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IKEA: Product, Pricing, and Pass-Through*

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Abstract

With over 300 stores in 40 countries, IKEA is a major international presence in retail housewares and furnishings. IKEA publishes country-specific catalogs with local-currency prices guaranteed to hold for 1 year. This paper explores a new dataset of IKEA products and catalog prices covering six countries for the time period 1994-2010. The dataset, with over 140,000 observations, is uniquely poised to shed light on the way in which a large multinational retailer operates in a setting characterized by a very large number of goods, distributed and priced in many countries. Thus, the goal of this paper is to document the choices made by IKEA in several related decision areas. In doing so, this paper provides evidence against which existing theories can be evaluated and revised in the light of this new information.

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With over 300 stores in 40 countries, IKEA is a major international presence in retail housewares and furnishings. IKEA publishes country-specific catalogs with local-currency prices guaranteed to hold for 1 year. This paper explores a new dataset of IKEA products and catalog prices covering six countries for the time period 1994-2010. The dataset is uniquely poised to shed light on the way in which a large multinational retailer operates in a setting characterized by a very large number of individual, mostly durable goods, distributed and priced in many countries. Although recent research has emphasized the central role played by large firms with multiple products, both within countries and in dominating international trade, the kind of information contained in this dataset has not previously been available.[1]

The primary goal of this paper is to document the decisions made by IKEA in several decision areas. For example, how does IKEA distribute goods across countries? Are there goods that are specific to particular regions of the world? Is there a country or set of countries that are used as "introduction" countries for new goods? These questions are answered in Sections 1 and 2. Specifically, Section 1 introduces IKEA and describes the company's development and its unusual policy of issuing comprehensive catalogs with local currency prices. The catalogs are issued in late summer of each year and prices are guaranteed to hold until the next catalog is released. Section 2 describes the changes over time in the distribution of goods across countries, and describes the rising globalization of product distribution. We note in particular an increase over time in the number of goods appearing in all catalogs in the same year. Further, we show that there is a great deal of product turnover in the catalogs ("churning"), although there are also goods which appear for every year in the sample. IKEA sharply reduced the number of catalog goods in response to the recent global recession, something that was not apparent in the much milder 2001-2002 recession. The recent drop in the number of goods was driven mainly by a sharp decline in the introduction of new goods; removal of existing goods was a much smaller contributor to the overall decline.

The next set of questions that our dataset is poised to answer concerns the nature of product pricing and the response of prices to changes in the exchange rate. A natural benchmark against which to measure pricing is the "Law of One Price" (LOP), which states that goods should have a common price when expressed in a common currency in the ab-

[1] Contributions to the study of exchange rates and prices using micro data include contributions by Bhattarai and Schoenle (2012), Broda and Weinstein (2008), Burstein and Jaimovich (2009), Crucini and Landry (2012), Crucini, Telmer, and Zachariades (2005), Crucini and Shintani (2008), Crucini and Telmer (2009), Fitzgerald and Heller (2012), Gopinath and Itskhoki (2010), Gopinath and Rigobon (2008), Gopinath et al. (2010), Imbs, et al. (2010), Nakamura (2008), Nakamura and Steinsson (2008, 2011) and Schoenle (2010).

sence of transportation costs, local distribution costs, and country- or good-specific markups. Although long experience has shown that the law of one price does not hold over short horizons, this benchmark measure provides a way of organizing the behavior of prices within and across countries. To this end, Section 3 studies the deviations from the law of one price, within and across countries. We investigate whether deviations from the law of one price are related to the newness of the good or the magnitude of the good's price. We find very weak dependence of LOP deviations to these characteristics of IKEA goods. Taking the next logical step, section 4 estimates exchange-rate pass-through in a model that allows for good-specific costs and markups that can vary by country and time. Our estimated passthrough is relatively low at 14%-30% per year, depending on the specification. Our estimates are in line with those obtained in the literature.

In section 5, we present brief evidence on the distribution of price changes within and across countries. This part of the investigation is related to the rapidly growing literature which uses microeconomic data on product prices to test alternative models of price setting. Although initially part of the present paper, we plan to develop a separate paper on this topic. Section 6 concludes with a summary of results and directions for future research.

1 The IKEA phenomenon

IKEA is a multinational retailer of furniture and home goods. Ingvar Kamprad, the founder of IKEA, was born in 1926 in southern Sweden. He began retailing at about 5 years of age, according to popular accounts: [2]

> "Kamprad was born in the south of Sweden in 1926 and raised on a farm called Elmtaryd, near the small village of Agunnaryd. At an early age, he learned that he could buy matches in bulk from Stockholm and sell them at a fair price, but a good profit. He reinvested his profits and expanded to fish, seeds, Christmas tree decorations, and pens and pencils. At age 17, Kamprad's father gave him a nice reward for doing well in school. What did he spend it on? He founded IKEA....
>
> IKEA has now become known worldwide for its innovative and stylish designs. Almost all IKEA products are designed to for flat packaging, which reduces shipping costs, minimizes transport damage, increases store inventory capacity, and makes it easier for customers to take the furniture home themselves, rather than needing delivery. But the original reason for it was competitive pressure from

[2] http://entrepreneurs.about.com/cs/famousentrepreneur/p/ingvarkamprad.htm

IKEA's competitors to their suppliers, who actually boycotted IKEA, forcing IKEA to do it themselves."

According to Deloitte, et al. (2010), IKEA was the 30th largest retailer in the world in 2008. IKEA is listed as the fourth-largest firm in the sector 'Hardlines & Leisure Goods' (page G26), behind Home Depot, Lowe's, and Best Buy.[3] IKEA sales have quintupled since 1995, with 2010 sales of 23.1 billion Euros.[4] The top 5 countries, in terms of total sales, are Germany (15%), US (11%), France (10%), Italy (7%), and UK (6%). As of 2010, 79% of worldwide sales were in Europe, followed by North America (15%) and Asia/Australia (6%).[5]

IKEA purchased inputs from 1,074 suppliers in 55 countries as of 2010. Since IKEA's main product is furniture, thus, wood products are its most important non-labor input. Currently, IKEA is the third-largest purchaser of wood products in the world (behind Home Depot and Lowe's). The top 5 country sources of material inputs were China (20%), Poland (18%), Italy (8%), Germany (6%), and Sweden (5%). Regionally, 62% of inputs are sourced in Europe, 34% in Asia, and 4% in North America. IKEA has reportedly pursued aggressive and creative sourcing strategies, showing great flexibility in changing locations of product sourcing in response to changes in the size of the product market (IKEA simply outgrew the ability of Sweden to handle its requirements for wood products) and changes in relative attractiveness and ability of alternative locations to meet IKEA's needs. A case study by Hultman, et al. (2009) illustrates this nicely through the study of how sourcing of materials for one particular product evolved over time. As the size of the market grew, technology was transferred from the initial production location in Sweden to other countries.

In 1982, partly in response to high Swedish tax rates, Kamprad set up an intricate and unusual corporate structure. The parent company is Ingka Holding, a private Dutch company which is itself entirely owned by a Dutch nonprofit corporation, Stichting Ingka Foundation. IKEA nevertheless seems to encourage people to believe that it is still Swedish, with its prominent blue-and-yellow stores and frequent references to Swedish values and

[3] According to Deloitte, et al. (2010), Home Depot had 2008 fiscal-year sales of about $71 billion, the figure for Lowe's was 48 billion. IKEA's 2008 worldwide sales total, in dollars, was about $38 billion.

[4] IKEA: Facts and Figures, various annual reports, from www.ikea.com.

[5] It is somewhat surprising that IKEA does not have a larger presence in Asia. IKEA opened its first store in Japan in 1974–two years before Canada, and 11 years before entry into the US. However, IKEA did not fare well in Japan. According to Business Week (November 14, 2005), "A foray into Japan 30 years ago was a disaster (the Japanese wanted high quality and great materials, not low price and particle board)." IKEA closed its Japanese stores in 1986. In 2006, IKEA returned to Japan, with five stores as of 2008.

design. The previously-quoted study by Deloitte, et al. lists IKEA as a Swedish company. One important part of the IKEA empire, Swedwood Inc, is based in Ängelholm, Sweden. Swedwood is responsible for all aspects of sourcing, production, and distribution of IKEA's wood furniture. Much of the design work is still done in Sweden. Most, if not all, of the members of the board that oversee IKEA are Swedish (the board currently includes Kamprad, his wife, and 3 other members). Thus, in an important sense, IKEA is still Swedish.

2 Patterns of product diffusion

This dataset provides a window into a multinational firm's decisions regarding the changing geographic and temporal patterns of product availability in its global marketplace. Indirectly, the data also provide insight into IKEA's changing perspective on the character of the global marketplace. In this section, which we view as background to the analysis to come, we exposit the salient features of the IKEA product mix as it pertains to product availability within and across countries.

Figure 1 shows the number of goods present in the catalogs of each of the countries in our sample. In the early part of the sample, the European countries (France, Germany, Sweden and UK) showed very similar fluctuations in the number of goods present in their catalogs. In 1994, these countries had nearly 1200 goods in each of their catalogs, but this number fell below 1000 in 1996. The number of goods in the European catalogs continued to rise and fall together, although with an upward trend. With the onset of the global recession, the number of goods in every catalog fell dramatically. Between the 2008 catalog and the 2010 catalog, the number of goods in European catalogs fell by 21%.

The US and Canadian catalogs show a time pattern quite distinct from that of the European countries. In 1994, the US and Canada had many fewer goods in their catalogs than did the European countries–about 600 goods in 1995 for the US and Canada, compared with about 1150 for Europe. Over time, the number of goods available in the US and Canadian catalogs grew markedly, although not always in a synchronized fashion. This contrasts with the European countries, for which the fluctuations in the number of catalog goods moved together. By 2008, the North American catalogs had about 1200 goods, compared with 1350 for the European countries. North American was definitely catching up to the Europeans in terms of the number of goods available. However, the onset of the global recession affected the US and Canada in exactly the same way as it did the European countries: the number of goods available in the catalogs fell dramatically.

The thick solid line at the top of Figure 1 represents the number of "unique" goods offered

by IKEA, defined as a single product, counted only once even though it may be offered in more than one country. We find that the number of unique goods displays a mild downward trend over the sample period despite the rising trend at the country level in the number of goods in a country's catalog. These two facts, taken together, imply that the number of goods common across countries rose during the sample period.

To explore this changing pattern of global distribution of goods, Figure 2 graphs the fraction of goods that exist in only 1 country's catalog. In the initial part of our sample, about 40%-50% of goods were found in a single country. After about 2004, the distribution of goods broadened, and single-country goods now represent only about 35% of unique goods. Figure 2 also shows the number of unique goods that appear in all six countries' catalogs. In the early part of the sample, there were few goods distributed in all countries at the same time, measuring only 1% of all goods in 1996. From this point onward, the number of goods represented in all catalogs rose steadily, passing 10% of all goods by the year 2002. The peak value of 34% was reached in 2005, and subsequently has hovered at about 30%.

3 The Law of One Price

In this section, we explore whether IKEA pricing adheres to the predictions of the law of one price (LOP). As one of the basic international 'parity conditions,' this prediction of the effects of spatial arbitrage has engendered a long and rich literature.[6] IKEA products are typically produced in a single location, e.g., the "LACK" coffee tables would all be produced in and shipped from one country. If transportation costs from this location were identical across countries, if nontraded goods costs (local costs) were also identical, and if pricing were competitive, then the implications of spatial arbitrage would imply that IKEA would endeavor to set identical prices across countries. This section undertakes an empirical exploration of this textbook version of the law of one price.

[6] The relevant literature is immense. Early contributions focus on Purchasing Power Parity–the aggregative version of the Law of One Price. More recently, as data for individual goods has become available, the "micro-based" literature has been able to study the Law of One Price in a way more consistent with the original theory. Papers that give a sense of the literature's evolution over time include Marston (1990), Feenstra, et al. (1996), Rogoff (1996), Goldberg and Knetter (1997), Engel and Rogers (1996), Campa and Goldberg (2005), Crucini and Shintani (2008), Nakamura (2008), Nakamura and Steinsson (2011), Fitzgerald and Heller (2012), Berger et al. (2012), Boivin, Clark and Vincent (2012), and Gopinath et al. (2011).

3.1 Deviations from the law of one price

IKEA publishes prices in local currency units, inclusive of value-added-tax (VAT) in countries that impose this tax. The VAT is denoted by τ_{jt}. Let $\widetilde{P}_{ijt}$ denote the local-currency price, inclusive of VAT, of good i in country j at date t. The VAT varies across countries but not across the catalog goods. We focus on the amount received by IKEA from the sale of product i, i.e., the net-of-VAT local currency price P_{ijt}:

$$P_{ijt} \equiv \widetilde{P}_{ijt}/(1+\tau_{jt})$$

Let E_{jt} denote the exchange rate between country j and Sweden at date t, measured in local currency units per Swedish krona. The simplest form of the law of one price states that the exchange-rate adjusted net-of-VAT price is equalized across all countries:

$$\frac{P_{ijt}}{E_{jt}} = \frac{P_{ikt}}{E_{kt}} \tag{1}$$

for all countries (j,k) for every good i and date t.

We define the deviation from the law of one price as the log deviation in the given year of each country's exchange-rate-adjusted price from the cross-country mean price. Letting lowercase letters denote natural logarithms, we define $\overline{p}_{it}$ to be the log of the period-t geometric mean price for good i, where N_{it} is the number of catalogs in which good i appears in year t:

$$\overline{p}_{it} = N_{it}^{-1} \sum\nolimits_{j=1}^{N_{it}} \left(p_{ijt} - e_{jt}\right). \tag{2}$$

For good i in country j in period t, the deviation from the law of one price is:

$$d_{ijt} = (p_{ijt} - e_{ijt}) - \overline{p}_{it}. \tag{3}$$

where e_{jt} is the exchange rate at the time that the catalog prices are determined. Note that the deviation from the law of one price has mean zero when averaged across all countries for a given good i at time t. However, the mean deviation from the law of one price is not necessarily zero when averaged across all goods in a particular country's catalog.

At date t, there are M_{jt} goods in country j's catalog. The mean law of one price deviation for country j at time t is defined as follows, where all goods in the catalog are weighted equally:

$$\overline{d}_{jt} = M_{jt}^{-1} \sum\nolimits_{j=1}^{M_{jt}} d_{ijt}.$$

Figure 3 plots the country-level average deviations from the law of one price for each country in the sample over the entire time period. The corresponding data is shown in Table

1. If IKEA strove to adhere to the law of one price, we would expect that the country-level deviations would be uncorrelated over time and would have mean equal to zero. Clearly, this is not what we find. The deviations across countries show wide dispersion and no detectable pattern overall. If we set Canada aside, there is evidence that the deviations are smaller in absolute value from about 2004 onward. The deviations for Canada actually rise over this period to levels unprecedented in the earlier data. It is natural to wonder if the lack of relationship between these deviations reflects the fact that the overlap in goods across catalogs is not 100%. That is: there are many goods that are not represented in all six catalogs. Figure 4 plots the country-level law of one price deviations using only goods that are available in all six catalogs (again, the data are in Table 1). Strikingly, the pattern of deviations looks nearly exactly the same as in Figure 3 which uses all goods.

In both Figures 3 and 4, Sweden is the low-price country throughout the sample period. That is: Sweden's mean deviation from the law of one price is negative throughout, implying that Sweden's prices are lower than those of other countries. The Swedish deviations from the law of one price were much larger in the earlier part of the sample, averaging about -20% from 1994 to about 2002, but subsequently were in the neighborhood of about -5%. A first explanation that springs to mind is that transportation costs are lower to Sweden, since IKEA is a Swedish country. For some goods, this is true, but IKEA sources the bulk of its goods in Eastern Europe and in Asia, especially China. The transportation costs from these production locations to Sweden must be at least as high as the transportation costs from these locations to France or Germany. However, we find that the French and German deviations from the law of one price are substantially smaller than Sweden's in nearly every year. The French and German cases are particularly interesting, as the law of one price deviations for these two countries track each other quite closely. The US is the high-price country in the early part of the sample, an honor taken over by Canada toward the end of the sample. If transportation costs were important determinants of deviations from the law of one price, we would expect that these two North American destinations would have similar deviations from the law of one price. However, we do not find strong evidence to support this prediction.

3.2 New vs. continuing goods

When a new good is introduced into an IKEA catalog, a price must be assigned to that good. A good that has been present in previous years already has a price, and IKEA must decide whether to change the price. There is thus a basic asymmetry between new and continuing goods. A standard menu cost story (see, for example, Barro 1972) would specify

that the menu cost of changing a price that applies to each individual good regardless of whether other goods' prices are also changed. More recently, Midrigan (2011) has specified that the marginal menu cost is zero if another good's price is already being changed. Thus, new goods always entail menu costs, while changing the price of existing goods may or may not entail these costs on the margin. To the extent that menu costs are larger or more pervasive for new goods, we would expect that deviations from LOP would be smaller for the class of new goods than for the class of existing goods.[7] Figure 5 graphs the law of one price deviations for new goods vs. continuing goods for each country. If IKEA is attempting to adhere to the law of one price for new goods, the deviations for new goods will be closer to zero than the deviations for continuing goods. However, there is no clear indication that law of one price deviations tend to be smaller for new goods. For some countries such as Sweden and the UK, the deviations for new goods are smaller (in absolute value) than for continuing goods. Overall, however, the prediction that IKEA attempts to achieve the law of one price for new goods is not well-supported by the data.

Table 2 presents summary statistics for the mean and standard deviation of the law of one price deviations for new and continuing goods. This table shows the mean and standard deviations of law of one price deviations over the entire sample period. Here, once we average out year-to-year variation, we do find support for the prediction that deviations are smaller for new goods. In every country, the mean law of one price deviation is smaller for new goods than for continuing goods (in absolute value). Canada, Sweden and the US are high-average-deviation countries (in absolute value), while Germany, France and the UK are low-average-deviation countries. The US is an unusual case, because the mean deviation for new goods is very close to the mean deviation for continuing goods. The standard deviation is also uniformly smaller for new goods than for continuing goods. Surprisingly, however, the standard deviations are quite similar across the high-average-deviation countries and low-average-deviation countries.

3.3 High vs. low-price goods

IKEA altered its mix of goods over our sample period, introducing many more low and medium-low priced products in the most recent years. To remove effects potentially stemming from the changing product mix, we break our sample into four price categories, where goods

[7] Charles Engel (private correspondence) noted that one would expect that LOP would hold in goods whose prices are changed only if we expect that goods' prices are set in order to achieve LOP. If this is not the goal of the firm, or if it is not possible within the firm's other constraints, then we would not expect LOP to hold for new goods even if they entailed higher menu costs.

are assigned to price categories based on their real value (net of VAT, deflated using the CPI) in Swedish krona. The price ranges for the categories were chosen so that each category contains roughly 20%-25% of all the goods in a typical catalog. The cutoff values, in year-2000 krona, are as follows: (1) low-price goods, price less than 70 krona (about $10) ; (ii) medium-low price goods, price between 70 and 250 krona ($10-$40) ; (iii) medium-high price goods, price between 250 and 1000 krona ($40-$150); and (iv), high-price goods, price higher than 1000 krona ($150).

Table 3 shows the deviations from the law of one price separately for each price group in each country. This table shows no evidence that IKEA adheres more closely to the law of one price when pricing high-price goods compared with low-price goods (differences would overwhelmingly fail to be statistically significant). Overall, there is no evidence of greater adherence to the law of one price for any of the groups. Rather, the main findings from this part of the investigation is that LOP deviations in all price groups move together within each country.

3.4 Persistence of deviations from the law of one price

A major focus of past research is persistence in the deviations from the law of one price. We therefore investigated the extent to which IKEA price deviations are persistent. Specifically, we estimated univariate autoregressions of price changes in each country. An observation is a price change for a particular product in a particular country's catalog. Thus, this product enters the autoregression only if it is present in the catalog for a sufficient number of years. For example, if we wish to estimate a first-order autoregression in the price changes, the good must be in the catalog for three years. The number of observations available will drop sharply as we increase the order of the autoregression, so we have restricted ourselves to first- and second-order autoregressions.[8] These are estimated for the sample as a whole, and also for each country separately. The results are presented in Table 4. The AR(1) coefficients range from 0.62 to 0.74, while the sum of coefficients in the AR(2) ranges from 0.68 to 0.80. With annual data, this implies a half-life of deviations from the law of one price of about three to four years. The attractive feature of our data is that we do not have product substitution. Thus the half-life of deviations from the law of one price is unaffected by bias stemming from this issue. Prior work by Nakamura (2008) and Nakamura and Steinsson (2011) have shown that these considerations can be quite important.

[8] We did estimate an AR(3) for those goods with enough price quotes. The AR(3) coefficient was uniformly insignificant.

4 Exchange-rate pass-through

The simple version of the law of one price described above ignores cross-country differences in transportation costs and local distribution costs. In reality, these factors are likely to be extremely important. An important literature on exchange-rate pass-through has sought to isolate the important determinants of the extent of pass-through. For example, it may be affected by the currency in which the good is invoiced or the type of good being traded. Exchange-rate pass-through can vary due to deliberate corporate decisions to vary the good's markup.[9] However, when the good is priced in advance in the customer's currency, as is the case with IKEA, pass-through can vary due to unexpected movements in the exchange rate.

Let C_{it} denote the cost in Swedish kronor of good i in period t. Country-specific transportation costs and local distribution costs, κ_{jt}, are assumed proportional to price. The country- and year-specific markup is denoted by μ_{jt}. The pass-through coefficient γ measures the extent to which variations in the exchange rate are passed through to local currency prices. Thus the net-of-VAT kronor-denominated price is given by:

$$P_{ijt}/E_{jt} = C_{it} * (1 + \mu_{jt}) * (1 + \kappa_{jt}) E_{jt}^{\gamma - 1}$$

or, in logs, where $c_{it} = \ln(C_{it})$:

$$p_{ijt} - e_{ijt} = c_{it} + (\mu_{jt} + \kappa_{jt}) + (\gamma - 1) e_{jt} \tag{4}$$

The kronor-equivalent price at date t thus depends on a good-specific component, c_{it}, a component that varies with the good and the country, $(\mu_{ijt} + \kappa_{ijt})$, and a country-specific component,e_{jt}.[10] Since the cost of the good is not directly observable, we can use the price of good i at time t in another location, k, to develop an equation that does not contain the cost term by subtracting equation (4) for country k:

$$\phi_{i,jk,t} = (p_{ijt} - e_{jt}) - (p_{ikt} - e_{kt}) = (\mu_{jt} - \mu_{kt}) + (\kappa_{jt} - \kappa_{kt}) + (\gamma - 1)(e_{jt} - e_{kt}). \tag{5}$$

[9] Fabinger, et al. (2012) have recently studied markups and pass-through for durable vs. nondurable goods.

[10] In principle, variation in p_{ijt} could be decomposed into a country-specific component, a good-specific component, and a component that reflects both country and good-specific influences. This is an idea pursued in prior literature (Marston (1990), Knetter(1989,1993)). For example, we could assume that the markup is country- and good-specific but not time-varying (this corresponds to constant demand elasticities, an assumption made by Knetter in his work). The barrier to our implementation of their methodology is is that we have a lot of goods but very few goods that are distributed in many countries even for a small number of periods. Thus the Knetter approach of identifying time and country effects, separately for each good, is not possible.

We construct the dependent variable, $\phi_{i,jk,t}$ by using pairwise data for all countries j, k in which good i appears in year t. To be included in the regression, a good must appear in at least two countries for at least one year. The presence of country- and year-specific markups and distribution costs lead to the following estimating equation:

$$\phi_{i,jk,t} = \alpha_L + (\gamma - 1)(e_{jt} - e_{kt}) + \{\text{year dummies}\} + \{\text{country dummies}\} + u_{ijt}. \quad (6)$$

The results are presented in Table 5-A. When we include both country and year dummies, $(\widehat{\gamma} - 1) = -0.70$, implying an estimated pass-through coefficient of $\widehat{\gamma} = 0.30$. The coefficients on the country and year dummies are suppressed due to space considerations. We then estimate this equation using only goods that were new in both countries in year t. The estimate of passthrough rises to $\widehat{\gamma} = 0.36$. When we look at pairs of goods that previously existed in both countries, the estimated pass-through falls to $\widehat{\gamma} = 0.26$. Evidently, pass-through is significantly higher when we focus on new goods rather than goods already existing in the catalogs. This provides some support to the hypothesis that prices are chosen more carefully when the good is newly introduced to the catalog.

There may be concern that the specification (5) contains non-stationary variables and thus could be susceptible to well-known problems of inference and estimation. Our time series for individual goods is rarely longer than 4 years, so that unit-root testing is not possible. We can, however, proceed by estimating a first-differenced specification similar to (5), which will remove I(1) components from the variables in the regression and difference out the year and country dummies (the average year effect is now contained in the constant). Table 5-B presents the results from estimation of the following:

$$\phi_{i,jk,t} - \phi_{i,jk,t-1} = \alpha_D \ + (\gamma - 1)\left[(e_{jt} - e_{j,t-1}) - (e_{kt} - e_{k,t-1})\right] + v_{ijt}. \quad (7)$$

The estimate of the pass-through coefficient is $\widehat{\gamma} = 0.14$. This estimate is quite a bit smaller than the estimate generated by the levels regression.

How do these results for pass-through compare to those in the literature? Goldberg and Knetter (1997, p.1250) provide a careful survey of exchange-rate passthrough literature through 1997. They summarize the literature's results as follows: *"For the United States, pass-through appeared to be in the neighborhood of 60 percent in the floating exchange rate period, although the more detailed data used by Feenstra for certain Japanese industries suggested a somewhat higher degree of passthrough. For other countries, ERPT appeared to be higher, with economic size an apparent determinant of less than full pass-through."* More recently, in their study of the market for imported beer, Goldberg and Hellerstein (2012, p. 40) report: *"The pass-through observed in our data is between 6 and 7%."* Gopinath

and Rigobon (2008, p. 1), summarize their overall findings for detailed US import prices as follows: *"even conditioning on a price change, exchange rate pass-through into U.S. import prices is low, at 22%."*

Our estimated pass-through coefficient for the full sample is in the range of 0.14 to 0.31, depending on the specification of the estimating equation. This estimate is lower than the pass-through coefficient reported in the early pass-through literature, but is consistent with more recent studies. Further, recent studies have also emphasized the importance of country effects in explaining differences in pass-through. Local costs represent a large fraction of retail costs and do not vary with the exchange rate. Thus, these may be the main reason for country-specific differences in in pass-through. Goldberg and Hellerstein (2008, p. 39) report that: *"Manufacturers' local non-traded costs play the most significant role in the incomplete transmission of the original shock to retail prices."*

5 The frequency and timing of price changes

A key focus of the recent literature on micro-pricing, both at the closed-and open-economy levels, has been on the size of price adjustments. This information is useful in constructing, refining, and evaluating alternative models of firm pricing behavior.[11] Our dataset is different in many ways from those used in prior studies. There is a single economic agent setting prices for all goods, and the prices are set in multiple countries at the same time. We are able to match specific, unique goods being sold in different countries as in Burstein and Jaimovich (2009), Boivin, Clark, and Vincent (2012), and Gopinath, et al. (2011). The use of catalog prices was earlier implemented by Kashyap (1996) and Haskel and Wolf (2001). Related work using the posted prices of *The Economist* magazine was undertaken by Ghosh and Wolf (1994) and Knetter (1997).[12]

5.1 Fractions of goods with price changes

Computation of price changes is complicated by the fact that prices in the French and German catalogs were quoted in French francs and Deutsche marks, respectively, until 2002.

[11] This growing literature includes contributions by Bils and Klenow (2004), Eichenbaum, Jaimovich, and Rebelo (2011), Klenow and Krystov (2008), Midrigan (2011), Nakamura and Steinsson (2008, 2011), Gopinath and Rigobon (2008), Gopinath and Itaskhoki (2010) and many others.

[12] There is one price for every store in a given country. We thus cannot address the "border effect" in any serious way. Trivially, any cross-country price difference is entirely due to the border effect, because of IKEA's decision to conform to the "Law of One Price" with each country.

In the 2002 French and German catalogs, prices were presented in both Euros and the local currency units. The Euro price was more prominently featured, appearing in large type with the photo of the good. In the text describing the good, the Euro price was listed in boldface type, while the previous local currency price was listed last in parentheses and not boldfaced. Interestingly, the French franc price was in integers, as is typical for prices in IKEA catalogs. The associated Euro price thus was not in integers, but typically was listed with two digits after the decimal. For example, the Granas table base was listed with a Euro price of 90,71€. The associated French franc price was listed as 595F. Apparently, IKEA took pains to keep the French franc prices in the year-2000 catalog in units that would look familiar to French consumers. The reverse decision was made in the case of Germany. In the year-2000 German catalog, the Euro prices are in integers, e.g. €120 (or with a typical form for lower priced goods, e.g., €2.99), while the local currency prices are shown with two digits. From the 2003 catalog onward, both the French and German catalogs present prices in Euros in integers.[13] The adoption of the Euro thus necessarily introduced small price changes into common-currency prices (e.g., all German prices expressed in Euros throughout the sample) even if IKEA's intention was to keep the price of the good the same through the conversion year. Thus we count a price as unchanged if, in France or Germany over the period 2001-2002, the new price is different from the prior price by no more than one Euro. With this adjustment, we then compute an indicator variable that takes on three values, depending on whether a particular good's price increases, stays the same, or decreases between period t and period $t+1$. This indicator is computed at the level of the individual country. Using the notation presented earlier, where p_{ijt} measures the net-of-VAT price of good i in country j in period t, we compute:

$$\begin{aligned}
\Delta_{ijt} &= 1 \text{ if } \frac{P_{ij,t+1}}{P_{ijt}} > 1 \text{ (price increase)} \\
&= 0 \text{ if } \frac{P_{ij,t+1}}{P_{ijt}} = 1 \text{ (no change in price)} \\
&= -1 \text{ if } \frac{P_{ij,t+1}}{P_{ijt}} < 1 \text{ (price decrease) .}
\end{aligned}$$

In our data, the vast majority of potential price changes–59%–are zero. Of the remainder, 18% involve price decreases while 23% involve price increases. The median price decrease (conditional on an observed decrease) is 13.5%–much larger than the median price increase of 8.3%. The means are more nearly equal: the mean decrease is 15.3%, the mean increase is

[13] The prices of low-price goods are frequently not in integers. As is common in retailing, a good may have trailing digits of .95 or .99, e.g., $4.95 instead of $5.00. Most goods in the catalog, and nearly all higher-price goods, have prices in integers.

12.1%. Many prior studies have focused on the behavior of absolute price changes. Klenow and Kryvtsov (2008) report a 13.3% monthly average absolute price change for goods in the CPI. Broda and Weinstein (2010) report a mean quarterly change of 8.8%. In our data, the mean absolute price deviation is stable at around 13.7% per year.

Figure 6 provides a visual summary of the distribution of non-zero price changes. This histogram clearly shows that small price increases are far more numerous than small price decreases. The large number of small increases combined with a large average increase was also noted by Midrigan (2011) in grocery store prices and by Klenow and Kryvtsov in their study of goods in the U.S. CPI. These authors, as well as others including Dotsey, King and Wolman (2006), Goloslov and Lucas (2007), Klenow and Willis (2007) have argued that this evidence suggests the need for a departure from a standard menu cost story or the standard Calvo price-setting model. In a separate, future paper, we plan provide more detail on the structure of price-setting in the IKEA catalogs and use this new data to evaluate alternative theories of price-setting.

6 Summary and Conclusion

This paper examines international pricing behavior using a newly-created dataset consisting of prices of every item in the IKEA catalogs of six countries across 17 years. Deviations from the law of one price are large, as is typically found in both aggregate and micro data. The deviations are not highly correlated across countries except for a close relationship between the deviations for France and Germany. We asked whether deviations were smaller for newer goods, where there is no possibility of ignoring the price-setting decision (i.e., no chance to avoid the menu cost of price setting), so that prices should adhere more closely to this parity condition. Our results show some support for this theory when we average across all years, although this relationship does not hold on a year-by-year basis. We also investigated whether the percentage deviations were smaller for more expensive goods, studying goods divided into four price groups. Again, the finding was negative. Very low price goods do have larger deviations in some countries, but the deviations for the highest-price group of goods are no smaller than for the other three price groups.

Exchange-rate pass-through is experiencing a renewal of interest in the literature using micro-data. Our findings are broadly consistent with those being generated by other researchers. Our estimated exchange rate pass-through is relatively low at 14%-30% per year, depending on the specification. We find, however, that exchange-rate pass-through is significantly higher when we focus on new goods rather than goods already existing in the catalogs. This provides some support to the hypothesis that prices are chosen more

carefully when the good is newly introduced to the catalog.

Our results on the distribution of price changes contribute to the growing literature in this area. We find zero price changes in 59% of all potential price changes, increases in 23% of all potential changes and decreases in the remaining 18%. The data show a very large fraction of small price changes. Generally, the distribution of price increases has more mass at lower price increases, but the distribution of price decreases has more mass at larger price changes.

There is much research that remains to be done. The data can shed light on the importance of currency union for pricing and product distribution. Specifically, we plan to study whether IKEA's pricing and product placement policies were affected by the introduction of the Euro, which occurs roughly in the middle of our sample period. A major problem in evaluating the importance of currency areas and common market arrangements is the inability to standardize the group of goods that are available in the different countries. The IKEA catalogs provide the needed standardization. Further, our sample is ideally poised to investigate pricing policy (i) within a common currency zone (France and Germany); (ii) within a common market but not a common currency (UK and Sweden), and (iii) countries neither sharing a currency nor a formal common market (US and Canada). On the theoretical side, the stylized facts developed in this paper will serve to guide and restrict the development of current and future models of international product pricing.

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Table 1: Deviations from Law of One Price

A. Mean deviations from law of one price

year	Canada	Germany	France	Sweden	UK	US
1994	7%	4%	12%	-18%	-5%	4%
1995	-1%	6%	7%	-15%	-2%	6%
1996	-2%	5%	3%	-8%	-2%	6%
1997	-2%	-1%	3%	-3%	-1%	5%
1998	1%	-2%	0%	-14%	11%	8%
1999	-1%	-5%	-2%	-12%	12%	10%
2000	1%	-5%	-4%	-13%	13%	11%
2001	6%	-7%	-5%	-8%	12%	13%
2002	7%	-8%	-7%	-14%	11%	19%
2003	3%	-5%	-5%	-8%	4%	13%
2004	6%	-1%	-2%	-3%	-2%	2%
2005	7%	-5%	-3%	-3%	4%	1%
2006	14%	-8%	-6%	-4%	3%	2%
2007	20%	-8%	-7%	-3%	1%	1%
2008	19%	-8%	-7%	-6%	2%	0%
2009	12%	1%	0%	-1%	-6%	-6%
2010	15%	0%	-1%	-11%	-3%	1%

B. Mean deviations from law of one price for goods available in ALL countries

year	Canada	Germany	France	Sweden	UK	US
1994	17%	0%	10%	-25%	-12%	10%
1995	5%	1%	4%	-17%	-10%	17%
1996	-2%	3%	1%	-15%	-1%	14%
1997	4%	-5%	-4%	-6%	0%	10%
1998	7%	-9%	-5%	-20%	11%	15%
1999	6%	-10%	-5%	-18%	10%	18%
2000	12%	-9%	-11%	-21%	8%	21%
2001	15%	-15%	-13%	-16%	7%	22%
2002	15%	-14%	-12%	-22%	5%	27%
2003	8%	-7%	-9%	-12%	2%	17%
2004	7%	-1%	-2%	-3%	-4%	2%
2005	9%	-5%	-4%	-4%	4%	1%
2006	15%	-9%	-6%	-5%	2%	3%
2007	21%	-10%	-8%	-5%	0%	2%
2008	20%	-9%	-8%	-6%	2%	1%
2009	12%	2%	0%	-1%	-6%	-7%
2010	16%	-1%	-2%	-12%	-4%	3%

Table 2: Percent deviations from law of one price

	mean		std. dev.	
Country	**new goods**	**continuing goods**	**new goods**	**continuing goods**
Canada	7.4%	9.7%	16.3%	16.8%
Germany	-2.9%	-4.0%	13.8%	15.3%
France	-2.2%	-2.8%	13.0%	13.5%
Sweden	-6.7%	-8.5%	12.5%	13.9%
UK	2.8%	3.4%	14.2%	15.1%
US	5.0%	5.0%	15.4%	16.1%

Table 3: Percent deviations from law of one price by price groups

A. Mean

Country	low	med-low	med-high	high
Canada	7.0%	9.4%	9.6%	6.6%
Germany	-5.1%	-2.9%	-3.1%	-1.4%
France	-5.5%	-1.2%	-1.2%	0.5%
Sweden	-10.1%	-8.2%	-8.5%	-6.4%
UK	-0.3%	1.6%	3.1%	5.3%
US	0.0%	3.3%	5.8%	8.8%

B. Std. dev.

Country	low	med-low	med-high	high
Canada	18.9%	17.2%	15.5%	15.3%
Germany	17.9%	16.0%	13.6%	12.1%
France	15.2%	14.0%	13.4%	12.2%
Sweden	15.6%	13.6%	12.7%	12.7%
UK	17.0%	15.0%	13.8%	13.8%
US	18.3%	16.1%	14.6%	13.8%

Table 4: Autoregressions for deviations from the law of one price

	lopdev(t) = a + b* lopdev(t-1) + u(t)						lopdev(t) = a + b* lopdev(t-1) + c* lopdev(t-2)+ u(t)					
	Canada	**Germany**	**France**	**Sweden**	**UK**	**US**	**Canada**	**Germany**	**France**	**Sweden**	**UK**	**US**
lopdev(t-1)	0.67	0.67	0.66	0.62	0.72	0.74	0.64	0.50	0.59	0.47	0.73	0.70
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
lopdev(t-2)							0.12	0.18	0.09	0.22	0.03	0.10
							(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
sum							0.77	0.68	0.68	0.70	0.76	0.80
Constant	0.03	-0.01	-0.01	-0.03	0.01	0.00	0.03	-0.02	-0.01	-0.03	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	4240	5817	5691	5807	5490	3850	1824	2638	2495	2622	2449	1564
R-squared	0.46	0.43	0.46	0.39	0.49	0.55	0.51	0.45	0.44	0.43	0.52	0.57

Standard errors in brackets

Table 5: Estimating passthrough

A. Estimation in levels

$$(p_{ijt}-e_{ijt})-(p_{ikt}-e_{ikt})=(\gamma-1)(e_{ijt}-e_{ikt})+\{\text{country dummies}\}+\{\text{year dummies}\}$$

Passthrough (γ):	γ	Adj. R^2	# obs.
All observations	0.30	0.25	150,134
	(93.22)		
New in both countries	0.36	0.25	62,965
	(56.29)		
Previously existed in both countries	0.26	0.27	72,653
	(67.21)		

t-statistics in parentheses

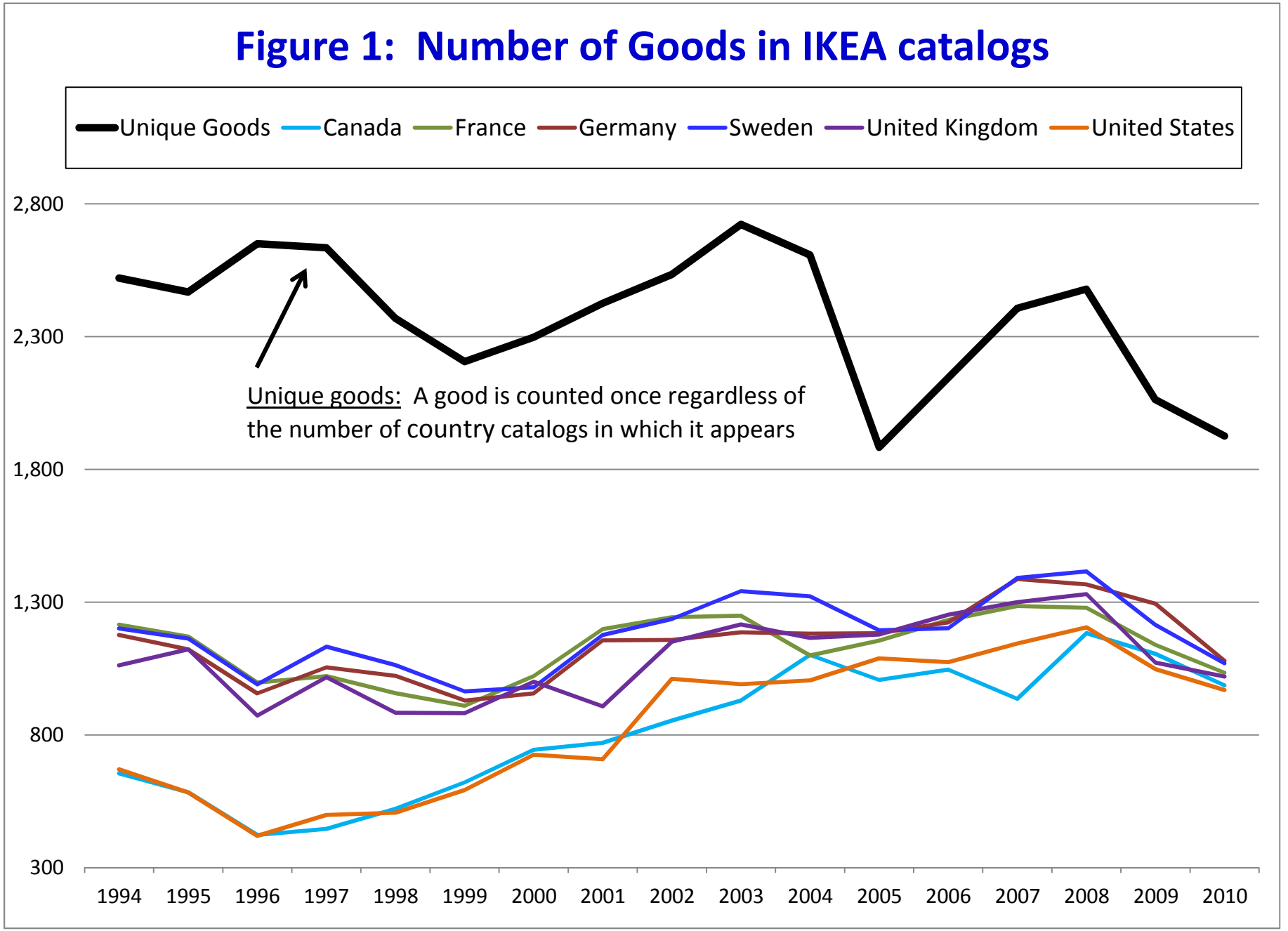
B. Estimation in differences

$$\Delta[(p_{ijt}-e_{ijt})-(p_{ikt}-e_{ikt})]=\text{constant}+(\gamma-1)\Delta(e_{ijt}-e_{ikt})$$

Passthrough (γ):	γ	Adj. R^2	# obs.
All observations	0.14	0.16	98,221
	(138.63)		

t-statistics in parentheses

Figure 1: Number of Goods in IKEA catalogs



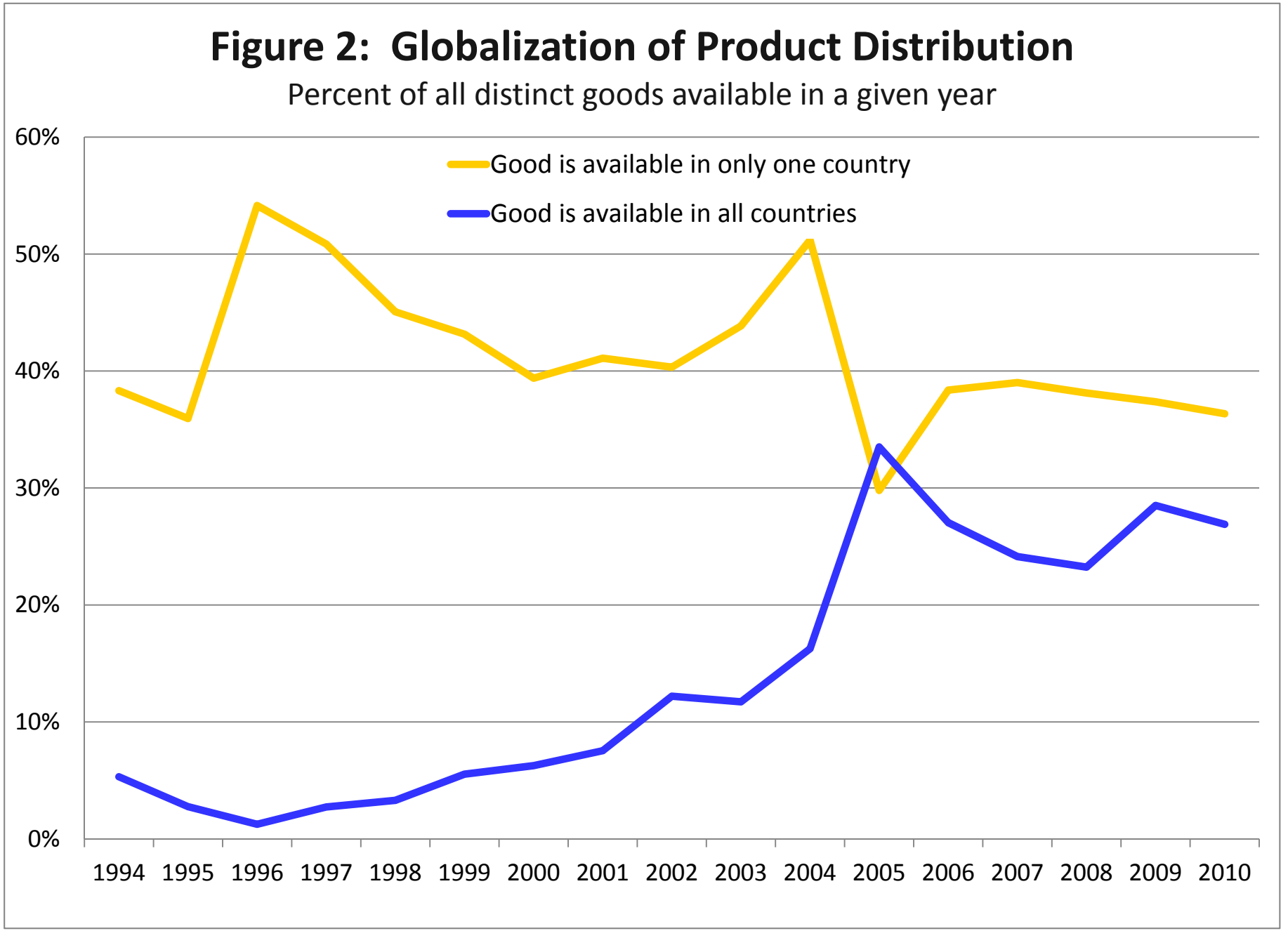


Figure 2: Globalization of Product Distribution
Percent of all distinct goods available in a given year
Good is available in only one country
Good is available in all countries
60%
50%
40%
30%
20%
10%
0%
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

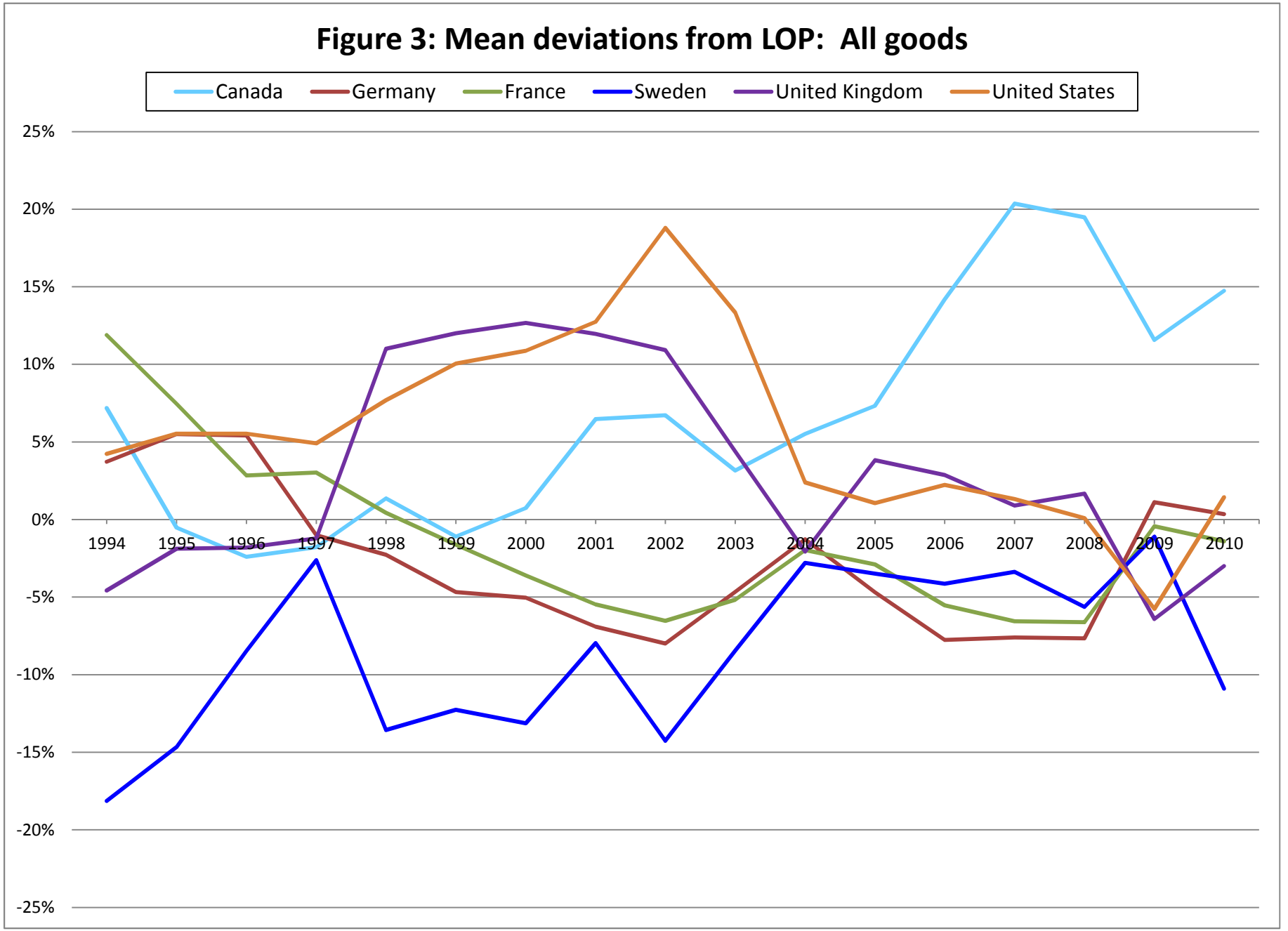


Figure 3: Mean deviations from LOP: All goods
Canada
Germany
France
Sweden
United Kingdom
United States
25%
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
-25%
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

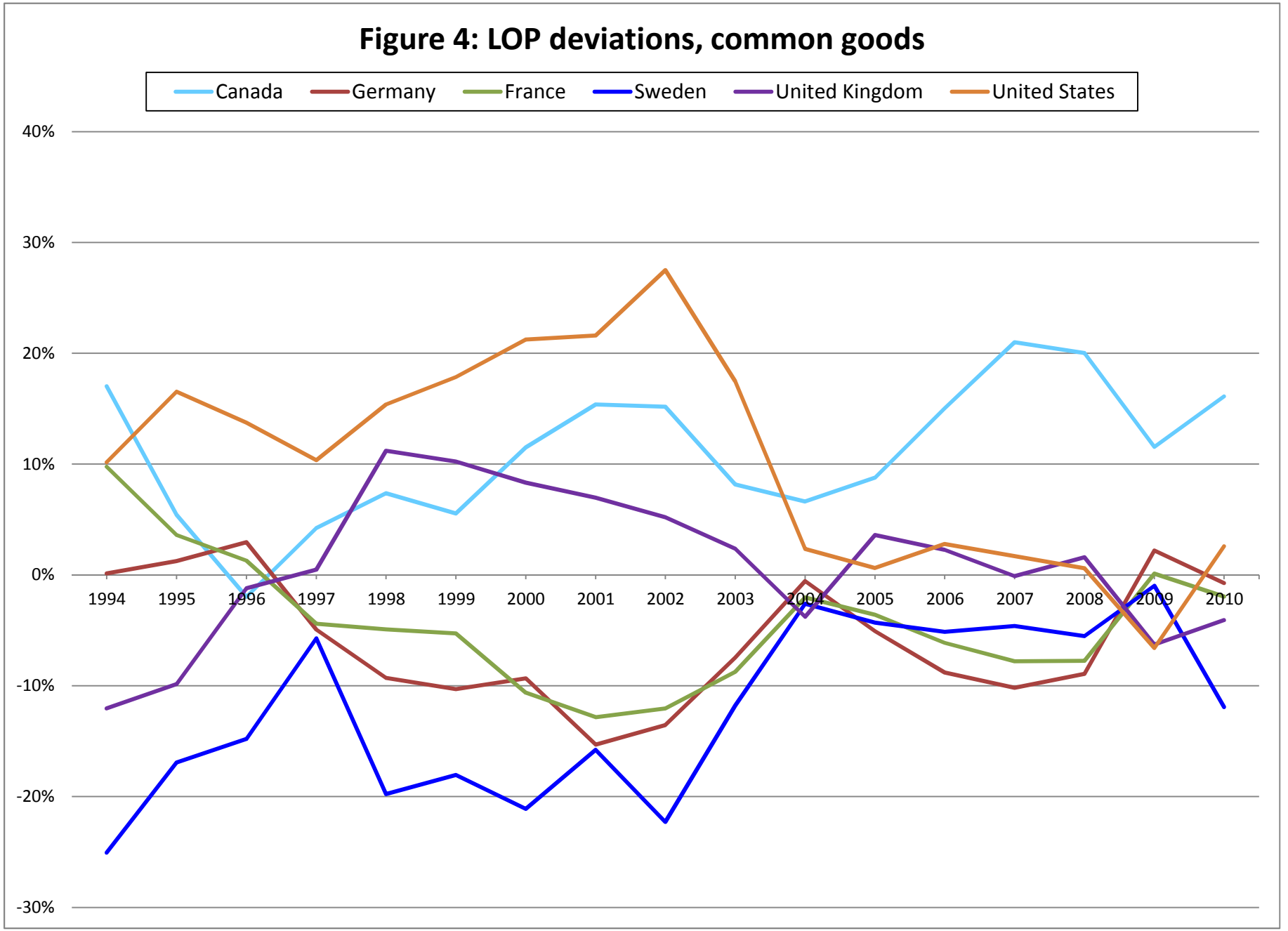


Figure 4: LOP deviations, common goods
Canada
Germany
France
Sweden
United Kingdom
United States
40%
30%
20%
10%
0%
-10%
-20%
-30%
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

Figure 5: Price deviations for new vs. continuing goods

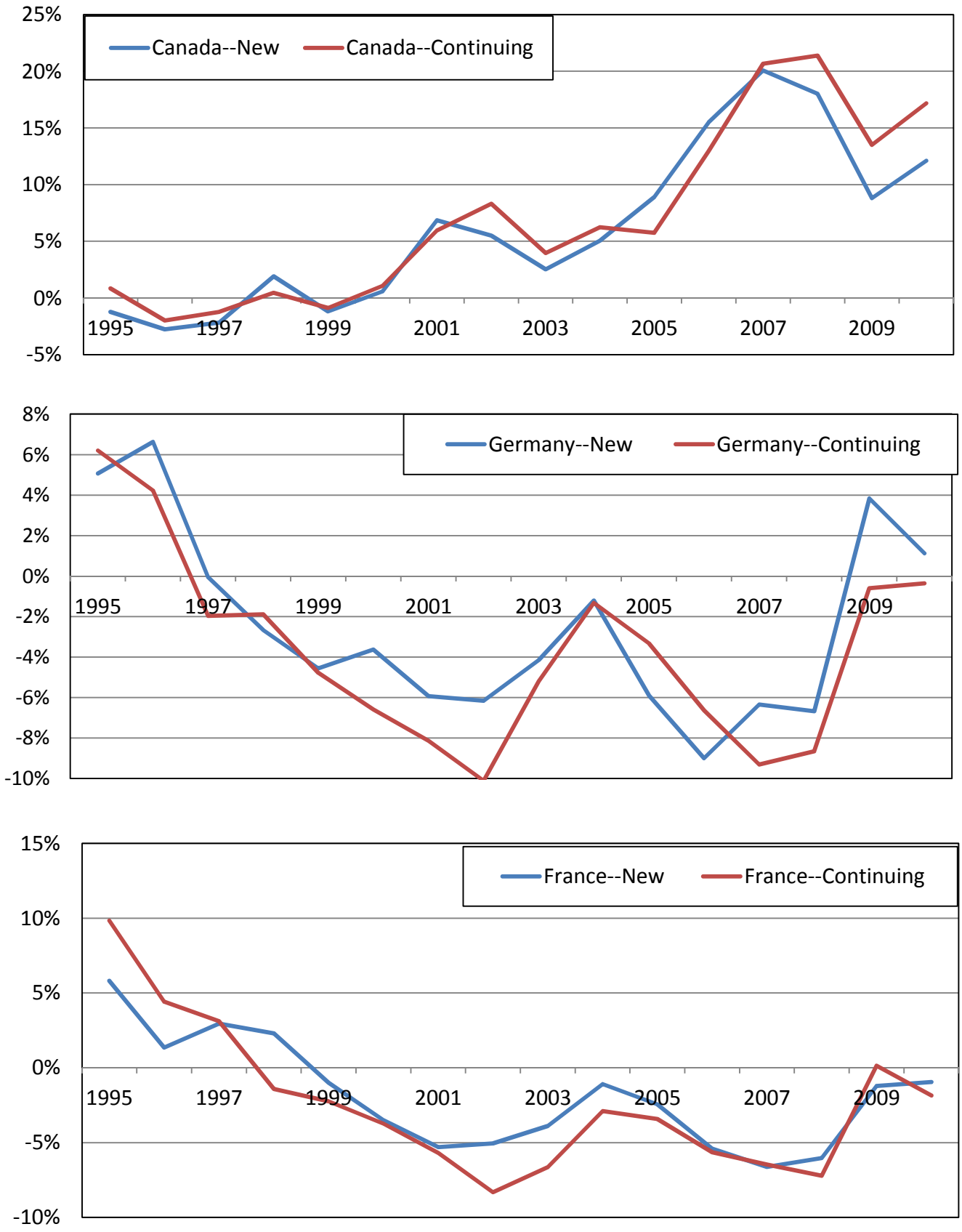


Figure 5, cont'd: Price deviations for new vs. continuing goods

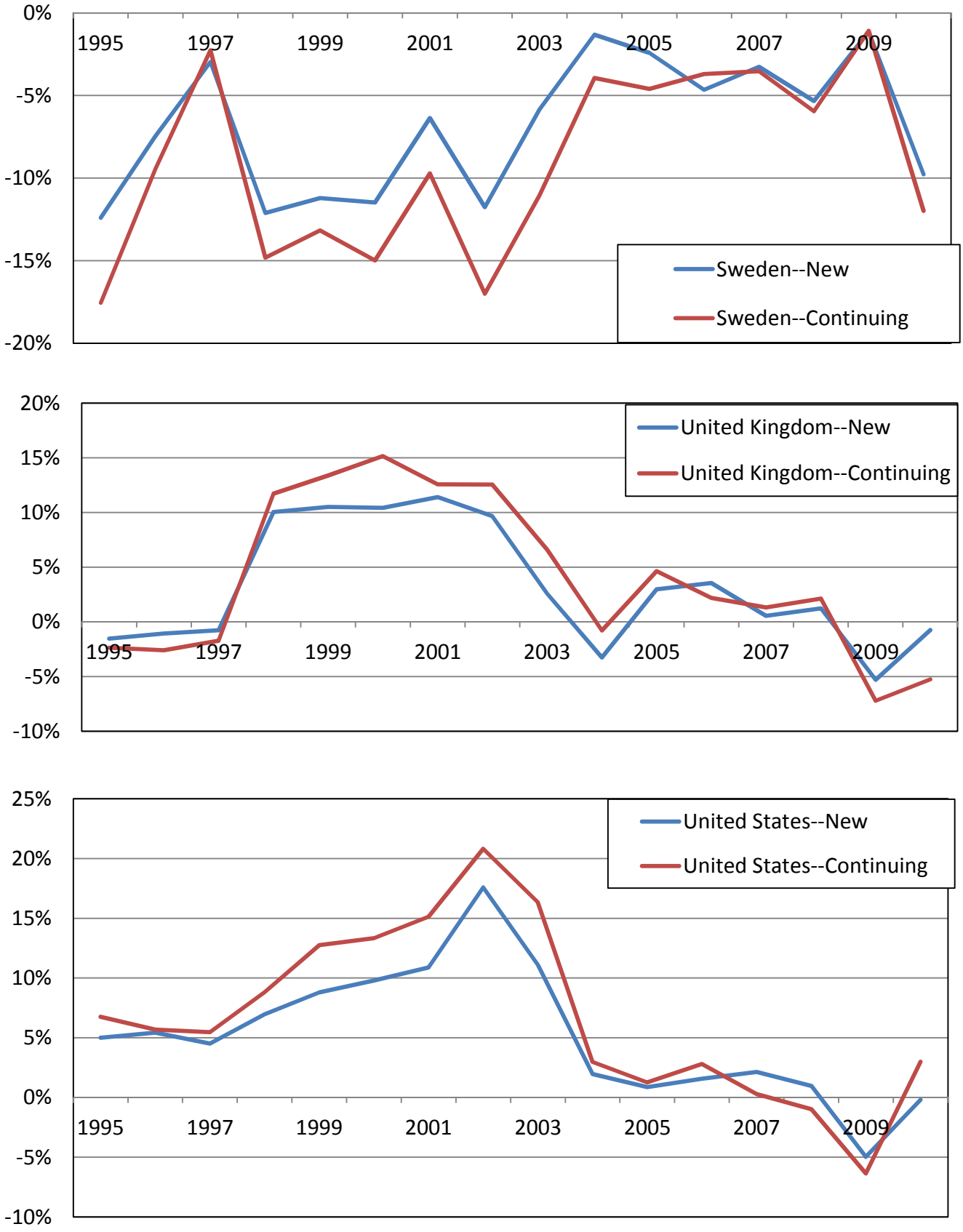


Figure 6: Distribution of non-zero price changes

Bin width: 5%