

Analysis and review of J. Padilla, “The impact of plain packaging of cigarettes in the UK: a simulation exercise”

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Summary

Jorge Padilla recently produced an econometric simulation of the potential impacts of introducing plain packaging of cigarettes in the UK, for Philip Morris International. Padilla's results suggest that the introduction of plain packaging will reduce average cigarette prices by between 4.4% and 16.1% and increase consumption by between 2.2% and 13.6%. I argue that the model of the cigarette market which Padilla uses overstates the extent to which prices will fall for a number of reasons. Most importantly his emphasis on branding as the sole determinant of cigarette pricing and of the oligopolistic structure of the current cigarette market in the UK and elsewhere is misplaced, and ignores other equally if not more important determinants of market structure (for example, economies of scale in production and distribution). There are also a number of misspecifications in the econometric model which Padilla uses to estimate the price and demand effects of plain packaging, which mean that the predicted effects are almost certainly too large. Furthermore, to the extent that the introduction of plain packaging does result in a fall in cigarette prices, I show that tobacco duties can be adjusted to compensate for any fall in the prices charged by retailers, leaving the average post-reform price unchanged from the pre-reform price. This would have the additional effect of reducing excess profits in the tobacco industry, with a corresponding increase in tax receipts.

Introduction

This paper is an evaluation and critique of a report produced for the tobacco company Philip Morris International by Jorge Padilla¹ which conducts an econometric simulation of the potential impacts of introducing plain packaging of cigarettes in the UK. Section 1 of the paper looks at the assumptions from economic theory underlying Padilla's analysis. Section 2 looks at the specific technical details of Padilla's econometric model. Section 3 discusses the reliability of the empirical estimates from the model and discusses potential policy responses in the UK if Padilla's forecasts of substantial price decreases as a result of the introduction of plain packaging turn out to be correct. I argue, however, that the price responses forecast by Padilla's model are highly likely to be overestimates of the true price decrease that would take place if plain packaging were introduced, for a number of reasons, as explained below.

1 Theoretical assumptions

Product differentiation and branding

Padilla's simulation model starts from the assumption that suppliers with brands that consumers value highly are able to charge higher prices than firms with weaker brands. This seems unobjectionable in itself. But Padilla goes on to argue that, because tobacco is a relatively homogeneous product in terms of actual product characteristics (e.g. the type and quality of tobacco used, flavourings, pack size etc.), the value of the brands themselves is responsible for most – if not all – of the variation in price between different brands.

Because Padilla assumes that the brand itself is the main attribute differentiating cigarettes of different brands from one another, he models the introduction of plain packaging as essentially eliminating most of the price differentials between brands. This conclusion is open to challenge on two grounds.

Firstly, the adoption of plain packaging reduces the ability of brands to differentiate themselves but it does not eliminate brand differentiation entirely because brand *names* – a crucial component of branding – remain, and smokers are likely to retain some brand loyalty based on the names. So plain packaging is unlikely to result in a completely homogeneous cigarette market.

Secondly, to the extent that there are real differences in characteristics between brands in taste, quality etc. which are nothing to do with plain packaging, these will remain after plain packaging has been introduced. Again, these are likely to provide a certain amount of

¹ J. Padilla, *The impact of plain packaging of cigarettes in the UK: a simulation exercise*, a report for Philip Morris International, November 2010.

market differentiation². The implication of this is that the collapse in the cigarette market to (almost) a completely homogeneous one-price market is unlikely to be as severe as Padilla has suggested. No doubt there will be some contraction in the price spread between premium, economy and ultra-low brands, but it is unlikely that the differentiation between segments of the market will disappear completely, as Padilla suggests. Hence his estimates of the effects of introducing plain packaging are likely to be overstated compared to what would actually happen if the policy were introduced.

Brand value as a determinant of smoking propensity

An implication of Padilla's model is that the brand itself is a key aspect of what smokers value about cigarettes – that is, the brand is not just a signal of certain innate characteristics of the cigarette itself, but it has value to the smoker over and above anything to do with the taste or quality of the cigarette. If this is the case, then an implication of plain packaging, which removes a large proportion of brand differentiation (although the names of different brands are retained), is that the value of cigarettes to smokers decreases. Assuming all other things equal, this is equivalent to a decline in the quality of the product, which should make consumers less likely to buy the product. In other words *if Padilla's assumption about branding being a key component of the "value of cigarettes" to smokers is correct, we would expect plain packaging to be accompanied by a fall in demand for cigarettes – at least in the premium categories where the brand value is highest – if the price of those premium brands remained constant.*

Padilla's model assumes that the price of premium brands will fall, but he then calculates increased demand for cigarettes *from a baseline assumption of unchanged demand at the original price after the introduction of plain packaging.* This methodology is difficult, if not impossible, to reconcile with his assumption that brands have an intrinsic value. While it is likely that reducing the prices of cigarettes after the introduction of plain packaging will tend to increase demand, there is also likely to be a negative impact on demand in the premium branded market from the loss of the brand differentiation at the same time – assuming Padilla is correct that brands have an intrinsic value. Recent academic research using evidence from interviews with smokers about how health warnings and plain packaging affect the perceived attractiveness of smoking supports the hypothesis that plain packaging will reduce the demand for cigarettes, other things being equal³. This implies that Padilla's estimates overstate the increase in demand for cigarettes that would occur as a result of the introduction of plain packaging.

² It is also possible that cigarette manufacturers may react to the introduction of plain packaging by increasing other types of differentiation between cigarette brands – for example differences in taste between brands.

³ See, for example: J Hoek *et al* (2011), "Effects of dissuasive packaging on young adult smokers", *Tobacco Control* vol 20, pp183-188; C Moodie *et al* (2011), "Young adult smokers' perceptions of plain packaging: a pilot naturalistic study", *Tobacco Control* vol 20, pp367-373

On the other hand, if Padilla's basic model is wrong and branding has no intrinsic value, but is simply a signal for other tangible differences in cigarette quality, then it is not clear that plain packaging will actually reduce prices – in which case there is no reason to believe that there will be a positive impact on overall demand for cigarettes. This is the view taken in the report by Europe Economics⁴ on the possible impact of plain packaging for JTI which reached very different conclusions to Padilla's paper. It is noteworthy that two tobacco industry-funded simulation studies of the potential impacts of plain packaging, both grounded in microeconomic theory, reach such different conclusions as to the likely impact of introducing the policy. This should make us cautious about placing too much reliance on any one model – notwithstanding the fact that many of the econometric assumptions in Padilla's particular model seem to be questionable (as I outline below).

Possible demand effects if premium brands are "Veblen goods"

One of the references given in support of Padilla's view that the brand itself is the main product-differentiating characteristic which consumers value is Thorsten Veblen's 1899 work *The Theory of the Leisure Class*, which introduced the concept of "Veblen goods" – commodities where high price was *itself a characteristic of the good that consumers value*, because it enables consumers of such products to signal their high status. An important characteristic of Veblen goods is that – over a certain price range – the demand curve for such a good may be *upward-sloping*, i.e. an increase in price causes an *increase* in demand for the good (because it becomes more desirable). The corollary of this is that if the price of such goods falls then demand might *decrease*, or at least, it might not increase. This means that if Veblen's theory is correct, then reductions in the prices of premium-brand cigarettes as a result of the introduction of plain packaging may result in cigarette demand *falling*, not rising. One possible rationalisation of this effect would be that, if people are smoking premium brands *because* they convey a certain premium status, if that premium status then disappears, there may be little incentive to continue smoking at all, as opposed to switching to a cheaper generic brand. Again, Padilla largely ignores this possibility.

Barriers to entry

Padilla assumes that the only significant barrier to entry in the tobacco market is a consequence of brand differentiation, and that if this disappears, then there will be market entry which will drive down prices. However, brand value is not the only potential source of barriers to entry in the industry. The current oligopolistic structure of the tobacco industry

⁴ Europe Economics (2008), *Economic Analysis of a Display Ban and/or a Plain Packs Requirement in the UK*, report to JTI and Gallaher. Available at <http://www.jti.com/file.axd?pointerID=8e10b02017a843cd920459089c544088>

probably reflects economies of scale in the production and distribution of cigarettes and other tobacco products, and the cross-subsidisation opportunities in different price segments and different markets that are open to large firms compared with small firms, as much as it does brand values. Recent research by Gilmore *et al* on the market structure of the global tobacco industry shows that “the cigarette trade is dominated in virtually all major markets by a very small, and declining, number of cigarette manufacturing companies.” In many countries the top three cigarette manufacturers control over 90% of the market⁵. While it is not clear how much new entry there would be into the industry if plain packaging is introduced, it seems entirely possible that an oligopolistic structure with a few big producers – rather than a competitive structure with a large number of producers – might persist simply due to the economies of scale in production and distribution which large firms enjoy, even in the absence of incumbent brand advantages. New entrants, who would inevitably be operating at a smaller scale than the incumbents (at least initially) would, in all probability, face significant barriers to reaching an efficient scale of production even if plain packaging were introduced. It would also be difficult for new entrants to inform smokers about their entry into the market because of the bans on tobacco advertising already in place. Empirical research for the US suggests that “large market share of incumbents is the most important barrier to entry in the tobacco market”⁶. The implication is that Padilla’s assumptions on entry are unlikely to be realised.

Smuggling and counterfeiting

Padilla suggests that plain packaging “will make it more attractive, easier and cheaper to produce counterfeit cigarettes which sell at lower prices than legitimate products” and “it will make it more attractive to import contraband cigarettes which also sell at lower prices”. However, if plain packaging causes the price of cigarettes to fall, then other things being equal, this would make it *less* attractive for firms to engage in counterfeiting as they would no longer be able to earn so much from getting a slice of the price premium currently being paid for high-end brands. Furthermore, even if consumers do prove willing to pay for branded counterfeit/contraband products, the very fact that they are branded would make them stand out in the market place, and thus be more easily dealt with by law enforcement authorities.

⁵ A Gilmore, J Branston and D Sweanor (2010), “The case for OFSMOKE: how tobacco price regulation is needed to promote the health of markets, government revenue and the public”, *Tobacco Control*, vol 19 pp 423-430

⁶ F Karakaya and R Kerin, (2007), “Impact of product life cycle stages on barriers to entry”, *Journal of Strategic Marketing*, Volume 15 Issue 4, pp269-280.

Marginal costs of cigarette production and market segmentation

Padilla estimates the impact of new entry into the cigarette market under the assumption that new competitors supply “no-name” products, a new segment of the market which Padilla assumes will have significantly lower costs than the existing super-low brand segment of the market. Padilla assumes that marginal costs per cigarette in the “no-name” sector would be anything between 25 and 75 percent lower than costs in the existing ultra-low sector. Given that, branding aside, cigarettes are a relatively homogeneous product, with little in terms of actual product content to distinguish premium from economy brands, it is not clear how Padilla can justify his assumption that the marginal costs of cigarette production for “no-name” brands will be up to 75 percent lower than ultra-low brands.

In the UK the ultra-low segment of the market has expanded rapidly in recent years, from 9.6% (by volume of cigarettes sold) in 2006 to 19.7% in 2009, while the market share of the premium and mid-price brands (taken together) fell from 35.8% to 29.3% over the same time period. As shown in recent research by Gilmore and colleagues at the University of Bath⁷, the profit margin on ultra-low brands is much lower than on premium, mid-price or economy brands. The fact that ultra-low price brands already have a significant market share in the UK is an additional reason to think that Padilla’s estimates of possible price reductions arising from the introduction of plain packaging will be an overestimate for the UK, over and above problems with his interpretation of economic theory and the issues arising from the specification of his econometric model of cigarette supply and demand described below.

2 Assumptions in the econometric model

This section deals with technical assumptions underlying the econometric model which Padilla uses rather than the underlying economic theory behind the model.

Nested logit modelling

Padilla’s estimation of the effect of plain packaging on prices and consumption involves estimating a ‘nested logit’ model of cigarette demand. A criticism of standard multinomial logit models for consumer demand in markets where there are a number of different brands of a product is that the multinomial logit imposes an “Independence of Irrelevant Alternatives” (IIA) assumption. This means that when a consumer is making a choice between brand *a* and brand *b* of a product, the presence or absence of brand *c* does not affect the consumer’s probability of choosing brand *a* versus brand *b*. IIA is often an

⁷ B. Tavakoly, G. Taylor, H. Reed and A. Gilmore, “How tobacco industry pricing strategies undermine public health: the example of the British market”, paper submitted to 15th World Conference on Tobacco or Health, 20-24 March 2012, Singapore

implausible restriction to make on consumer choices. For example, if brand *a* is a generic ultra-low brand of cigarettes and brand *b* is a premium brand such as Marlboro, it is likely that the introduction of another ultra-low brand as brand *c* would split demand for ultra-low cigarettes between brands *a* and *c* with brand *b* relatively unaffected. This would violate the IIA assumption.

The **nested** logit model partially overcomes this problem by grouping brands in different price categories into different ‘nests’. So, in the example above, Marlboro would be in a separate nest to the ultra-low brands. IIA is assumed to hold *within* nests but not *across* nests. This means that the nested logit can account more realistically for the example shown above. However, the nested logit model still assumes that IIA holds *within* nests and it is not obvious that this is a sensible assumption. Within the premium segment in the UK, for example, IIA implies that if (for example) Benson & Hedges were to disappear from the market, then the relative strength of demand for Marlboro and Silk Cut (the other two most popular brands in the premium segment) would be unaffected. There is no obvious reason why this should be the case, however; it is quite possible that ex-Benson and Hedges smokers would be more likely to favour Marlboro rather than Silk Cut, or indeed vice-versa. So it seems clear that the specification of the structure of the cigarette market which the nested logit model implies is questionable, although how this misspecification might affect the model estimates is not easy to say *a priori*.

Profit maximisation assumption

The model proposed by Padilla is a single-period model with no intertemporal dimension; it assumes that firms set their cigarette prices to maximise total industry profits in each time period. However, recent research by Professor Anna Gilmore with colleagues at the University of Bath in the UK and the present author⁸ suggests that “the industry may, perhaps unsurprisingly, be attempting to maximise both short-term and long-term profitability. This could be achieved through increasing prices on high-end brands in order to maximise profits at the expense of volume declines, while attempting to maintain smoking rates (at least in some sectors of the population) and entice the young to take up the habit by keeping low-end brands cheap.” The Bath research finds that there is extensive cross-subsidisation of ultra-low brands in particular with the pricing structure geared towards encouraging new cohorts to take up smoking in such a way as to maximise profits over the lifetime of each smoker, and hence long-run industry profits, rather than short-run. This means that a single-period model of price-setting is potentially a fundamental mischaracterisation of the decision process facing tobacco companies, and it is not clear that the estimates of price changes arising from the model are a reliable indication of what would actually happen if plain packaging were introduced.

⁸ B. Tavakoly, G. Taylor, H. Reed and A. Gilmore, “How tobacco industry pricing strategies undermine public health: the example of the British market”, paper submitted to 15th World Conference on Tobacco or Health, 20-24 March 2012, Singapore.

Assumptions on consumer rationality and utility

Padilla's model for the demand side of the cigarette market is a single-period model of utility maximisation from consumption of tobacco. This model is over-simplistic and mis-specified both from the perspective of "rational addiction" models of tobacco consumption⁹, as well as more recent approaches derived from behavioural economics which do not assume full rationality¹⁰. The rational addiction model is explicitly intertemporal and so consumption today will be affected by consumer expectations of price changes in the future – not just the current 'spot price' for cigarettes. To the extent that the model fails to include a framework for modelling future price expectations it is mis-specified. Meanwhile, behavioural models assume that many smokers want to quit – i.e. they are aware of the disutility conveyed by smoking – but are unable to do so because of "myopic" behaviour: their short-run addiction outweighs their long-run rationality¹¹. It is inappropriate to model consumer decisions as a simple one-period utility maximising decisions in either of these models, and so it is unclear what the theoretical microfoundations for Padilla's chosen model specification actually are. In the light of this, the model estimates are unlikely to have a clear interpretation or application to the real world.

3 Model results

Based on the critique above, there are a number of good reasons to believe that the estimated price effects from the Padilla model are too large, and should be viewed as an extreme upper boundary for the price impacts of plain packaging, rather than a central scenario. It is unlikely that the product differentiation in the cigarette market will collapse to the extent Padilla claims. In addition, there are several misspecification problems in the Padilla study which make the results somewhat suspect.

Even if the reduction in cigarette prices as a result of plain packaging were in the region of 16% (as in Padilla's most extreme case), in a UK context it would be a relatively straightforward matter to adjust specific duties on cigarettes to restore prices to their average level before the introduction of plain packaging. As a companion to this review piece I have produced a spreadsheet which compares the current weighted average price

⁹ For example Becker G and Murphy K (1988), "A theory of rational addiction", *Journal of Political Economy* 96: 675-700.

¹⁰ For example Gruber J and Koszegi B (2004) "Tax incidence when individuals are time-inconsistent: the case of cigarette excise taxes", *Journal of Public Economics* 88:9-10, 1959-1968

¹¹ Recent evidence from surveys of smoking behaviour supports the myopia hypothesis: see for example B Hidayat and H Thabrany (2011), "Are smokers rational addicts? Empirical evidence from the Indonesian Family Life Survey", *Harm Reduction Journal*, vol8 no6.

(WAP) of cigarettes purchased at UK retailers with what the average price would fall to if the most extreme version of Padilla's model – a 16.1% fall in cigarette prices - were correct.

The current WAP in the UK is around £6.00 per pack¹². A reduction of 16.1% in response to the introduction of plain packaging means that the WAP would reduce to £5.03. To counteract this and restore a WAP of £6.00, specific duty on cigarettes would have to increase from £154.95 per 1,000 sticks to £187.50 – an increase of around 21 percent.

This increase in specific duty would mean that at the new WAP, specific duty as a proportion of total tax would increase from 60.9% to 65.3%. EU legislation means that specific duty cannot be more than 76.5% of the total tax burden on cigarettes; the new specific duty level would still be comfortably below this upper limit.

Overall, it is clear that even if the most extreme version of Padilla's pricing model for the cigarette market is correct and UK cigarette prices fell by 16% (which is unlikely), it would be a straightforward matter for the UK government to make upward adjustments in tobacco duties to ensure that the introduction of plain packaging did not result in any net price reductions on average. Furthermore, if tobacco duties were increased in this way, the result would be equivalent to a transfer from tobacco company shareholders to taxpayers – providing a net gain to the public finances at the same time as reducing the excess profits of the tobacco industry. As shown in recent research on the European market, tobacco companies are far more profitable than comparable companies in other industries such as food and beverages¹³, and so to the extent that the result of the introduction of plain packaging is a reduction in excess tobacco industry profits and a transfer to taxpayers, this is surely a desirable outcome of the policy on top of any reduction in long-run smoking prevalence rates which plain packaging could potentially achieve.

¹² Weighted Average Price level of £6.00 arrived at by using data on weighted average prices from European Commission (http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/tobacco_products/rates/excise_duties-part_iii_tobacco_en.pdf) and adjusting for changes in UK tobacco duties in the March 2011 Budget.

¹³ Gilmore *et al* (2010), see footnote 8.