HAS EXCHANGE RATE VARIABILITY AFFECTED TROPICAL NON-TRADITIONAL EXPORTS: EVIDENCE FROM UGANDA'S FLOWER EXPORTS (1994-2001)

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Abstract:

This study examines the effects of exchange rate variability on Uganda's flowers exports during 1994-2001 by testing the central hypothesis that following the floating exchange rate regime, 'Uganda's exports of tropical flowers are negatively and significantly correlated with exchange rate variability.' The absence of pure *I(0)* or *I(1)* in the data, and lack of endogeneity and simultaneous bias problems invites us to apply *ARDL* approach to cointegration and *OLS*. The results suggest that although Uganda's flower exports are negatively correlated with exchange rate variability, the measured effects are insignificant.

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Keywords: Exchange rate variability, flowers exports, Uganda, dependent-economy

N.B. This is a Draft Working Paper, Any comments are welcome

I Introduction: Exchange Rate Variability and Trade

Following the breakdown of the Britton Woods system in February 1973, several countries have adopted a new system of flexible exchange rate regimes, inducing periodic volatilities in the exchange rates of the floating currencies. Theoretically, the effect of exchange rate variability on exports is still a debatable issue. One strand of literature (Friedman, 1953; and Johnson, 1969) argues that flexible exchange rates are beneficial to the economy as they promote trade and overall macroeconomic stability and that short-run fluctuations in exchange rates have no effects on trade volumes. On the other hand, some economists argue that partly because of market imperfections particularly in LDCs, hedging is both imperfect and very costly as a basis for avoiding exchange risk (e.g. Mundell, 2000; Doroodian, 1999; Krugman, 1989). Hence, exports may be negatively correlated with exchange rate variability in line with *risk-aversion* hypothesis. Differences in the theoretical literature suggest that alternative approaches to investigating the effects of exchange rate variability on exports remain largely an empirical issue.

Due to the ambiguities of its effects on exports at the theoretical level, several studies have attempted to empirically investigate the extent to which the uncertainty induced by high exchange rate variability might have been detrimental to world trade (Abbott, et.al. 2001; Doyle, 2001; Arize, 1995, 1996, 1997; Savvides, 1992; De Grauwe, 1988; Hooper and Kohlhagen, 1978). One strand of studies empirically reveals that exchange rate variability is not an important negative factor for exporters (e.g. Abbott, et.al. 2001; Doyle, 2001). However, another group of studies provide evidence, which suggests that exchange rate variability is an important negative factor among exporters (Kihangire, Potts and Cameron, 2005; Kihangire, 2004; Sukar and Hassan, 2001; Sekkat and Varoudakis, 2000, 2002; Saurer and Bohara, 2001; Hassan and Tufte, 1998; Doroodian, 1999; Arize, 1995, 1996; Ghura and Grennes, 1993; Grobar, 1993; Savvides, 1992; Bahmani-Oskooee, and Ltaifa, 1992; Bini-Smaghi, 1991; De Grauwe, 1988).

In spite of the above studies, another group of studies reveals that the effect of exchange rate variability on exports is ambiguous: positive or negative (Du and Xu, 2001; Klaassen, 1999). Although most studies have focused on industrial countries with a high proportion of manufactured exports, there are hardly any studies examining the impact of exchange rate variability on exports of specific agricultural primary commodity dependent economies such as those in SSA (e.g. see Klaassen, 1999). It is Klaassen's (1999) viewpoint that in order to try to answer the ambiguity that surrounds the effects of exchange rate variability on exports, further studies should focus on developing countries with high time-variant exchange rates. Departing from Klaassen's (1999) standpoint, this paper aims at contributing to the literature by empirically examining the long-run effects of exchange rate variability on Uganda's exports of under the floating exchange rate regime.

In Uganda, the government adopted a floating exchange rate regime in November 1993, partly to improve the incentives to the exporters by removing the implicit taxation to exporters and related rent-seeking activities (Reinikka, and Collier, 2001). Since then, the exchange rate for the shilling to the United States Dollar (*Shs/US$*) has been flexible and at times very volatile. However, there are mixed (largely speculative) views regarding the effects of exchange rate variability on Uganda's predominantly agricultural primary commodity exports. From Henstridge and Kasekende's (2001) viewpoint, it is argued that "…although subsequent periods of [*exchange rate*] turbulence have taken place, the overall performance of the foreign exchange market as a way to determine the exchange rate and allocate foreign exchange has been good enough for it not to have been called into question" (p. 56). Departing from Klaassen's (1999) standpoint, this study adopts the risk-aversion hypothesis to investigate the effects of exchange rate variability on Uganda's exports of flowers under the floating exchange rate regime. We test the central hypothesis that Uganda's flowers exports are invariant to exchange rate variability.

II Theoretical Framework and Hypotheses

Consistent with Klaassen (1999), we adapt an analytical framework encompassing two concepts: the mean-variance-analysis (Tobin, 1959; De Grauwe, 1988) and the *augmented* imperfect substitution model (Goldstein and Khan, 1978; 1985). The simplified model comprises five equations, given by:-

$$X_S = f([P_X/P]*REER, CU, TOT, V) \quad \text{.....(1)}$$

$$f_1,\ f_2,\ >0;\ f_3 \pm 0;\ f_4 < 0$$

$$X^D = g([P_X/P_X^*]*REER, Y^*, TOT, V) \quad \text{.....(2)}$$

$$g_1,\ g_4,\ <0;\ \ g_2,\ g_3, >0$$

$$X^S = X^D = X \quad \text{.....(equilibrium).....(3)}$$

$$\Delta X^S = (X^S - X_{t-1}) \quad \text{.....(disequilibrium).....(4)}$$

$$\Delta P_X = f(X^D - X) \quad \text{...(disequilibrium).....(5)}$$

Where,

X^S = Uganda's real export supply value index for flowers (based on US dollar earnings);

P_x / P = The ratio of Uganda's flowers export price index, P_x (approximated by Uganda's overall export index) to domestic price levels, P (i.e. domestic export competitiveness vis-à-vis non-traded goods);

P_x / P_X^* = The ratio of Uganda's flowers export price index, P_x **,** to world export price levels, P_X^* (i.e. Uganda's external export competitiveness vis-à-vis other export substitutes from the rest of the world);

P = Uganda's domestic price levels (proxy of prices of non-traded goods);

P_x = Uganda's (f.o.b.) flowers export price index[1];

CU = Represents capacity utilisation for Uganda's industrial sector;

Y^* = Represents world income for Uganda major trade partners;

$REER$ = Uganda's real effective exchange rate, (an internal competitiveness factor);

TOT = Uganda's net barter terms of trade; and

[1] The general export price index is used as a proxy due to lack of Uganda's commodity export price data on these commodities.

V = A measure of exchange rate variability.

And X^D and X are world export demand and equilibrium export supply respectively; P_X^* is world agricultural export price index, and Y^* is world income of Uganda's major trading partners, and other variables as defined above. Equation (1) suggests that Uganda's exports supply of flowers is a positive function of relative export price, real levels of exchange rate, and capacity utilisation; and a negative function of exchange rate variability. However, Uganda's exports supply of flowers is ambiguously correlated with terms of trade in line with the Prebisch-Singer thesis. Equation (2) suggests that the world demand for Uganda's flowers exports is a negative function of relative export price, the levels of exchange rate, and exchange rate variability; and a positive function of world income and terms of trade. Equation (3) suggest that the flowers export market might be in equilibrium; while equations (4) and (5) suggest that due to some structural problems, it might be in disequilibrium.

There are several theoretical reasons explaining why exports might be negatively correlated with exchange rate variability (Abbott, 2001, Akhtar and Hilton, 1984, IMF, 1984).

- Since most export contracts in Uganda are priced and paid for in foreign currency, exchange rate variability affects export earnings valued in domestic currency.
- Export contracts may involve long time lags due to production delays, delivery lags and the actual settlement date, all of which may increase the extent of uncertainty.
- Imperfections regarding hedging facilities may make it difficult to fully anticipate and contain uncertainty caused by exchange rate variability.
- The extent of export product diversification, and market power determines a firm's ability to suffer or export the risk.

It can be inferred from the above that exchange rate variability might be a major source of uncertainty regarding prices exporters receive measured in domestic currency terms. If Ugandan flowers exporters are sufficiently *risk-averse*, such variability could be detrimental to the exports growth as agents reduce

their export volumes in line with the risk-aversion hypothesis (Baum, Barkoulus and Caglayan, 2002; De Grauwe, 1988; Hooper and Kohlhagen, 1978; Ethier, 1973).

The above suggests that it is possible to empirically investigate the impact of exchange rate variability on Uganda's exports under three possible frameworks:

(a) Single equation structural export supply, model (equation 1);

(b) Reduced-form equilibrium export quantity econometric model (equations 1, 2, and 3); or

(c) Reduced-form disequilibrium export quantity econometric model (1, 2, 3, 4 and 5) above.

Since the world demand for Uganda's exports of tropical flowers may be assumed exogenous in line with a small country-assumption, our analysis focuses on the structural export supply function, mindful of the endogeneity and simultaneous bias considerations among the various determinants in the model.

III General-to-Specific Estimations ARDL-ECM Estimations and Bounds-tests

The corresponding *ARDL-ECM* structural real export supply econometric model re-representation for Uganda's tropical flowers exports may be expressed as:-

$$\log \Delta X_t^S = \beta_0 + \sum_{i=1}^{l-1} \beta_{1i} \Delta \log (P_X / P)_{ti} + \sum_{i=1}^{m-1} \beta_{2i} \Delta \log CU_{ti} + \sum_{i=1}^{n-1} \beta_{3i} \Delta \log REER_{ti} + \sum_{i=1}^{p-1} \beta_{4i} \Delta \log TOT_{ti} + \sum_{i=1}^{q-1} \beta_{5i} \Delta V_{ti} + ..$$
$$+ \gamma \log X_{t-1}^S + \gamma_1 \log (P_X / P)_{t-1} + \gamma_2 \log CU_{t-1} + \gamma_3 \log REER_{t-1} + \gamma_4 \log TOT_{t-1} + \gamma_5 V_{t-1} + \upsilon_t \quad \text{.....(6)}$$

On the basis simplified estimated model (6), we carried out *bounds tests* using the calculated *F-statistic* and tested the null hypothesis H_0 of 'no long-run relationship' vis-à-vis H_A as:

$$H_0 : \gamma = \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0 \quad \text{.....(7)}$$

$$H_A : \gamma \neq \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0 \quad \text{.....(8)}$$

Support for existence of a long-run relationship prevails if there is insufficient evidence to accept H_0 in (12) and hence the corresponding *ARDL-ECM* long-run parameter estimates are derived from (11) above in an equation of the form:-

$$\log X_t^S = \varphi_1 \log (P_X / P)_t + \varphi_2 \log CU_t + \varphi_3 \log REER_t + \varphi_4 \log TOT_t + \varphi_5 V_t \quad \text{.....(9)}$$

Where

$$\varphi_1 = \frac{\gamma_1}{\gamma}; \quad \varphi_2 = \frac{\gamma_2}{\gamma}; \quad \varphi_3 = \frac{\gamma_3}{\gamma}; \quad \varphi_4 = \frac{\gamma_4}{\gamma}; \quad \varphi_5 = \frac{\gamma_5}{\gamma} \qquad \text{.....(10)}$$

IV Empirical Results

The source of data for the study, and the construction of the various series is as explained in appendix (1).

Unit Root Considerations

The analysis of data for unit roots revealed that there is lack of pure *I(0)* or pure *I(1)* for all the series in the model. This suggests that *ARDL*-approach to cointegration (Pesaran, Shin and Smith, 2001) may be an appropriate method for analysis. In addition, we examined the various aspects relating to autocorrelation, exogeneity, simultaneous bias, heteroskedasticity, and multicollinearity before undertaking any diagnostic tests in order to obtain interpretations based on reliable, consistent, and efficient estimations[2]. In general, the results suggested that:-

- There is lack of pure *I(0)* and *I(1)* for all the series. Likewise there was insufficient evidence of endogeneity and simultaneous bias problems. Hence the study adopted *ARDL* approach to cointegration and *OLS* estimation methods;
- Estimations from the corresponding autocorrelation functions from the cointegrating equations revealed some evidence of serial autocorrelation. This is expected, given that we are dealing with time series data, and the fact that there are no lagged dependent variables;
- There was insufficient evidence of heteroskedasticity in the initial cointegrating estimations;
- Based Hausman-specification tests for exogeneity, there was insufficient evidence of endogeneity among the various explanatory factors, particularly the exchange rate variability as the *focus variable*;
- Based on Hausman-specification tests for simultaneous bias, there was insufficient evidence of simultaneity between export supply and export demand via the relative export price variable.
- The results of the various variance inflation factors, *VIFs*, revealed that multicollinearity was not a worrisome problem, particularly with regards to the *focus variable* i.e. exchange rate

[2] Details of the results and their corresponding interpretations are available from author on request

variability: the calculated *VIFs* for exchange rate variability was less than 2, agiant the rule of thumb of 10. Hence,

- ARDL approach to cointegration was adopted as an appropriate estimation method for investigating the effects of exchange rate variability on flowers exports.

The results of the initial *ARDL-ECM* estimations suggest that all the initial static flower export supply models pass all the diagnostic tests relating to serial correlation, functional specification, as well as homoskedasticity. On this basis, reductions of variables to the corresponding parsimonious models (Tables 10.6(b)) below) were possible, starting with those variables found to be least significant.

Table 10.6(b): Results of General to Specific Flowers Export Supply Estimations, 1994M1-2001M12

	MONTHLY LAGS											
	0	1	2	3	4	5	6	7	8	9	10	11	12
C	5.4013*												
	(1.8986)												
T	0.0129*												
	(3.2698)												
DLFLOW				0.9240*									
				(2.9634)									
DSQLFLOW				-0.2681*									
				(-2.8710)									
DLCUIID	7.5183*	-34.823*	(-24.056*	-14.5193*	-6.1468*								
	(3.2999)	(-2.9464)	(-2.72650)	(-2.6585)	(-2.6380)								
DLTOTU					1.4626*								
					(2.9615)								
DLPXCPI	0.8891**			-0.8853**									
	(1.8841)			(-1.9044)									
DLNEERO					5.3623*								
					(2.6028)								
DLVNEERO				0.1362*									
				(2.0278)									
LFLOW		-0.5516*											
		(-5.6371)											
LTOTU(-1)		-0.54184											
		(-0.4855)											
LCUIID(-1)		52.6459*											
		(3.3999)											
LPXCPIH(-1)		0.5900											
		(0.5953)											
LNEERO(-1)		-2.2837**											
		(-2.0264)											
LVNEERO(-1)		0.0140											
		(0.1707)											
R2-Bar					0.56586								
DW Statistic					2.0794								
RSSR					2.8023								
Serial Correlation	χ^2 (12) (LM version)				8.9875 (0.704)								
Functional Form	χ^2 (1) (LM version)				0.2812 (0.596)								
Normality	χ^2 (2) (LM version)				1.7387 (0.419)								
Heteroskedasticity	χ^2 (1) (LM version)				0.1150 (0.734)								

Source: Based on data collected from Uganda, May-July 2002 (files FLOW99.OUT; RSLTCF.xls)

An *F-test* for the null hypothesis that 'variable deletion is data-permissible' against the alternative hypothesis that 'variable deletion is not data permissible' suggests that each of the corresponding calculated *F-statistic* of 0.6014; 0.1613; 0.1615; and 0.3945 respectively was much lower than the tabulated $F_{(38, 84)}$ statistic of 1.59 at the 5% level of confidence[3]. Hence, there was insufficient evidence

3 For details, results in electronic files FLOW99.OUT flowers

to reject the null hypothesis that 'variable deletion is data permissible'. The diagnostic tests also suggested that the parsimonious empirical models in Table 2 pass all the diagnostic tests relating to serial correlation, functional specification, normality, heteroskedasticity, as well as prediction.

V Results of the Long-Run ARDL-Approach to Cointegration

On the basis of the parsimonious model, the study applied *bounds-test* analysis for cointegration. The calculated *F-statistics* (Table 1) were much higher than the tabulated critical values of *I(0)=2.649; I(1)=3.805* (intercept, with no trend) at the 5% level of confidence (See Pesaran and Pesaran 1997: 478). This suggested lack of sufficient evidence to accept the null hypothesis of a 'no long-run relationships between Uganda's structural exports supplies of flowers and their major determinants. Similar analysis based on each of the nine different market conditions mentioned above yielded results leading to similar conclusions (see Table 2 for flower exports).

Table 1: CALCULATED F-BOUND TESTS (*Critical. Bounds Value: I(0) = 2.6459; I(1) =3.805)*

	F-BOUNDS STATISTIC FOR FLOWERS
	(1) F Statistic F(7, 72)= 5.9689[.000]=>*I(1)*
	(2) F Statistic F(7, 72)= 5.8820[.000]=>*I(1)*
	(3) F Statistic F(7, 72)= 7.7999[.000]=>*I(1)*
	(4) F Statistic F(7, 69)= 7.8765[.000]=>*I(1)*
	(5) F Statistic F(7, 83)= 2.5086[.022]=>*I(0)*
	(6) F Statistic F(7, 81)= 5.2606[.000]=>*I(1)*
	(7) F Statistic F(7, 72)= 5.9884[.000]=>*I(1)*
	(8) F Statistic F(7, 72)= 4.3522[.000]=>*I(1)*
	(9) F Statistic F(7, 72)= 6.6216[.000]=>*I(1)*

Source: Based on Results of F-bounds statistic tests derived from ARDL-ECM GTS estimations

On this basis, the study concluded that the long-run relationship between Uganda tropical flower exports and its determinants was possible on the basis of the *ARDL* approach to cointegration. The results (Table 2) are the basis of discussions in the subsequent section.

Table 2: Effects of Exchange Rate Variability on Uganda's exports of flowers (1994-2001): Results of long-run elasticities based on *ARDL* approach to Cointegration

(b) EFFECTS OF EXCHANGE RATE VARIABILITY ON EXPORTS OF FLOWERS, 1994 - 2001

	STRUCTURAL FLOWER EXPORT SUPPLY					CAP.	TOT	REL.TO DOM. PRICE		LOG-EXCHANGE RATE									EXCHANGE RATE VARIABILITY (LOG STDD DEVIATION OF 3-MONTHS EXCHANGE RATE)									
	ARDL (REAL EXPORT EARNINGS INDEX)				CONST	LCUID	LTOTU	LPXCPIH	LPXCPIU	LNEERo	LNEERp	LREERoh	LREERph	LREERimf	LNEERo	LNEERp	LREERou	LREERpu	LVNEERo	LVNEERp	LVREERoh	LVREERph	LVREERmf	LVNEERo	LVNEERp	LVREERou	LVREERpu	*AKAIKE INF. CRITERIA*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
19	FLS111	1	HEADLINE	LNEERo	19.702*	5.579	6.833**	4.484		3.911									-0.146									
	FLS111	9			*(-2.895)*	*(1.091)*	*(1.826)*	*(1.581)*		*(1.116)*									*(-0.532)*									
20	FLS122	9		LNEERp	-16.656*	6.771	8.193*	6.194*			1.018									-0.264								ARDL(1,0,3,0,0,0)
	FLS122	4			*(-2.476)*	*(1.238)*	*(2.129)*	*(2.178)*			*(0.293)*									*(-0.890)*								
21	FLS133	M		LREERoh	-18.228*	8.087	8.057*	6.304*				2.015									-0.675							ARDL(3,0,0,0,0,1)
	FLS133	1			*(-1.958)*	*(1.056)*	*(2.052)*	*(2.403)*				*(0.575)*									*(-1.334)*							
22	FLS144	-		LREERph	-15.274*	6.544	8.065*	6.492*					0.504									-0.575						ARDL(1,0,3,0,3,0)
	FLS144	2			*(-2.034)*	*(1.163)*	*(2.366)*	*(2.980)*					*(0.173)*									*(-1.528)*						
23	FLS155	0		LREERimf	-14.069	8.992	8.443*	6.421*						-0.556									0.115					ARDL(1,0,3,0,0,2)
	FLS155	0			*(-1.331)*	*(1.488)*	*(2.464)*	*(3.113)*						*(-0.186)*									*(0.282)*					
24	FLS166	1	UNDERLYING	LNEERO	---	---	---		---						---									---				...
	FLS166	M			--	--	--		--						--									--				
25	FLS177	1		LNEERP	-4.281	6.755	2.006		6.206*							1.017									-0.267			ARDL(1,0,3,0,0,0)
	FLS177	2			*(-0.589)*	*(1.236)*	*(1.394)*		*(2.189)*							*(0.293)*									*(-0.898)*			
26	FLS188			LREEROU	0.651	64.333***	2.590		8.898*								-2.037									-0.444		ARDL(3,2,3,0,0,0)
	FLS188				*(0.083)*	*(1.679)*	*(1.226)*		*(2.561)*								*(-0.502)*									*(-1.245)*		
27	FLS199			LREERPU	1.813	62.497**	2.831		9.259*									-2.881									-0.406	ARDL(3,2,3,0,0,0)
	FLS199				*(0.237)*	*(1.742)*	*(1.409)*		*(2.871)*									*(-0.727)*									*(-1.161)*	

Source: Based on data on Uganda compiled from *BOU, UBOS, UCDA, IMF, URA* (May-July 2002) (See Kihangire, 2004)

V Interpreting the Results for Uganda's flowers Exports Supply

The study has estimated Uganda's structural export supply function of fresh tropical flowers to investigate the research hypothesis that Uganda's tropical flowers exports are negatively and significantly correlated with exchange rate variability. In general, the study found insufficient evidence to accept the research hypothesis. Although Uganda's flowers exports were negatively correlated with exchange rate variability in all the eight perspectives considered, the measured effects were insignificant even at the 10% level of confidence. Consistent with the research objectives, the following observations can be made:-

- Does exchange rate variability matter for Uganda's exports of tropical flowers? The empirical evidence suggests the affirmative: Uganda's flowers exports were negatively correlated with exchange rate variability in line with risk aversion theory under the floating exchange rate regime.
- Does nominal exchange rate variability matter for Uganda's flowers exports? The observed negative but insignificant elasticity suggests that although nominal exchange rate variability in the inter-bank foreign exchange market might matter for Uganda's flowers exporters, the overall effect is an insignificant factor.
- Does real exchange rate variability matter for Ugandan tropical flowers exports? The observed negative but insignificant relationship suggests that it might be a less important negative factor among Ugandan fresh flower exporters.
- Does exchange rate variability in different foreign exchange markets (i.e. inter-bank vis-à-vis bureau) matter for Ugandan exporters? Although the empirical evidence suggests a negative relationship exists in line with risk-aversion in each foreign exchange market, the overall effect is insignificant.

Overall, the results of the study suggest that although Uganda's exports of flowers are negatively correlated with nominal effective exchange rate variability in both the 'interbank' and 'bureau' foreign exchange markets, the measured effects are insignificant. The average elasticity of responsiveness was -0.35 under the floating exchange rate regime. In particular, Uganda's exports of flowers were found to be negatively correlated with exchange rate variability in all the nine scenarios considered, although none was significant even at the 10 percent level of confidence.

These results are partly explained by the fact that exports of fresh tropical flowers are highly perishable. Hence, against conditions of high and unstable exchange rate variability, farmers have no option apart from exporting otherwise they face what Doyle (2001) has called 'weather thy storm or face the consequences of loss of income or exit from the market'.

VI Evaluating the Consistency of Results with Respect to Economic Theory

For each estimated flowers structural export supply function, the study estimated the corresponding marginal coefficient (long-run elasticity) of Ugandan flowers exports with respect to exchange rate variability using *ARDL* approach to the cointegration. In each case, the measured elasticity was negative, and consistent with risk-aversion theory.

For example, with respect to the control variables, Uganda's flowers export supplies were found to be consistently and positively correlated with relative export price in line with comparative advantage theory, although the measured effects were insignificant. The elasticity of flowers exports with respect to the terms of trade factor as well as relative prices were found to be highly positive (8.4 and 6.5 respectively), which may be explained by the comparative advantage theory. The coefficient on capacity utilisation was found to be highly positive but insignificant. This is partly explained by *vent for surplus* in Uganda's flowers export market. Following trade liberalisation and the adoption of the floating exchange rate regime, Uganda's flower industry

has emerged as one of the most important *non-traditional* exporter of flower commodities. It is likely that this sector has not yet reached its full production possibility frontier.

It is important to note that there is insufficient evidence of studies investigating the effects of exchange rate variability on flowers exports following adoption of the floating exchange rate regime. This makes it relatively difficult to discuss in detail the extent to which the results of this study encompass or support others.

From a broader perspective, the observed elasticity for Uganda's flowers commodity exports which, for example, overall averages -0.45 was generally consistent with other studies focusing on specific export sectors in line with risk-aversion theory. For example, in a study involving 22 African Countries, Sekkat and Varoudakis (2000) observed elasticities, which ranged between –0.47 and –0.51 for textiles; -0.30 and –0.36 for chemical products; and invariant for metal products. However, the results on Uganda also compare with other studies that found an invariant effect of exchange rate variability on exports in support of risk-neutrality theory (Abbott, Darnell and Evans, 2001; Bailey, Tavlas, and Ulan, 1986; Gotur, 1985). However, it is worth noting that the negative but insignificant relationship observed for Uganda's exports of flowers might also be explained by the perishability of fresh flowers exports: once ready, they must be harvested and sold off immediately since the lifespan of the product is short.

VII Evaluating the Consistency of the Different Results in the *Control Variables* with Respect to Economic Theory and their Implications for Different sub-Sector Exports in Uganda

It must be recalled that the main objective of this study was to investigate the effects of exchange rate variability on Uganda's fresh flower exports, following the adoption of the floating exchange rate regime. To achieve this, the study adopted a conceptual framework that controlled for the main factors (i.e. *the control variables*) theoretically considered to be affecting the supply of

exports so that one might obtain internally valid results. Hence, although it was beyond the focus of the study, it is intuitive for one to ask: what were the effects on Uganda's exports of flowers, of the main *control variables* and what are the implications of the different results for the fresh tropical flower export industry in Uganda? The following sub-section examines this issue focusing on the estimated long-run elasticities for: (a) relative nominal and real exchange rate, export prices relative to domestic price levels, (c) terms of trade, and (d) capacity utilisation.

i. Evidence of Uganda's Sub-Sector Export Supply Response Elasticities with respect to Levels of Nominal and Real Effective Exchange Rate

In section II, it was hypothesised that the supply of exports is positively correlated with the levels of the exchange rate in line with devaluation theory (elasticities approach to the balance of payments). The empirical evidence in this study provides support for the devaluation theory hypothesis: Uganda's export supply elasticities for flowers with respect to the levels of exchange rate were found to be positively correlated with the levels of exchange rate (elasticity of response was more than unity), consistent with the devaluation theory, although the measured effects were insignificant. These results suggest that although Uganda's aggregate supplies of flowers exports are positively correlated with the levels of exchange rate, this be an insignificant factor among Ugandan exporters of flowers, or that the flower industry is very competitive at the prevailing levels of exchange rate so that exporters do not see it as a problem. This is partly explained by the fact that high world demand conditions for fresh flowers, which result in high world prices for flowers overshadow the influence of exchange rate. Implicitly, it also suggests that Ugandan flower exporters are able to compete more favourably at the prevailing levels of exchange rate.

ii. Evidence of Uganda's Sub-Sector Export Supply Response Elasticities with respect to Levels of f.o.b. Export Prices relative to Domestic Price Levels

In section II above, we also reasoned that abstracting from market distortions, Uganda's export supplies of flowers should be positively correlated with realised own-export prices relative to

domestic price levels in line with comparative advantage and dependent-economy theories. The empirical evidence in this study suggests further support for the *dependent economy* theory in this respect. The elasticity of supply response of Uganda's exports of flowers with respect to export prices relative to domestic price levels was very high (average of +6.11). The implications are that policies that maintain export price competitiveness, by lowering domestic inflation might benefit Ugandan production and supply of flowers exports in line with the dependent economy theory.

(c) Evidence of Uganda's Sub-Sector Export Supply Response Elasticities with respect to Terms of Trade

In section II above, we hypothesised that Uganda's exports of fresh-flowers, being primary commodity exports of a primary-commodity dependent economy, are positively (comparative advantage theory) or negatively (Prebisch-Singer Hypothesis) correlated with the terms of trade. The empirical evidence suggests that the positive elasticity of response observed for Uganda's flowers exports (average of 8.6) is consistent with the comparative advantage theory hypothesis under the floating exchange rate regime. The implications are that policies to liberalise trade and exchange rate have benefited the flower export industry in Uganda.

(d) Evidence of Uganda's Sub-Sector Export Supply Response Elasticities with respect to Capacity Utilisation

It was also hypothesised in section II above that Uganda's fresh flowers export supply is a positive function of capacity utilisation. However, in a *dependent economy framework*, theory suggests that this relationship depends on whether or not the economy is below its full production frontier (hence a positive relationship) or at its full production possibility frontier (hence a negative relationship). The results for Ugandan exports of flowers indicate a positive but insignificant elasticity of response. In general, these results suggest that Uganda's fresh flower export industry might be close to its full production possibility frontier, although some slack capacity might exist. The implication of this is that to increase exports and overall output further,

competitive relative export price and exchange rate incentive policies must be accompanied by other non-market policy incentives to increase substantial investments in productivity and capacity in flower export industry so that Uganda's production possibility frontier can be shifted further outwards.

In summary, it can be concluded from the above discussions that having controlled for the main factors affecting flower exports supplies, Uganda's exports of flowers are negatively, although insignificantly, correlated with exchange rate variability. This is partly explained by the perishability of the fresh flowers, which once ready must be harvested and sold immediately. In addition, the elasticity of response of Uganda's fresh flowers commodity exports to its various determinants is also broadly consistent with the theory.

VIII Evaluating the Results with Respect to Methodological Issues

The second aspect of evaluation of the results pertains to methodological issues relating to: (i) encompassing and parsimonious; (ii) data-coherence; (iii) data admissibility, (iv) exogeneity; and (v) parameter stability. Firstly, with respect to data-coherency, there were no main specification errors relating to the randomness of the residuals. The results of diagnostic tests relating to flowers export supplies suggest that each of the corresponding parsimonious export model on which the long-run estimations are based passes all the necessary tests relating to serial correlation, model specification, normality, homoskedasticity and predictive ability.

Secondly, based on Hausman specification tests for exogeneity, the study did not find sufficient evidence to accept the null hypothesis that there is a 'contemporaneous relationships between the various regressors, the *focus variable* and the error term' for each of the flower export supply functions estimated for Uganda. These results suggest that the various regressors, including the exchange rate variability as the *focus variable*, are truly exogenous.

Thirdly, on the basis of the Hausman specification tests for simultaneous bias, the study investigated the extent of simultaneity between Uganda's 'structural export' supply and demand functions for Ugandan exports of flowers via their respective relative export price factors. The results revealed that there was insufficient evidence to accept the null hypothesis that there is a 'contemporaneous relationship between the various regressors and the error term'. On these bases, it can be concluded that the corresponding results based on *ARDL* approach to cointegration and *OLS* related estimation technique are consistent and efficient.

Fourthly, the study considered the issue of data-admissibility on the basis of *F-tests* for variable deletion for the general-to-specific parsimonious models. The corresponding results of the *F-tests* for the various flower export models estimated revealed that the *bounds-tests* for variable deletions were data-permissible. Finally, the study examined the parameter stability of the various parsimonious export supply models for Ugandan flowers exports based on recursive tests. The results suggested that the underlying parsimonious *ARDL-ECM* models passed the necessary stability tests.

In general, the differences between the results of this study vis-à-vis other studies in industrial countries may partly be attributed to lack of well developed hedging markets in Uganda following the adoption of the floating exchange rate regime. The perishability of Ugandan tropical fresh flowers exports also partly explains the differences.

IX Concluding Remarks and Policy Implications

This study aimed at investigating the effects of exchange rate variability on Uganda's exports of flowers by testing the hypothesis that Uganda's fresh tropical flower exports are negatively correlated with exchange rate variability. Having controlled for the main factors in the theoretical debate of primary commodity dependent economies, the results suggested that Uganda's fresh

flowers exports were negatively, although insignificantly, correlated with exchange rate variability:

To some extent, the above results support the *risk-aversion* hypothesis, which, in line with Doroodian (1999), may partly be attributable to lack of well-developed hedging facilities and institutions in Uganda's foreign exchange market. They may also reflect the view that Ugandan exporters of fresh flowers are *risk-averse* although the measured effects are insignificant. In general, although relative prices, terms of trade, capacity utilisation, a competitive exchange rate and other factors are important for Ugandan flower exports growth, exchange rate variability may be an insignificant factor in relation to other policies aimed at supporting the growth of this sub-sector category of Ugandan exports.

APPENDIX

The table below provides a summary of the main variables and the sources of data.

Appendix Table 1: Description of key variables used in the specific agricultural commodity export models

	VAR LEVEL	LN OF LEVE	DIFF. OF LN	DESCRIPTION OF VARIABLE NAME	SOURCE
1	GRXPTS	LGRXPTS	dLGRXPTS	Gross Exports, (mn US$)	**URA/BOU**
2	REXPTDX	LREXPTDX	dLREXPDX	Real Export Expenditure Index (1990=100)	Constructed
3	VCOF			Value of Coffee (US$mn)	BOU/UCDA
4	VTEAdx			Value of Tea (US$mn)	BOU
5	RVCOF	LRVCOF	dLRVCOF	Log Real Value of Coffee Index, 1995=100)	Constructed
6	RVTEA	LRVTEA	dLRVTEA	log Real Value of Tea Index 1995=100	Constructed
7	VFISH			Value of Fish Exported (US$)	BOU
8	VFLOW			Value of Flowers Exported (US$)	BOU
9	RVFISH	LFISH	dLFISH	Real Fish Export index (Sep 1995=100)	Constructed
10	RVFLOW	LFLOW	dLFLOW	Real Flower Export index (Sep 1995=100)	Constructed
	FOCUS VARIABLE				
11	VNEERo	LVNEERo	dLVNEERo	Variability of NEER, Interbank Market, 1993/94=100)	Constructed
12	VNEERp	LVNEERp	dLVNEERp	Variability of NEER, Bureau Market, 1993/94=100)	Constructed
13	VREERoh	LVREERoh	dLVREERoh	Variability of REER, Interbank Market, based on Headline CPI, 1993/94=100)	Constructed
14	VREERou	LVREERou	dLVRERou	Variability of REER), Interbank Market, based on Underlying CPI, 1993/94=100)	Constructed
15	VREERph	LVREERph	dLVRERph	Variability of REER, Bureau Market based on Headline CPI, 1993/94=100)	Constructed
16	VREERpu	LVREERpu	dLVRERpu	Variability of REER, Bureau Market, based on Underlying CPI, 1993/94=100)	Constructed
17	VREERimf	LVREERmf	dLVRERmf	Variability of REER, Uganda (IMF Series, 1995=100)	Constructed
	CONTROL VARIABLES				
18	GRXPTS	LGRXPTS	dLGRXPTS	Gross Exports, (mn US$)	**URA/BOU**
19	NEERo	LNEERo	dLNEERo	Nominal Effective Exchange Rate, (NEER) Interbank Market, 1993/94=100)	Constructed
20	NEERp	LNEERp	dLNEERp	Nominal Effective Exchange Rate, (NEER) Bureau Market, 1993/94=100)	Constructed
21	REERoh	LREERoh	dLREERoh	Real Effective Exchange Rate, (REER) Interbank Market Headline CPI, 1993/94=100)	Constructed
22	REERou	LREERou	dLREERou	Real Effective Exchange Rate, (REER) Interbank Market Underlying CPI, 1993/94=100)	Constructed
23	REERph	LREERph	dLREERph	Real Effective Exchange Rate, (REER) Bureau Market Headline CPI, 1993/94=100)	Constructed
24	REERpu	LREERpu	dLREERpu	Real Effective Exchange Rate, (REER) Bureau Market Underlying CPI, 1993/94=100)	Constructed
25	REERimf	LREERimf	dLREERimf	Real Effective Exchange Rate, (REER) Uganda (IMF Series, 1995=100)	**IMF(IFS)**
26	PxINDXu	LPxINDXu	dLPxNDXu	Uganda Export Prices, 1995=100	**BOU/URA**
27	TOTu	LTOTu	dLTOTu	Uganda Terms of Trade (Price of exports as a ratio of price of imports), (1995=100)	**BOU**
28	IIPWORLD	LIIPWOLD	dLIIPWOD	Index of Industrial Production in Industrial Countries, (1995=100)	**UBOS**
29	PxLDCs	LPxLDCs	dLPxLDC	Commodity Export Price Index in M & LDCs, (1995=100)	**IMF(IFS)**
30	PxWORLD	LPxWOLD	dLPxWOD	Commodity Export Price Index in World, (1995=100)	**IMF(IFS)**
31	PxAGRIC	LPxAGR	dLPxAGR	Commodity Export Price Index in Agriculture, (1995=100)	**IMF(IFS)**
32	IID	LIID	dLIID	Index of Industrial Production, (1995=100)	**UBOS**
33	CUIID	LCUIID	dLCUIID	Economic capacity, quarterly moving average trend index less actual Index of Ind.Prod.	Constructed*
34	PxCPIH	LPxCPIH	dLPxCPIH	Ratio of Export Price Index to Headline Consumer Price Index, (1995=100)	Constructed
35	PxCPIU	LPxCPIU	dLPxCPIU	Ratio of Export Price Index to Underlying Consumer Price Index, (1995=100)	Constructed
36	PxPxAGR	LPxPxAGR	dLPxPxAG	Ratio of Export Price Index to World Agric.Raw Materials export price Index, (95=100)	Constructed
37	PXCFPXAG	LPXCFPXAG	dLPXCFPXAG	log price of coffee relative to world agric. export price (1995=100)	Constructed
38	PXTEPXAG	LPXTEPXAG	dLPXTEPXAG	log price of tea relative to world agric. export price (1995=100)	Constructed
39	PCOFCPU	LPCOFCPU	dLPCOFU	Difference of Log of Relative coffee export price to Underlying Consumer Price Index (1995	Constructed
40	PTEACPU	LPTEACPU	dLPTEAU	Difference of Log of Relative Tea export price to Underlying Consumer Price Index (1995=1	Constructed
41	PCOFCPH	LPCOFCPH	dLPCOFH	Difference of Log of Relative coffee export price to Headline Consumer Price Index (1995=	Constructed
42	PTEACPH	LPTEACPH	dLPTEAH	Difference of Log of Relative Tea export price to Headline Consumer Price Index (1995=10	Constructed

Key: BOU: BANK OF UGANDA; UBOS: UGANDA BUREAU OF STATISTICS; URA: UGANDA REVENUE AUTHORITY; IMF: INT. MONETARY FUND

N.B. Due to lack of specific export price data for Uganda's exports of flowers, Uganda's general export index and the corresponding relative export prices are used as a proxy.

Source: As indicated in table, Series constructed are based on Data collected from Uganda during May-June 2002

The data for flowers exports and exchange rate was sourced from Uganda's balance of payments statistics compiled by the Bank of Uganda. Exchange rate and price indices data for Uganda's main trade partners was sourced from the IMF's IFS. Uganda's Consumer price index series was obtained from Uganda Bureau of Statistics. The series of nominal and real effective exchange rate were constructed as a weight.

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