cost of purchasing an additional durable good by comparing the discounted future flow of services derived from that good to the utility from immediately consuming a non-durable good, or to saving the income and consuming it in a later period. The appendix sets out some simple consumer theory of durable goods. The variable E denotes durable spending and the variable C denotes non-durable spending. Under simplifying assumptions, we can show that in the long run the real and nominal ratios of durable to non-durable spending, $(e - c)^{real}$ and $(e - c)^{nominal}$, are given by the following relationships:

$$(e - c)^{real} = -\sigma p + \Psi \qquad (1)$$

$$(e - c)^{nominal} = p - \sigma p + \Psi \qquad (2)$$

where lower-case letters denote natural logarithms.

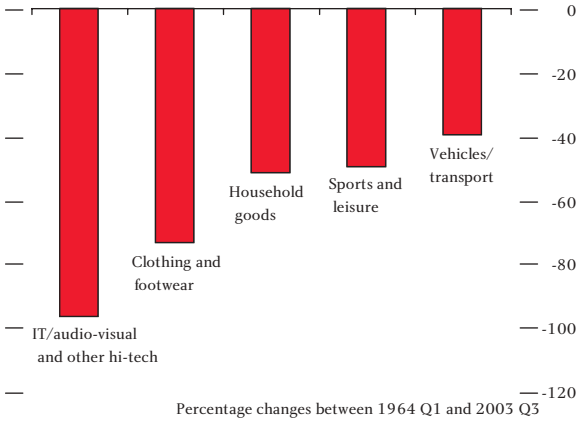
The long-run path of the ratio of durable to non-durable spending depends on the variable p, the relative price of durable to non-durable goods. The parameter σ is the elasticity of substitution between durable and non-durable goods which determines the degree of substitution consumers will make between these types of goods as the relative price changes. Because durable goods last for more than one period the ratio of durable to non-durable expenditure also depends on the costs/gain associated with holding the durable good, such as the real rate of interest, the expected capital gain or loss on those goods (the expected future price of the good) and how fast the good depreciates. The appendix outlines those parameters in detail, but for simplicity we can aggregate those and other structural parameters into a single variable denoted as Ψ.

Intuitively, like the analysis of the business investment to GDP ratio, we can think of the long-run equilibrium durable spending ratio as reflecting a 'demand' effect and a 'price' effect. If σ is large, there is a strong demand effect on the real ratio: consumers' demand for durable goods increases rapidly when the relative price falls. For the nominal ratio there is an offsetting price effect: as the relative price of durable goods falls, nominal spending on durable goods falls relative to that on other goods and services. In order to consider the long-run equilibrium path more quantitatively, estimates of the long-run behaviour of relative prices, σ, and the variable Ψ are required.

Relative prices

The relative price of durable to non-durable goods and services has fallen by about 64% between 1964 Q1 and 2003 Q3. Within durable goods, all the major categories have experienced declines in their relative prices during that period. The most notable falls have been among IT/audio-visual goods and clothing and footwear (see Chart 5).

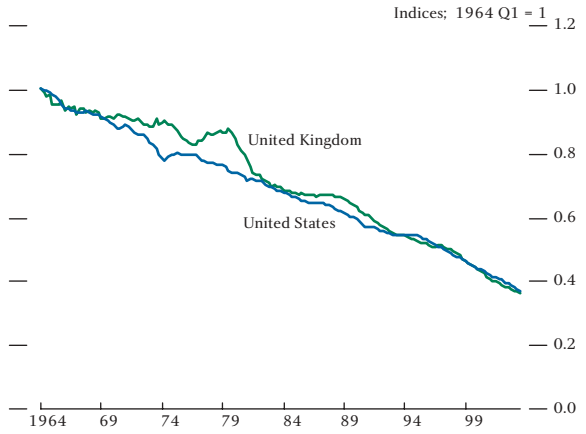
Chart 5
Relative price of durable to non-durable expenditure



Percentage changes between 1964 Q1 and 2003 Q3

The persistent decline in the relative price is likely to reflect faster technical progress in those sectors that produce durable goods, compared with those that produce other goods and services. The durable goods producing sectors are also likely to trade internationally and therefore are subject to more competitive pressures than producers of consumer services. If that is true, and if there is faster technical progress in the durable goods producing sector, then the relative price of durable goods should fall, not just in the United Kingdom but also in the rest of the world. Chart 6 shows that falling relative prices are likely to be a global phenomenon as the relative price of durable to non-durable spending has also fallen in the United States, in line with the decline observed in the United Kingdom.

Chart 6
Relative price of durable to non-durable expenditure



Sources: Bureau of Economic Analysis and ONS.

Chart 7
Relative price of durable to non-durable expenditure

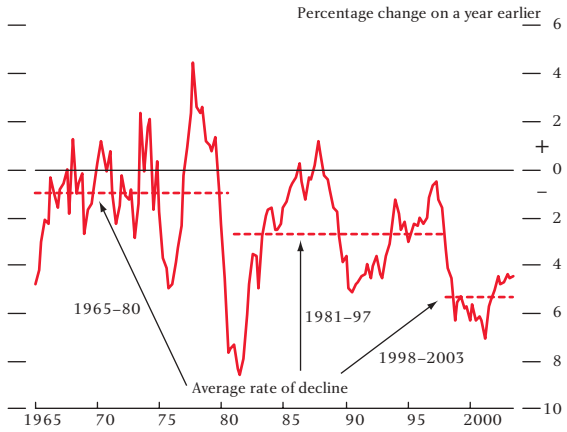
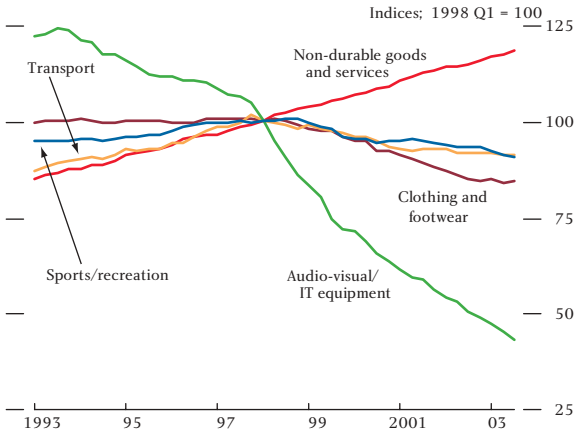


Chart 8
Consumption expenditure deflators



In the United Kingdom, the average rate of decline in the relative price has become more marked over time, particularly so since 1998 (see Chart 7). Between 1998 Q1 and 2003 Q3 the actual price deflator for durable and semi-durable goods fell about 14%, while the price of non-durable expenditure (which includes both goods and services) continued to increase. As Chart 8 shows, the actual prices of some of the major components of durable and semi-durable spending, such as vehicles, clothing and sports goods, have fallen since 1998. But within durables-only expenditure, the fall has been particularly acute among IT/audio-visual goods. The fall partly reflects an increase in the quality of the services these goods provide, rather than a decline in their retail price per unit.

The fall in the durable and semi-durable goods deflators since 1998 probably reflects a combination of factors. One possibility is that the decline follows from the rise in the UK terms of trade. Since 1995, the price of UK imports has fallen relative to that of UK exports, thus giving rise to an increase in the terms of trade. A recent *Quarterly Bulletin* article noted that, within goods, the rise can almost entirely be accounted for by the rise in the terms of trade for ICT goods, possibly reflecting an increase in the efficiency of foreign countries' ICT-exporting sector.(1) The import price of electrical engineering goods, which includes some of the raw material used in the production of ICT/audio-visual goods as well as finished ICT/audio-visual goods themselves, has fallen by about 24% since 1998 Q1. So that could have contributed to some of the fall in the deflator for IT and audio-visual equipment consumer goods if those goods have a high import content. It is likely that those goods (and indeed all durable goods) have a higher import content than the typical consumer good.

But import prices are unlikely to account for the fall in the deflator for some of the other major categories of durable goods, such as vehicles and clothing. That is because, although the import price deflators for those goods have fluctuated between 1998 and 2003, there has been either only a small trend decline or no trend decline in their import deflators during that period. Between 1998 Q1 and 2003 Q3, the vehicles import deflator fell by about 4%, while the clothing imports deflator actually rose by about 1%. That compares with a much larger fall in the clothing and vehicles consumption deflators (about 16% and 10% respectively).

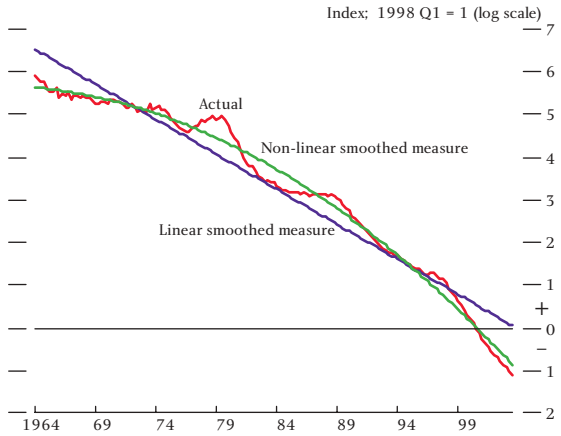
An alternative explanation is that there has been a more marked increase in competition in the UK retail sector during the past five years, which could have driven down the price of some durable goods. For example, following the publication of the Competition Commission's

(1) See Dury, Piscitelli, Sebastia-Barriel and Yates (2003).

inquiry into UK car dealing, car producers were required to offer retailers the same volume-related discounts afforded to fleet buyers, by 1 December 2000. The vehicles deflator fell by about 5% between 1999 Q4 and 2001 Q4, possibly reflecting the impact of that ruling. The fall in the clothing and sports/leisure goods deflator is also consistent with market anecdote that falling margins and discounting have become more prevalent in those retail sectors since the late 1990s.

Whatever the reason, the persistent decline in the relative price of durable goods should be reflected in the long-run estimate of the relative price path. One simple way to capture that would be to smooth through the actual relative price path with a linear time trend, as shown in Chart 9. That assumes that the long-run rate of change in relative prices is well characterised by its average since 1963. But it ignores the feature of the data that the relative price of durable and semi-durable goods has fallen at a faster rate over time. So an alternative would be to use a non-linear time trend, also shown in Chart 9. This follows the profile of the relative price more closely.

Chart 9
Relative price of durable to non-durable goods



The elasticity of substitution between durable and non-durable spending

There is little or no UK micro-literature on the elasticity of substitution between durable and non-durable spending. But the US literature suggests an elasticity of substitution of about 1.[1] Such an elasticity implies that a 1% rise in the relative price of durable goods will cause demand to shift away from durable goods by 1%. As a result, the nominal expenditure share of durable goods is unaffected by relative price movements: price effects are offset by corresponding volume effects, so the relative price terms disappear in the expression for the nominal ratio of durable to non-durable spending (equation **(2)**). The aggregate UK data appear to be consistent with a unitary elasticity (see Chart 3): relative price movements appear to have had little or no effect on the nominal ratio. So that value has been used to estimate the long-run equilibrium.

Other parameters and variables

The variable Ψ is a function of other structural parameters, including the depreciation rate of durable goods, the real interest rate, the long-run growth rate of the stock of durable goods, and the long-run rate of change of the relative price of durable goods. A rise in the real interest rate would lower Ψ and reduce the long-run equilibrium ratio. That is because higher interest rates reduce the discounted future resale value of durable goods (it increases their user cost). That could elicit some substitution away from durable goods to non-durable goods and services.[2] The sensitivity of durable spending to credit conditions should be even greater if expensive durable goods such as cars, household goods and audio-visual equipment are financed through borrowing. Changing depreciation rates have an ambiguous effect on Ψ. On the one hand, a higher depreciation rate reduces the future resale value of durable goods and therefore lowers the desired stock of durable goods. But on the other hand, although that stock might be lower, a higher depreciation rate requires increased spending on durable goods to maintain that particular level of stocks. The net effect on the ratio is ambiguous. An increase in the long-run growth rate of the desired stock would also increase Ψ and hence the long-run equilibrium ratio. By raising the resale value of currently purchased durable goods, an increase in the long-run rate of change of relative prices also increases Ψ.[3]

(1) Ogaki and Reinhart (1998) estimate an elasticity of 1.17 for the United States.
(2) In principle, a rise in interest rates should reduce both durable and non-durable consumer spending as a result of intertemporal substitution, but because the change in interest rates also affects the user cost of durables, that could elicit substitution away from durables to non-durable spending. Mankiw (1985) shows that durable spending in the United States is more interest rate sensitive than spending on non-durable goods and services.
(3) Higher future durable goods price inflation increases the resale value of durable goods bought today. That might elicit substitution toward the purchase of durable goods. This result relies on the existence of secondary markets (which may not be plausible for many durable goods). However, to the extent that consumers can delay purchases of durable goods, the intuition is still valid—higher expected future durable goods price inflation might induce people to buy goods now rather than later.

We consider two methods to estimate Ψ. The first method simply assumes that the structural parameters which determine Ψ are constant over time. We can choose the best fitting value by a linear regression: the value of Ψ that minimises the gap between the observed ratios and the estimated long-run equilibrium values for the relative price and the imposed value for σ. The second method assumes that the structural parameters which determine Ψ are time varying. Although we have no model to consider the evolution of those factors we can relax the assumption that they are constant over time by using a non-linear method to estimate Ψ. That may be a more appropriate way to estimate Ψ given that the non-linear long-run path for relative prices implicitly embeds the assumption that the rate of change of the relative price has varied over time.

Equilibrium paths

Charts 10 and 11 show the real and nominal long-run ratios consistent with the outlined assumptions. There are two long-run ratios in both real and nominal space. That reflects the alternative assumptions for the long-run relative price path and Ψ. For simplicity we use the constant-value assumption for Ψ with the linear relative price time trend (constant rate of change) and the time-varying assumption for Ψ with the non-linear relative price time trend (increasing rate of decline).

The actual real ratio is well above the estimated long-run ratio where long-run relative prices are estimated using the linear time trend and constant Ψ. Where the long-run relative prices are estimated using a non-linear time trend the actual ratio remains above the long-run equilibrium path, but the gap is narrower.

The unitary elasticity of substitution assumption between durable and non-durable goods implies that the long-run nominal ratio is unaffected by relative prices. So the long-run nominal ratio is simply determined by Ψ. The two methods to determine Ψ yield two alternative paths for the long-run ratio: a constant path and a time-varying path. Currently, unlike in the late 1980s, the nominal ratio is only slightly above both estimates of the long-run path.

Current issues and conclusions

The strength of real durable spending since 1998 largely reflects the effects of sharply falling relative prices. The previous analysis suggested that some of the rising real level was consistent with movements in an estimated

Chart 10
Real ratio of durable to non-durable consumption

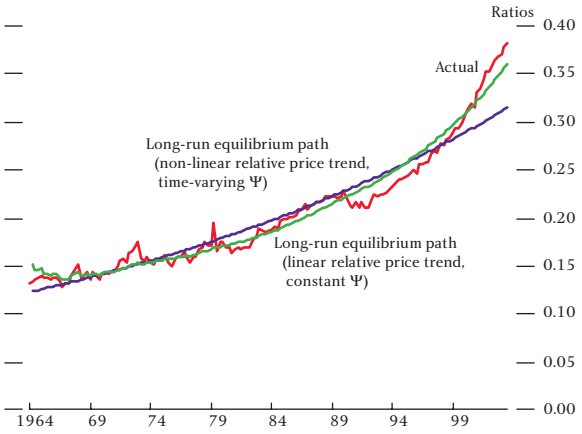
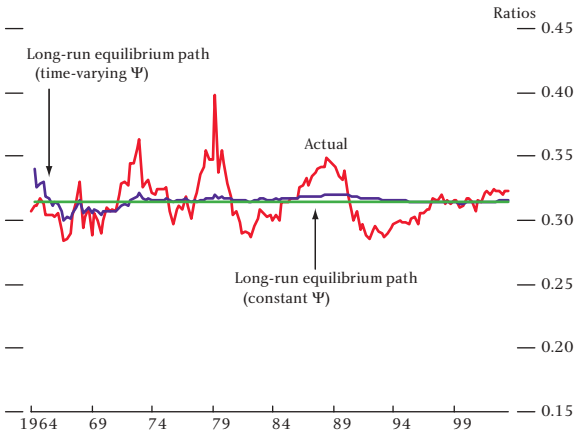


Chart 11
Nominal ratio of durable to non-durable consumption

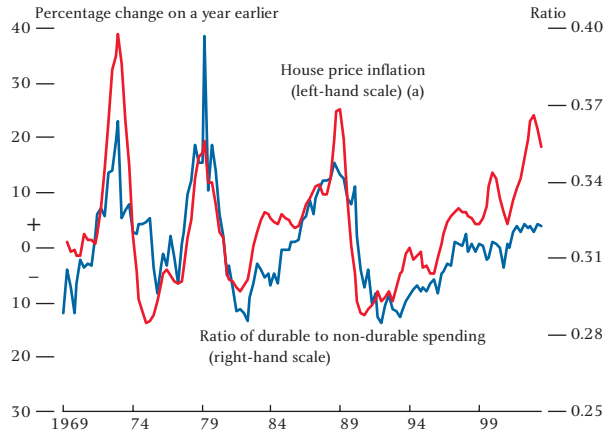


long-run equilibrium path. Looking forward, if relative prices continue to fall sharply, the strength of real durable spending should persist.

But abstracting from the effects of changing relative prices, Chart 2 also makes clear that, with the exception of a temporary pickup between 2001 Q3 and 2002 Q2, nominal durable spending has grown broadly in line with spending on other goods and services since 1998. Moreover, although the ratio of durable to non-durable spending has risen slightly in recent years, it has remained close to its estimated long-run path. That suggests that, unlike in previous cycles, there is currently little imbalance in durable spending.

This may be surprising, as we might have expected durable spending to have reacted more to the fall in interest rates and rising housing equity during the past two to three years. Indeed, there appears to have been a close relationship in the past between the nominal ratio of durable to non-durable expenditure and house price inflation (see Chart 12). That relationship probably

Chart 12
House price inflation and the nominal ratio of durable to non-durable expenditure



Sources: HBOS, Nationwide, ODPM and ONS.

(a) Deflated by the consumer expenditure deflator.

reflects several interrelated factors. First, the relative demand for durable goods and housing is likely to fluctuate procyclically. As mentioned in the introduction, if income expectations rise, households might temporarily increase their relative demand for durable goods in order to build up their desired stocks. But higher income expectations could also increase the demand for housing, which (in the presence of short-run supply constraints) would act to push up house prices. So, because house price inflation and durable spending react similarly to an income shock, that could lead to an indirect positive relationship between them. Second, the link between durable spending, income expectations and house price inflation could be more direct, given that some expensive durable goods such as cars, household goods and PCs tend to be financed through borrowing. For some households, particularly those which are credit-constrained, increased house price inflation might facilitate any increased demand for durable goods from higher income expectations. That is because higher house price inflation raises the collateral against which they can borrow on a secured basis. And secured borrowing tends to be less costly than unsecured borrowing. Third, even in the absence of changing income expectations, rising house prices could make it cheaper for households to borrow in order to increase their stocks of durable goods to their desired levels.

It is puzzling therefore that, unlike in the late 1980s, when house price inflation also increased sharply, there has only been a small pickup in the nominal ratio in recent years. Although there are a number of explanations why the nominal ratio has not risen more, one possibility is that rising housing equity and lower interest rates have not been accompanied by a marked increase in households' future income expectations, so they have not increased current durable consumption. Another is that, prior to the rapid rise in housing equity since 2001, consumers' credit constraints were already sufficiently relaxed that further rises in housing equity would not elicit the same consumption response from households as they might have done in the past. A final hypothesis is that households have viewed some of the recent increases in house prices and falls in interest rates as transitory and therefore have not changed their spending decisions.

Appendix
The theory behind the ratio of durable to non-durable spending

This appendix derives the two long-run relationships described on page 23 using consumer and user cost theory.

The user cost of durables

Where goods are non-durable (or the service from the good is exhausted during the period in which it is purchased), the cost of using them (user cost) is just their relative price. However, durable goods provide a flow of services over a number of periods, so their user cost per period is less than their purchase price.

We can derive the user cost of durable goods as follows. We consider the constant elasticity of substitution case. In any period the consumer's utility (U) depends on the stock of durable goods (D) and non-durable goods (C).

$$U = \left[\alpha C_t^{-\rho} + (1-\alpha) D_t^{-\rho} \right]^{-1/\rho} \qquad \textbf{(A1)}$$

$$\sigma = \frac{1}{1+\rho}$$

σ is the elasticity of substitution between durable and non-durable consumption goods.

The consumer faces a budget constraint, in any period, to choose either to increase the stock of durables (which depreciates at a rate δ), purchase the non-durable good, or save the consumer's income in a risk-free asset (A). P_t is the relative price of the durable good (the price of the non-durable good is 1) and r_t is the real risk-free interest rate.

$$A_t = A_{t-1}(1 + r_t) - C_t - P_t[D_t - (1 - \delta)D_{t-1}] \qquad \textbf{(A2)}$$

It is useful to point out some underlying simplifying assumptions inherent in this model at this stage. We assume that the consumer's utility depends directly on the outstanding stock of durable goods. But in principle the consumer's utility in any period should depend not on the stock, but on the service flow from that stock. So this case assumes that the service flow is linearly related to the stock in each period. This is a reasonable assumption where there is only one durable good which depreciates at a constant rate. However, in reality, there are many types of durable goods, which depreciate at different rates (for example IT goods depreciate more quickly than some household goods) and which have different relative prices. So the link between the service flow and the stock at any particular point is not clear-cut. But in order to make the analysis tractable it is useful to consider this simple case. Hamilton and Morris (2002) present a flow of services measure of consumption which makes different service-life assumptions for the components of durable goods. We can update those service flow estimates and also consider a rough estimate of the stock of durable goods. The estimates suggest that the assumption of the service flow being linearly related to the stock is reasonable.

We consider the user cost from the first-order conditions of the consumer's maximisation problem. In equilibrium the user cost of the durable good equals the marginal rate of substitution of the utility flow from the durable and non-durable good (the ratio of the marginal utilities). This is similar to a consumer's maximisation problem for two non-durable goods, where consumers will adjust their consumption bundle such that at any point in time the utility trade-off between consuming an additional unit of either good is given by their relative price. For the case of the durable and non-durable good, the appropriate relative price is the user cost. The key point however is that in any period the user cost of the durable good is less than the relative price of the durable good as the good can be re-used or resold in a future period. It can be shown that the user cost of durable goods relative to that of non-durable goods and services is given by **(A3)**, or equivalently **(A4)**:

$$\text{Usercost} = P_t - P_{t+1}\left(\frac{1-\delta}{1+r_t}\right) \quad \textbf{(A3)}$$

$$\text{Usercost} = P_t\left[\left(\frac{r+d}{1+r}\right) - \left(\frac{1-d}{1+r}\right)\left(g_t^p\right)\right] \quad \textbf{(A4)}$$

(A3) says that the user cost is the relative price of the good, P_t, less the discounted proceeds of its resale value in the next period (in each period the good depreciates at a rate δ). Assuming constant future interest and depreciation rates, **(A3)** can be rewritten in terms of the future rate of increase in relative prices, g^p **(A4)**.

(A4) shows that the user cost rises as the relative price of durable goods increases. But if their price is expected to rise in the future, then the user cost falls. That is because future price increases raise the resale value of the good. The user cost also increases as the real interest rate and depreciation rate rise.

Given the constant elasticity of substitution utility function, the maximisation problem yields an equilibrium condition for the stock of durable goods relative to other consumption goods:

$$\frac{D_t}{C_t} = \frac{1}{\left(\frac{1-\alpha}{\alpha}\text{usercost}\right)^{\sigma}} = \frac{1}{\left(\frac{1-\alpha}{\alpha}p_t\left[\left(\frac{r+\delta}{1+r}\right) - \left(\frac{1-\delta}{1+r}\right)E\left(g_t^p\right)\right]\right)^{\sigma}} \quad \textbf{(A5)}$$

The stock of durables relative to other consumption goods rises if the user cost falls. The sensitivity of the stock of durables to changes in the user cost is given by the elasticity of substitution: if durables and non-durables are highly substitutable then small changes in the user cost will have a relatively large impact on the stock of durables relative to other consumer spending.

Ratio of durable to non-durable spending

Noting that in any particular period durables expenditure is given by:

$$E_t = D_t - (1 - \delta)D_{t-1} \quad \textbf{(A6)}$$

and taking logs (where lower case indicates the natural logarithm), it can be shown that:

$$d_t = e_t - \ln\left(\frac{g_t^d + \delta}{g_t^d + 1}\right) \quad \textbf{(A7)}$$

where g^d is the growth rate of the stock of durables.

Taking logs of **(A5)**, and substituting for d_t with **(A7)** gives the real ratio of durable spending (e_t) to non-durable goods spending (c_t) in **(A8)**

$$\left(e_t - c_t\right)^{\text{real}} = -\sigma p_t + \ln\left(\frac{g_t^d + \delta}{g_t^d + 1}\right) - \sigma\ln\left(\frac{1-\alpha}{\alpha}\right) - \sigma\ln\left(\left[\frac{r+\delta}{1+r}\right] - \left[\frac{1-\delta}{1+r}\right]g_t^p\right) \quad \textbf{(A8)}$$

In nominal terms **(A8)** becomes:

$$\left(e_t - c_t\right)^{\text{nominal}} = p_t - \sigma p_t + \ln\left(\frac{g_t^d + \delta}{g_t^d + 1}\right) - \sigma\ln\left(\frac{1-\alpha}{\alpha}\right) - \sigma\ln\left(\left[\frac{r+\delta}{1+r}\right] - \left[\frac{1-\delta}{1+r}\right]g_t^p\right) \quad \textbf{(A9)}$$

An increase in the growth rate of the desired stock would raise the share of durable to non-durable consumption, as would a fall in the user cost (through interest rates, relative prices, or the rate of change of relative prices). However, changes in the depreciation rate have offsetting effects on the share of durable to non-durable spending. On the one hand, by increasing the user cost, an increase in the depreciation rate reduces the desired stock of durables (and the steady-state flow of durables expenditure) relative to other consumption expenditure (through the fourth right-hand side term in **(A8)**). But in order to maintain a given desired stock a rise in the depreciation rate requires increased durable spending, thus offsetting the 'user cost' effect (the second right-hand side term in **(A8)**). The net effect depends on several factors. However, under reasonable assumptions which the data tend to support it is likely that the second effect dominates, so rising depreciation causes the share of durable to non-durable spending to increase.(1)

For positive values of the elasticity of substitution, **(A8)** and **(A9)** suggest that spending on durables relative to other consumer spending falls if the relative price of durables increases (p_t). However, if the elasticity of substitution is one (Cobb-Douglas preferences), then the current-price share of durable to non-durable spending is unaffected by movements in relative prices—any price effects are offset by a corresponding volume effect.

We can rewrite the ratio of durable to non-durable spending as a function of the level of relative prices and other structural terms:

$$(e_t - c_t)^{\text{real}} = -\sigma p_t + \Psi_t \qquad \textbf{(A10)}$$

$$(e_t - c_t)^{\text{nominal}} = p_t - \sigma p_t + \Psi_t \qquad \textbf{(A11)}$$

By making assumptions about the long-run behaviour of p and Ψ, as is done in the main text, we can drop the time subscripts and consider the equilibrium ratio of durable to non-durable spending:

$$(e - c)^{\text{real}} = -\sigma p + \Psi \qquad \textbf{(A12)}$$

$$(e - c)^{\text{nominal}} = p - \sigma p + \Psi \qquad \textbf{(A13)}$$

which are equations **(1)** and **(2)** in the text.

(1) For a unitary elasticity of substitution between durable and non-durable goods, the condition that the real interest rate be greater than the sum of the growth rate of the stock of durables and the rate of change of relative prices is sufficient for rising depreciation rates to have a positive effect on the share of durable spending. Given that relative prices are falling rapidly, the data suggest that this condition is currently supported.

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