

1 Does Reimportation Reduce Price Differences for Prescription Drugs?

2 Lessons From the European Union

3
4 **Objective:** To examine the effect of parallel trade on patterns of price dispersion for
5 prescription drugs in the European Union.

6 **Data Sources:** Longitudinal data from an IMS Midas database of prices and units sold
7 for drugs in 36 categories in 30 countries from 1993 through 2004.

8 **Study Design:** The main outcome measures were mean price differentials and other
9 measures of price dispersion within European Union countries compared to within non-
10 European Union countries.

11 **Data Collection/Extraction Methods:** We identified drugs subject to parallel trade using
12 information provided by IMS and by checking membership lists of parallel import trade
13 associations and lists of approved parallel imports.

14 **Principal Findings:** Parallel trade was not associated with substantial reductions in price
15 dispersion in European Union countries. In descriptive and regression analyses, about half of the
16 price differentials exceeded 50 percent in both European Union and non-European Union
17 countries over time, and price distributions among European Union countries did not show a
18 dramatic change concurrent with the adoption of parallel trade. In regression analysis, we found
19 that although price differentials decreased after 1995 in most countries, they decreased less in the
20 European Union than elsewhere.

21 **Conclusions:** Parallel trade for prescription drugs does not automatically reduce
22 international price differences. Future research should explore how other regulatory schemes
23 might lead to different results elsewhere.

24 **Key Words:** Drug Costs; Economic Competition; Health Care Sector; Internationality

25

25 **Introduction**

26 Cross-national differences in prescription drug prices have been a topic of much
27 discussion in the media and in policy circles (Bright 2006; Baker 2004). Researchers have
28 described some of the underlying causes of these price differences, including international
29 exchange rates and differences in patient demand and national income. Government regulations,
30 such as price controls and reimbursement policies, can also contribute to price differences by
31 fixing prices or reducing the price sensitivity of patients or their agents (Stuart et al 2000;
32 Danzon and Chao 2000; Danzon and Furukawa 2003).

33 One way to reduce price differences would be to remove restrictions on the flow of
34 prescription drugs across markets (i.e., to permit arbitrage). “Parallel trade,” or “reimportation,”
35 has been proposed to allow people in countries with higher drug prices to acquire prescription
36 drugs from countries with lower prices. In the United States, President Bill Clinton signed
37 legislation in October 2000 to permit parallel trade under strict safety rules (Medicine Equity and
38 Drug Safety Act 2000). Regulations to implement the legislation have not been developed,
39 however, due to concerns about safety and logistics (Rubin 2000). Thus, parallel trade remains
40 illegal in the United States. However, the question of whether parallel trade would reduce
41 prescription drug prices in the United States and other countries without parallel trade remains
42 open.

43 With parallel trade being illegal in the United States, we set out to examine data from the
44 European Union, where parallel trade is permitted. Parallel trade is part of a comprehensive
45 effort to move toward a single market for all goods, including prescription drugs, in the
46 European Union (Farquason and Smith 1998). Nonetheless, safety concerns still exist and there
47 are strict rules governing such trade. A parallel importer must obtain licenses to import products

48 of identical chemical composition for each dosage form, dosage strength, and market of origin.
49 The cost of the license is approximately €1500 in most countries, or €3480 for products approved
50 through the European Agency for the Evaluation of Medicinal Products. If the product has
51 packaging in a different language, a different brand name, or a different pack size, the parallel
52 trader may also incur repackaging costs (Arfwedson 2004).

53 In economics, the law of one price states that identical tradable goods should have the
54 same price in all locations (or the difference cannot exceed transportation costs). If not, it would
55 be profitable for someone to arbitrage the price difference indefinitely and make infinite earnings
56 (Mankiw 2007). Indeed, parallel traders act as arbitrageurs by purchasing products in low-price
57 markets and reselling them in high-price markets. This trade can affect price dispersion in two
58 ways. First, migration of products from low-price to high-price markets can reduce the average
59 price paid for a particular product in high-price markets, especially if parallel traders sell their
60 imports at lower prices than the original products in the high-price market, thus narrowing the
61 price difference between markets. Second, manufacturers may reduce the prices of their products
62 in high-price markets to match lower prices offered by parallel importers or in response to the
63 threat of parallel trade. Thus, even if parallel trade does not actually occur, its possibility may
64 constrain prices. In theory, firms could also raise prices in low-price markets to make parallel
65 trade less appealing. In practice, however, price controls in the European Union allow little
66 flexibility in this regard. Indeed, many countries impose mandatory price reductions over time.
67 The specifics of price control policies have been described in detail elsewhere (Jacobzone 2000).
68 The effect of such policies is that any price change in a country with price controls tends to be a
69 reduction rather than an increase.

70 The impact of parallel trade also depends on the incentives of key agents in each country
71 to substitute parallel imports for (presumably more expensive) original products, much like the
72 development of a market for generic versions of off-patent drugs. Some institutional features of
73 particular countries may dampen such incentives, such as additional regulations on the profits of
74 pharmacists, and patient copayments that are generally the same whether a drug is a parallel
75 import or an original product. However, Kanavos et al. (2003) have noted that “traditionally
76 high-price countries seem to have mature policies in place enabling their health insurance
77 systems to benefit somewhat from parallel importation of pharmaceuticals.”

78 The legalization of parallel trade and the elimination of exchange-rate fluctuations
79 resulting from the adoption of the euro in most European Union countries should have reduced
80 the dispersion of prescription drug prices in the European Union. We would expect to see a
81 greater reduction in price dispersion over time in the European Union than in places where
82 parallel trade is not allowed. For example, Goldberg and Verboven (2005) found such a
83 reduction in automobile price dispersion in the European Union during a similar time period. In
84 other sectors of the economy, such as gas, electricity, and telecommunications, price dispersion
85 in the European Union fell from 1985 through 1999, and the standard deviation of the price
86 index for tradable goods fell from 0.11 in 1990 to 0.05 in 1999 (European Commission 2001).

87 However, little evidence on the effect of parallel trade exists. When the British House of
88 Commons considered the question of international exhaustion of trademarks in 1999, its
89 Committee on Trade and Industry noted, “[whilst] we appreciate that it is difficult to determine
90 empirically the precise size and character of the flow of parallel imports, we share the Minister’s
91 concern that very little empirical research has been undertaken into the potential effects of
92 international exhaustion” (House of Commons 1999). Evidence regarding the impact of parallel

93 trade on price dispersion for prescription drugs is limited. Previous studies examined the effect
94 on prices for top-selling drugs in select markets, but not how prices have changed across the
95 European Union relative to changes in other countries (Enemark, Pederson, and Sorensen 2006;
96 Kanavos et al. 2004; Ganslandt and Maskus 2004). Therefore, we analyzed price dispersion of a
97 larger set of prescription drugs in the European Union over a 12-year period to address these
98 questions.
99

99 **Methods**

100 We obtained data for all prescription drugs in 36 therapeutic categories (see Appendix) in
101 30 countries from the first quarter of 1993 through the third quarter of 2004. The data constitute
102 a subset of the IMS Midas database (IMS Health; Fairfield, Conn.), the most comprehensive
103 source of information on international drug prices and sales. Therapeutic classes were selected in
104 an effort to provide a mix of small molecules and biologics that have high use in most markets,
105 as well as some with high costs (e.g., oncology products). A total of 1,023 chemicals (or unique
106 chemical combinations) are included in these classes, and about 20 percent were still on patent at
107 the end of the study period.

108 The data set contains information at the package level (e.g., chemicals, dosage form,
109 strength, and pack size) on the quantity sold in each country through both retail and hospital
110 channels, and through other important channels in the United States, such as sales to health
111 maintenance organizations, clinics, and physician offices. The data set includes the ex-
112 manufacturer price (i.e., the price paid by wholesalers to manufacturers), the wholesale price (i.e.,
113 the price paid by retailers to wholesalers), and the retail price per standard unit (i.e., the price
114 paid by consumers or third-party payers) measured in US dollars at the current exchange rate in
115 each quarter. We used the ex-manufacturer price for two reasons. First, the retail distribution of
116 pharmaceuticals varies substantially across countries and may lead to different price markups for
117 reasons unrelated to parallel trade. Second, neither pharmacists nor patients in many countries,
118 particularly European Union countries, may have much incentive to find the lowest price for
119 drugs, because profits are regulated or they face copayments that are the same whether the drug
120 is a parallel import or an original product. Wholesalers likely have the most to gain from the use
121 of parallel imports, and previous studies have established that parallel trade usually occurs at the

122 wholesale level rather than the retail level (NERA 1999; Maskus and Chen 2002). However, we
123 replicated the analyses using wholesale and retail prices and obtained similar results, so we
124 report only the analysis of ex-manufacturer prices.

125 We identified drugs that were subject to parallel trade in two ways. IMS identifies some
126 products as parallel imports in the MIDAS database, but only for Germany and the United
127 Kingdom. We assumed that products sold elsewhere in the European Union by the same firms
128 that were identified as selling parallel imports in the MIDAS database were also parallel imports.
129 We verified that these firms were parallel traders by checking their names against the
130 membership lists of parallel import trade associations in the European Union and lists of
131 approved parallel imports available from regulators in the United Kingdom and Denmark. Our
132 estimates of parallel trade activity are consistent with other studies using different data sets
133 (Enemark et al. 2006; Kanavos et al. 2004).

134

135 Statistical Analysis

136 This study examines the total impact on prescription drug pricing across the European
137 Union that can be plausibly tied to parallel trade. If parallel trade amounted to perfect arbitrage,
138 price dispersion would vanish in the European Union (or would reflect only transportation costs
139 and, in this case, licensure or repackaging costs). If parallel trade affected prices in only a subset
140 of countries, or if parallel trade affected prices only moderately in all countries, price dispersion
141 would fall in the European Union, as compared to countries outside the European Union where
142 parallel trade is not legal. Our analysis relies on a comparison of the “treated” countries (i.e.,
143 European Union countries) to “control” countries (i.e., non-European Union countries).

144 We calculated descriptive statistics on prescription drug volume and sales from across
145 our market-basket sample. We do not address within-country price dispersion across packages
146 (or across payers), because in countries outside of the United States there is typically a single
147 payer. In all markets, a drug is usually marketed in many presentations (dosage forms and
148 strengths), few of which may be the same in all countries. Since a cross-national comparison of
149 packages would include only a subset of the 30 countries, we aggregated to the drug level and
150 used the quantity-weighted mean price across all presentations of a chemical combination in
151 subsequent analyses.¹ As Danzon and Furukawa (2006) have noted, comparing prices at the drug
152 level rather than the package level yields more matches across countries (though not without
153 some tradeoffs in the precision of the comparison).

154 We measured price differentials as the absolute percent difference between the mean
155 price across all presentations in each country and the mean price in all countries in the sample,
156 all European Union countries in the sample, and all non-European Union countries in the sample.
157 Although parallel trade occurred before 1995, it was after that year that much of the legal
158 uncertainty concerning intellectual property was resolved and parallel trade became more
159 widespread. In addition, Spain and Portugal, which tend to have relatively low drug prices,
160 became legal sources of parallel exports in 1995.² Since it may take time for parallel traders to
161 establish operations and apply for licenses, a change in price dispersion may not be immediate
162 after the change in policy. Therefore, we report the distributions of price differentials for the
163 periods 1993 through 1994, 1995 through 1999, and 2000 through 2004.

164 In addition to calculating mean price differentials, we calculated alternative measures of
165 price dispersion, including the mean maximum price differential across countries, the coefficient
166 of variation of the price for each drug across countries, and the standard deviation of the price for

167 each drug across countries. Each of these measures has been used in other studies of price
168 dispersion (Kanavos et al. 2004; Carlson and Pescatrice 1980; Brynjolfsson and Smith 2000;
169 Sorensen 2000; Goldberg and Verboven 2004). If the law of one price holds, all should be equal
170 to 0. We used Wilcoxon signed rank tests to compare price dispersion in European Union
171 countries and non-European Union countries in the three time periods.

172 Because the results of the descriptive analysis could reflect differences in the products
173 available across markets or differences in the products available across markets over time (as
174 new drugs were introduced or were introduced in more countries), we also examined price
175 dispersion using regression techniques similar to an approach by Goldberg and Verboven (2004).
176 Specifically, for each country and quarter, we examined the relationship between the absolute
177 log price difference of each drug and the mean European Union price for that drug while
178 (1) controlling for country-drug fixed effects and (2) interacting a dummy variable equal to 1 for
179 European Union countries with dummy variables for each year in the data set. We used the log
180 price difference because the distribution of price differentials is highly skewed. Although the
181 errors may be nonnormal, which makes standard t tests suspect, we have a very large sample size,
182 so the deviation from normality should be inconsequential for hypothesis testing. We repeated
183 this analysis for the log price difference of minimum prices across all presentations of a drug
184 within a country, since the lowest-priced products may be targeted at the most price-sensitive
185 buyers, who may find parallel imports most appealing. We also repeated the analysis after
186 excluding the United States from the data set, in case the value of the US dollar caused changes
187 in price dispersion over time. Note that changes in the value of the dollar would affect only the
188 price differential between the United States and other countries, not the price difference between
189 other countries using a different currency.

190 This “difference-in-differences” approach is one way to identify the effects of parallel
191 trade. In other words, because prices in countries outside the European Union after 1995 should
192 not have been affected by parallel trade, this approach allowed us to compare price differences in
193 European Union and non-European Union countries before and after parallel trade. If non-
194 European Union countries experienced a decline in price dispersion at the same time that
195 European Union countries were “treated” with the legalization of parallel trade, and if this
196 change affected only non-European countries, then our difference-in-differences approach would
197 be invalid. However, reductions in transportation costs, greater price transparency, and other
198 forces that would be likely to affect price dispersion would affect all countries, not only non-
199 European Union countries. The inclusion of country–drug fixed effects addresses concerns about
200 changes in the supply of drugs over time that might have driven changes in price dispersion as
201 we focused on within-country and within-drug changes in price differentials. We also estimated
202 the same regression using a time trend instead of a dummy variable for the post-1995 period to
203 capture any gradual changes during this period.

204

204 **Results**

205 Table 1 describes the data available for the analysis. We included information on 1,023
206 prescription drugs in 30 countries. There were 7,133 chemical–dosage form–strength
207 combinations—a mean of 6.96 presentations per drug available anywhere, but only 2.36
208 presentations available per country. The mean parallel importer share was 18 percent at the
209 presentation level and 12 percent at the drug level, because not all presentations of a drug were
210 subject to parallel trade. Although some countries (notably Sweden, Denmark, and the
211 Netherlands) experienced a marked increase in the penetration of parallel imports during the
212 study period, even the threat of parallel trade (in countries that did not show an increase) could
213 have an effect on prices if manufacturers adjust prices to make arbitrage less attractive.

214 The Figure shows the mean distribution of mean price differentials for European Union
215 countries, non–European Union countries, and all countries by time period. The mean price
216 differential is the percentage difference between the ex-manufacturer price and the mean price
217 for the same drug across countries. (The patterns were similar when we used wholesale prices
218 and retail prices instead of ex-manufacturer prices [data not shown].) As shown in the Figure,
219 there was substantial price dispersion across all countries and within the European Union. There
220 was a slight reduction over time in the number of extreme price differentials. However, about
221 half of the price differentials exceeded 50 percent in all three sets of countries in each time
222 period. Although we had no reason to expect a reduction in price differentials among non–
223 European Union countries, the distributions among the European Union countries did not show a
224 dramatic change concurrent with the adoption of parallel trade.

225 Table 2 presents summary statistics for the aforementioned group measurements and for
226 the mean standard deviation and the mean coefficient of variation of prescription drug prices

227 across all countries and in the European Union. In each set of countries over time, there was little
228 change in the magnitude of any of the measures of price dispersion, except for a marked increase
229 in the standard deviation. In European Union countries, the mean price differentials were
230 significantly different between the 1995-1999 period and the other time periods, but the
231 difference between the 1993-1994 and 2000-2004 periods was not statistically significant. The
232 maximum price differentials for European Union countries in the 2000-2004 period were
233 statistically different from the earlier periods and, in fact, increased over time. The mean
234 standard deviation of prices across countries actually increased between the period before
235 parallel trade and the more recent observations (all countries, 16.1 to 20.6; European Union
236 countries, 10.8 to 17.3).

237 Table 2 also shows p values for Wilcoxon tests of price dispersion measures between the
238 time periods for all three country subsets. Price dispersion was greater outside of the European
239 Union than within it. Comparisons of dispersion in each of the three time periods between each
240 country category (data not shown) showed that dispersion was significantly different across
241 country categories.

242 Table 3 presents the results of the regression analysis. Each row contains the estimated
243 coefficient for the dummy variable for each year, with one column for the main effect and
244 another column for the interaction with the European Union dummy variable. Across all
245 specifications, the results indicate a reduction of price dispersion after 1995 for all countries
246 relative to the first year in the data set (1993); all coefficients after 1995 are negative and
247 statistically significant at the 1 percent level. However, the interaction with the European Union
248 variable is frequently positive and statistically significant, particularly for the most recent years.
249 In the post-1995 period, only in 2000 and 2001 did price differentials fall more for European

250 Union countries than for other countries. The qualitative results are the same across our choice of
251 average or minimum price differences and the inclusion or exclusion of the United States from
252 the data set.
253

253 **Discussion**

254 Parallel trade is thought to be one way to reduce cross-market price discrimination by
255 prescription drug manufacturers (Danzon and Chao 2000; Ridley, Grabowski, and Moe 2006). In
256 the United States, pressure to permit parallel trade has resulted from growing concerns about
257 high drug prices and international price disparities. In this study, using data from the European
258 Union, we found little evidence that parallel trade affected price dispersion of prescription drugs
259 over a 12-year period.

260 Specifically, we looked at information on over 1,000 products in 36 categories in 30
261 countries over a 12-year period to determine whether price dispersion decreased in the European
262 Union (where parallel trade is permitted, especially after 1995) and non-European Union
263 countries (where parallel trade is not permitted). In both descriptive analysis and regression
264 analysis, we found that about half of the price differentials in prescription drugs exceeded 50
265 percent in all European Union and non-European Union countries in each time period, and that
266 the distributions of prices among European Union countries did not show a dramatic change
267 concurrent with the adoption of parallel trade. In regression analysis, we found that although
268 price differentials decreased after 1995 for most countries, they decreased less in the European
269 Union than elsewhere.

270 To be clear, we do not suggest that parallel trade had no effect anywhere, or that parallel
271 trade does not have the potential to have a significant impact on prescription drug markets. Our
272 findings imply that the legalization of parallel trade does not necessarily lead to a reduction in
273 price differences across countries. Some impediments to parallel trade in the European Union
274 have been examined in greater detail elsewhere (Kyle 2006).

275 The lack of a direct effect of parallel trade may be due to the particular regulatory scheme
276 adopted in the European Union (i.e., individual country licenses at the dose–pack level) and to
277 responses by manufacturers to continue price discrimination through the use of different
278 packaging and brand names (Kyle 2006). Important differences between the European Union and
279 US markets regarding the regulation of parallel trade and other aspects of pharmaceutical
280 markets make it difficult to predict how parallel trade would fare in the United States. Unlike
281 national health insurance programs in European countries, many patients in the United States
282 purchase prescription drugs on a self-pay basis or within tiered copayment structures (Huskamp
283 et al. 2003; Joyce et al. 2002). Because these patients are more sensitive to drug prices than their
284 European counterparts, parallel trade may have greater opportunity to impact prices in the United
285 States.

286 In addition to the relative insensitivity to prescription drug prices among patients in the
287 European Union, the profits of pharmacists are regulated in many countries. Although the
288 Netherlands and the United Kingdom use “clawback” mechanisms, which enable savings from
289 the use of parallel imports to be shared between pharmacists and the government health authority,
290 pharmacists in other European Union countries have little incentive to find a low-cost supply.

291 Another area of uncertainty concerns rationing of supply to low-price countries, a
292 strategy attempted by firms in Europe and in dealings with Canadian Internet pharmacies that
293 sell prescription drugs illegally to patients in the United States. Competition laws in the
294 European Union may limit the ability of firms to ration, because rationing may be interpreted as
295 an abuse of market power. However, it is unclear how US and Canadian competition laws would
296 affect rationing. Given the relatively small size of the Canadian prescription drug market

297 (roughly one-tenth the size of the US market), it is unlikely that parallel trade from Canada alone
298 would have a large impact on prices in the United States (Porter 2004).

299 Our analysis has some limitations. First, we assessed pharmaceutical products in 36
300 therapeutic categories, but there may be different results in drug categories that we did not
301 examine. Second, parallel trade may have less effect in the European Union than it would in
302 higher-price markets like the United States, where pharmacists, insurers, and patients have
303 greater incentive to switch to less expensive prescription drugs. In any case, it is clear that the
304 development of a regulatory infrastructure for parallel trade does not automatically reduce
305 international price dispersion for prescription drugs.

306

306 **Endnotes**

- 307 1. For example, a drug that sold 5 units of a presentation at \$5, 10 units of a presentation at \$10,
308 and 10 units of a presentation at \$1 would have a quantity-weighted mean price of
309 $(5 / 25) \times 5 + (10 / 25) \times 10 + (10 / 25) \times 1 = \6.00 , whereas a drug that sold 5 units of a
310 presentation at \$5, 15 units of a presentation at \$10, and 5 units of a presentation at \$1 would
311 have a quantity-weighted mean price of $(5 / 25) \times 5 + (15 / 25) \times 10 + (5 / 25) \times 1 = \7.04 .
312 The \$7.04 reflects the fact that more relatively expensive units were sold.
- 313 2. When Spain and Portugal became member states of the European Union, they were required
314 to make changes to their patent laws to provide the same level of intellectual property
315 protection as other member states. Also, a derogation period that prohibited parallel exports
316 of products that had not received strong patent protection prior to membership was imposed
317 for both countries, which ended in 1995.

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318 **References**

- 319 Arfwedson, J. 2004. "Re-importation (Parallel Trade) in Pharmaceuticals." Lewisville, Tex:
320 Institute for Policy Innovation; July 2004. Policy Report 182.
- 321 Baker, C. 2004. "Would Prescription Drug Reimportation Reduce U.S. Drug Spending?"
322 Economic and Budget Issue Brief. Washington, DC: Congressional Budget Office; April
323 29, 2004.
- 324 Bright, B. 2006. "Most Americans Support Legalizing Drug Imports From Canada, Poll Finds."
325 *Wall Street Journal*. August 31, 2006.
- 326 Brynjolfsson, E., and M. Smith. 2000. "Frictionless Commerce? A Comparison of Internet and
327 Conventional Retailers." *Management Science* 46(4): 563-585.
- 328 Carlson, J.A., and D.R. Pescatrice. 1980. "Persistent Price Distributions." *Journal of Economics*
329 *and Business* 33(1): 21-27.
- 330 Danzon, P., and L. Chao. 2000. "Cross-National Price Differences for Pharmaceuticals: How
331 Large and Why?" *Journal of Health Economics* 19(2): 159-195.
- 332 Danzon, P., M. Furukawa. 2003. "Prices and Availability of Pharmaceuticals: Evidence From
333 Nine Countries." *Health Affairs* 2003;Suppl Web Exclusives: W3-521-536.
- 334 Danzon, P., M. Furukawa. 2006. "Prices and Availability of Biopharmaceuticals: An
335 International Comparison." *Health Affairs* 25(5): 1353-1362.
- 336 Enemark, U., K. Pederson, and J. Sorensen. 2006. "The Economic Impact of Parallel Import of
337 Pharmaceuticals." [accessed May 2, 2007]. Available at:
338 http://www.cast.sdu.dk/pdf/Parallel_import_rapport_13_06_1430_opdateret_final.pdf.
- 339 European Commission, Directorate-General for Economic and Financial Affairs. 2001. "Price
340 Levels and Price Dispersion in the EU." *Economic Trends Supplement A*, No. 7

341 [accessed July 30, 2007]. Available at:
342 [http://ec.europa.eu/economy_finance/publications/european_economy/2001/a2001_07_e](http://ec.europa.eu/economy_finance/publications/european_economy/2001/a2001_07_en.pdf)
343 [n.pdf](http://ec.europa.eu/economy_finance/publications/european_economy/2001/a2001_07_en.pdf).

344 Farquason, M., and V. Smith. 1998. *Parallel Trade in Europe*. London, UK: Sweet & Maxwell
345 Publishers.

346 Ganslandt, M., and K. Maskus. 2004. "Parallel Imports and the Pricing of Pharmaceutical
347 Products: Evidence From the European Union." *Journal of Health Economics* 23(5):
348 1035-1057.

349 Goldberg, P. K., and F. Verboven. 2005. "Cross-Country Price Dispersion and the Euro."
350 *Economic Policy* 19(40): 484-521.

351 House of Commons Select Committee on Trade and Industry. 1999. Eighth Report [accessed
352 August 14, 2007]. Available at: [http://www.parliament.the-stationery-](http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmtrdind/380/38002.htm)
353 [office.co.uk/pa/cm199899/cmselect/cmtrdind/380/38002.htm](http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmtrdind/380/38002.htm).

354 Huskamp, H.A., P.A. Deverka, A.M. Epstein, R.S. Epstein, K.A. McGuigan, and R.G. Frank.
355 2003. "The Effect of Incentive-Based Formularies on Prescription-Drug Utilization and
356 Spending." *New England Journal of Medicine* 349(23): 2224-2232.

357 Jacobzone, S. 2000. "Pharmaceutical Policies in OECD Countries: Reconciling Social and
358 Industrial Goals. Paris, France: OECD Directorate for Employment, Labour and Social
359 Affairs; 2000. OECD Labour Market and Social Policy Occasional Papers 40.

360 Joyce, G.J., J.J. Escarce, M.D. Solomon, and D.P. Goldman. 2002. "Employer Drug Benefit
361 Plans and Spending on Prescription Drugs." *Journal of the American Medical*
362 *Association* 288(14): 1733-1739.

363 Kanavos, P., J. Costa-i-Font, S. Merkur, M. Gemmill. 2004. "The Economic Impact of
364 Pharmaceutical Parallel Trade in European Union Member States: A Stakeholder
365 Analysis." LSE Health and Social Care Special Research Paper [accessed May 2, 2007].
366 Available at:
367 <http://www.lse.ac.uk/collections/LSEHealthAndSocialCare/pdf/Workingpapers/Paper.pdf>.

368 Kyle, M. 2006. "Strategic Responses to Parallel Trade." National Bureau of Economic Research
369 Working Paper 12968 [accessed August 15, 2007]. Available at:
370 <http://www.nber.org/papers/w12968>.

371 Mankiw, G. 2007. Principles of Economics, 4th edition. Mason, Ohio: Thomson Higher
372 Education.

373 Maskus, K. E., and Y. Chen. 2002. "Parallel Imports in a Model of Vertical Distribution:
374 Theory, Evidence, and Policy." *Pacific Economic Review*. 7(2): 319-334.

375 Medicine Equity and Drug Safety Act, Public Law No. 106-387, 114 Stat 1549 (2000) (codified
376 at 21 USC § 384).

377 National Economic Research Associates. 1999. "The Economic Consequences of the Choice
378 of Regime in the Area of Trademarks." London, UK: National Economic Research Asso-
379 ciates.

380 Porter, E. 2004. "Importing Less Expensive Drugs Not Seen as Cure for U.S. Woes." *New York*
381 *Times*. October 16, 2004: A1.

382 Ridley, D., H. Grabowski, and J. Moe. 2006. "Developing Drugs for Developing Countries."
383 *Health Affairs* 25(2): 313-324.

384 Rubin, A.J. 2000. "Plan Dropped to Reimport U.S.-Made Medications." *Los Angeles Times*.
385 December 27, 2000: A1.

386 Sorensen, A. 2000. "Equilibrium Price Dispersion in Retail Markets for Prescription Drugs."
387 *Journal of Political Economy* 108(4): 833-850.

388 Stuart, B., N. Brandt, N. Briesacher, et al. 2000. "Issues in Prescription Drug Coverage, Pricing,
389 Utilization, and Spending: What We Know and Need to Know." Report prepared for the
390 US Department of Health and Human Services, Office of the Assistant Secretary for
391 Policy and Evaluation, Office of Health Policy. Baltimore, Md.: University of Maryland;
392 February 18, 2000.

393

Table 1. Data Available for the Analysis

Variable	n	Mean	SD	Minimum	Maximum
Quarters	47	—	—	—	—
Countries*	30	—	—	—	—
Therapeutic classes†	36	—	—	—	—
Drugs	1,023	—	—	—	—
Unique presentations‡	7,133	—	—	—	—
Observations with parallel trade	16,546	—	—	—	—
Presentations per drug across all countries	1,023	6.97	14.7	1.0	172.0
Presentations per drug in each country	1,023	2.36	2.6	1.0	32.0
Share of parallel imports for a presentation‡	16,448	0.18	0.2	0	1.0
Share of parallel imports for a drug§	8,761	0.12	0.2	0	1.0
Ex-manufacturer price of presentation	518,995	34.33	148.8	6.4	12,775.4
Standard units of a presentation sold in quarter	519,011	13.85	70.5	1.0	2846.0

SD indicates standard deviation.

* The following countries were included in the analysis: Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Colombia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Poland, Portugal, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

† See Appendix.

‡ “Presentation” refers to a drug–dosage form–strength combination.

§ Conditional on parallel trade taking place.

|| Values are expressed as 2000 US dollars. Negative prices were excluded from the analysis. All values are reported to two significant digits.

Table 2. Summary Statistics

Variable	Period			<i>p</i> -Value*		
	1993-1994	1995-1999	2000-2004	1993-1994 versus 1995-1999	1995-1999 versus 2000-2004	1993-1994 versus 2000-2004
All countries						
Maximum price differential, percentage of all-countries mean (median)	221.53 (223.99)	215.92 (214.69)	233.44 (235.86)	0.03	< 0.001	0.03
Mean price differential, percentage of all-countries mean (median)	50.61 (50.82)	48.70 (48.57)	51.50 (51.53)	< 0.001	< 0.001	0.10
Coefficient of variation†	0.73	0.70	0.75			
Standard deviation‡	16.12	20.71	29.85			
EU countries						
Maximum price differential, percentage of EU mean (median)	148.32 (221.04)	152.95 (152.82)	162.21 (162.02)	0.28	< 0.001	< 0.001
Mean price differential, percentage of EU mean (median)	43.56 (43.77)	40.97 (40.58)	42.65 (42.58)	< 0.001	0.003	0.24
Coefficient of variation†	0.60	0.57	0.59			
Standard deviation‡	10.80	12.80	17.28			
Non-EU countries						
Maximum price differential, percentage of non-EU mean (median)	205.55 (206.60)	187.36 (186.40)	200.73 (200.59)	< 0.001	< 0.001	0.53
Mean price differential, percentage of non-EU mean (median)	51.92 (52.07)	51.98 (51.74)	54.11 (53.95)	0.48	< 0.001	0.005
Maximum price differential, percentage of EU mean (median)	151.47 (153.66)	161.80 (161.87)	169.98 (169.88)	< 0.001	0.002	< 0.001
Mean price differential, percentage of EU mean (median)	93.37 (91.81)	111.26 (112.69)	101.96 (98.01)	0.36	0.13	0.88
Coefficient of variation†	0.74	0.73	0.76			
Standard deviation‡	19.28	27.31	35.86			

EU indicates European Union.

* *p*-Values from Wilcoxon tests.

† Mean of (standard deviation of price / mean of price) within drug name across all countries.

‡ Mean standard deviation of drug price across all countries.

Table 3. Results From Regressions of Log Price Differentials

Year	Quantity-Weighted Average Price, Coefficient (Standard Error)				Minimum Price, Coefficient (Standard Error)			
	Non-EU Countries		Non-EU Countries, Excluding US		Non-EU Countries		Non-EU Countries, Excluding US	
	EU Countries	EU Countries	EU Countries	EU Countries	EU Countries	EU Countries	EU Countries	EU Countries
Intercept	0.885 (0.003)†		0.827 (0.003)†		0.923 (0.003)†		0.847 (0.003)†	
1994	0.019 (0.005)†	-0.050 (0.007)†	0.024 (0.005)†	-0.053 (0.007)†	0.005 (0.006)	-0.041 (0.008)†	0.009 (0.006)	-0.042 (0.008)†
1995	-0.210 (0.006)†	0.023 (0.007)†	-0.189 (0.006)†	0.011 (0.007)	-0.237 (0.007)†	0.023 (0.009)†	-0.224 (0.007)†	0.019 (0.009)†
1996	-0.207 (0.006)†	0.025 (0.007)†	-0.192 (0.006)†	0.018 (0.007)†	-0.238 (0.007)†	0.033 (0.009)†	-0.234 (0.007)†	0.035 (0.009)†
1997	-0.168 (0.006)†	-0.012 (0.007)	-0.162 (0.006)†	-0.010 (0.007)	-0.201 (0.007)†	0.012 (0.009)	-0.207 (0.007)†	0.025 (0.009)†
1998	-0.193 (0.006)†	0.029 (0.007)†	-0.191 (0.006)†	0.035 (0.007)†	-0.226 (0.007)†	0.044 (0.008)†	-0.237 (0.007)†	0.061 (0.009)†
1999	-0.148 (0.006)†	-0.001 (0.007)	-0.150 (0.006)†	0.009 (0.007)	-0.161 (0.007)†	-0.004 (0.008)	-0.174 (0.007)†	0.016 (0.009)
2000	-0.069 (0.006)†	-0.065 (0.007)†	-0.079 (0.006)†	-0.046 (0.007)†	-0.071 (0.007)†	-0.082 (0.008)†	-0.088 (0.007)†	-0.058 (0.008)†
2001	-0.075 (0.006)†	-0.047 (0.007)†	-0.083 (0.006)†	-0.029 (0.007)†	-0.072 (0.007)†	-0.065 (0.008)†	-0.091 (0.007)†	-0.038 (0.008)†
2002	-0.130 (0.006)†	0.013 (0.007)	-0.139 (0.006)†	0.032 (0.007)†	-0.118 (0.007)†	-0.015 (0.008)	-0.136 (0.007)†	0.011 (0.008)
2003	-0.161 (0.006)†	0.052 (0.007)†	-0.159 (0.006)†	0.059 (0.007)†	-0.144 (0.007)†	0.019 (0.009)†	-0.153 (0.007)†	0.036 (0.009)†
2004	-0.172 (0.006)†	0.069 (0.008)†	-0.159 (0.006)†	0.068 (0.008)†	-0.144 (0.007)†	0.024 (0.009)†	-0.143 (0.007)†	0.033 (0.009)†
F	301.87		268.77		264.01		244.94	
R ²	0.0348		0.0323		0.0306		0.0295	
n	189,919		182,802		189,919		182,802	

EU indicates European Union.

* The unit of observation in the regressions is drug–country–quarter. The dependent variable is the log price difference between the ex-manufacturer price for a drug in a country and the mean price for that drug in the European Union. Regressions included country–drug fixed effects and were estimated using the XTREG procedure in Stata (StataCorp LP, College Station, Tex.).

† Coefficient is significantly different from 0 at the 1 percent level.

Appendix. Therapeutic Classifications Included in the Analysis*

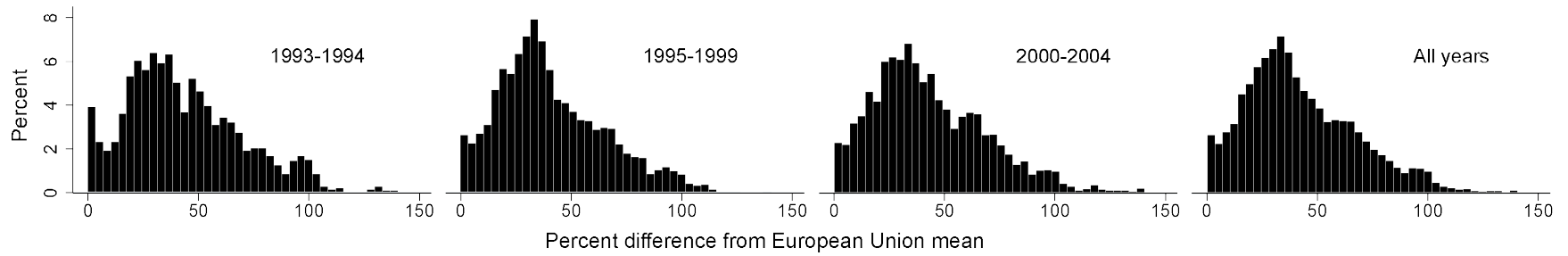
Category	Code	Therapeutic Classification	
Alimentary tract and metabolism	A4A1	Serotonin antagonists antiemetics/antinauseants	
	A4A9	Other antiemetics and antinauseants	
Blood and blood forming organs	B1C1	Cyclo-oxygenase inhibitor platelet aggregation inhibitors	
	B1C2	ADP (adenosine diphosphate) receptor antagonist platelet aggregation inhibitors	
	B1C3	GP IIb/IIIa (glycoprotein) antagonist platelet aggregation inhibitors	
	B1C4	Platelet cAMP enhancing platelet aggregation inhibitors	
	B1C5	Platelet aggregation inhibitors, combinations	
	B1C9	Other platelet aggregation inhibitors	
	B1D	Fibrinolytics	
	Cardiovascular system	C3A1	Potassium-sparing agents plain
C3A2		Loop diuretics plain	
C3A3		Thiazides and analogues plain	
C3A4		Potassium-sparing agents with loop diuretic combinations	
C3A5		Potassium-sparing agents with thiazides and/or analogue combinations	
C3A6		Other diuretics	
C7A		Beta-blocking agents, plain	
C7B1		Combinations with anti-hypertensives and/or diuretics	
C7B2		Combinations with other drugs of group C	
C7B3		Combinations with all other drugs except those of group C	
C8A		Calcium antagonists, plain	
C9A		ACE inhibitors, plain	
C9B1		ACE inhibitor combinations with antihypertensives (C2) and/or diuretics (C3)	
C9B2		ACE inhibitor/beta-blocker combinations	
C9C		Angiotensin-II antagonists, plain	
C9D		Angiotensin-II antagonists, combinations	
Anti-infectives for systemic use		J1D2	Injectable cephalosporins
Antineoplastic and immunomodulating agents		L1A	Alkylating agents
		L1B	Antimetabolites
	L1C	Vinca alkaloids and other plant products	
	L1D	Antineoplastic antibiotics	
	L1X1	Adjuvant preparations for cancer therapy	
	L1X2	Platinum compounds	
	L1X3	Antineoplastic monoclonal antibodies	
	L1X9	All other antineoplastics	
	L3A1	Colony-stimulating factors	
	L3A9	All other immunostimulating agents excluding interferons	

* From the Anatomical Classification of Pharmaceutical Products developed and maintained by the European Pharmaceutical Marketing Research Association, as provided in the IMS Midas database.

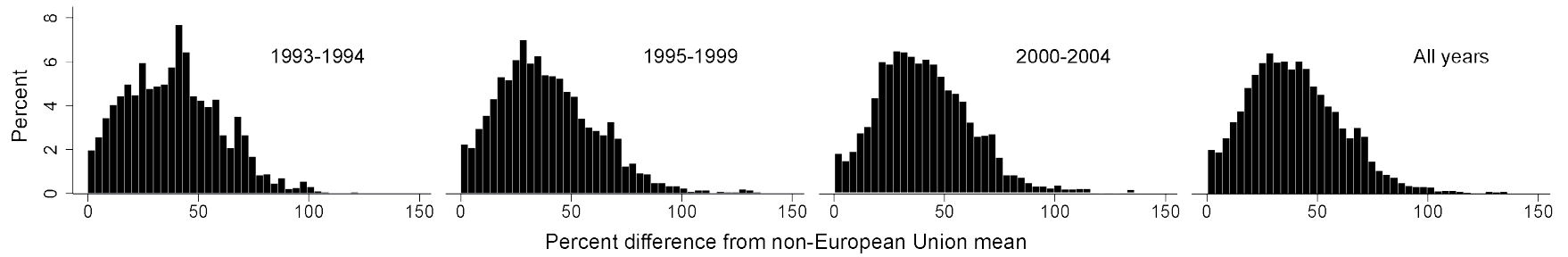
Figure Legend

Distributions of prescription drug price differentials by time period in European Union countries, non-European Union countries, and all countries.

European Union countries



Non-European Union countries



All countries

