



## Differential Pricing for Pharmaceuticals: Reconciling Access, R&D and Patents

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This paper reviews the economic case for patents and the potential for differential pricing to increase affordability of on-patent drugs in developing countries while preserving incentives for innovation. Differential pricing, based on Ramsey pricing principles, is the second best efficient way of paying for the global joint costs of pharmaceutical R&D. Assuming demand elasticities are related to income, it would also be consistent with standard norms of equity.

To achieve appropriate and sustainable price differences will require either that higher-income countries forego trying to “import” low drug prices from low-income countries, through parallel trade and external referencing, or that such practices become less feasible. The most promising approach that would prevent both parallel trade and external referencing is for payers/purchasers on behalf of developing countries to negotiate contracts with companies that include confidential rebates. With confidential rebates, final transactions prices to purchasers can differ across markets while manufacturers sell to distributors at uniform prices, thus eliminating opportunities for parallel trade and external referencing.

The option of compulsory licensing of patented products to generic manufacturers may be important if they truly have lower production costs or originators charge prices above marginal cost, despite market separation. However, given the risks inherent in compulsory licensing, it seems best to first try the approach of strengthening market separation, to enable originator firms to maintain differential pricing. With assured market separation, originators may offer prices comparable to the prices that a local generic firm would charge, which eliminates the need for compulsory licensing.

Differential pricing could go a long way to improve LDC access to drugs that have a high income market. However, other subsidy mechanisms will be needed to promote R&D for drugs that have no high income market.

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### 1. Introduction

Developing countries (DCs) have two primary needs in access to medicines. The first is access to medicines that target diseases that are prevalent in both high and low income countries at prices DCs can afford, with distribution systems and health care infrastructure to assure effective use. The second need is for the development of new medicines to treat

diseases that exist primarily in DCs. At the center of the international debate over improving DC access to medicines is the role of patents. Patents are generally considered necessary to encourage R&D, particularly in an R&D-intensive industry such as pharmaceuticals. Acceptance of a 20 year patent term is a condition of membership in the World Trade Organization (WTO), with transitional arrangements for DCs. This has led to widespread concern that the adoption of patents in DCs will lead to higher prices than are currently paid for generic “copy” products, which would no longer be legal, thereby making drugs even more unaffordable.

In this paper, we argue that differential pricing makes it possible to reconcile patents, which are necessary for innovation, with affordability of drugs for DCs, at least for drugs with an affluent country market. Under well-designed differential pricing, prices in affluent (and, to a lesser extent, middle income countries) exceed the marginal cost of production and distribution in these countries by enough, in aggregate, to cover the joint costs of R&D, while prices in DCs cover only their marginal cost. Antibiotics and HIV-AIDS drugs exemplify medicines that serve both high income and DC markets, for which differential pricing could simultaneously yield prices that are affordable to low income countries while preserving incentives for R&D.<sup>1</sup>

For drugs to treat diseases found only in DCs, there is no high income market where prices can exceed marginal costs in order to cover the joint costs of R&D. For most DC drugs, the prices that DC patients can afford to pay are insufficient to cover costs and hence to create incentives for innovators to invest in R&D. Thus some external subsidy—either a demand-side subsidy to patients or a supply-side subsidy to innovator firms—is necessary to create incentives to develop treatments for DC—only diseases. Patents are necessary but will not suffice: having the legal authority to charge high prices is of no value if patients or governments cannot pay. Various subsidy options have been proposed for funding R&D on DC drugs, but these are not discussed here. The focus of this paper is on the use of differential pricing for drugs that serve both high income and DC markets.

The structure of the paper is as follows: Section 2 reviews the importance of joint costs in the cost structure of the research-based pharmaceutical industry. Section 3 outlines the theory of Ramsey pricing, and compares these Ramsey-optimal price differentials to the price differentials that in theory emerge in monopolistically competitive markets with entry. Section 4 examines the determinants of actual price differences within the US and cross-nationally; reviews the effects of parallel trade and external referencing (benchmarking prices in higher income countries to lower foreign prices); and discusses the cost shifting argument against differential pricing. Sections 5 and 6, respectively, discuss implementation of differential pricing and compulsory licensing. Section 7 concludes.

## **2. The Cost Structure of Research-Based Pharmaceuticals and the Economic Role of Patents**

The research-based pharmaceutical industry in the US spends 15.6 percent of global sales on R&D, compared to 3.9 percent for US industry overall excluding drugs and medicines (PhRMA, 2001). This sales-based measure understates R&D expense as a percentage of the total costs of developing and producing new drugs, because it omits the “opportunity”

or capital cost of funds over the 8–12 years required for drug discovery and development.<sup>2</sup> Adding in this cost of funds, R&D accounts for roughly 30 percent of the total cost of developing, producing and marketing new drugs, with all costs measured as discounted present value at the time of product launch (Danzon, 1997).

This large R&D expense complicates pricing for several reasons. First, R&D is a fixed, globally joint cost; that is, this cost is largely invariant to the number of patients or countries that ultimately use the drug and cannot be causally attributed to specific countries. Once a compound has been developed to serve affluent countries, no incremental R&D expense is needed to serve low-income countries.<sup>3</sup> Second, this global joint cost is largely sunk by the time the product is launched and price is negotiated. The marginal cost or incremental cost incurred to serve an additional country or patient group depends on the decision at hand. As a drug advances through its life cycle and is launched in more countries, country-specific launch costs are sunk. Marginal cost includes only the variable cost of producing and selling additional units, which is usually very low.<sup>4</sup>

If there were no patents, generically equivalent “copy” products could enter freely and competition would force prices down to marginal cost. Marginal cost pricing would suffice to cover the expenses of copy products that incur only production and distribution costs with negligible R&D or promotion expense. But marginal cost pricing cannot generate sufficient revenue to cover the R&D costs of innovator firms. Hence free entry and the resulting marginal cost pricing are incompatible with sustained incentives for R&D. The economic purpose of patents is therefore to bar entry of copy products for the term of the patent, to provide the innovator firm with an opportunity to price above marginal cost and thereby recoup R&D expense, in order to preserve incentives for future R&D.

Economic theory views patent protection as a “second best” way to pay for R&D. In a “first best” or fully efficient outcome, all consumers whose marginal benefit exceeds marginal cost should use the product; however, patents permit pricing above marginal cost, hence some consumers may forego the product even though their marginal benefit exceeds the marginal cost. But with large fixed costs of R&D no first best solution is possible: marginal cost pricing to consumers would generate inadequate revenue to sustain innovation unless the government subsidized R&D. However, raising the necessary taxes undermines efficiency and possibly equity in other sectors of the economy and allocating subsidies *ex ante* in a way that creates efficient incentives and avoids waste is difficult, if not impossible. Thus a patent system, which enables innovator firms to charge prices above marginal cost to consumers who use the product, is generally viewed as the best practical approach to funding R&D in industrialized countries.

The objection to patents in DCs assumes that patent-holders would charge prices significantly above marginal cost and above the prices currently charged for copy products, making drugs even less affordable and leading to suboptimal utilization. Some have argued for *ex post* government purchase of a patent (Kremer, 1996) or of licensing rights (Ganslandt, Maskus and Wong, 2001).<sup>5</sup> However, even though patents may in theory enable a firm to charge a price above marginal cost, this may not be in the firm’s self-interest in markets where consumers cannot afford to pay. Thus a patent-holder may rationally set prices near marginal cost in low-income markets where demand is highly price-elastic, provided that these low prices cannot spill-over to other, potentially higher-priced markets in the

same country or other countries. It has been argued that this will not happen. For example, Lanjouw (1998) argues that patents will substantially increase drug prices in India.<sup>6</sup> However, this is in part because of the potential for Indian prices to spillover through external referencing by high income countries, and because she expects the extension of medical insurance (to cover some or all of the 70% of the currently uninsured population) to increase prices. We argue below that US and other evidence indicates that powerful third party payers obtain lower prices than out-of-pocket purchasers.<sup>7</sup> We discuss later policies necessary to prevent price-spillovers and options to enable governments/purchasers in DCs to bargain effectively on behalf of their populations to achieve the lowest possible price.

### 3. Efficient Payment for R&D: Ramsey Pricing

Necessary conditions for (second best) efficiency in drug utilization and drug development are: (1) price  $P$  is at least equal to marginal cost  $MC$  in each market or country; and (2) prices exceed  $MC$  by enough, in aggregate over all markets, to cover the joint costs of R&D, including a normal, risk-adjusted rate of return on capital ( $F$ ):

$$P_j \geq MC_j, \text{ and} \quad (1)$$

$$\Sigma(P_j - MC_j) \geq F \quad (2)$$

The first condition, that price covers marginal cost in each market, assures that the product will be supplied and that marginal benefit exceeds marginal cost, as required for efficient resource use. In the case of health services, the price paid for drugs may include social insurance and possibly other subsidy payments, reflecting the willingness of higher income taxpayers/countries to subsidize consumption for lower income populations. The second equation is both a break-even condition for the firm and a necessary condition for efficient investment in R&D. These necessary conditions for efficiency in drug consumption and innovation do not imply or require that prices should be the same for all consumers.

The key policy question is, What pricing structure across markets would satisfy these two conditions and yield the greatest social welfare for consumers?

Ramsey optimal pricing (ROP) (Ramsey, 1927; Baumol and Bradford, 1970) is the set of price differentials that yield the highest possible social welfare, subject to assuring a specified target profit level for the producer, usually a normal, risk-adjusted return on capital. The ROP solution is that prices should differ across market segments in inverse relation to their demand elasticities. In the case of a single product, the condition for the optimal markup of price over marginal cost for submarket  $j$  is:<sup>8</sup>

$$\frac{p^j - c^j}{p^j} = -\frac{\lambda}{(1 + \lambda)} \frac{1}{E_j} \quad (3)$$

or

$$L^j = D/E_j \quad (3)'$$

where  $E_j$  is the own elasticity of demand in market  $j$ . Thus  $L^j$ , which is the mark-up of price over marginal cost (also called the Lerner index) in market  $j$ , should be proportional to the demand elasticity  $E_j$ . The proportionality term  $D$  is defined by the normal profit (or other) constraint. Thus if marginal cost is the same in all markets, ROP means prices differ depending only on demand elasticities. If marginal cost differs across markets, these conditions apply to mark-ups over market-specific marginal cost.

The intuitive explanation for ROP is simple. Recall that the ideal would be to charge everyone their marginal cost but this is not practical because pricing at marginal cost would not cover R&D. The Ramsey solution minimizes the welfare loss from departing from this ideal: more price-sensitive users should be charged a smaller mark-up over marginal cost than less price sensitive users, because the price-sensitive users would reduce their consumption by proportionately more, if faced with the same prices. Charging lower prices to more price-sensitive users is also consistent with equity, assuming that lower income consumers have more elastic demand, on average.<sup>9</sup>

### 3.1. Ramsey Price Differentials vs. Profit-Maximizing Differentials

One common objection to ROP is that it proposes price differentials similar to those charged by a price discriminating monopolist (PDM). The monopolist's profit-maximizing mark-up in market  $j$  is:

$$(p^j - c^j)/p^j = L^j = 1/E_j \quad (4)$$

Comparing the price markups in equations (3) and (4), the *relative* markups across markets are the same under PDM as under ROP, but the *absolute* prices may differ due to the profit constraint factor,  $D$  (which is unity for the monopolist). Ramsey prices are derived to yield a specific target return on capital for the firm. By contrast, the unconstrained monopolist may try to maximize profit, but may actually realize more or less than a normal rate of return in any given year. But in the long run, with unrestricted entry and exit of firms offering competing but differentiated products, dynamic competition will reduce *expected* profits to normal levels at the margin. This is simply the standard monopolistic competition result, which fits the pharmaceutical industry reasonably well. Under monopolistic competition, entry occurs until excess expected profits are eliminated for the marginal firm and the marginal product in each firm's portfolio of products. Ex post of course actual realized profits of a given firm may be above or below normal levels. Given the scientific and market risks faced by the pharmaceutical industry, it is not surprising that expectations in pharmaceuticals are not always accurate. Grabowski and Vernon (1990, 2003) conclude that on average, new chemical entities (NCEs) launched in the 1980s and 1990s, earned at most modest excess returns on average, but that 70 per cent of new products generated insufficient global revenues to cover the average cost of R&D. Some firms have been very successful while others have exited through merger or other means, and average profitability has varied over time. Moreover, there is strong evidence that dynamic entry in response to *expected* profits occurs long before those profits are actually realized. The pace of entry of

successive entrants to new therapeutic classes has accelerated, such that follower products now can enter within a year of the first drug in a new class ([www.PhrMA.org](http://www.PhrMA.org)).

This similarity between the welfare maximizing (ROP) and profit maximizing pricing structures is not surprising and is fortuitous. It means that firms, pursuing their own self-interest, will attempt to set price differentials across markets that are second best efficient and also meet standard norms of equity, assuming low income consumers have more elastic demand. Entry should assure that on average profits are bid down to normal levels and price markups over marginal cost approximate to ROP levels. In practice, price differentials between and within countries may differ from ROP levels, due to spillovers across markets, regulation and other factors discussed below.

### ***3.2. Regulation vs. Competition***

ROP was originally applied to the regulation of utilities. However, while the pharmaceutical industry resembles utilities in having large joint costs and low marginal costs, these industries differ in other important ways. Utilities were usually local natural monopolies. By contrast, any market power enjoyed by individual drugs derives primarily from the intentional grant of patents in order to permit pricing above marginal cost. As we note above, competition from therapeutic substitutes makes pure monopoly rare and temporary. Competition can also be encouraged by the design of insurance arrangements, including incentives for consumers and physicians to be cost-conscious. Thus the monopoly rationale for regulation does not apply in the case of pharmaceuticals, which is closer to the model of monopolistic competition.

Traditional utility pricing formulae generally explicitly recognized the need to provide a reasonable return on capital. Because the utility's production capacity was country-specific, local users could not free ride: if they did not pay for capacity costs, their future access to services would obviously be at risk.<sup>10</sup> By contrast, the global nature of the joint costs of pharmaceutical R&D creates the incentive and opportunity for regulators in each country to free ride, paying only marginal cost and leaving others to pay the joint costs. Moreover, the long lag between initiating R&D and bringing products to market means that even if current low prices do reduce R&D and hence the future supply of new drugs, it will be hard to attribute future lack of innovation to specific current policies or politicians.

Any attempt to regulate pharmaceutical prices based on costs is likely to be imprecise and probably downward biased because full costs are unobservable and optimal allocation rules may be unknown and/or politically unacceptable. First, the full cost of an R&D project includes investments made over 10–15 years, which is hard to track, plus the time cost of money, which is not captured in accounting statements. Second, the full cost of developing a new drug includes the costs of the many failures or “dry holes” during the drug discovery and development process (DiMasi, Hansen and Grabowski, 2003). Third, the degree of jointness of R&D and production costs is hard to measure; even if known, the appropriate sharing rule for joint costs between, say, Italians and Americans depends on demand conditions in their respective countries. Thus in the case of pharmaceuticals, accounting costs do not provide an accurate measure of full economic costs or an appropriate benchmark for setting prices. If regulators base prices on allowable costs defined as costs that are clearly attributable to

a specific product in a specific country, cost-based regulation will lead to prices that are inadequate to cover total costs.

The airline industry offers an example of differential pricing that works reasonably well without regulation in an industry characterized by large joint costs and monopolistic competitive market conditions. Since airline deregulation in the US, price differentials have increased while average price levels have fallen significantly. Each airline may have some local monopoly power, but competition between incumbents, reinforced by entry by new airlines, constrains profits to roughly normal levels on average. This may be imperfect, but a rough second best is the best we can hope for in industries with large global joint costs.

### ***3.3. Welfare Conclusions on Price Discrimination***

A considerable literature has examined the welfare effects of price discriminating monopoly relative to a single-price monopoly. Most of these models focus exclusively on static efficiency (i.e. creating the most efficient outcome from existing products), ignoring dynamic effects on R&D. In the static efficiency context, a necessary condition for price discrimination to increase social welfare is that output is greater with differential pricing across markets than with a uniform price in all markets. In the case of pharmaceuticals, it seems highly likely that this condition is met. With approximately uniform prices, many consumers in low income countries drop out of the market because the uniform price is unaffordable. Consumption by these consumers would probably increase considerably under price discrimination, at least for drugs with modest costs of production. For example, Dumoulin (2001) simulates worldwide pharmaceutical prices, revenues and number of consumers served under the extremes of price discrimination between each national market (i.e. one price per country) and a single global price. He concludes that price discrimination increases access by a factor of roughly 4–7 times. Access in this model can only be further increased by governments or other agencies financing the purchase of pharmaceuticals in low income countries.

A further interesting feature of this model is that, comparing two countries with the same average GDP per capita, the country in which wealth is most concentrated will face a higher price under price discrimination because in such markets companies would rationally price for the rich market rather than the numerically larger (in terms of people) lower income market. Thus market segmentation *within* and *between* countries could significantly increase affordability for low income populations, particularly those with a highly skewed income distribution. The efficiency case for price discrimination is even stronger in models that consider both dynamic and static efficiency (see, for example, Hausman and MacKie-Mason (1988)) and where demand dispersion between countries is very great (Malueg and Schwartz, 1994).

### ***3.4. Differential Pricing Does Not Imply Cost-Shifting***

A common objection to differential pricing is that it implies “cost shifting” from low-price to high-price markets. This argument either ignores the jointness of costs or mistakenly assumes that joint costs should be allocated equally to all users. As long as markets are

separate, a firm would rationally set the price in each market based on conditions in that market, independent of prices in other markets. If low price users cover at least their marginal costs and make some contribution to the joint costs of R&D, prices in high price countries can be *lower* than they would have to be to cover joint costs in the absence of contributions from the low price countries.

If price differences are unsustainable, due to parallel trade and external referencing, then manufacturers will tend to charge a single price that is between the differentiated prices that would have been offered. Under such uniform pricing, consumers with relatively inelastic demand may have somewhat lower prices due to associating with consumers with more elastic demand. Although the high-income, inelastic users may try to justify this as “eliminating cost-shifting,” it could more appropriately be called “free riding” by the high-income, price-inelastic consumers on the low-income, price-elastic consumers.

#### **4. Actual vs. Optimal Price Differentials and the Breakdown of Market Separation: Parallel Trade and External Referencing**

Opposition to the differential pricing approach is based in part on the observation that actual price differences within countries and between countries do not appear to approximate likely ROP levels, given income differentials. In fact, these observations show that the current system is not well designed to achieve appropriate price differentials; they do not show how the approach might work if the necessary reforms were adopted.

##### ***4.1. The Breakdown of Market Separation Parallel Trade and External Referencing***

The breakdown of market separation and hence of manufacturers' ability to maintain price differentials is probably the single most important obstacle to lower prices in low-income countries. The primary factors are two policies favored by higher-income countries: parallel trade and external referencing. Parallel trade occurs when an intermediary exports an originator product from one country to another to profit from the price differentials set by the manufacturer. Parallel trade violates traditional patent rules, whereby the patent holder could bar unauthorized importation of its product. These traditional patent rules were preserved in the North American Free Trade Association (NAFTA). However, the European Union authorizes parallel trade within the EU, adopting the view that the originator firm exhausts its patent rights with respect to parallel trade once it places the product on the market anywhere in the EU. The US recently enacted provisions to permit re-importation of drugs. This legislation has so far not been implemented, due to concern over assuring quality of imports and doubt about whether cost savings would be passed on to consumers. However, imports from Canadian internet pharmacies into the US are now sufficiently large to be attracting responses by manufacturers.

Parallel trade is often erroneously defended using the standard economic arguments for free trade, but these do not apply. Lower prices in countries that parallel export pharmaceuticals usually result from aggressive price regulation, lack of patent protection, or lower per capita income which leads the originator firm to grant lower prices.<sup>11</sup> None of these factors creates an efficiency gain from trade. In fact, parallel trade can increase social costs, due to



costs of transportation, relabelling and quality control. Most of the savings usually accrue to the intermediaries, not to the consumers or payers in the importing country who continue to pay the higher price.<sup>12,13</sup>

The second policy that erodes separate markets and promotes price spillovers is external referencing, which occurs when governments or other purchasers use low foreign drug prices as a benchmark for regulating their domestic prices. Such external referencing is used formally by the Netherlands, Canada, Greece and Italy, among others, and used informally by many other countries.<sup>14</sup> External referencing is equivalent to fully importing a foreign price. The risk that low prices granted in low-income countries would lead high-income countries to demand similarly low prices is probably the single most important obstacle to lower prices in these low income countries.

Faced with price leakages due to external referencing and parallel trade, a firm's rational response is to attempt to set a single price or narrow band of prices. Consistent with this prediction, companies frequently now attempt to obtain a uniform launch price throughout the EU, and launch may be delayed or not occur in countries that do not meet this target price.<sup>15</sup> Formally, if two markets L and H are linked, the profit-maximizing strategy is to charge a single price  $P$  in both markets, where  $P$  is based on the weighted average of the elasticities in the two markets, with weights that reflect relative shares of total volume  $Q$ :

$$(P - MC)/P = 1/(E_h w_h + E_l w_l) \quad (5)$$

where  $w_l = q_l/Q$  and  $w_h = q_h/Q$ .

Thus if the low income market is small and price-elastic, relative to the high income market, the single price will be dominated by conditions in the high income market. This single price could far exceed the price that would have been charged in the low income market, had markets been separate, as determined by equation (4).

This breakdown of price differentials that are appropriate to the different conditions in each market is inefficient and inequitable. Consumers in low-income countries face inappropriately high prices and forego medicines, even though they might be willing to pay prices sufficient to cover their marginal cost. High-income countries might appear to benefit in the short run from trying to import low prices. But in the long run these countries are also likely to lose as the break-down of differential pricing leads to lower revenues, less R&D and hence fewer new medicines.

#### 4.2. *Cross-National Price Differentials*

Cross-national price differentials appear to deviate significantly from what might be expected based on income as a proxy for price sensitivity: some high income countries have relatively low prices, while some low-income countries face high prices relative to their income level. For example, Maskus (2001) looking at a sample of list prices for 20 drugs in 14 countries in 1998 found a correlation between average price and per capita income of only around 0.5, with significant dispersion. Some prices in relatively poor countries were higher than US prices. Scherer and Watal (2001) found that for 15 AIDS antiretroviral drugs in 18 countries for the period 1995–9 the average price was 85% of the US list price,

and a fifth of prices were above the US level. They found that per capita income did help to explain price differences, but the link weakened over the period as companies began offering discounts that were unrelated to per capita income.

Several factors contribute to the weak relationship between per capita income and prices. First, regulators in some high-income countries use their bargaining leverage—sometimes combined with external referencing—to reduce their prices to relatively low levels, leaving others to pay for the joint costs of R&D. Second, the threat of external price spillovers makes manufacturers reluctant to grant low prices to low income countries for fear that these would undermine potentially higher prices in other countries. Third, the tendency for prices in low-income countries to be inappropriately high, relative to their average per capita income, may reflect manufacturers' response to internal price spillovers between high and low-income market segments. The highly unequal distribution of income in some countries, and the lack of programs to provide subsidized medicines to poorer people, means that a small, high-income subgroup dominates potential pharmaceutical sales, leading to prices that are geared to that subgroup but are unaffordable for other subgroups.<sup>16</sup> The ideal solution in such cases is to separate the submarkets within the country, for example, by establishing a program that serves the low-income subgroup only, with discounted prices that are not available to the higher income subgroup. Although many DCs in theory make drugs available at no or low charge to low income patients through public sector hospitals and clinics, in practice many poor people purchase drugs in the private sector, because public clinics are not geographically convenient, often require long waits, or simply do not have the drugs.

#### *4.3. Price Differentials Within the US*

In the US, actual price differentials between market segments for on-patent drugs are reasonably consistent with inverse demand elasticities. Health plans either manage their own pharmacy benefits or contract with pharmacy benefit managers (PBMs). These PBMs use tiered formularies to define lists of generic, preferred brand and non-preferred brand drugs, with significant co-payment differentials between the tiers. With incentives for consumers and sometimes physicians to use drugs on the preferred list, PBMs can shift market share to preferred drugs from non-preferred drugs, effectively increasing the demand elasticity facing pharmaceutical companies. Companies give larger discounts, the greater the PBM's ability to shift market share to drugs on the preferred tier. PBMs use similar strategies to negotiate discounts on dispensing fees charged by pharmacists. By contrast, patients who have unmanaged drug coverage or no drug insurance get neither manufacturer discounts nor discounted pharmacy dispensing fees. They have no price-sensitive intermediary that can shift market share towards firms that offer lower prices.<sup>17</sup> Although in theory physicians might play this role, in practice physicians' prescribing decisions appear to be relatively price-insensitive. This US experience suggests the value of having an intermediary that can influence demand and hence can bargain with manufacturers on behalf of consumers, making demand more elastic. We discuss this below in the context of DCs.

A major political obstacle in the US to acceptance of differential pricing for DCs is the sense that prices are too high for uninsured seniors in the US. This is, however, fundamentally an insurance problem that is best addressed by extending managed drug benefits to seniors

and other low income individuals, which would enable them to benefit from negotiated discounts on drug prices and dispensing fees similar to the discounts enjoyed by others with PBM-managed benefits. Trying to address the problem faced by seniors in the US through parallel imports or external referencing to lower prices in other countries may not benefit seniors in the US in the long run because of the dynamic effects on R&D and the supply of new drugs. Even in the short run the effect may simply be to make drug companies even more reluctant to grant lower prices in other countries, including lower income countries, for fear that these discounts may be “imported” into the US through referencing or parallel trade.

Competitive discounting in the US has been constrained since 1991 by the Medicaid “best price” provision, which requires manufacturers of branded products to give the public Medicaid program the largest discount that they give to any private customer. But Medicaid demand is relatively price-inelastic: beneficiaries have low or zero co-payments and most states do not use formularies to shift market share to products that give lower prices, unlike managed private plans.<sup>18</sup> Thus the effect of linking Medicaid’s relatively price-inelastic market to the more price-elastic private market has been to reduce discounts that manufacturers are willing to grant to private buyers.<sup>19</sup> Essentially, the Medicaid best price provision links the less price-elastic Medicaid market to the most price-elastic market segment in the private market. Thus in the US as in the international context, leakages from more elastic to less elastic markets tend to erode discounts in the more price-elastic markets.

## **5. Policies to Maintain Separate Markets and Price Differentials**

A sustainable, broad-based differential pricing structure will only be possible if higher income countries accept the responsibility to pay higher prices, foregoing the temptation to try to obtain the lower prices granted to low income countries, and middle income countries recognize that it may be appropriate for them to pay prices that provide a return on R&D for at least part of their populations. We discuss next specific policies and recent initiatives that could help sustain price differentials. We then review the pros and cons of confidential negotiation; procurement processes and the associated publishing of price information; and proposals for transparent published discount structures.

### ***5.1. Defining Patents Based on National Boundaries, Including the Right to Bar Parallel Trade***

The simplest way to stop parallel trade is to define patents to include the right for a patent holder in each country to bar unauthorized imports of products that are under patent protection, that is, no doctrine of international exhaustion. This is consistent with traditional law on patent rights in the US and in the countries comprising the EU with respect to non-member states. The economic efficiency case for national boundaries for patents is strongest for industries, such as pharmaceuticals, that incur significant global, joint R&D expense that is optimally recouped by differential pricing.

The World Trade Organisation’s (WTO) Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) provisions permit individual countries to choose their own policies on international exhaustion. It is therefore possible for high income countries to

prohibit parallel trade and many do. It is, however, also possible for countries receiving low prices to ban parallel exports, thus protecting themselves from losing the benefit of these low prices (Maskus, 2001).<sup>20</sup> It may be difficult for a low income country to police a parallel export ban, but there are strong incentives to do so. However, even if these measures stop parallel trade, they will not prevent spillovers due to the external referencing of prices.

### **5.2. *Higher Income Countries Should Forego Regulation Based on Foreign Prices***

Any institutional framework to preserve differential pricing will only work if higher income countries forego the temptation to try to reduce their prices by referencing lower prices in low-income countries. The UK Government recently committed itself not to benchmark or reference DC prices (Short, 2002). We are not aware of similar commitments by other higher income countries. However, even if governments of the G-8 countries committed not to reference DC prices, the risk would remain that other middle income governments or advocates of lower prices in high income countries would reference low DC prices if these are observable. If so, making these prices unobservable may be the best approach to achieving the lowest possible prices for DCs.

### **5.3. *Implementing Differential Pricing Through Confidential Rebates***

Both parallel trade and external referencing can be addressed by manufacturers and purchasers in low income countries or market segments using confidential rebates as part of their procurement arrangements, such that low prices granted to one purchaser are unobservable to others and cannot be copied. If discounts to low income countries or market segments are given as confidential rebates paid directly to the ultimate purchaser, while wholesalers are supplied at a common price (or act as distribution agents who do not own the product), this eliminates the opportunity for other purchasers to demand similar rebates. It also eliminates the opportunity for wholesalers or other parallel traders to purchase the product at the low price intended for low-income countries and export it to higher-price countries, and prevents leakages of products between market segments within countries, confining discounts to the intended beneficiaries. Confidential discounts are the chief means by which US managed care purchasers get lower prices. Discounts are targeted to payers that can move market share, implying elastic demand. Other, less-elastic purchasers cannot demand similar discounts because the discounts are not known. In the case of low income countries, discounts could also be negotiated and linked to specific volume of use. By making rebates payable *ex post* depending on volume of use (or by having a fixed volume contract) difficulties of determining elasticities *ex ante*, due to bluffing and other bargaining strategies, are reduced.

A second argument for keeping prices confidential is that confidentiality encourages competition whereas publishing bid prices can promote collusion between suppliers (which may be tacit rather than an explicit cartel<sup>21</sup>) (Stigler, 1964; Scherer, 1997) where goods are subject to repeat bids to different or the same customers. This is both because companies are seeking only to beat the published price rather than to quote their lowest possible price<sup>22</sup> and because companies send tacit signals to one another in the pattern of their bid prices.

An argument for price disclosure is that transparency increases public accountability, enabling the public to see if buyers are doing a good job, and reduces the chance of collusion between procurement bodies and bidding companies. In the case of pharmaceuticals there is also significant public pressure for companies to be seen to offer discounted prices to DCs. These disclosure objectives can, however, be achieved by audit by an approved third party, without incurring either the adverse spillover effects that result when prices are publicly observable or the risk of tacit collusion.

Implicit in these arguments for transparency is the assumption that DCs lack bargaining power and hence public scrutiny is required to see if companies have taken advantage of this. But if the small DC truly has very elastic demand, then it is in the seller's self-interest to charge a price close to marginal cost, since this would be the profit-maximizing price if volume is highly responsive to price. If companies seek to charge high prices they will lose business as low income buyers look for other products, or, in the case of a single source product, switch to other health priorities where their limited resources can be used more cost-effectively. The small size and low income of some DCs should not *per se* affect their ability to bargain for low prices unless there are significant fixed costs of operating in these countries (which is an unavoidable component of country-specific marginal cost) or there is significant risk of price spillovers to larger countries with less elastic demand.

It will, however, be useful for governments or other third party procurers to bargain on behalf of low income populations in DCs, analogous to the role played by PBMs in the US. If such procurement agents negotiate confidential discounts and shift volume towards suppliers who give the lowest prices while maintaining quality, this should assure that small DCs achieve the lowest feasible prices. In countries with a significant middle/high income market, such procurement should be confined to the low income population, in order to avoid pooling the less elastic high income consumers with the more price elastic low income consumers. Procurement for low income populations already exists for vaccines and some drugs, through UNICEF and public procurement by individual governments. The supply prices of manufacturers to such programs are generally confidential, although UNICEF indicates the delivered prices at which it will supply countries.

The Global Fund to Fight AIDS, Tuberculosis and Malaria is playing such an intermediary role, becoming a major purchaser of drugs for the treatment of HIV/AIDS, TB and Malaria, buying multi source off-patent drugs as well as newer more innovative products, some of which may be single source.<sup>23</sup> Procurement is the responsibility of local recipients, but they must follow the procurement policies the Global Fund has developed, including using international procurement agencies when local skills are lacking. On price the Global Fund (2002) requires:

- use of competitive purchasing to get the lowest price, subject to meeting licensing and quality requirements;
- recipients to meet national law albeit encouraging such laws to exploit the flexibilities in international agreements on intellectual property including the TRIPS and Doha declaration;
- disclosure of prices paid by recipients, on principle, to provide transparency and accountability.

Sharing information on the prices paid by countries at similar income/elasticity levels may increase buyer bargaining power by increasing the information available to buyers about companies' willingness to supply. It also assures public accountability, assuming these posted prices are in fact the final transactions prices. However in practice, once prices granted to DCs are observable, similar prices may be demanded by middle income countries or by advocates for lower drug prices in high income countries. Such referencing may make companies reluctant to offer low prices to Global Fund recipient countries if these prices are observable to all. In the case of the Global Fund, the clear focus on three diseases and on a defined list of countries may reflect a general recognition that prices offered to the Fund will not be available to other purchasers and that referencing is inappropriate. However, if this turns out not to be the case then the Global Fund should review its policy on open publication of the prices it obtains in competitive tender and consider whether a more limited publication to beneficiary countries could achieve its objectives without promoting spillovers.

It could be argued that if most high-income countries accept that parallel trade and external referencing from DCs is not compatible with DCs getting low prices and these activities are, in practice, negligible, then price confidentiality is no longer required. Several companies have publicly declared policies on differential pricing for HIV/AIDS drugs (MSF, 2002) for defined groups of low income countries, in part in response to political pressure for transparency, but also suggesting a lack of practical concern over spillover effects. However, these company policies do not disclose prices for other countries or for products to treat other diseases. There is in part an empirical issue. If significant spillovers do occur companies will respond by withdrawing differential prices that become public domain. As stated above, independent audit can provide public reassurance without compromising low prices for DCs.

#### **5.4. *Structured Discounts and a Global Tiered Pricing Structure***

Some proponents of differential pricing have argued for regulatory frameworks within which voluntary differential pricing by companies of the sort we see as efficient can operate. Two recent examples of this approach are proposals by the EU Commission and the UK Working Group. Others have argued that such an approach will lead to, or, some would advocate (MSF, 2002) should lead to, a published schedule of discounts, perhaps in the name of one or more international bodies, with discounts related to GDP per capita levels and to disease burden. We consider the two proposals and the issues involved in moving to a more formal published schedule.

**5.4.1. *The European Commission Council Regulation.*** This regulation (EU, 2002, 2003) is intended to create a voluntary global tiered pricing system for key pharmaceuticals for the prevention, diagnosis and treatment of HIV/AIDS, TB and malaria and related diseases for the poorest developing countries and to prevent product diversion of these products to other markets by ensuring that effective safeguards are in place. To qualify, companies are asked to commit to supply medicines at a discount of 75% off the average "ex-factory" price in OECD countries, or at production cost plus 15%.<sup>24</sup> How the production costs or OECD prices are

to be calculated is not defined (e.g. sales weighted, GDP weighted or unweighted). Under the production cost plus option, company data would remain confidential; an independent auditor agreed by the manufacturer and the Commission would be required to certify that the price exceeds production cost by the allowed margin. Price information on the OECD discount option must be disclosed to the Commission in application. Companies are required to supply an annual sales report for each product to the Commission on a confidential basis. The implication is that prices offered remain confidential. The current list includes 76 countries, including China, India and South Africa, from which reimportation into the EU is expressly prohibited for both on-patent and generic products. Products on the list will bear an EU logo and should look different (different color, size or shape), to assist EU-member state customs officials in preventing the importation of these products into the EU.

**5.4.2. The UK Working Group.** Following the 2001 G8 Summit, the UK Government set up a working group, comprised of the pharmaceutical industry, WHO, EU and Foundations, to establish “an international framework that would facilitate voluntary, widespread, sustainable and predictable differential pricing as the operational norm.” The objective is to get international commitment at the June 2003 G8 Summit. The scope proposed is 49 DCs and all Sub-Saharan Africa (i.e. 63 countries in total), focusing initially on drugs to treat HIV/AIDS (including opportunistic infections), TB and malaria. There is no formula, but prices should be close to the cost of manufacture (undefined). Independent audit would be used where needed to ensure confidentiality whilst establishing whether a product met such criteria. The Working Group recommended systematic global monitoring (with methodology and improved databases) to determine whether differential pricing was significantly improving country access. WHO has agreed to develop the monitoring framework in cooperation with industry and other stakeholders.

Common elements to these two proposals are: an emphasis on voluntary differential pricing, with at most modest incentives for compliance; limitation to a few key diseases, at least initially; and limitation to a defined number of low income countries. The proposals appear to differ on price disclosure, with the EU not explicitly requiring this, and the UK Working Group seeking extensive monitoring by the WHO (although not necessarily publication of price).

MSF has argued strongly for a uniform preferential pricing system that does not leave discretion with companies. However there are strong arguments against such a proposal:

First, even if the aim is confined to achieving prices close to marginal production cost for drugs to treat HIV/AIDS, Malaria, and TB in the poorest countries, there is no single, simple discount per cent that would achieve this, since production costs and relevant country-specific fixed costs differ. More generally, there is no simple formula to translate the two main criteria for discounts, GDP per capita and disease burden, into a banded discount table applicable across many diseases and countries. Moreover, average per capita income for the entire population is less relevant than per capita income of the poorest groups, for whom the government or some international agency is buying. In practice, many policy makers are reluctant to discriminate within countries, on either political or practical grounds. For example, the UK Working Party rejects such differentiation within DCs on the grounds that costs would exceed benefits. However, in countries with a sizeable middle class, confining

discounts to the poorest groups may be necessary to encourage companies to give them the lowest feasible prices. Maintaining a more profitable sector would permit spreading the country-specific fixed costs to a more affluent subgroup and may also encourage companies to invest in a country, providing employment, training and technology transfer.

Second, reaching agreement on a specific banded discount table by an international body seems unlikely, given the implications for those countries and subgroups that would not get the lowest prices. The EU regulation proposes 75% discounts for the poorest 76 countries; the UK proposal applies similar discounts to 63 countries. This may reflect a view that other countries are able to look after themselves. However it likely also reflects the difficulty of specifying appropriate discount percentages and classifying countries, once one goes beyond the most essential drugs for killer diseases in the poorest countries. By contrast, a system of confidential, negotiated rebates is fully flexible and hence can be extended to the full range of drugs and countries that should benefit from some degree of discounts. This is extremely important, given the large and growing disease burden in DCs of non-infectious, chronic diseases, for which effective medicines exist, but are unaffordable to the poor in these countries.

Third, as noted above, published discounts could freeze prices and undermine competition. This is most likely in classes with few competitors. Such convergence to the published price has occurred under reference pricing in some high income countries—prices converge to the reference level, some by falling others by rising, with no dynamic downward pressure on prices over time. Thus there is a risk that published prices become a norm, stopping access to larger discounts. Alternatively, such published prices might be a starting point, from which buyers seek discounts through competitive negotiations or tendering (and possibly compulsory licensing). In that case, it is not obvious the published prices are necessary.

Fourth, defining the benchmark price will be difficult and, as noted earlier, the EU regulation does not include a definition of price. Moreover, once the benchmark has been defined the discount schedule is effectively linking prices in different markets, implying a modified version of equation (5).<sup>25</sup> If prices in high income countries are the benchmark from which discounts for low and middle income countries are calculated, these high income country prices may be affected by the linkages to other markets. For example, a discount structure intended to reduce prices in middle income countries (by proposing fixed percentage discounts off high income country prices, albeit smaller discounts than for low income countries) could lead to *higher* prices in some developed markets if the middle income market is large and relatively inelastic. Specifically, it may be profitable for companies to raise prices in a higher income country (above the optimal level for that market) because application of the discount formula results under in a higher price in a large, middle income country market where demand is inelastic. Such effects would be similar to the US experience, where the requirement to give “best” private price to Medicaid led to smaller discounts for private buyers.

Fifth, companies could refuse to offer these discounts to some or all of the listed countries. The only effective sanction is bad publicity. Moreover, companies may resist such regulated, transparent discounts, even though they might be willing to offer similar discounts in confidential negotiations, both because of the risk of spillovers of these low prices and, more generally, because they might see scheduled discounts as a first step towards a



comprehensive system of international price regulation. Such an approach would be highly inefficient given the competitive nature of the pharmaceutical industry.

As an alternative to scheduled discounts off benchmark (presumably high income) prices, both the EU and UK governments propose regulating discounts as a mark-up over audited costs. This approach avoids the pitfalls of linking prices across markets by a rigid discount schedule, but has other problems common to all cost-based approaches. It might be manageable in the case of drugs for HIV/AIDS, TB and malaria for a defined list of least developed countries. But if applied to a broader list of drugs and countries, including some that should appropriately contribute to R&D, cost-based pricing raises major economic, accounting and political issues, some of which were mentioned earlier.

First, cost-plus pricing proposals leave unspecified whether marginal cost should include contributions towards production capacity for drugs where the supply of DCs will require construction of additional, costly production capacity. This is most acute for anti-retrovirals, for which existing capacity is inadequate to meet DC needs, and for vaccines and other new drugs that may be developed for DCs. A related issue is whether marginal cost can include country-specific fixed costs.

Second, defining prices in terms of costs is widely recognized to be an inefficient approach to regulation in any industry, because cost plus pricing rules reduce incentives to keep costs down (Averch and Johnson, 1962). Third, in the case of pharmaceuticals for which some recoupment of R&D is appropriate, the measurement and allocation of R&D costs pose additional problems. Product-specific accounting data would not reflect the cost of R&D failures, or the cumulative cost of R&D investments, plus the time cost of money, over the 10–15 year lag between drug discovery and product approval. There is no agreed mechanism for allocating the joint costs among users in different countries. Moreover companies may be reluctant to disclose costs for competitive reasons and because they may be used in pricing formulas in developed markets. The fundamental problem is that it is not generally appropriate to price a pharmaceutical in a particular market by reference to the cost of supplying that particular product to that market, even if this cost could be measured.

In conclusion, negotiated, confidential price discounts are likely to provide the most efficient approach to achieving appropriate price differences. However, this approach will work best if bargaining is conducted by either an international or national procurement agency that can make price-volume commitments. Recognizing the widespread scepticism about relying on private contracts, auditing could assure that some details are in the public domain without compromising the confidentiality of the negotiation. We note that companies and the Global Fund are putting price information in the public domain, and that the UK Working Party is proposing price monitoring by the WHO. Our view is that these policies may need to be revisited if the price information is used by middle and high income countries to demand lower prices for drugs. It may be that by focusing disclosure on three diseases and a defined group of low income countries any leakage into other markets of price disclosure will be limited, and price disclosure will enhance rather than diminish the bargaining power of DCs and their agents. However, attempts to generalize discount structures, as proposed by MSF, moving beyond a narrow number of diseases and countries are likely to be counterproductive and increase the prices paid by DCs for drugs.

## 6. Compulsory Licensing: Doha and Beyond

The TRIPS agreement in 1994 introduced 20 year patent protection for pharmaceuticals in all WTO countries with transitional arrangements for DCs. In particular less developed countries were exempt until 2006,—delayed at Doha in 2001 until 2016 (WTO, 2001). IP protection was not backdated but applied prospectively, with a requirement to set up a mailbox from 1995 such that when patent protection was introduced all products registered since 1995 could receive protection.

Under Article 31 of the TRIPS agreement compulsory licensing (which requires the patent holder to grant a license to another entity, usually a local generic company, to produce the patented product) was permitted, albeit with requirements for negotiations with the patent holder and for royalties to be paid on “reasonable commercial terms.” In “national emergencies” governments could dispense with the need to negotiate. However, compulsory licenses could only be issued “predominantly for the supply of the domestic market.”

Following protests the TRIPS agreement was revisited at Doha in 2001 (WTO, 2001). A national emergency was said to include “public health crises including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics.” It was also agreed to tackle the issue of restricting compulsory licensing to domestic use, to enable countries with no domestic industry to import compulsory licensed products, and to clarify the definition of public health emergency. However, follow up discussions to resolve this issue broke down at the end of 2002. Whilst there was an agreement on the mechanism, i.e. that no country would report the importation of compulsory licensed products to the WTO, there was disagreement about the scope. The US wanted to confine concessions on compulsory licensing to a defined number of DCs and to a limited number of diseases—HIV/AIDS, tuberculosis, malaria and other epidemics. This was not acceptable to the other countries.

The case against compulsory licensing is strongest if compulsory licensees have no real production cost advantage over originator firms for a given product quality. Since labor is a relatively small part of production cost and many multinational firms have plants in low wage countries, it is not obvious that local firms would have a significant cost advantage. Any country-specific fixed costs of operating in a market will have to be incurred by generic companies also. Originator firms may incur higher costs of providing medical information, monitoring of adverse reactions etc. and other safety issues. However, if these are valued by the country, they do not imply a difference in quality-adjusted cost.<sup>26</sup> If the originator firm charges a price above marginal cost due to market power, the generic licensee faces the same incentives, unless there are multiple competitors.<sup>27</sup> Thus to the extent that originator firms do charge higher prices than potential compulsory licensees, this may simply reflect the risk of price spillovers to other markets that is a concern for multinational R&D-based companies but not for generic manufacturers.<sup>28</sup> The appropriate solution is to reduce the risk of price spillovers, as described above, rather than to permit compulsory licensing.

However, if after the elimination of price spillover risks compulsory licensees still have lower, quality-constant prices than originators, due to lower costs, then there is a case for permitting compulsory licensing of one or more local generic companies and exports to countries that have no local generic producers. The compulsory licensing process should be done by competitive tender, with commitments to assure that the licensee in fact charges the

lowest feasible price. This assumes that the benefits to consumers in the DCs from access to lower price medicines is large, and that the revenue loss and hence adverse effect on R&D incentives of originator firms is small because their prices would have approximated marginal cost.

Compulsory licensing may also be helpful in circumstances where low income patients lack a third party procurement agent to bargain on their behalf. In such cases, the availability of competing compulsory licensed products would exert competitive pressure on the originator firm's prices. Where governments or international agencies act as procurement agents the potential threat of compulsory licensing will be less relevant, particularly in therapeutic classes with multiple therapeutic substitutes. As discussed above, companies have a commercial incentive to price close to marginal cost in these circumstances.

The risk of permitting compulsory licensing is that this approach may expand to cover a broad range of countries seeking to use compulsory licensing as a way to avoid making any contribution above marginal cost to pay for R&D. Many middle and even high-income countries face health needs for their populations that exceed the budgets available, as new drugs offer new treatment possibilities. It is a fact of life in every country that "needs" are infinite but budgets are finite. Thus many countries could make a hardship case for compulsory licensing of a wide range of drugs. In the absence of clear criteria to define which drugs and countries/ populations should be eligible, the compulsory licensing approach is at risk of undermining the function of patents over broad markets and therapeutic categories. This approach may seem to offer cheap drugs to needy people in the short run, but at the risk of undermining incentives to develop new drugs in the longer run.

A second, often implicit rationale for compulsory licensing is industrial policy, since compulsory licensing has the effect of transferring revenues that might have accrued to a multinational company to a local firm. If there is an implicit infant industry or local production rationale for compulsory licensing, this argument should be made explicit and evaluated on its merits.

## **7. Conclusions**

Differential pricing would go a long way towards making drugs that are developed for high income countries available and affordable in DCs, while preserving incentives for R&D. Differential pricing based on Ramsey pricing principles, which implies prices inversely related to demand elasticities across markets, is consistent with the criterion of economic efficiency. It is also consistent with standard norms of equity.

Unfortunately, actual price differentials are not optimal, partly because manufacturers are reluctant to grant low prices in low-income countries because these low prices are likely to spill over to higher-income countries through parallel trade and external referencing.

To achieve appropriate and sustainable price differences will require either that higher-income countries forego these practices of trying to "import" low prices from low-income countries or that such practices become less feasible. The most promising approach that would prevent both parallel trade and external referencing, is for payers and companies to negotiate contracts that include confidential rebates. With confidential rebates, final transactions prices to purchasers can differ across markets without significant differences

in manufacturer prices to distributors, such that opportunities for parallel trade and external referencing are eliminated. As long as higher income countries can and do attempt to bargain for lower prices that are given to low income countries, companies will rationally be unwilling to grant these low prices to the low-income countries. This severely undermines the ability of these countries to achieve access to existing drugs, which in turn creates hostility to patents. However, patents need not—and probably would not—entail high price-marginal cost mark-ups in low income countries if companies could be confident that low prices granted to low income countries would not leak to high and middle income countries.

Differential pricing alone cannot solve the problem of creating incentives for R&D to develop drugs for diseases that are confined to DCs, for which there is no high income market to pay prices sufficient to pay for the R&D. Differential pricing will also not fully resolve the problems of affordability for existing drugs if these have high marginal costs—due, for example, to high production or distribution costs—or if intermediaries add high margins, such that retail prices are significantly higher than manufacturer prices. Chronic medications, especially those that are costly to produce such as anti-retrovirals, may be unaffordable for the neediest populations even at prices close to marginal cost. In such contexts, differential pricing can reduce but not eliminate problem of making drugs affordable to DC populations.

It is important that the option of compulsory licensing is available for use if generics have lower production costs than originators or if governments or other agencies are not procuring on behalf of low income populations. However, given the risks inherent in the compulsory licensing “solution,” it seems best in practice to first try the approach of strengthening market separation, to enable originator firms to maintain differential pricing. In these circumstances originators can be expected to offer prices comparable to the prices that a local generic firm would charge, eliminating the need for compulsory licensing.

## Notes

1. Even with prices at marginal cost in DCs, the neediest patients may require subsidies for chronic medicines and for those with high production costs. In these cases differential pricing can still be an important part of, but not the whole of, a solution.
2. The opportunity cost is the highest alternative return that the company could have realized on the funds invested (See DiMasi, Hansen and Grabowski, 1991, 2003).
3. Drug discovery is a pure joint cost. Drug development, including clinical trials to prove safety and efficacy, is increasingly a joint cost with the harmonization of requirements and conduct of multi-country trials that are used for regulatory submissions in many countries.
4. Vaccines and biologics may be an exception, with relatively high production costs.
5. Ganslandt, Maskus and Wong (2001) propose such a scheme for drugs for DCs, with developed countries funding the purchase of licensing rights. This addresses the problem of lack of purchasing power as well as allocative efficiency. Lanjouw (2002) proposes a variant whereby companies can opt to either have patent rights in rich countries or in poor countries but not in both. However, this does not reduce the need to price above marginal cost in the rich markets and if, as we argue, prices in poor countries will be set close to marginal cost, then it has no substantive effect on static efficiency. Unlike the Ganslandt et al. proposal, the Lanjouw proposal does not enhance incentives to develop drugs for predominantly DC diseases.
6. Watal (2000) and Fink (2001) also consider the case of India, modelling price increases following patent introduction, using assumptions about demand elasticity. However, the critical issue is the likely demand

elasticity of third party payers purchasing for the currently uninsured, not the demand elasticity of those who are currently buying drugs.

7. It has been put to us that third party payers in DCs may have less bargaining power than those in high income countries, but there is no obvious reason why this should be the case. The key is an ability to deliver increased volume in exchange for price discounts.
8. With multiple products and nonzero cross-price elasticities, optimal price mark-ups should take into account these cross-elasticity effects; with multiple firms, strategic interactions by firms should also be taken into account (Breutigam, 1984; Laffont and Tirole, 1993; Prieger, 1996; Danzon, 1997).
9. This may not always be the case when some patients have access to third party buyers as we note in our discussion of differential pricing in the USA in Section 4.3.
10. As these utilities expand across national boundaries, allocating joint costs across countries may become more problematic, and problems may arise similar to those already experienced by pharmaceuticals.
11. Lower labor cost is only a small fraction of total production costs, hence is unlikely to account for significant price differences. The legal liability system in the US may also contribute to its higher prices, at least for some drugs (Manning, 1997).
12. The UK and the Netherlands attempt to “claw back” the profit that accrues to the pharmacy when it dispenses a cheaper parallel import rather than brand.
13. Malueg and Schwartz (1994) found that mixed systems (in which blocks of countries with similar income levels permit parallel trade) yield greater benefits than either uniform pricing in all markets or complete discrimination (i.e. a different price in each country), provided that there were no “holes” in the groups. They argue that the EU should put its member states into sub-groups banded by income and only permit parallel trade within each subgroup.
14. President Clinton’s 1994 Health Security Act proposed to limit US prices to the lowest price in 22 countries.
15. Danzon, Wang and Wang (2003) provide evidence on lags in launch.
16. We are indebted to Jayashree Watal for emphasizing this point.
17. This is explained in more detail in Danzon (1997).
18. Under the 1990 OBRA Medicaid agreed to adopt open formularies in return for the best price discount provisions, that is, to give up the potential for state Medicaid buyers to use formularies to increase price elasticity in exchange for exploiting the discounts obtained by private sector purchasers. Some states no longer adhere to this—for example, Florida recently required companies to give a larger discounts (or assure cost savings through other means) as a condition of having their drugs listed on the Florida Medicaid formulary.
19. For evidence, see CBO (1996). Formally, given the Medicaid best price provision (or linkage between any two markets), the firm will set the price based on a weighted average of the elasticities in the two separate markets. If the less elastic market is significantly larger, this dominates the common price and the more elastic market will face a higher price than it would if markets were separate (see equation (5) below).
20. WTO laws prohibit export quotas which may affect restrictions on parallel exportation. Patent holders could, however, design licensing agreements and purchasing contracts in such a way that their products were only legally for sale in the domestic market—providing national competition regulations did not prohibit companies from including such restrictive clauses in licensing and purchasing contracts.
21. In the case of a cartel, public disclosure makes it easier for participants to monitor each other’s prices and hence to detect and sanction a company that undercuts the cartel price.
22. In contrast there is often price disclosure for context-specific public projects such as buildings, where information on the winning price bid has limited spillover effects as it is a one-off purchase.
23. It expects that the first two rounds of grants will lead within 5 years to a six fold increase in the numbers of patients in sub-Saharan Africa receiving anti-retroviral drugs and a two fold increase in the numbers in other DCs being treated, giving a total of 790,000 recipients. The numbers of additional patients receiving TB and malaria treatments are even higher.
24. These rates, together with the list of countries and of diseases are included in Annexes to the Regulation. This makes them easier to amend and so change the scope of the proposal.
25. The prices in the two markets are not the same but are linked by a fixed discount percentage.
26. It may also be that innovator companies value the data on the use of their product for product support in other markets, in which case they may not regard it as a cost to be recovered in local prices.

27. Consistent with this, a sole generic producer in a market typically "shadow prices" just below the originator price.
28. Price spillovers are not a social concern for generic manufacturers, including those with international operations, assuming that they incur minimal investments in R&D. In any case, in markets such as the US or Germany or the UK, generic prices are determined by local competition, not by prices in other countries.

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