

The background features a light beige color with a subtle grid pattern. Overlaid on this are several stylized gear icons in various shades of brown and tan, some of which are partially obscured or faded. The gears are of different sizes and are arranged in a way that suggests a mechanical or industrial theme.

# Exchange Rate Impact on Growth in Jamaica

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# Outline

- Motivation
- Objectives
- Empirical Literature
- Data and Methodology
- Results
- Conclusion and Policy Discussion

# Motivation

- To what extent can exchange rate movements stimulate real economic activity ?
- How are industries impacted by exchange rate movements?
- To what extent is the growth- exchange rate nexus influenced by inflation?

# Objectives

- **Time Series Estimation**

- Examine how exchange rate movements impact real economic activity.
- Determine the impact of exchange rate movements on tradable and non-tradable industries .
- Test the possibility of asymmetries of the growth- exchange rate nexus during high inflation episodes.

- **Panel Estimation**

- Explore the impact of exchange rate movements on the investment decisions of the manufacturing industry at the firm level.

# Empirical Literature

- Exchange Rate Causes Economic growth.

- *Rodrick (2008)*
- *Rapetti et al. (2011)*
- *Tarawalie (2010)*

- Economic Growth Determines The Exchange Rate.

- *Balassa-Samuelson effect.*
- *Houthakker-Magee-Krugman hypothesis.*

# Empirical Literature

- Rodrick (2008)
  - used cross-country panel regressions
  - found correlation of his measure of undervaluation with economic growth, especially in developing countries.
  - *Woodford (2009) critiqued the above : monetary policy alone cannot maintain a weak real exchange rate for long enough to serve as part of a long-run growth strategy.*
- Rapetti et al. (2011)
  - Used a dynamic panel approach using GMM to study of REER-growth relationship similar to Rodrick(2008)
  - showed that a depreciated exchange rate would have an expansionary impact on growth in developing countries.
- Tarawalie (2010)
  - employed the Johansson cointegration technique for the period 1990Q1–2006Q4
  - found supporting evidence that a depreciation of the REER, amongst other variables, increased output growth. Of note ,the REER was found to have the least effect on output growth.

# Empirical Literature

- Di Mauro et al. (2008)
  - investigated the impact of exchange rate changes on euro area economy
  - Found that the impact of exchange rate changes on euro area export volumes of goods may have declined over time.
- Campa and Golberg (1999)
  - studied the REER-growth relationship of United States, Canada, the United Kingdom, and Japan
  - showed that the sensitivity of investment, and ultimately growth, to exchange rates movements varies over time.
- Razin and Rubinstein (2006)
  - employed the GMM approach in the study of 106 low and middle income countries.
  - the relationship between the exchange rate and economic growth was not stable over time or clear-cut due to the existence of nonlinear effects.

# Empirical Literature

- McPherson et al, (2000)
  - For the period 1970 to 1996, found no evidence of a strong direct relationship between changes in the exchange rate and GDP growth in Kenya.
  - Used a fully specified (but small) macroeconomic model, a single equation instrumental variable estimation, and a vector-autoregression model
  - Concluded that improvements in exchange rate management alone is not sufficient to stimulate growth in Kenya, without a broader program of economic reform.
- MacFarlane (2002), Di Mauro et al (2008) and others
  - Found a more distinct link between the exchange rate and inflation, and states that inflation increases uncertainty that impedes economic growth.



# Data and Methodology

- Data
  - Quarterly time series data covering the period 1992:Q1 to 2012:Q1.
  - Annual panel data of the companies listed on the JSE
- Times Series Estimation of the impact of exchange rate movements on economic activity using a GMM and VECM frameworks.
  - Considers the following measures of exchange rates:
    - i. The REER
    - ii. the nominal end-of-period and;
    - iii. the nominal quarterly average exchange rates
  - Considers asymmetric impact on Nontradables and Tradable industries
  - Considers nonlinear impact during high inflation and low inflation

# Data and Methodology

## Times Series Models

### GMM

$$\Delta y_t = c + \Delta y_{t-1} + \gamma_1 FD_{t-1} + \gamma_1 e_t + \Delta TI_{t-1} + \Delta GB_{t-1} + \pi_{t-1} + \Delta edu_{t-1} + dumgdp + FDI_{t-1} + \varepsilon_t$$

### VECM

$$\Delta X_t = \alpha_0 + \varphi \times X_{t-1} + \sum_i c_i \times \Delta X_{t-1} + \varepsilon_t$$

# Data and Methodology

## Panel Model

- Panel Estimation examining the impact of exchange rate movements on the investment decisions of the manufacturing industry through an optimizing adjustment-cost model of investment.

$$\Delta I = \beta_0 + \beta_1(MKUP_{t-1})\Delta e_t + \beta_2\Delta sales_{t-1} + \beta_3\Delta r_{t-1} + \Delta I_{t-1} + \varepsilon_t$$

# Results

- Times series estimation

## Granger Causality Test

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Pairwise Granger Causality Tests	Levels		1st difference	
Null Hypothesis:	F-Statistic	Prob.	F-Statistic	Prob.
LXRATE1 does not Granger Cause LY	1.65	0.17	1.07	0.38
LY does not Granger Cause LXRATE1	1.11	0.36	1.07	0.38
LXRATE2 does not Granger Cause LY	0.84	0.51	0.40	0.80
LY does not Granger Cause LXRATE2	2.25	0.07	2.15	0.08
LREER does not Granger Cause LY	0.32	0.86	0.11	0.98
LY does not Granger Cause LREER	3.68	0.01	3.55	0.01

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# Times Series Results

- Cross correlation

	Nominal Exchange rate (End of period)		Nominal Exchange rate (Quarterly Average)		Real effective Exchange Rate	
	LY,LXRATE1(-i)	LY,LXRATE1(+i)	LY,LXRATE2(-i)	LY,LXRATE2(+i)	LY,LREER(-i)	LY,LREER(+i)
i	lag	lead	lag	lead	lag	lead
0	0.8273	0.8273	0.8259	0.8259	-0.0730	-0.0730
1	0.8067	0.8085	0.8044	0.8117	-0.0522	-0.1238
2	0.7854	0.7858	0.7827	0.7910	-0.0318	-0.1205
3	0.7561	0.7633	0.7548	0.7678	-0.0300	-0.0514
4	0.7408	0.7427	0.7400	0.7450	-0.0193	-0.0036
5	0.7149	0.7276	0.7139	0.7293	-0.0357	0.0221
6	0.6848	0.7112	0.6839	0.7139	-0.0808	0.0675
7	0.6813	0.7062	0.6796	0.7066	-0.0727	0.0906
8	0.6799	0.6944	0.6776	0.6959	-0.0384	0.1014
9	0.6667	0.6747	0.6637	0.6770	0.0077	0.0955
10	0.6411	0.6447	0.6379	0.6497	0.0370	0.0982

# Times Series Results

- Cross correlation

Changes in Nominal Exchange rate (End of period)			Changes in Nominal Exchange rate (Quarterly Average)		Changes in Real effective Exchange Rate	
	DLY,DLXRATE1(-i)	DLY,DLXRATE1(+i)	DLY,DLXRATE2(-i)	DLY,DLXRATE2(+i)	DLY,DLREER(-i)	DLY,DLREER(+i)
<b>i</b>	<b>lag</b>	<b>lead</b>	<b>lag</b>	<b>lead</b>	<b>lag</b>	<b>lead</b>
<b>0</b>	0.3292	0.3292	0.1935	0.1935	-0.0895	-0.0895
<b>1</b>	0.0098	0.2684	-0.0072	0.3803	0.0189	-0.2603
<b>2</b>	-0.0020	-0.0649	-0.1157	0.0471	0.0409	-0.3526
<b>3</b>	-0.1488	-0.1740	-0.0657	-0.1171	0.0429	0.1275
<b>4</b>	-0.1385	-0.0064	-0.1833	-0.0775	0.0209	0.2017
<b>5</b>	-0.0080	-0.0119	-0.0325	-0.0709	0.1394	-0.1372
<b>6</b>	0.0359	-0.0929	0.1796	-0.0141	-0.0133	0.1803
<b>7</b>	-0.0009	0.1556	0.0386	0.0650	-0.0647	0.0159
<b>8</b>	0.0496	0.1306	0.0033	0.1501	-0.0992	-0.0819
<b>9</b>	0.0256	0.0834	-0.0510	0.0876	-0.0012	-0.0206
<b>10</b>	-0.0154	0.0443	-0.0550	0.0751	0.1070	-0.0487

# Times Series Results

- Impact of Exchange rate on Overall GDP
  - Economic activity is negatively impacted by increases in government consumption as well as the lack of price stability
  - The level of trade openness and FDI were found to be growth enhancing
  - Credit growth, was significant & positively impacts economic growth.

	(1)	(2)	(3)
<b>Initial output</b>	-0.096469 (0.090306)	-0.161631*** (0.046739)	-0.051266 (0.082454)
<b>Financial development</b>	-0.000517 (0.002541)	0.005743* (0.002827)	0.007609** (0.003208)
<b>Exchange rate</b>	-0.057893*** (0.012841)	0.089366*** (0.016695)	0.132281** (0.020520)
<b>Control variables</b>			
<b>Inflation</b>	-0.082051* (0.043871)	-0.072757** (0.029282)	-0.075048* (0.039353)
<b>Government burden</b>	-0.013215*** (0.003968)	-0.011807** (0.005090)	0.006739 (0.004922)
<b>Trade openness</b>	0.021268*** (0.006419)	0.025758*** (0.005601)	0.022549** (0.006937)
<b>Education</b>	-0.330323*** (0.070566)	-0.205916*** (0.026001)	-0.242032** (0.082700)
<b>Intercept</b>	0.262471*** (0.062075)	-0.003681 (0.003675)	-0.013019** (0.005274)
<b>FDI</b>	0.002120** (0.001025)	0.002976 (0.000821)	0.005069 (0.001170)
<b>Dummy</b>	-0.007217*** (0.002186)	-0.014120*** (0.001768)	-0.015406*** (0.002413)
<b>Sargan test of over-identifying restrictions</b>			
Null Hypothesis: the over-identifying restrictions are valid			
<b>Prob(J-statistic)</b>	0.934471	0.958048	0.95365

# Times Series Results

## Impact of Exchange rate on the Value Added of Tradable Industries

- Similar results, however, a depreciation in the end of period nominal exchange rate leads to a contraction in economic activity.

	(1)	(2)	(3)
<b>Initial output</b>	0.305812*** (0.050077)	-0.067652 (0.051538)	0.292468*** (0.047197)
<b>Financial development</b>		-0.006761 (0.007524)	-0.001116 (0.003675)
<b>Exchange rate</b>	-0.191923** (0.087346)	-0.167522** (0.079071)	0.350057*** (0.133320)
<b>Control variables</b>			
<b>Inflation</b>	-0.870474** (0.346153)	-0.460424*** (0.148784)	-0.401948*** (0.065698)
<b>Government burden</b>	-0.134206*** (0.024471)	-0.080274*** (0.013788)	-0.110100*** (0.019642)
<b>Trade openness</b>	0.216623*** (0.035315)	0.169215*** (0.018503)	0.221291*** (0.031657)
<b>Education</b>	-1.577353*** (0.419244)	-1.843930*** (0.266808)	-0.483310 (0.396093)
<b>Intercept</b>	0.921752** (0.404701)	-0.010851** (0.009411)	0.013948 (0.015590)
<b>FDI</b>	-0.001840 (0.003721)	0.007635 (0.002186)	-0.001116 (0.003675)
<b>Durbin-Watson stat</b>	1.912593	1.750037	2.231426
<b>Sargan test of over-identifying restrictions</b>			
<b>Null Hypothesis: the over-identifying restrictions are valid</b>			
<b>Prob(J-statistic)</b>	0.910377	0.994135	0.994094



# Times Series Results

	(1)	(2)	(3)
<b>Initial output</b>	-0.288705*** (0.063338)	0.137579 (0.08003)	-0.186628*** (0.081819)
<b>Financial development</b>	-0.008153*** (0.001660)	0.000349 (0.003249)	0.004425*** (0.001977)
<b>Exchange rate</b>	-0.068165*** (0.012991)	0.111685** (0.045065)	0.128842*** (0.018521)
<b>Control variables</b>			
<b>Inflation</b>	-0.111577** (0.055649)	-0.134884*** (0.036305)	-0.167527*** (0.030944)
<b>Government burden</b>	0.011778*** (0.003731)	0.009379** (0.004468)	0.008581** (0.003973)
<b>Trade openness</b>	0.015901*** (0.005496)	-0.019701*** (0.006099)	0.011541*** (0.003626)
<b>Education</b>	-0.116704* (0.06535)	0.191472 (0.115302)	-0.209433*** (0.038307)
<b>Intercept</b>	0.340633*** (0.060846)	0.024559*** (0.0044459)	
<b>FDI</b>	-0.005224*** (0.001033)	-0.004037*** (0.001211)	0.002660*** (0.000429)
<b>dummy</b>		-0.00730 (0.002909)	-0.012666*** (0.001996)
<b>Durbin-Watson stat</b>	1.669958	1.871906	1.810725
<b>Sargan test of over-identifying restrictions</b>			

Null Hypothesis: the over-identifying restrictions are valid

- Impact of Exchange rate on the Value Added of Non-tradable Industries
  - Positive impact of a depreciation on economic activity
  - However, relationship with trade openness and FDI not consistent

# Times Series Results

## Nonlinear Impact of Exchange rate on Overall GDP

- The positive impact of depreciation on overall GDP was found to be higher during lower inflationary periods

	(1)	(2)	(3)
<b>Initial output</b>	-0.091500	-0.311938**	-0.053920
	0.073439	0.114591	0.102926
<b>Initial Output in high inflation periods</b>	0.957149***		
	0.051006		
<b>Financial development</b>	-0.005021**	0.004855	0.007369
	0.002710	0.006173	0.005019
<b>Exchange rate</b>	-0.026071**	0.089569**	0.131153***
	0.013298	0.039925	0.020841
<b>Exchange rate (high inflation)</b>	0.042165***	-0.103585*	-0.017545
	0.016265	0.055998	0.058520
<b>Control variables</b>			
<b>Inflation</b>	-0.117887***	-0.084671	-0.096605
	0.028464	0.056543	0.068920
<b>Government burden</b>	-0.008722***	-0.013664*	-0.010451*
	0.003164	0.007772	0.005800
<b>Trade openness</b>	0.003567	0.026583***	0.023237**
	0.004173	0.005756	0.007170
<b>Education</b>	-0.105414	-0.138936***	-0.192419*
	0.062817	0.042226	0.095716
<b>Intercept</b>	0.103983**	-0.004982	-0.008086
	0.058754	0.005269	0.005528
<b>FDI</b>	0.003412***	0.003298**	0.004044**
	0.000889	0.000991	0.001275
<b>Dummy</b>	-0.003187*	-0.012625	-0.013992***
	0.001706	0.002879	0.002995
<b>State of inflation Dummy</b>	-0.190908**	0.000478	-0.000556

# Times Series Results

- Nonlinear Impact of Exchange rate on the Value Added of Tradable industries

	(1)	(2)	(3)
<b>Initial output</b>	0.100150 (0.091067)	-0.098567* (0.055877)	0.202260*** (0.038555)
<b>Initial Output in high inflation</b>			1.030797*** 0.051288
<b>Financial development</b>	0.056149 (0.054022)	0.046254*** (0.011503)	0.013401 (0.008109)
<b>Financial development in high Inflation</b>		-0.134501*** (0.017074)	
<b>Exchange rate</b>	-0.643589* (0.358731)	-0.299755*** (0.066347)	0.469874*** (0.100153)
<b>Exchange rate (high inflation)</b>	1.220829** (0.452028)	0.425574*** (0.078750)	-0.537914*** (0.158393)
<b>Control variables</b>			
<b>Inflation</b>	-1.413129* (0.504213)	-0.370420** (0.157783)	-0.057208 (0.063919)
<b>Government burden</b>	-0.156049** (0.030614)	-0.102791*** (0.019203)	-0.098584*** (0.023387)
<b>Government burden in high inflation</b>	-0.096525* (0.049155)		
<b>Trade openness</b>	0.049023 (0.041243)	0.198781*** (0.026571)	0.245782*** (0.052816)
<b>Education</b>	2.414003** (0.931435)	-1.907258*** (0.390953)	0.487700 (0.295278)
<b>Intercept</b>	3.209806** (1.543612)	0.040064 (0.029248)	0.013307 (0.009898)
<b>FDI</b>	-0.035246* (0.020358)	-0.004412 (0.003873)	-0.001650 (0.001911)
<b>Dummy</b>			
<b>State of inflation Dummy</b>	-5.660226***	-0.081419***	-0.002993

# Times Series Results

- Nonlinear Impact of Exchange Rate on the Value Added of Non-Tradable Industries
  - Intuitively, lack of price stability reduces the impact of exchange rate management to influence economic growth.

	(1)	(2)	(3)
<b>Initial output</b>	-0.130793** (0.057012)	0.017210 (0.036485)	-0.112662** (0.050344)
<b>Initial Output in high inflation</b>	0.854353** (0.072692)	0.932185*** (0.049019)	0.908643*** (0.052315)
<b>Financial development</b>	-0.009810** (0.001941)	0.001988 (0.001974)	3.66E-05 (0.002710)
<b>Exchange rate</b>	-0.034687** (0.014589)	0.245948*** (0.026534)	0.270726*** (0.037668)
<b>Exchange rate (high inflation)</b>	0.042013** (0.015803)	-0.175873*** (0.034770)	-0.243969*** (0.038502)
<b>Control variables</b>			
<b>Inflation</b>	-0.127101*** (0.046729)	-0.037424 (0.022626)	-0.073464* (0.041688)
<b>Government burden</b>	0.014268*** (0.003426)	0.011845*** (0.002547)	0.014441*** (0.002847)
<b>Trade openness</b>	0.006885* (0.003424)	0.005220*** (0.002004)	0.010352*** (0.003420)
<b>Education</b>	-0.114289 (0.094510)	0.043364 (0.5940)	0.055248 (0.045358)
<b>Intercept</b>	0.153136** (0.066982)	-0.002037 (0.003283)	
<b>FDI</b>	0.001098* (0.000632)	0.000525 (0.000669)	-7.30E-05 (0.000659)
<b>Dummy</b>			-0.002983 (0.001807)

	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>
<b>Intercept</b>	2.34871*** (0.552068)	-1.07693* (0.582208)	-1.10106* (0.587885)
<b>Exchange rate Interaction</b>	-0.73161*** (0.166857)	0.335954* (0.185099)	0.343972* (0.187115)
<b>Investment (t-1)</b>	0.210344*** (0.051376)	-0.26397 (0.155822)	-0.26285 (0.156155)
<b>Sales</b>	0.233619** (0.108034)	0.402563 (0.283531)	0.408026 (0.287805)
<b>Real interest Rate</b>	0.029836 (0.030962)	-0.04754** (0.013467)	-0.0461** (0.013108)
<b>Observations</b>	58	31	31
<b>R-squared</b>	0.55314	0.7286	0.7307
<b>Sargan test of over-identifying restrictions</b>			
Null Hypothesis: the over-identifying restrictions are valid			
<b>p-value</b>	0.999955	0.999501	0.999527

# Panel Results

- The Impact of Exchange Rate on Investment in the Manufacturing Industry
  - depreciation of the exchange rate leads to an increase in total investment
  - The increase in investment ranges from 0.33 per cent to 0.73 per cent

Dependent Variable	GDP			Tradable GDP			Nontradable GDP		
<i>Measure of exchange rate</i>	<i>LREER(-1)</i>	<i>LXRATE1(-1)</i>	<i>LXRATE2(-1)</i>	<i>LREER(-1)</i>	<i>LXRATE1(-1)</i>	<i>LXRATE2(-1)</i>	<i>LREER(-1)</i>	<i>LXRATE1(-1)</i>	<i>LXRATE2(-1)</i>
<b>Exchange rate</b>	0.374	-0.347	-0.34	-0.148625	-0.254	-0.239	0.356	-0.216	-0.202
	[ 6.21]	[-5.08]	[-5.35]	[-0.333]	[-0.517]	[-0.503]	[ 4.63]	[-6.84]	[-6.285]
<b>Real interest Rates</b>	0.0041	0.0052	0.004	0.0494	0.049	0.0456	0.000908	-0.001	-0.0016
	[ 5.98]	[ 3.827]	[ 3.82]	[ 6.42]	[ 6.77]	[ 6.63]	[ 1.0015]	[-2.613]	[-2.91567]
<b>Alumina Price</b>	-0.1674	-0.182	-0.176	0.093	-0.1262	-0.073	-0.1542	-0.126	-0.121
	[-8.727]	[-8.495]	[-8.931]	[ 0.641]	[-0.815]	[-0.497]	[-6.082]	[-11.96]	[-11.43]
<b>@TREND(86Q1)</b>	--	0.0066	0.006	0.016	0.021	0.019	--	0.002	0.002
	--	[ 4.412]	[ 4.56]	[ 4.921]	[ 2.21]	[ 2.057]	--	[ 3.91]	[ 3.392]
<b>C</b>	-12.62	-9.875	-9.932	-11.995	-10.40	-10.66	-12.44	-10.296	-10.36
<b>Error Correction:</b>									
<b>Cointegrating Eqn</b>	-0.191	-0.236	-0.256	-0.297	-0.243	-0.296	-0.283	-1.023	-1.06
	-0.07156	-0.08063	-0.08544	-0.12734	-0.12027	-0.12958	-0.15305	-0.23327	-0.22904
	[-2.66]	[-2.93]	[-2.99]	[-2.34]	[-2.02]	[-2.28]	[-1.85]	[-4.39]	[-4.63]
<b>R-squared</b>	0.4189	0.4905	0.4913	0.2068	0.1979	0.2106	0.1839	0.3813	0.4023
<b>Adj. R-squared</b>	0.3027	0.3406	0.3417	-0.0095	-0.0208	-0.0047	-0.0113	0.2334	0.2593
<b>Sum sq. resids</b>	0.0058	0.0051	0.0051	0.3561	0.3601	0.3544	0.0104	0.0079	0.0076
<b>S.E. equation</b>	0.0103	0.0100	0.0100	0.0900	0.0905	0.0897	0.0150	0.0131	0.0129
<b>F-statistic</b>	3.6049	3.2727	3.2837	0.9560	0.9049	0.9782	0.9423	2.5775	2.8145

# Results Summary

- The results from all measures of the exchange rate showed that a depreciated exchange rate had a positive impact on economic growth in Jamaica.
- The response to a depreciated exchange rate on:
  - Overall growth for ranged between 0.05 per cent to 0.13 per cent.
  - Tradable industries growth ranged between 0.19 per cent to 0.35 per cent
  - Non-tradable industries growth ranged between 0.07 per cent to 0.13 per cent
- Investment of the typical manufacturing firm is positively associated with depreciation in the exchange rate.
  - The increase in investment ranges from 0.33 per cent to 0.73 per cent

# Conclusion

- Depreciation in the exchange rate has a positive impact on overall economic growth.
  - mainly reflective of the positive impact of exchange rate movement on non-tradable industries activity.
- There is support for the existence of a nonlinear impact of the exchange rate on economic growth in high and low inflation periods
  - In high inflation periods the positive growth impact in response to depreciation is lower than that which will prevail in low inflation periods.
- Investment of the typical manufacturing firm is positively associated with depreciation in the exchange rate.



# Policy Discussion

- The puzzle: the annual depreciation in the Jamaican Dollar and growth in GDP between 1996 and 2011 averaged 5.7 per cent and 0.4 per cent, respectively.
  - Possibly other structural factors play a major role
  - Does this supports the critique of Rodrick (2008) that exchange rate management is a useful but not sufficient policy instrument to engender long run sustainable growth?

# Policy Implication

- In addition to being informed by the exchange rate and economic growth association, it is recommended that policymakers, employ policy to enhance the productivity in all sectors and encourage stability in the real exchange rate.