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Market power and the pricing of commodities imported from developing countries: the case of US vanilla bean imports

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Abstract

A declining trend in the prices of vanilla beans reduce export earnings of developing country exporters. At the same time, currencies for these developing countries have depreciated. The 'new' trade theories suggest that market structure plays an important role in relating exchange rate devaluations to price declines. This paper investigates the market structure and estimates the impact of exchange rate movements on prices for vanilla beans imported by the USA from five producers of vanilla beans in developing countries. Unlike other studies, the estimation is based on a 'fixed-effects' econometric model derived from the importer's profit equation and the 'Pricing to Market' (PTM) hypothesis. Data are a pooled cross-section and time series covering the period 1967–1997. The results reveal some evidence that US importers of vanilla beans have the market power to apply price discrimination and to adjust import prices in reaction to exchange rate movement vis-à-vis exporters. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Exchange rates; Exports; Imports; Market structure; Prices; Vanilla beans

1. Introduction

The declining trends of agricultural commodity prices continue to depress the export earnings of small developing countries. These trends are of particular importance to countries that are highly specialized in the export of only a few commodities (Borensztein and Reinhart, 1994). In the case of vanilla beans, both real and nominal prices have been falling since the 1970s. The sharpest price decline occurred during the period 1991–1997 when the real average price decreased by 30% per year. Over the same period, the growth rate of the volume of trade largely exceeded the growth rate of production of vanilla beans. In fact, between 1991 and 1997, FAO data indicate that the year-to-year average growth rate of world vanilla bean trade was 13% while world production increased by only 2.8% per year. This implies that inventories shrunk over this period. The declining vanilla bean price considerably reduces foreign exchange earnings for countries such as Comoros which derives about half of its total export revenues from vanilla exports (FAO, 1997; USDA). Some studies (De Melo et al., 1996; Metzel et al., 1999) attribute part of the vanilla price decline to the policy of market liberalization of exporting countries and increased competition among exporters. These studies, however, have not addressed the causes of the overall trend.

In the search of for an explanation for declining prices, this study focuses on two unexplored but

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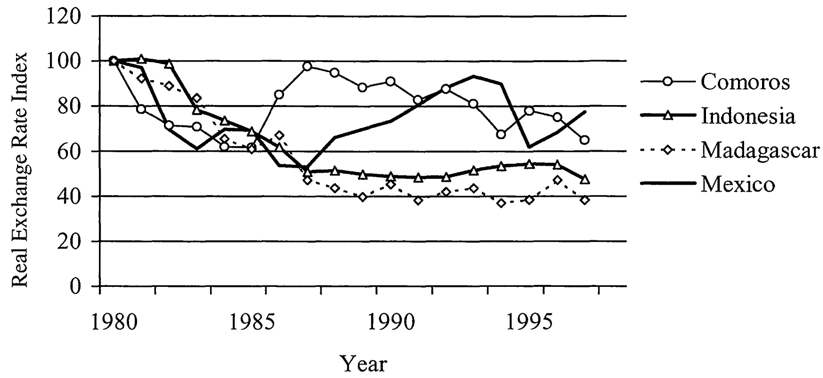

Fig. 1. Changes in real exchange rates (index, 1980 = 100). *Sources*: Government of Comoros (2001), Government of Madagascar (2001) and International Monetary Fund (2001). *Note*: The real exchange rate is calculated as the nominal exchange rate adjusted to relative rates of inflation.

important facts about the vanilla bean market. First, world vanilla bean imports are highly concentrated. The USA and EU are the largest importers, purchasing about 50 and 35%, respectively, of total world vanilla imports (FAO, 1997). Second, for the last 20 years, currencies in exporting countries have depreciated sharply. For example, from 1980 to 1997, the currencies of Comoros, Indonesia, and Madagascar (major vanilla exporting countries), lost about 30, 50, and 60%, respectively, of their real values (see Fig. 1). In many cases, the exchange rate adjustment was a deliberate policy choice with the goal of increasing export incentives and earnings.

In this study, we employ new developments in trade theory that emphasize the role of market structure, and in this case the role of high import concentration, to explain the link between currency depreciation and market price adjustments. The theory is based on the 'Pricing to Market' (PTM) hypothesis (Krugman et al., 1987) according to which, in an imperfect market, a large trader can adjust prices when exchange rates move. The objective of this study is to test the PTM hypothesis and estimate the impact of exchange rate movements on US import prices of vanilla beans from five exporting countries — Comoros, French Polynesia, Indonesia, Madagascar, and Mexico. More specifically, we test the completeness of the exchange rate pass-through (EPT) to identify whether market structure has had any influence on price realization following the exchange rate adjustment. Unlike earlier papers that test the PTM hypothesis based on exporters' behavior using the monopoly model (Froot and Klemperer, 1989; Knetter, 1989; Pick and Park, 1991), this paper tests PTM on a large importer's behavior using a monopsony model. A 'fixed-effect' econometric model derived from profit-maximising behavior of vanilla processors is estimated using pooled cross-section time-series data. The results indicate that US importers of vanilla beans have the market power to apply price discrimination and to adjust import prices in response to exchange rate movement vis-à-vis exporters. In the following sections, the paper reviews some features of the vanilla bean market and PTM theory, present the conceptual framework, and describes the data and procedures. The results are then summarized and used to draw conclusions and implications.

2. Vanilla bean prices and market structure

Vanilla beans are produced for their alcohol content called vanillin or more simply vanilla extract. Vanilla extract serves to flavor some food and beverages, or as an ingredient in many cosmetic and pharmaceutical products. The production of vanilla beans is highly labor-intensive and requires specific soil and climate conditions (Bourriquet, 1954; Blarel and Dolinsky, 1995). The main producers and exporters of vanilla beans are Comoros, French Polynesia, Indonesia, and Madagascar. Other producing

Table 1
US import of vanilla beans[a]

Country of origin	Unit value (US$/kg)		Share of US vanilla imports (by value, %)	Share of vanilla in the value of total merchandize exports (%)		Share of total vanilla exports destined for the USA (by value, %)
	1985–1987	1995–1997	1995–1997	1985–1987	1995–1997	1995
Comoros	64.45	31.88	4.02	68.17*	42.25	29.39
French Polynesia	57.43	50.03	1.09	0.60	0.37	47.08
Indonesia	38.45	25.62	35.12	0.06	0.03	93.00
Madagascar	68.63	31.5	55.39	18.82	5.77	97.00
Mexico	67.33	31.55	0.66	<0.001	<0.001	26.95

[a] *Sources*: Governments in exporting countries, FAO Trade Yearbook, U.S. Department of Agriculture/Foreign Agricultural Service (2001); (*): in the period 1985–1986.

countries with smaller export shares include Costa Rica, French Reunion Island, Mexico, Tonga, and Uganda.

Vanilla bean prices depend partly on quality which, in turn, differs by source and variety. Moreover, the quality from each source or particular variety may vary over time according to the handling of the post-harvest operations, namely, drying, fermentation, and storage of beans before processing. Vanillin and humidity contents, and length of the bean define the quality of vanilla beans (Bourriquet, 1954). The variety "bourbon" (mainly produced in Comoros, French Polynesia, and Madagascar) usually offers the highest quality (Anand and Smith, 1986) and is relatively more expensive than others (see Table 1). Despite quality differences, all vanilla beans are close substitutes because they all can produce pure natural vanilla extract. In some countries, the quality of the pure vanilla extract is regulated. US regulations,[2] in particular, require a minimum of 35% alcohol content in any commercialized product named 'pure vanilla extract'. Regulations also differentiate between natural vanillin, extracted from vanilla beans, and artificial vanillin,[3] produced from industry by-products.

For the last 20 years, world prices and in particular US import prices of vanilla beans, regardless of origin, have declined. The first two columns of Table 1 show how nominal US import prices have declined between the mid-1980's and 1990s. In this study, one of our concerns is how the structure of the world market may partly explain this declining trend. Previous studies of the world vanilla market are based on models that emphasize the oligopoly power, due to comparative advantage, of large producers and exporters (Blarel and Dolinsky, 1995; De Melo et al., 1996; Metzel et al., 1999). However, these studies fail to take into account the dominant role of the few importers and the fact that the market may be segmented. In fact, an increasing number of exporters and a high concentration of importers characterize the structure of the world market for vanilla beans. From 1967 to 1997, the USA alone purchased each year about 50% of all world vanilla imports (FAO, 1997; UNCTAD, 1982). Other leading importers are France and Germany with import shares of 10 and 7%, respectively, in 1997 (FAO, 1997). As Table 1 indicates, the USA also represents the largest vanilla market for exporting countries. Responding to the high concentration of importers during the 1980s, some vanilla exporters, led by

[2] Under US Food and Drug Administration (FDA) regulations, "pure vanilla extract" must contain a minimum of 35% ethyl alcohol. A "single-fold" vanilla extract is prepared from 0.378 kg of first quality vanilla bean to meet the FDA standard. In the profession, the first quality of vanilla bean is also called "single-fold". A total of 0.756 kg of "two-fold" vanilla bean (that is twice as much quantity as the "single-fold") is used to prepare a single-fold vanilla extract. Classification of vanilla bean and its extract can extend to as many as 20-fold (Galinsky and Laws, 1998; Gallagher, 1993).

[3] Production of artificial vanillin started in the early 1960s and ever since its health effects have been questioned. It is far cheaper than the natural extract. Users affirm that natural and artificial vanillin are complementary; when combined, the two give even more pronounced flavour to dairy products and beverages.

Madagascar and Comoros, formed an alliance to gain bargaining power. Leading exporters outside the alliance, however, have increased their world market share over time. For example, Indonesia's volume share rose from 9% in 1980 to 23% in 1990 (FAO, 1997). As a result, the alliance could not prevent declining world and US import prices, and formally disbanded in the early 1990s. Also, the market liberalization policies adopted by exporting countries such as Madagascar led to the dissolution of vanilla marketing boards. These policies appear to have precipitated the decline of world and US import prices (Metzel et al., 1999).

Our focus is also on the fact that a sharp depreciation of the currencies of the exporting countries coincided with the fall of US import prices during the last 20 years. This depreciation was often caused by currency devaluations which were part of the market liberalization policies implemented to promote exports (Edwards, 1989; Reinhart, 1995). The real depreciation of currencies in selected exporting countries is illustrated in Fig. 1, which shows downward trends of the currency values especially for large exporters such as Indonesia and Madagascar. In this study, we employ theories that take account of high import concentration to explain the correlation between the sharp decline of vanilla market prices and the depreciation of exporters' currencies.

3. Market structure and PTM

Market structure plays an important role in the so-called 'new' theories of international trade. One of the important components of new trade theories, the PTM hypothesis (Krugman et al., 1987), offers an explanation for the link between exchange rate movements and price adjustments. According to PTM, trading partners — exporters in the past studies — who have market power can adjust their prices in reaction to changes in the strength of the other trading party's currency. In this case, EPT is incomplete because prices denominated in the price taker's currency do not fully reflect the change in the value of the exchange rate. Therefore, to test whether PTM occurs and affects price trends, we need to check the completeness of EPT and, at the same time, identify the presence of market power.

It should be noted that the law of one price is a basis for testing the completeness of EPT. The law of one price in relative terms is written as $\hat{r} = \hat{e} + \hat{r}^*$, where r and r^* represent the domestic and foreign prices of a given commodity, respectively, e the exchange rate (domestic currency per unit of foreign currency), and $\hat{\ }$ indicates relative changes. Alternatively, in terms of elasticity with respect to the exchange rate, the law of one price can be written as

$$\frac{\hat{r}}{\hat{e}} = 1 + \frac{\hat{r}^*}{\hat{e}}. \tag{1}$$

The left-hand side of Eq. (1) represents elasticity of price, denominated in domestic currency, with respect to exchange rate, which is 0 when EPT is complete, and otherwise differs from 0 (Bowen et al., 1998; Dornbusch, 1977; Krugman et al., 1987).

Although complete EPT may indicate a perfectly competitive market, the reverse is not always true. In fact, incomplete EPT may also occur in perfectly competitive markets if, for example, demand or supply elasticities are affected by changes in exchange rates. To test the PTM hypothesis, Knetter (1989) developed an empirical model that estimates the completeness of EPT and, at the same time, distinguishes between the two likely explanations of incomplete EPT; changing elasticity of demand or supply, and imperfect competition. In Knetter's model, the first-order conditions of the profit maximization problem for exporters are of the form $p_{it} = c_t\ [\varepsilon_{it}/(\varepsilon_{it} - 1)]$, where p_{it} is the export price in the exporter's currency, c_t the marginal cost and ε_{it} the price elasticity of demand facing the exporter. The subscripts i and t indicate the country of destination and time, respectively. The basic expression of the Knetter model is written as: $\ln p_{it} = \theta_t + \lambda_i + \beta_i \ln e_{it} + u_{it}$, where u_{it} is the error term and θ_t, λ_i, and β_i are the parameters that capture trend effects, country effects and exchange rate effects, respectively. Three cases are distinguished depending on the values of the parameters.

1. $\theta_t \neq 0$, $\lambda_i = 0$, and $\beta_i = 0$.
   This indicates a competitive export market since price equals marginal cost and prices are equal across destinations. In this case, EPT is complete and the main source of price variability is shifts in marginal costs.
2. $\theta_t \neq 0$, $\lambda_i \neq 0$, and $\beta_i = 0$.

This indicates an imperfectly competitive market, where there is price discrimination among destinations by the monopolist exporter but no exchange rate effect (no intervention to adjust price). This is the case when the price elasticity of demand in each importing country is constant over time.

3. $\theta_t \neq 0$, $\lambda_i \neq 0$, and $\beta_i \neq 0$.
   This reveals the existence of imperfect competition, where in addition to price discrimination among destinations, there is also price adjustment by the monopolist so that EPT is incomplete.

Other studies use the same approach to test or discuss the ability of Knetter's model to test for PTM (Abbott et al., 1993; Pick and Park, 1991; Yumkella et al., 1994).

Knetter's model is based on large exporters' behavior and allows for estimation of the impacts of market destination characteristics, changes in mark-up over marginal cost, and exchange rate movements on export prices. Earlier studies that have employed such models only focus on the behavior of large exporters and their ability to price discriminate in different import markets (Knetter, 1989; Pick and Park, 1991; Yumkella et al., 1994). No study has ever used Knetter's approach to identify market structure and test whether large importers also apply PTM.

4. Conceptual framework

4.1. Economic model

The profit π_t function for US vanilla bean importers and processors with a production function $f(\cdot)$, and the unconstrained first-order condition regarding vanilla bean inputs can be written as

$$\pi_t = p_t f(x_{1t}, x_{2t}, \dots, x_{nt}, L_t, K_t) - \sum_{i=1}^{n} x_{it} r_{it} - \omega_t L_t - c_t K_t, \quad (2)$$

$$p_t \frac{\partial f(\cdot)}{\partial x_i} = r_{it}\left(1 + \frac{1}{\eta_{it}}\right) \quad \text{(f.o.c.)}, \quad (3)$$

where $i = 1, 2, \dots, n$ exporting countries and $t = 1, 2, \dots, T$ represents time, p is the unit price in dollar of the alcohol extract, x the quantity of vanilla beans imported in kilograms, L the labor and K the capital, r, ω, and c represent the import price (c.i.f) of vanilla beans in US$/kg, the unit cost of labor, and the unit cost of capital, respectively and η_{it} is the price elasticity of vanilla bean import supply perceived by the USA.

It is assumed that the output (vanilla extract) market is competitive. The right-hand side of Eq. (3) is the value of marginal product, which should be equal to the factor price r_{it} under a perfectly competitive market supply ($\eta_{it} \to \infty$) of vanilla beans for the ith country. The term in parenthesis is the markdown to the value of marginal product in the monopsony model. Rearranging terms in Eq. (3), the import price of vanilla beans can be written as

$$r_{it} = p_t (\text{MPP}_x)_{it} \left(\frac{\eta_{it}}{\eta_{it} + 1}\right). \quad (4)$$

In Eq. (4), $\partial f(\cdot)/\partial x_i$ is rewritten as $(\text{MPP}_x)_{it}$ (marginal physical product) of factor x. As the notation indicates, MPP_x is allowed to vary over time. Taking the logarithms of the terms in Eq. (4) and including exchange rate terms, we propose the following econometric model for panel data:

$$\ln r_{it} = \theta_t + \lambda_i + \alpha \ln p_t + \beta_i \ln e_{it} + u_{it}, \quad (5)$$

where e is the exchange rate, u_{it} the error term, and the remaining variables are as defined above. The model in Eq. (5) serves as the basis for the identification of the market structure of vanilla beans and the evaluation of the impact of exchange rates, while allowing for differences in vanilla bean prices by country of origin and across time. An important feature of the model is that the impact of the supply elasticity on price specified in Eq. (4) is embedded in the parameters in Eq. (5). This is why the elasticity term is not specified in Eq. (5). Moreover, analogous to Knetter's model, a key assumption of this model is that the impact of exchange rate movement on prices mainly depends on whether or not this movement affects the supply elasticity perceived by importers. This is the main reason why the exchange rate variable is included directly in Eq. (5). This also allows a direct estimation of the completeness of EPT, because the coefficient on the exchange rate can be interpreted as the elasticity on the LHS of Eq. (1).

4.2. Interpretation of the parameters

The parameter θ_t captures the time trend and may include the change in MPP (quality of vanilla beans) over time. The λ_i reflects country effects; comparisons among the λ_i's may indicate differences in the elasticities of the supply curves facing the importer and price discrimination across exporting countries based on quality (MPP). Abbott et al. (1993) suggest that empirical models testing for PTM should include separate variables capturing the characteristics of the products (quality or origin) in addition to the variable representing price discrimination effects. In this study, there is not enough information to separate MPP from other country effects, but we realize that part of the disparity in vanilla bean prices by country is due to differences in quality of the beans. The coefficient α represents the inverse of the pooled elasticity of output price with respect to input price; α indicates the change in benefit margin and is expected to be positive. The parameter β_i indicates how import prices of vanilla beans adjust in response to changes in the exchange rate in country i. Holding all variables except the exchange rates in Eq. (5) constant, the estimate of β_i is the same as the value of the LHS of Eq. (1). To further illustrate the model, it is useful to describe the following three important cases.

1. $\beta_i = 0$ and $\lambda_i = 0$, for all i.
   This is the case of perfect competition with complete EPT and no price discrimination. The lack of market power does not allow the importer to affect import prices when the exchange rate varies, or to price discriminate among sources. The remaining part of Eq. (5) would state that import price is equal to the marginal value product.
2. All β_i's $= 0$ but some $\lambda_i \neq 0$.
   This is the case of complete EPT under imperfectly competitive market conditions with price discrimination. In this case, exchange rate movements have no direct impact on the supply elasticity of vanilla specified in Eq. (4) and do not affect import prices. Knetter (1989), and Pick and Park (1991) argue that the hypothesis of the invariance of elasticity in earlier studies relied on the assumption that any change in price is limited to a small movement along the demand curve. In the present case, we argue that the same assumption should hold for the supply curve facing the importer. However, although EPT is complete in this case, the market may still be imperfect. In fact, the supply elasticities perceived by the importer may be constant but they may differ across exporting countries. In other words, market power allows the importer to price discriminate by source, i.e. $\lambda_i \neq 0$ for the ith exporter. As stated above, some non-zero λ_i could also represent quality differences since the model is not able to separate quality effects from country effects.
3. $\beta_i \neq 0$ and $\lambda_i \neq 0$ for some i.
   This is the case of an imperfectly competitive market with incomplete EPT and price discrimination. The elasticities of supply curves, as perceived by importers of vanilla beans, vary with the exchange rates; hence, the markdown to the value of marginal product in Eq. (4) varies and affects prices so that the coefficient β_i is non-zero for some exporting countries. A non-constant supply elasticity can be attributed to market power, allowing a large importer to adjust its markdown to the value of marginal product or PTM as exchange rates move. This is similar to the behavior of a large exporter that has the ability to adjust its mark-up over marginal cost. Moreover, market power also allows the importer to price discriminate by sources, i.e. $\lambda_i \neq 0$. Again, the fact that λ_i is non-zero may capture pricing based on quality difference.

5. Data and procedure

This study includes five exporting countries (Comoros, French Polynesia, Indonesia, Madagascar, and Mexico) and one importing country, the USA; data are annual and cover the period of 1967–1997. Nominal exchange rates are IMF "official average period rates", except for French Polynesia for which data are from the FAO. Price-adjusted real exchange rates are calculated using the consumer price index (CPI). CPI data for all countries are from the IMF, except for Comoros. The Comoros data are from the World Bank and from publications of the Government of Comoros (2001). Proxies are used to represent the price variables because of data limitation. The unit value (value divided by quantity) of US imports of vanilla bean products (calculated using USDA data) is

Table 2
Price correlation among origins

	Comoros	French Polynesia	Indonesia	Madagascar	Mexico
Comoros	1	0.818	0.918	0.966	0.723
French Polynesia		1	0.869	0.818	0.657
Indonesia			1	0.901	0.735
Madagascar				1	0.816
Mexico					1

used as proxy for factor price. Output prices are represented by the producer price index (PPI) of vanilla extract using data from Bureau of Census (2001), Bureau of Labour Statistics (2001) and the Chemical Market Reporter (1972–1997).

There are many ways of presenting the panel data depending on different assumptions regarding the structure of the error terms. The expression in Eq. (5) is a fixed-effect model, and therefore, we are able to isolate country effects. This is also supported by the data that clearly indicate that prices received by each supply source are different (see Table 1). Preliminary testing reveals the presence of autocorrelation, and the time series process is identified using PROC ARIMA in SAS, which indicates a typical AR(1) model from the data in each cross-sectional unit. The data also display correlation between the import prices from different countries, especially Comoros, Indonesia, and Madagascar (Table 2). This is probably because these three countries are the dominant suppliers of vanilla beans to the US market. The Pearson coefficient between Comoros and Madagascar is particularly high at 97%. One reasonable explanation for this result is the geographical proximity of the two countries, which leads to almost identical weather conditions and product quality.

Given the above conditions, Parks' method (Parks, 1967), provided in the SAS PROC TSCSREG program, was used to estimate parameters in Eq. (5). Parks' method corrects for first-order autocorrelation, contemporaneous correlation, and heteroskedasticity. It estimates the first-order autocorrelation coefficient for each cross section from OLS residuals and uses these coefficients to transform the variables. The residuals from OLS estimation of the transformed equations are then used to obtain the estimated contemporaneous variance–covariance matrix of errors which is used to obtain consistent estimates of the parameters. Parks' method is criticized[4] for being overconfident in estimating the error covariance when the number of observations in each cross-sectional unit is smaller than or close to the number of cross-sectional units. However, in this study, we have a relatively long time series compared to the number of cross-sectional units. Prior to all estimations, one of the five dummy variables capturing country effects is dropped to avoid perfect collinearity. Also, time is divided into two periods, before and after 1980, using dummy variables. The Hausman test rejects the null hypothesis that estimates from the error–component model are consistent and efficient, while the estimates from the fixed-effect model are consistent.

6. Results and discussion

We estimate the parameters of two separate models: one using nominal prices and exchange rates and the other using real prices and exchange rates. Table 3, part (a), presents the estimates from the fixed-effects model using nominal prices as the dependent variable and nominal exchange rates as one of the independent variables. The coefficients on time and output price

[4] Beck and Katz (1995) argue that application of Parks' method for panel data estimation leads to underestimation of the standard error of its FGLS estimates and is in general overconfident compared with simple OLS especially when the ratio of number of time periods to the number of cross-sectional units is close to or less than one ($T/N \leq 1$). They show that correction of the contemporaneous correlation of the error may use too few observations for the estimation of the elements of the estimated variance–covariance matrix. They also criticize the use of unit-specific autoregressive coefficients, that is the treatment of first order autoregressive coefficient as different from unit to unit and suggest that a single pooled coefficient for all cross-section units would be better. Instead of Parks' method, Beck and Katz propose the panel corrected standard error (PCSE) method.

Table 3
Parameter estimates of the fixed-effect models for US import prices[a]

Cross-section unit	Intercept	Time effects, θ^b	Country effect, λ	Output price effect, α	Nominal exchange rate effect, β
(a) Nominal US import prices (dependent variable) and nominal exchange rate (independent variable)					
	−1.277 (1.089)	$\theta_1 = 0.031^*$ (0.018), $\theta_2 = 0.048^{***}$ (0.012)		0.858*** (0.274)	
Comoros			4.382*** (1.637)		0.743*** (0.283)
French Polynesia			−2.600 (3.630)		−0.341 (0.394)
Indonesia			0.344 (0.761)		0.107 (0.107)
Madagascar			1.502** (0.682)		0.217** (0.097)
Mexico					0.020 (0.056)
$R^2 = 0.60$					
(b) Real US import prices (dependent variable) and real exchange rate (independent variable)					
	−2.19* (1.159)	$\theta_1 = 0.034^{**}$ (0.018), $\theta_2 = 0.045^{***}$ (0.010)		0.910*** (0.263)	
Comoros			4.351** (1.798)		0.593** (0.299)
French Polynesia			0.265 (2.728)		−0.107 (0.288)
Indonesia			1.169 (1.757)		0.114 (0.241)
Madagascar			0.083 (1.544)		−0.09 (0.211)
Mexico					−0.768* (0.429)
$R^2 = 0.60$					

[a] Values in parentheses are standard deviations.
[b] $\theta_1 = 1$ for the period 1967–1980, and 0 elsewhere; $\theta_2 = 1$ for 1981–1997, and 0 elsewhere.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

are significant and positive as expected. For Comoros and Madagascar, the coefficients on nominal exchange rates are significant and indicate that the US importers apply PTM vis-à-vis vanilla beans imported from these two countries. For Comoros, the exchange rate coefficient indicates that a 1% nominal devaluation of the Comorian Franc results in a 0.74% reduction of the dollar import price of vanilla beans. In other words, of a 1% devaluation, only 0.26% is passed through to prices denominated in Comorian Franc. For Madagascar, a 1% nominal devaluation of the Malagasy Franc results in a 0.22% reduction in the US import price denominated in dollars, so that 0.78% passes through to the price denominated in Malagasy Franc and received by exporters. The high US import share of vanilla beans from Madagascar compared to Comoros (see Table 1) may partly explain the fact that EPT is more complete for Madagascar than for Comoros. The importers' market power may be limited when they face a relatively large vanilla exporter. Furthermore, the coefficients on country effects are also significant for Comoros and Madagascar and are evidence of discriminatory pricing of vanilla beans imported from these two countries. The results suggest that country effects are more due to differences in supply elasticities between exporting countries — importer's exercise of market power to price discriminate — than to differences in the quality of vanilla beans. If country effects were due to quality differences, we would expect the coefficient λ for French Polynesia, a producer of the highest quality vanilla beans, to be significant.

Table 3, part (b), presents the estimates from the fixed-effects model using real prices as the dependent variable and real exchange rates as one of the independent variables. The coefficients on the time dummies are significant, as before. The coefficient on output price is significant and positive as expected. For Comoros, both country effects and real exchange rate effects are positive and significant. A 1% real devaluation of the Comorian Franc results in a 0.59% reduction of the real price of vanilla beans from Comoros denominated in dollars; only 0.41% is passed through to the real price denominated in Comorian Franc. PTM is also observed in the case of Mexico, but the negative sign on the coefficient indicates that US importers increase the real dollar import price by 0.77% for a 1% real depreciation of the Mexican Peso. This behavior is interpreted in the literature (Bowen et al., 1998) as willingness on the part of US importers to save the small import share from Mexico, perhaps due to proximity and close trade links. Indonesia, the second largest supplier, and Polynesia appear to face no significant price adjustment when their exchange rates move.

In comparing Table 3(a) with (b), results show that parameter estimates, especially of the exchange rate effects, nominal versus real, are different. We do not have any specific explanation for this difference, which has also puzzled earlier PTM-related studies that use both real and nominal exchange rates and prices. One practical explanation is that traders rely more on nominal exchange rate and price data for their decisions because inflation data are weak, especially for developing countries. Nevertheless, the results are consistent for Comoros as the coefficients for exchange rate and country effects are significant in both models.

One concern with PTM-related studies in general, and with the model in this study in particular, is the aggregation over firms and the assignment of market power to a country. Generally it is firms, not countries, that engage in trade; hence the aggregation of all firms in a country into a single agent seems unrealistic. In the case of vanilla beans, however, there are reasons to believe that US vanilla importers have unified access to information on prices and exchange rates compared with exporters or isolated producers in developing countries.

7. Conclusion and implications

This paper investigates the market structure and estimates the impacts of exchange rate movements on prices for vanilla beans imported by the USA from five developing country producers of vanilla beans. The results of the study are consistent with the PTM theory which suggests that since the US imports on average more than 50% of the vanilla beans supplied world-wide, it exercises market power and can adjust prices when exchange rates vary. The US importers adjust vanilla bean import prices downward and increase their profit margins following currency devaluation in large vanilla exporting countries such as Comoros and Madagascar. This paper has shown that, in general, incomplete EPT does occur and, therefore, does contribute to the declining international prices on world markets for agricultural commodities such as vanilla where firms in the importing country have market power. The results also confirm remarks by Abbott et al. (1993) that monopsony or oligopsony power exists and has to be taken into account in the international markets of some food and agricultural products. An example is the oligopsony model for the world wheat market proposed by Carter and Schmitz (1979).

The results of this study have two major implications. First, for Comoros and Madagascar, a key macroeconomic policy such as exchange rate adjustment can lose its effectiveness for generating export revenue in the face of imperfect markets. This finding is very important, especially for small countries such as Comoros that have no bargaining power and are highly dependent on one export commodity. These results, although focusing on EPT, have similar implications with regard to the impacts of tax or tariff rate abatement when imperfect markets prevail.

Second, this study casts some doubt on the assumption of perfectly competitive global markets and the ability of individual small exporting countries to take advantage of policies under the WTO agenda. In the past, collusion on the part of vanilla producing countries and the late 'International Commodity Agreement' for many other commodities have been criticized as price distorting and nonmarket-based in alleviating price variation (Claessens, 1993). Such collusion, however, was a way to increase the bargaining power of exporting countries that face few large importers. Perhaps the full implementation of WTO provisions will increase competition and open new export markets for agricultural commodities and other products from developing countries. That will allow small countries to employ policy instruments such as currency devaluation and export tax reduction to improve their financial situation.

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