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The Economics of Parallel Trade

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Summary

The potential for parallel trade in the European Union (EU) has grown with the accession of low price countries and the harmonisation of registration requirements. Parallel trade implies a conflict between the principle of autonomy of member states to set their own pharmaceutical prices, the principle of free trade and the industrial policy goal of promoting innovative research and development (R&D).

Parallel trade in pharmaceuticals does not yield the normal efficiency gains from trade because countries achieve low pharmaceutical prices by aggressive regulation, not through superior efficiency. In fact, parallel trade reduces economic welfare by undermining price differentials between markets. Pharmaceutical R&D is a global joint cost of serving all consumers worldwide; it accounts for roughly 30% of total costs. Optimal (welfare maximising) pricing to cover joint costs (Ramsey pricing) requires setting different prices in different markets, based on inverse demand elasticities. By contrast, parallel trade and regulation based on international price comparisons tend to force price convergence across markets. In response, manufacturers attempt to set a uniform 'euro' price. The primary losers from 'euro' pricing will be consumers in low income countries who will face higher prices or loss of access to new drugs. In the long run, even

higher income countries are likely to be worse off with uniform prices, because fewer drugs will be developed.

One policy option to preserve price differentials is to exempt on-patent products from parallel trade. An alternative is confidential contracting between individual manufacturers and governments to provide country-specific *ex post* discounts from the single 'euro' wholesale price, similar to rebates used by managed care in the US. This would preserve differentials in transactions prices even if parallel trade forces convergence of wholesale prices.

Prices of pharmaceuticals have traditionally differed significantly across countries of the European Union (EU), reflecting differences in healthcare systems as well as income and other factors. These traditional price differences are increasingly being undermined by parallel trade, whereby a wholesaler or other intermediary transports products purchased in a low-price country to a higher-price country. Although actual parallel trade flows are estimated at under 10% of total pharmaceutical sales, these flows are a much larger percentage relative to on-patent products which account for 25% of sales or less in some countries.[1] Moreover, actual trade flows understate the impact because manufacturers may reduce prices in order to preempt actual trade flows. Parallel trade thus 'exports' low prices from low-price countries to other potentially higher-price countries. The diffusion of low prices gains further impetus from the growing regulatory use of foreign prices to set limits on domestic prices as, for example, in Italy and the Netherlands. Such regulation reduces domestic prices across the board to the lower foreign price level and hence, is equivalent to 100% parallel trade.

Although parallel trade has existed on a small scale for many years, the potential profitability of such trade has increased recently with the accession to the EU of traditionally low-price countries including Spain and Greece and in the future, the countries of Eastern Europe. At the same time, the European Medicines Evaluation Agency (EMEA) has harmonised regulatory requirements for registration, dosage recommendations and labelling, thereby reducing the parallel importer's costs of repackaging to meet country-specific regulatory requirements. In 1996, in *Merck v. Primecrown* (C-267/95), the European Court of Justice upheld parallel importing as consistent with the free movement of goods even though the exporting country did not grant patent protection and the practical effect was to undermine patent protection in the importing country.

The status quo poses a clear conflict between competing EU policy goals. The subsidiarity principle preserves the autonomy of member states in health policy, which leads to price differentials for pharmaceuticals. However, the principle of free movement of goods permits traders to arbitrage these price differences, thereby reducing the prices and revenues earned by pharmaceutical firms in traditionally higher-price countries. This undermines the industrial policy goal of encouraging a vigorous, research-based pharmaceutical industry in Europe. Possible solutions to this conflict of principles are being considered by the European Commission, Member States and the pharmaceutical industry in the so-called 'Bangemann process'.[2,3]

This article examines the economics of parallel trade and, more generally, the case for price differentials for pharmaceuticals. We argue that parallel trade in pharmaceuticals does not yield the efficiency gains that normally result from trade, hence standard free trade arguments do not apply. Trade normally increases economic welfare by permitting consumers in importing countries to benefit from lower prices realised by more efficient or lower-cost producers in exporting countries. In the case of research-based pharmaceuticals, however, the lower prices in exporting countries generally reflect more aggressive regulation, not lower real production costs. Moreover, much of the margin between prices in the importing and exporting

countries accrues to intermediaries, not as lower prices to consumers, at least in the short run.

In fact, parallel trade in patented drugs almost certainly reduces economic welfare, tending to undermine the ability of manufacturers to recover the costs of research and development (R&D). Pharmaceutical R&D is a 'global joint cost' that benefits consumers worldwide. The economic theory of efficient pricing to cover joint costs – so-called Ramsey pricing – concludes that charging different prices to different users is the most efficient means of covering such joint costs when users differ in their true price sensitivity (elasticity). Differential pricing leads to more appropriate use of drugs and permits a higher level of R&D than would occur under uniform pricing. Parallel trade erodes price differences across countries and hence undermines the most efficient pricing mechanism for paying for R&D.

The problem of recouping joint costs is exacerbated by the monopsony power of some government purchasers who face a strong temptation to force prices down to the marginal cost of supplying that country, free-riding on others to pay for the joint costs of R&D. With parallel trade or regulation based on foreign prices, such free-rider behaviour in one country can export inadequate prices throughout the EU. Manufacturers are responding by attempting to set a uniform, relatively high launch price for new drugs throughout the EU. Consumers in low-income countries are clearly worse off due to higher prices and possibly restrictions on access to innovative medicines. Less obvious, consumers in previously high-price countries will also be worse off. Compared with price differentials, uniform pricing reduces revenues to manufacturers, hence some medicines may not be developed that consumers would have been willing to pay for, had differential pricing been viable.

In this article, section 1 reviews cost and pricing characteristics of the pharmaceutical industry which make pharmaceutical R&D particularly vulnerable to parallel trade. Section 2 outlines the principles of optimal pricing in the presence of joint costs, section 3 analyses the effect of parallel trade on consumer welfare, section 4 discusses policy options and section 5 provides some concluding remarks. Readers may also wish to refer to a complementary article by Towse which appears in this issue of *PharmacoEconomics*.

1. Costs and Pricing of Innovative Pharmaceuticals

1.1 The Cost Structure of Innovative Pharmaceuticals

The research-based pharmaceutical industry spends a higher percentage of sales on R&D than most other industries – roughly 21% of sales for US-based pharmaceutical companies compared with under 4% for US industry overall.[4] (These figures and the analysis in this paper apply to research-based firms, not to generic drug manufacturers and other firms which incur no major R&D expense.) This sales-based measure understates the importance of R&D as a percentage of the cost of developing and producing new drugs, because it omits the foregone interest on funds invested during drug development. This opportunity cost of funds accounts for roughly 50% of the $US359 million pretax R&D cost of bringing a new chemical entity to market.[5,6] When all costs are expressed in discounted present value at the time of product launch, R&D accounts for roughly 30% of total cost on either a pretax or after tax basis. These estimates are based on cost data from the US Government Office of Technology Assessment[6] and assume a 46% corporate tax rate.[7]

The important characteristic of R&D for pricing purposes is that R&D is a global joint cost; that is, the cost is the same regardless of the number of consumers or countries served. Because a global joint cost is not causally attributable to particular patients or countries, the cost structure alone cannot determine how much each country should contribute. In addition to R&D, joint costs also occur in primary production, where a single plant typically supplies several compounds to multiple countries, implying costs that are joint across products and countries. Similarly, the administrative cost of maintaining a local subsidiary is a country-specific cost that is a joint cost across all products

sold in that country. Joint costs cannot be allocated to specific products in specific countries. Nevertheless, these costs must be covered by consumers in the aggregate if the firm is to stay in business and develop new drugs.

The problem of pricing to cover the joint costs is exacerbated by the fact that these costs are largely sunk by the time of product launch and price negotiation. True short run marginal costs (costs that remain to be incurred), including processing and packaging, some promotion and distribution, account for roughly 30% of total cost. Every purchaser has an incentive to attempt to free-ride, paying only their user-specific marginal cost, leaving others to pay for the joint, sunk costs. If product markets are either highly competitive or monopsonistic (a single purchaser, as occurs in government-run healthcare systems), prices tend to be driven down to marginal cost. But for research-based pharmaceuticals, pricing at short run marginal cost would yield revenues that are seriously inadequate to cover the sunk costs of R&D and other joint costs.

The failure of competitive markets to provide revenues sufficient to pay for R&D is addressed in most developed countries by the granting of patents. A patent bars generic imitators for the life of the patent. This legal grant of limited market exclusivity may enable the patent holder to charge prices above marginal cost and hence generate revenues to pay for the R&D. In practice, competition from close but not identical substitutes constrains the market power granted through patents in any industry including pharmaceuticals. An innovative drug in a new therapeutic class may have temporary market exclusivity; however, the entry of similar but chemically distinct 'therapeutic' substitutes has accelerated over time and now typically occurs within months of the first entrant, facilitated in part by rational drug design techniques. Whether the current patent structure provides appropriate incentives for innovation is an important policy question but is beyond the scope of this article. Here, we take the patent structure as given and assume that a policy is desirable if it permits a higher rate of innovation within the current patent structure.

1.2 Pricing

Patent protection traditionally conveys the power to price discriminate between countries because the patent holder in each country can enjoin unauthorised distribution including parallel imports. However, the Treaty of Rome eliminates this right to bar unauthorised distribution from other EU countries, thereby authorising parallel trade within the EU, while retaining the patent holder's traditional right to bar distribution from non-EU countries. This primacy of free trade over patent protection has been upheld by the European Court of Justice's ruling in *Merck v. Primecrown*, which held that a manufacturer's patent rights are exhausted EU-wide once a product is placed on the market in any EU country, even if the exporting country does not recognise patents and the effect of parallel trade is to nullify the patent holder's rights in the importing country. Thus, in the EU, a patent holder's feasible range for price discrimination is limited to the parallel trader's cost of cross-shipping, which has declined with the EMEA's harmonisation of registration requirements and with the growth of pan-European wholesalers.

The value of patent protection for pharmaceuticals is further constrained in most EU countries by price regulation and other controls. An economic rationale for some governmental control over pharmaceutical expenditures derives from government's role in national health or social insurance programmes. Any insurer appropriately adopts some limits on reimbursed services in order to constrain overuse or excessive prices that may result from insurance-induced 'moral hazard'; that is, the tendency for insurance to make consumers insensitive to price. Indeed, private and public insurers use many similar strategies to control expenditures. But the same strategies have potentially much greater impact in the hands of a governmental insurer because, as sole purchaser, it has monopsony power. A monopsony government purchaser has the leverage to drive prices down to the country-specific marginal cost without interrupting the supply of medicines in the short run since any producer will rationally continue to supply a product

as long as price covers marginal cost. Moreover, when the government is the insurer, health policy becomes fiscal policy. The incentive to control healthcare spending for purely fiscal reasons has increased as EU governments attempt to limit their budget expenditures in order to comply with the Maastricht Treaty criteria.

If pharmaceutical firms are to have incentives to develop innovative medicines, global revenues must be sufficient to cover all costs, including the joint costs of R&D. Previously, small countries could pursue the free-rider strategy, attempting to drive the price they pay down to their country-specific marginal cost, with negligible impact on global industry revenues and hence on the future supply of medicines. However, now that low prices in one country diffuse more broadly through parallel trade and regulation based on foreign prices, free-riding by just one small country can significantly erode global revenues and incentives for R&D. The immediate concern is that very low prices in a few EU markets can erode potentially higher prices in other EU countries. The longer term concern, which poses a much greater threat to global revenues and hence to R&D, is that lower prices throughout Europe could ultimately spillover to the larger markets of Japan and the US, where governments also monitor their prices relative to foreign countries.[1]

It is the global nature of pharmaceutical joint costs that makes this industry more vulnerable to downward biased regulation than other regulated industries. Utilities such as telephone, gas and electricity, also have high joint sunk capital costs. But because the capital is country-specific, it clearly must be paid for by local users if their access to services is to continue. Traditional utility pricing formulae thus generally explicitly provide for a reasonable return on capital. In pharmaceuticals, by contrast, much of the capital is intangible R&D capital that is not specific to the country implementing the regulation. In practice such cost-based regulation is likely to be systematically downward biased, because of the political temptation for each country to ignore the joint costs. If all purchasers pay only the short run marginal cost of secondary production, packaging and distribution, the revenue shortfall could be 70% of total costs or more.[7] This estimate is consistent with the evidence that prices of generics, which incur minimal cost of R&D and promotion, ultimately fall to roughly 25% of the price of the originator product in the US.[8] If prices cover all costs except R&D, the shortfall would be roughly 30%.

Another implication of the high share of R&D is that accounting profits for the pharmaceutical industry are overstated relative to other industries. R&D is an investment in intangible capital, but is treated as an expense rather than as a capital investment in accounting statements. Accounting measures of capital are therefore downward biased and estimates of return on capital are upward biased for the pharmaceutical industry and any other industry with significant intangible investments. This bias fuels the perception that the pharmaceutical industry earns abnormally high profits, which in turn leads to pressure for lower prices. Indeed, Clarkson[9] demonstrated that if accounting rates of return are adjusted for intangible capital, the pharmaceutical industry is not out of line with other industries in terms of profits earned.

2. Welfare Effects of Price Differentials

2.1 Optimal Pricing to Cover Joint Costs

In any industry that incurs significant joint costs by serving different markets, total revenues are inadequate to pay for the joint costs if prices in each market just cover the short run marginal cost of serving that market. Economic theory (so-called Ramsey pricing) has addressed the problem of finding the set of prices that provides the highest well-being to consumers, while generating revenue sufficient to cover all costs, including joint costs.[10-12] Ramsey prices differ between users and, on average, must exceed short run marginal cost. Specifically, the mark-up of price over marginal cost should be greater for users who are relatively price-insensitive (inelastic demand) than

1 President Clinton's 1993 Health Security Act proposal would have limited US prices to the lowest price in 22 countries.

for users who are more price-sensitive (elastic demand). Such price differentials lead each group to reduce their demand by an equal percentage relative to the hypothetical demand at price equal to marginal cost. By contrast, if everyone is charged the same price, the price-sensitive users will reduce their consumption by more and hence experience a greater loss in welfare than the price-insensitive users. Users who are highly price-sensitive may drop out of the market entirely, although they might have been willing to pay a price sufficient to cover the marginal cost of serving them and, by definition, their use adds nothing to the joint costs.

Thus, this theory implies that global social welfare would be greater with a differential pricing strategy based on differences in price sensitivity than with uniform pricing. Note that this theory identifies the set of prices that would yield the greatest social welfare. It does not address problems of implementation, or why actual prices may differ from these optimal prices. In practice, individual countries may perceive that their own narrow self-interest is better served, at least in the short run, by pursuing a selfish, free-rider strategy rather than paying Ramsey prices. Furthermore, the level of R&D that can be sustained is greater with differential pricing than with uniform pricing, because manufacturer revenues are higher with differential pricing. Under uniform pricing, some innovative pharmaceuticals may not be economically viable, although consumers in aggregate would have been willing to cover the costs of development had differential pricing been feasible.

Ramsey pricing principles are commonly applied in public utilities and airlines where joint costs are also very significant relative to user-specific marginal costs. Peaktime users pay higher prices for electricity than do off-peak users; travellers with inelastic demand pay higher airfares than travellers who are more price-sensitive and hence are willing to accept the inconvenience of advanced booking and minimum stay requirements. Although those who pay higher prices may grumble, their prices can actually be lower than would be required to cover the cost of the same level of service without discount fares. Similarly, as long as pharmaceutical users who pay discounted prices cover their own marginal cost and make some contribution to the joint costs, the prices to other users can be lower than would be required to fund the same rate of innovation without the contribution from the low-price users.

2.2 Price Differences Do Not Imply Cost Shifting

There is a common perception that price differentials imply cost shifting: 'A pharmaceutical company may only be willing to sell in a low-price country because it can recoup any losses it makes there from sales in higher-priced countries.'[13]

This argument either ignores the jointness of costs or mistakenly assumes that all users should contribute equally, contrary to welfare-maximising principles.

Consider the short run problem of pricing products that are already on the market. A firm will not persistently sell at a price below the country-specific marginal cost. As long as each country covers its marginal costs, the terminology of cost shifting is inappropriate because, by definition, the other costs are joint and cannot be attributed to individual users from cost principles alone. Moreover, attempting to cost shift would imply irrational behaviour as long as marginal costs and demand are independent. A firm that can segment markets will attempt to charge the profit-maximising price in each market (subject to competitive and regulatory constraints). If demand is more inelastic in Germany than in Spain, for example, the price in Germany will be higher than in Spain. But if the German price is at the profit-maximising level, to increase it in an attempt to 'recoup losses' from a lower price in Spain would actually reduce net revenues. That is, if the German price is already at the profit-maximising level, any other price – higher or lower – would, by definition, reduce profits.

Next, consider the long term decision of whether to develop a new drug. A rational firm compares the expected total revenues to total costs. If low-price countries cover at least their marginal costs and make some contribution to the joint costs of R&D, prices in high-price countries can actually

be lower than they would have to be to cover joint costs in the absence of contributions from the low-price countries. Thus, from either a long run perspective (deciding which products to develop) or a short run perspective (pricing existing products) the cost-shifting argument assumes behaviour that is inconsistent with profit maximisation by firms.

If costs are truly joint, then the terminology of cost shifting is inappropriate. It is true that price-inelastic users will face a higher price if differential pricing is feasible than if the firm charges the same price to all users. However, the higher price paid by inelastic users under price discrimination reflects their own inelastic demand, not cost shifting. With a single price, the price-inelastic users essentially free-ride on the more elastic users who experience a negative spillover from being associated with the inelastic users.

3. Welfare Effects of Parallel Trade

3.1 Production Effects: No Efficiency Gains From Parallel Trade

Trade generally increases consumer welfare when: (i) lower prices in the exporting country reflect lower real costs of production due to either superior efficiency or lower input costs; and (ii) consumers in the importing country benefit from these lower prices by increasing their consumption.

Parallel trade in pharmaceuticals typically violates these necessary conditions for efficiency gains from trade. Countries achieve low pharmaceutical prices and become parallel exporters usually through stringent price regulation or weak patent protection, not through superior production efficiency. Indeed, price regulation may actually reduce efficiency, by distorting production efficiency[14] and distorting incentives for innovation.[15] Since pharmaceutical production must conform to regulated 'good manufacturing practice' (GMP) in all countries, production techniques are uniform. The only possible source of savings is lower labour cost of packaging and processing which is a tiny fraction of total costs. In fact, because parallel trade exploits regulated price differences that do not reflect real cost differences, such trade can actually increase societal costs because of additional transportation and administrative costs, yet still be profitable for the trader.

Moreover, in the short term, the net distributive effect of parallel trade is largely to transfer revenues from manufacturers to intermediaries who capture most of the margin between the low, export price and the higher regulated price in the importing country. Consumers and payers benefit only to the extent that payers reduce distribution margins to reflect the lower prices of parallel imports as in the UK and the Netherlands. On the other hand, consumers may face some increase in health risk, if the parallel imports include counterfeit products of inferior quality, if repackaging makes it harder to trace specific batches in the event of a recall or if consumers misuse the product because the labelling is literally in Greek. Although parallel importers are required to obtain a license, chemical testing for equivalence is not performed, and instances of counterfeit products have occurred.

3.2 Manufacturer Response: Uniform Prices

In the longer run, if the potential volume of parallel trade exceeds a critical level, the manufacturer's profit-maximising strategy is to attempt to set a single, uniform price in all connected markets, to the extent possible given currency fluctuations and regulatory constraints.

For inline products, the manufacturer's single price strategy may require price cuts in relatively high-price countries because prices cannot be increased in heavily regulated markets. The resulting loss in sales revenue may be worth incurring in order to deter parallel imports, retain the local market for its local subsidiary and reduce risks to its reputation if the parallel imports pose health risks for patients.

In launching new products, a manufacturer's optimal strategy in response to parallel trade is to set a uniform launch price in all countries that are connected through trade or international price comparisons. The profit-maximising launch price lies between the discriminatory prices that would have been charged, had the markets been separable;

the greater the expected downward regulatory pressure on prices after launch, the higher the manufacturer's launch price. Consistent with these predictions from theory, several of the major multinational companies now attempt to obtain a uniform launch price EU-wide for new drugs. Glaxo accepted a delay of several years for its antimigraine product sumatriptan (Imigran®) in France, rather than accept a low price that would have undercut its higher price elsewhere. In 1996, Merck launched its protease inhibitor indinavir (Crixivan®) at a common EU price, denominated in European Community Units (ECUs). Other companies also report withholding or delaying launch of new products in traditional low-price countries of the EU, rather than accept prices that would invite parallel trade and hence erode the prices that they can earn in other larger markets.

These pricing adjustments by manufacturers to preempt parallel trade imply that actual parallel trade flows can seriously understate the full impact on revenues. Indeed, the greater the percentage of the market that would be subject to parallel trade, the greater the manufacturer's incentive to preempt such trade through uniform pricing. At the limit, under uniform pricing there is no parallel trade. But this is an indicator that the threat is very significant, not that it is irrelevant. In practice, it is impossible to separate the effects of parallel trade from regulation based on foreign prices in driving the move to uniform pricing.

3.3 Effects on Consumers

The standard welfare analysis of price discrimination versus uniform pricing[16] applies to standard products with no joint costs for which marginal cost pricing is appropriate. In this context, the conclusion is that uniform pricing leads to lower consumer welfare than differential pricing if the total volume of consumption declines or some users drop out of the market under uniform pricing, although they could be served under differential pricing. In the case of pharmaceuticals, a decline in aggregate volume seems plausible because governments in previously low-price countries are likely to restrict access at the higher, uniform price, whereas usage is unlikely to increase significantly in higher-income countries that now face lower prices unless consumer copayments decline or physician reimbursement incentives change.

However, this standard welfare analysis is incomplete for pharmaceuticals because it ignores joint costs. Once we take into account the very significant joint costs of pharmaceutical R&D, Ramsey pricing principles apply. The theoretical conclusion is unambiguous, that price differentials related inversely to demand elasticities permit higher consumer welfare than uniform pricing, for reasons explained above.[2]

The distributive effects of uniform pricing would also generally be considered undesirable. Consumers in traditionally low-price countries – typically with relatively low income – are clearly worse off. They face higher prices and possibly loss of access to innovative medicines, although they would have been willing to pay a price sufficient to cover their country-specific marginal cost under differential pricing. If a company were solely concerned with short run revenues (ignoring reputation and nonfinancial concerns), the rational policy would be to withhold launch in a low-price country if the expected net revenue from that country is less than the revenue loss in other, potentially higher-price markets that would be caused by that country's low price. Thus small, low-price countries are most at risk of losing access.

Consumers in the initially high-price countries might appear to benefit if the uniform price is below the price that they would have paid with differentiated prices. However, in the long run, even these consumers lose because the revenue decline under uniform pricing is expected to reduce the supply of innovative medicines, eliminating some products that they would have been willing to pay for.

2 Actual price differentials may differ from Ramsey optimal differentials primarily due to monopsony power, as discussed in sections 3.2 and 3.3. In that case, it is possible that substituting a uniform price for these nonoptimal price differentials could increase overall welfare. However, welfare would be even higher under Ramsey optimal differentials than under uniform pricing.

4. Policy Options

Parallel trade in pharmaceuticals does not yield the usual efficiency gains from trade. On the contrary, it tends to reduce consumer well-being by forcing convergence of prices across markets that differ in consumers' ability and willingness to pay. Given the joint costs of R&D, consumer welfare would be higher if more price-sensitive countries pay lower prices than less price-sensitive countries, provided that the low prices are nevertheless sufficient to cover marginal cost and possibly make some contribution to the joint costs. Differential pricing would support a higher rate of development of innovative medicines for consumers worldwide in the long run and provide incentives for investments in the EU, consistent with industrial policy goals.

Several proposals are being considered as part of the review of the single market in pharmaceuticals initiated by Commissioner Bangemann. Here, we focus on proposals that would preserve cross-country price differentials since differential pricing offers the greatest consumer welfare.

4.1 An Exemption from the Law on Parallel Trade or Vertical Restraints

The simplest approach is to exempt from parallel trade, products that meet the following conditions: (i) products that are under patent in industries where patents are essential; and (ii) the same patents are registered across countries.

This restricts the exemption to products that incur significant global, joint costs of R&D investment and hence, products that require some period of pricing above marginal cost to pay for the R&D. The exemption could be further restricted to industries that are subject to price regulation since government monopsony power is the main noncompetitive constraint on the ability of innovator firms to charge prices above marginal cost. Of course, supra-marginal cost pricing may still be constrained by competition from close substitute products. However, this normal competitive constraint is consistent with the purpose of patent protection, whereas competition from perfect substitutes, as occurs with parallel trade, undermines the intent of patents. Although an exemption from parallel trade would not prevent a government from exploiting its monopsony power, the exemption would prevent the spillover to other countries.

Alternatively, an exemption from competition law with regard to vertical restraints would enable manufacturers to curtail parallel trade through their supply contracts with wholesalers. Although either of these exemptions would provide a relatively simple solution, such exemptions are unlikely to be politically feasible.

4.2 Country-Specific Contracts with Rebates

Assume that manufacturers maintain a roughly uniform EU supply price to wholesalers, to the extent feasible with currency fluctuations and regulation, in order to preempt parallel trade. A contract between a manufacturer and a government or other large purchaser could provide for a rebate from the list price with the rebate paid directly to the purchaser. Because wholesalers are supplied at a common list price, opportunities for parallel trade are preempted but differences in *ex post* prices to purchasers are preserved, consistent with Ramsey pricing principles. Such contracts could also include other terms. For example, the size of the rebate might be related to sales volume, with larger rebates if volume exceeds target levels. This inverse relation between price and volume already exists in several regulatory systems. A contract could also adopt a portfolio approach, bundling a higher price for one drug with a larger rebate for another drug in a company's portfolio.

In order for contracts to provide for sustainable price differentials, certain conditions are necessary. First, although the general structure of contracts should be public, consistent with the transparency requirements, the contractual details must be confidential and hence must be determined by negotiations between individual companies and governments, not set by a central authority. If rebates are public information, then each purchaser will demand the largest rebate given to any other purchaser, as currently occurs with international price comparisons. Prices then converge to the

lowest price which defeats the purpose of the rebate scheme. Thus to achieve cross-country price differentials, rebates must be confidential. Second, contracts should be negotiated by individual companies, not uniform across the industry, to permit rebates to vary across products and to preserve confidentiality. Note that these conditions are no different from those that already apply in the regulatory systems in the UK and France, and to the negotiation of drug prices for hospital use in several countries, including France.

Manufacturers in other industries commonly use rebate schemes to offer lower prices to more price-sensitive users. For example, products are often sold with a coupon that the buyer must submit to the manufacturer for a rebate. Since the price-sensitive buyers are more likely to take the time to send in the coupon, this achieves an *ex post* price discount to price-sensitive buyers although all buyers face a common *ex ante* price. Similarly, pharmaceutical manufacturers in the US give confidential, *ex post* rebates to price-sensitive managed-care purchasers. Because the rebates are delivered directly to the purchaser (usually an insurer, employer or managed-care company), not to the wholesaler or other intermediary, *ex post* price differentials are preserved without creating arbitrage opportunities for wholesalers.

Implementation of a rebate scheme raises a number of practical issues. There are no simple, observable criteria for determining appropriate rebates. Ramsey principles imply that rebates should reflect true price sensitivity or willingness to pay, but purchasers have an incentive to bluff or exploit monopsony power in order to obtain a lower price. However, that is no different from the status quo or indeed any bilateral price negotiation, where both seller and buyer attempt to determine the other's reservation price and converge on a mutually agreeable price.

Another objection is that if doctors and patients observe only the list price, they would make incorrect decisions relative to the true *ex post* price. One possible solution that is adopted by some managed-care plans in the US is to provide indicators to doctors and patients about relative prices rather than absolute prices. For example, formulary listings of available drugs may include asterisks, where more asterisks indicate a higher price. Similarly, patient copayments can indicate relative price rankings, as in the German system where the copayment level increases with the price or pack size of the drug. Such indicators of relative prices may suffice to achieve price-sensitive choices.

Of course, a contract scheme with rebates would entail costs of operation and provide users with less than perfect price information. However, the practical choice is between imperfect alternatives. A contract/rebate scheme is almost certainly preferable to the status quo, with increasing pressures for price convergence downward throughout the EU due to parallel trade and regulation based on international price comparisons.

4.3 Contract Prices *vs* Ramsey Prices

The price differentials that would be negotiated under such purchaser-specific contracts should, under certain conditions, roughly approximate Ramsey optimal price differentials.[3] This convergence occurs because the price differentials that a price-discriminating monopolist would seek to set in different markets are also inversely related to the demand elasticity in each market, as are Ramsey optimal price differentials. The difference is that the Ramsey optimal differentials are derived to yield just a normal rate of return. The discriminating monopolist may charge the same relative prices but the absolute price levels may yield a return that is above or below competitive levels in the short run.

In the long run, however, competitive entry drives expected returns to competitive levels. If expected returns are systematically above competitive levels, established companies and new entrants have incentives to invest in R&D until such excess returns are eliminated.

Thus, in a market such as pharmaceuticals which is characterised by free entry and competition

3 This is elaborated in Danzon[17] which also applies the analysis to price differentials within a country, specifically, between managed-care plans in the US.

between products that are close but imperfect substitutes, price differentials charged to competing buyers should roughly approximate Ramsey optimal price differentials. A necessary condition for this result is that buyers do not exploit monopsony power. If government purchasers do exploit monopsony power to drive prices close to marginal cost, low prices in some markets may be below the Ramsey optimal level and differentials across countries will exceed optimal differentials. If regulators can resist the temptation to exploit monopsony power, then a system whereby companies negotiate contracts with individual purchasers could lead to approximately optimal price differentials.

4.4 Ramsey Pricing *vs* Pricing Based On Pharmacoeconomics

Cost-benefit analysis, including the measurement of willingness to pay, can in theory be used to set prices. Elaborating the conditions under which pharmacoeconomic estimates of willingness to pay would approximate Ramsey optimal price differentials is an important topic but is beyond the scope of this article. Here we merely note that both approaches seek to measure value to users. This value should reflect societal willingness to pay, including both the altruistic willingness to pay for others as well as each individual's willingness to pay for healthcare for themselves. This value also depends on prices of complementary and substitute medical services, volume of use, income, preferences and other factors. Thus these same factors that are widely recognised to contribute to cross-country differences in willingness to pay also influence the Ramsey optimal pricing differentials.

4.5 Problems With Cost-Based Pricing

A commonly disputed question is whether prices should reflect the value to the user or the cost to the producer. The answer is that in a market that is either monopolistically or perfectly competitive, the long run equilibrium prices reflect both the value to the purchaser and the average total cost to the producer. However, for purposes of negotiating prices for individual products, purchasers should focus on value, taking into account prices and availability of other products, relying on competition to bring prices into alignment with costs.

The problem with trying to regulate prices based on cost is that the regulator cannot observe the relevant costs or the 'right' level of R&D. Accounting data do not provide a measure of the R&D cost for an individual drug, which reflects expenditures over several years, including allocated costs of unsuccessful drug candidates and the opportunity cost of funds due to the delay of the R&D process.[5] Moreover, even if the total R&D cost could be estimated accurately, the problem of allocating these joint costs cannot be resolved from accounting data; rather, Ramsey theory implies that the best sharing rule depends on demand conditions in different countries. In practice, attempts to regulate prices based on costs are likely to be arbitrary and downward biased, because regulators tend to focus on the verifiable, country-specific costs, omitting costs that are either joint across countries (R&D, primary production) or joint across products within a country (overhead).

Also, cost-based regulation distorts manufacturers' incentives for efficiency in production,[12] leads to 'creative accounting' and undermines incentives to focus R&D efforts on products that add the greatest value. Cost-based pricing provides for a normal return regardless of which drugs are developed. By contrast, if purchasers pay prices that reflect value, albeit imperfectly estimated, companies are rewarded for developing innovative drugs that purchasers value most highly and are penalised for products with low incremental value. Thus even if cost-based pricing was practical – which it is not — cost-based pricing would create very inefficient incentives for R&D, whereas pricing based on value to purchasers creates the incentives that purchasers want companies to have.

5. Conclusion

The EU faces a conflict of principles. The autonomy of individual countries in healthcare policy leads to price differentials for pharmaceuticals. However, if the free movement of goods is defined

to permit parallel trade, this undermines the ability of pharmaceutical companies to maintain price differentials between countries. This reduces revenues which in turn has adverse long run effects on the level of R&D, particularly R&D investments in the EU, and on price and availability of medicines to low-price countries. The welfare maximising set of prices to cover joint costs requires charging different prices to users who differ in their price elasticity of demand for innovative medicines.

Parallel trade undermines price differentials, driving prices down to the lowest price in the trading area. But for research-based pharmaceuticals there are no efficiency gains from trade because the low price usually reflects regulatory use of monopsony power or disregard for intellectual property, not superior efficiency. Indeed, consumer welfare is harmed as companies attempt to adopt uniform prices to preempt parallel trade which implies higher prices in traditionally low-price countries. Perhaps most threatening to pharmaceutical revenues, and hence to R&D, is that the incentive to free-ride is infectious, as evidenced by the fact that both Japan and the US have recently considered reducing their prices to levels paid in other countries.

If incentives for innovative R&D are to be preserved, there is a strong case for exempting from parallel trade pharmaceuticals and other products that are both patented and subject to price regulation. An alternative is to permit manufacturers to pay rebates selectively to final users, while selling at a common list price to wholesalers. Such a system of bilateral contracts between manufacturers and governments, including confidential rebates and possibly other terms, could preserve roughly optimal differentials in final prices without generating opportunities for parallel trade. A significant advantage of such a contract system is that it would also limit the ability of higher-price countries to import low prices through regulation based on foreign prices. Such regulation poses a potentially even greater threat of international diffusion of low prices than does parallel trade.

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