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Does Demand Volatility Lower Growth and Raise Inflation? Evidence from the Caribbean

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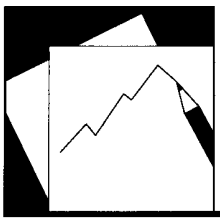

IMF Working Paper

Does Demand Volatility Lower Growth and Raise Inflation? Evidence from the Caribbean

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Does Demand Volatility Lower Growth and Raise Inflation? Evidence from the Caribbean

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Abstract

The paper investigates asymmetry in the allocation of aggregate demand shocks between real output growth and price inflation over the business cycle in a sample of fifteen Caribbean countries. In most countries, the evidence indicates the existence of structural constraints, implying that positive demand shocks feed predominantly into prices while negative demand shocks mainly affect output. The high variability of aggregate demand in Caribbean countries, frequently exposed to shocks that are exacerbated by pro-cyclical policy stance, tends to create an upward bias on inflation and a downward bias on real output growth, on average, over time. The analysis highlights the benefits of eliminating structural rigidities responsible for asymmetric real and inflationary effects and points to the dangers of pro-cyclical macroeconomic policies that exacerbate the adverse effects of demand variability.

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I. INTRODUCTION

In general, Caribbean countries have been largely successful in bringing annual inflation down to single digits in recent years. Nonetheless, their growth rates have been disappointing despite fiscal stimulus. Previous research (see, e.g. Sahay (2006)) suggests that absent higher growth, the fiscal position may not be sustainable over time. Indeed, deteriorating public finances have increased financing needs and the debt burden and constrained the ability of these economies to pursue countercyclical policies to weather increased vulnerability to external shocks.

Caribbean countries are small open economies that are highly dependent on tourism receipts. This unique feature exposes their economies to excessive demand variability from external shocks. The ability of these economies to absorb demand variability has implications for economic performance. Furthermore, as policy makers attempt to smooth the outcome of demand variability on economic performance, structural impediments and financing constraints may impose a serious challenge to their efforts.

To shed some light on structural rigidities governing the relation between demand variability and economic performance, this paper traces the nature of cyclical fluctuations on the macro-economy across a sample of fifteen Caribbean countries. The analytical framework is well suited to very small open economies such as Caribbean countries, which are presumed to be price takers and face capacity constraints caused by scarcity of resources and import rationing that are likely to render the aggregate supply curve steeper and accelerate price adjustments in the face of expansionary demand shocks. Moreover, institutional rigidities, such as an inflexible labor market, are likely to limit the speed of nominal adjustments in the face of contractionary demand shocks, necessitating a large output and employment contraction during cyclical downturns.

Demand-side fluctuations could arise from domestic factors or policies, including monetary or fiscal policies, or external factors, such as those affecting flows of remittances and/or other determinants of the external position. Demand variability could be exacerbated by a pro-cyclical fiscal response to external shocks, reflecting tight financial resources. Further, such constraints often limit fiscal space and the capacity of these economies to pursue necessary countercyclical policies to weather external shocks. The outcome of this variability could be detrimental to growth and inflation over time. Specifically, possible asymmetry in the response of real growth and price inflation to frequent and large demand shocks over the business cycle could produce net adverse effects of demand variability on economic performance over time.

Theoretical contributions have attributed sources of asymmetric adjustments to demand shocks to constraints in the product and/or labor markets. Along the first strand, is the vast literature on asymmetric price adjustments attributed to the cost of adjusting prices "menu costs", particularly in high inflationary environment (see, e.g., Ball and Mankiw (1994)). Other theoretical contributions have focused on rigidity in the labor market attributed to contractual agreements or indexation clauses to explain asymmetric adjustments of output and price to demand shocks (see, e.g., Gray (1978)). Several empirical studies have tested the validity of theoretical predictions using data for advanced countries and developed countries (see, e.g., Kandil (2008)). However, the evidence and implications of asymmetry have not been

investigated for small states, similar to the Caribbean sample, despite evidence of capacity constraints that have constrained growth during economic booms and structural impediments that have exacerbated the severity of output contraction during cyclical downturns.

The analysis indicates that the majority of the Caribbean countries are characterized by pronounced asymmetric responses to frequent demand variability. This implies that during demand expansions, inflation accelerates while the real output response is moderate. On the other hand, during demand contractions, structural and institutional rigidities exacerbate the drop in real output growth with only a small deceleration in inflation.

These results point to two important policy implications: (i) the need to address structural rigidities that constrain capacity during an economic boom and hamper flexible nominal adjustments to moderate output contraction during cyclical downturns, and (ii) the dangers of pro-cyclical policies that accentuate demand shocks and exacerbate the associated upward bias on inflation and downward bias on real growth.

The outline of the paper is as follows. Section II provides an overview of macroeconomic developments in the fifteen Caribbean countries, focusing on output growth and inflation. Section III provides a theoretical background for factors in the product and labor markets that underlie asymmetric responses to aggregate demand shocks. Section IV presents the empirical models and results. Section V analyzes the time-series results. Section VI presents the conclusion and policy implications.

II. AN OVERVIEW OF MACROECONOMIC DEVELOPMENTS IN CARIBBEAN COUNTRIES

The analysis of the paper concerns cyclicality in real growth and price inflation across Caribbean countries. This section summarizes major indicators characterizing real growth and price inflation across countries.

Table 1 presents average real GDP growth for each of the countries under investigation over the sample period 1980–2010.[2] The lowest average real growth is in Haiti (0.64%) and the highest average real growth is in Belize (5.4%). The volatility of real growth is generally high across Caribbean countries, as measured by the standard deviation. The lowest volatility is in St. Kitts and Nevis, 2.5 percent, and the highest volatility is in Suriname, 5.9 percent. As noted by Cashin (2006), output in Caribbean countries is, on average, about 1.6 times as variable as output in the United States.[3]

[2] For related literature analyzing Caribbean growth cycles, see Mamingi (1999), Borda, Manioc and Montauban (2000), and Craigwell and Maurin (2002), among others. DeMasi (1997) provides a summary of approaches taken by the International Monetary Fund in estimating growth cycles.

[3]Mendoza (1995) and Agenor et al. (2000) attribute the high volatility in developing countries to the greater incidence of exogenous shocks.

In Table 1, the rate of inflation, using the GDP deflator, ranges from a low of 2.8 percent in Belize to a high of 25.9 percent in Suriname over the period 1980–2010. The highest inflation variability is in Suriname, 39 percent, and the lowest inflation variability is in The Bahamas, 2.8 percent.[4]

Across countries, where inflation was high, real growth was low, providing some evidence for supply-side constraints. On average, the correlation coefficient between real growth and price inflation is negative (-0.57) and statistically significant across countries. The paper turns to the analysis of fluctuations contributing to variation in real growth and price inflation over time.

III. THEORETICAL BACKGROUND

Assume aggregate demand intersects with the aggregate supply curve at a level of output *y that corresponds to full capacity utilization**. Aggregate demand may be subject to random shocks that generate fluctuations around the steady state equilibrium output over time. Assume these shocks follow a symmetric distribution, i.e., shocks have zero mean and constant variance. Demand variability determines the size of demand shifts over the business cycle. The allocation of demand shocks between real growth and price inflation is dependent on capacity constraints in the face of expansionary shocks and structural rigidity constraining nominal adjustments in the face of demand contraction. Assuming symmetric responses to demand expansions and contractions, the effects of demand shifts, positive and negative, cancel out, implying demand variability does not determine trend real output growth or price inflation over time. However, this is not the case if capacity constraints limit output expansion during a boom and nominal rigidity is prevalent during cyclical downturns.

Theoretical explanations of asymmetric effects of aggregate demand shocks have emphasized the role of institutional and structural rigidities in the labor and product markets. In a framework in which nominal wage negotiations follow contractual agreements, the magnitude and speed of wage adjustments (degree of wage indexation) may be different during expansions and contractions. During boom periods, cost of living adjustments maybe specified to guarantee workers upward adjustment of wages to keep up with inflation. In contrast, employers may resist adjusting wages in the downward direction during recessions.[5]

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[4] The analysis employs the GDP deflator to measure inflation, in light of constraints regarding CPI data availability over a long time span for some countries. There are several advantages to this approach. First, the deflator inflation comprises price movement for all goods and services produced in the economy, which provides a comprehensive measure to test nominal rigidity, particularly as it relates to the cost of production over the business cycle. Secondly, CPI inflation could be subject to measurement errors related to small list of goods in the consumption basket and/or the weights assigned to these goods. Thirdly, the deflator inflation is the mirror image of capacity constraints hampering output adjustments during economic cycles. Where data are available, the direction of asymmetry characterizing inflationary adjustments during economic cycles remains robust upon using CPI inflation.

[5]Some (see, e.g., Kandil (2002a)), explain downward wage rigidity by employers' desire to retain experienced workers and avoid the search and training cost of hiring new workers to accommodate a potential future rise in demand. In the context of the Caribbean region, employment is dominant in the public sector. Political

(continued…)

Alternatively, the asymmetric flexibility of nominal wages maybe an endogenous response to uncertainty impinging on the economic system. Models of the variety of Gray (1978) have emphasized the dependency of the degree of indexation on the variability of stochastic disturbances. Higher demand variability may increase uncertainty and, therefore, the probability of realizing positive and negative demand shocks. Agents may form asymmetric behavior to hedge against uncertainty. Specifically, agents are more inclined to hedge against the risk of higher inflation, demanding a stipulation of cost of living adjustments to protect their real wages. In contrast, cost of living adjustments are usually not stipulated in anticipation of a slowdown in demand and, therefore, price deflation. Similarly, agents in economies with a history of high trend inflation are likely to have larger incentives for upward wage flexibility, compared to downward flexibility.

An alternative explanation of supply-side asymmetry is based on the frequency and speed of adjusting product prices. This framework emphasizes the cost of adjusting prices "menu costs" in determining producers' decisions. Menu costs comprise the cost and effort involved in changing prices (see, e.g., Ball and Mankiw (1994)). When trend inflation is high, the presence of menu cost implies an upward bias on inflation. High trend inflation increases producers' incentives to raise prices above the current equilibrium, in anticipation of the need for continuous upward adjustment. An expansionary demand shock, coupled with high trend inflation, creates a large gap between desired and actual relative prices. During a recession, producers may resist paying the menu cost to adjust prices downward as they expect trend inflation to decrease their relative prices in par with their competitors. As a result, positive shocks are more likely to induce a larger upward price adjustment, compared to downward adjustment in the face of negative shocks.

Other theoretical explanations of asymmetric price adjustments have emphasized the importance of synchronized price changes (time-dependent pricing) for price rigidity and asymmetric nominal adjustments (see, e.g., Klenow and Kryvtsov (2008)).[6] This evidence reinforces the implications of higher tendency to adjust prices upward in high inflationary environments. Other theoretical explanations have departed from the menu costs to explain price rigidity and asymmetric nominal adjustments. Rotemberg (2002) theorizes that price stickiness comes from consumer resistance to price increases they perceive to be "unfair", implying less tendency to increase prices during cyclical downturns. Davis and Hamilton (2004) document sticky wholesale gasoline prices but reject a menu cost interpretation in favor of strategic motives involving customers and competitors. The implication is a tendency to accelerate price adjustments upward in anticipation of similar behavior by competitors and general acceptance by customers. In contrast, there is a tendency to resist price adjustments

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consideration may necessitate higher compensation of civil servants during economic booms, while resisting a slowdown in the wage bill during downturns.

[6] Using micro data collected by the US Bureau of Labor Statistics to decompose the variance of consumer price inflation from 1988 through 2003, the authors find that around 95 percent of the variance of monthly inflation stems from fluctuations in the average size of price changes.

during cyclical downturns, particularly where monopolistic competition provides a bigger scope to manage downward rigidity and capitalize on inelastic demand. Burstein (2002) and Mankiw and Reis (2002) explore the implications of sticky plans and sticky information, rather than sticky prices per se. Sticky plans would work to avoid downward adjustments of prices during cyclical downturn in anticipation of a reversal of the cycle, particularly if consumers lack the information regarding the scope of the downturn. In another direction, Christian et al. (2004) and Eichenbaum and Fisher (2004) posit sticky relative prices, rather than sticky nominal prices. The implication is a higher tendency to maintain relative prices during a cyclical upturn, implying faster upward adjustment and rigidity to adjust prices downward absent pervasive evidence of a fast reduction in other prices.

Given asymmetry, demand variability induces a tradeoff between real output growth and price inflation. Assuming faster nominal adjustments and more binding capacity constraints in the face of positive demand shocks, demand variability will have a net average increase in price inflation and a net average output contraction over time. Accordingly, demand variability increases the trend of price inflation and decreases trend real output growth, on average, over time.

IV. Econometric Investigation

The investigation will study asymmetry in Caribbean business cycles over the period 1980–2010. Business cycles are fluctuations that develop randomly around the trend component of economic variables. The trend is the domain of real growth, which progresses over time in line with underlying fundamentals that determine production potential. The latter grows over time in line with growth in the economy's endowed resources of labor, capital, and technological advances. Consequently, the trend component follows a non-stationary stochastic trend. In contrast, cyclical fluctuations generate transitory deviations around the stochastic trend and, therefore, are the domain of short-term stationary shocks.

It is worth noting a few factors that differentiate the analysis of this paper from similar studies analyzing business cycles in Caribbean countries. Cashin (2006) uses a statistical business-cycle filter to eliminate the trend component from the random cyclical component following the suggestions of Baxter and King (1999). Similar to Cashin, the approach of this paper relies on a filtering technique to extract the cycle (stationary component) from the trend (nonstationary component) of the dependent variables under investigation: real GDP and the GDP deflator. However, in contrast to Cashin's work, the paper develops an empirical model to model the cycle, differentiating between the effects of supply and demand shocks and modeling asymmetry in short-term adjustments to expansionary and contractionary shocks.

The empirical model identifies the size and significance of cyclical responses during booms and recessions. To identify periods of economic booms and recessions, the paper analyzes fluctuations in nominal GDP growth. This measure captures a broad composite of aggregate demand shocks, attributed to external shocks and private spending, as well as the domestic policy stance. The objective is to employ the broadest measure for demand variability to contrast the implications across countries and avoid selection bias of specific demand shocks that may not be uniform with respect to their frequency and significance across countries. The empirical model seeks to identify symmetric demand shocks along a stable supply curve. Since

observed GDP reflects the intersection of supply and demand, however, it is necessary to control for the effects of factors that shift the supply curve. To isolate demand shocks, two controls are used: (i) dummy variables that correspond to the years of natural disasters (see Ramussen (2006)), and (ii) the energy price. While these two factors are arguably the major sources of supply-side shocks in the Caribbean countries, it must be acknowledged that other factors, not controlled for in the model, also play a role.

Fluctuations in nominal GDP are decomposed into a steady-state growth and a random cyclical component. The steady-state component corresponds to movements in the underlying fundamentals in full-equilibrium. Empirically, this component is derived as the *expected* GDP, using available information for a range of variables that are generally assumed to determine aggregate demand in theory.[7] The implication is aggregate demand growth varies with underlying fundamentals over time. However, unforeseen shocks could drive demand growth away from its forecast. These shocks are the source of cyclicality in the economic system.

The unanticipated residual in the forecast equation measures shocks to aggregate demand growth.[8] By construction, these shocks have a symmetric distribution, where positive shocks identify periods of economic booms and negative shocks identify periods of recessions. The difference between variables' responses to positive and negative shocks to aggregate demand will identify the degree and direction of asymmetry during booms and recessions.[9] If these responses are symmetric, cyclical fluctuations in the face of random demand shocks cancel out over time. A significant response to anticipated demand shifts implies lagged variables

[7] To decide on the list of variables in the forecast equation, nominal GDP growth is regressed on its lags and lagged values of variables that are likely to determine aggregate demand in theory. The list includes lagged variables of real output growth, price inflation, the growth of the money supply, the growth of government spending, the change in real effective exchange rate, the change in the oil price, and a dummy variable to control for structural breaks due to natural disasters or external shocks, as warranted by evidence. For example, Antigua and Barbuda has suffered a severe banking crisis and Barbados put in place a stringent internal devaluation policy in the early 90s, providing evidence of structural break. The final specification includes lagged variables that are proven to be statistically significant using a formal causality test. To establish robustness, the empirical models are estimated using alternative ad hoc specifications that include variations of the mix and/or lags of variables in the forecast model. The qualitative results are robust to these variations. For details, see Kandil (2008).

[8] Rational forecast requires two conditions: (i) the forecast error is purely random white noise, i.e., agents are not making systematic mistakes over time, and (ii) the forecast error is uncorrelated with lagged variables that enter the information list, i.e., agents have capitalized fully on available information.

[9] A number of studies have analyzed asymmetric cyclical fluctuations. Using quarterly data for the United States, the evidence of Cover (1992) suggests that positive money supply shocks do not have an effect on output while negative money supply shocks do. Kandil (1995) provides evidence and explanation of the asymmetric effects of monetary shocks across a sample of major industrial countries. Kandil ((1996), (2002a)) analyze the evidence of the asymmetric effects of aggregate demand shocks using aggregate data of real output, price, and wage for the United States. Kandil (1998), and (1999) contrast the evidence of supply-side asymmetry using aggregate demand shocks across a sample of developing and industrial countries. Kandil (2001) and (2002b) investigate asymmetry in the effects of monetary and government spending shocks using aggregate data for the United States. Other evidence on the asymmetry of business cycles includes DeLong and Summers (1988), Romer and Romer (1989) and Swanson and Van Dijk (2002).

underlying agents' forecasts of aggregate demand have a long-lasting effect on developments in the dependent variables, increasing persistence in observed variables.

Model Specification

The stationarity of the variables under investigation is tested following the suggestions of Nelson and Plosser (1982). Based on the results of the KPSS test for non-stationarity (see, Kwiatowski, Phillips, Schmidt, and Shin (1992)), the variables under investigation are nonstationary in level and stationary in first difference.[10] Given these results, the empirical models are specified in first-difference form as follows:

$$Dy_t = a_0 + a_1 E_{t-1} Dn_t + a_2 E_{t-1} Do_t + a_{3p} posn_t + a_{3n} negn_t + a_{4p} poso_t + a_{4n} nego_t + \eta_t \quad (1)$$

In equation (1), *D(.)* is the first-difference operator. The logarithm of real output is denoted by y_t. The logarithm of nominal GDP, n_t, approximates domestic demand for goods and services. This proxy is likely, however, to be affected by major sources of supply-side shocks. To control for the effects of these shocks and untangle demand-driven movements in nominal GDP, the empirical model captures a major source of movements in aggregate supply. The logarithm of the energy price is denoted by o_t. Anticipated changes at time *t-1* are denoted by E_{t-1}.

The empirical model explains developments in real output growth in response to demand and supply-side fluctuations. Aggregate demand is decomposed into anticipated demand shifts and random shocks that vary with unanticipated policy shocks, shocks in private spending and/or exogenous external shocks. In line with the anecdotal evidence that tourism activity may be impacted by transitory external demand shocks, for example a natural disaster or the electoral cycle in the home country of tourists, developments in external demand are likely to have a long lasting effect on output growth in the countries under investigations. In contrast, random shocks induce cyclical transitory effects on real growth. Shocks are decomposed into positive and negative components with the parameters in the empirical models measuring cyclical effects. A positive parameter indicates an increase in real growth with respect to economic booms and a decrease with respect to economic contractions. In contrast, a negative parameter indicates a countercyclical response, i.e., real growth is decreasing despite demand expansion during a boom or increasing despite demand contraction during a recession.

To detect asymmetry, shocks to the energy price and aggregate demand are decomposed into positive and negative components, denoted by pos_t and neg_t. The parameters a_{3p} and a_{3n} measure the responses of the dependent variable to the demand shock during booms and recessions. The direction and degree of asymmetry is measured by the statistical significance of the difference in the response of the dependent variable to the positive and negative components

[10] Nonstationarity test results are robust using alternative tests that assume nonstationarity as the null hypothesis. See, e.g., Dickey and Fuller (1981). Results are available upon request.

of aggregate demand shocks. Finally, the term η_t is a stochastic error with mean zero and constant variance.

Producers are expected to reflect the cost of anticipated demand fully into their pricing strategy, eliminating the need for additional adjustment in output. Nonetheless, institutional rigidity may prevent full adjustment to demand shifts, necessitating a positive response of real growth. Faced with aggregate demand shocks, producers are expected to vary the output supplied positively with a magnitude that is dependent on resource and structural constraints in the short-run.

In addition, the energy price is expected to determine the cost of production. Higher price of oil increases the cost of the output supplied and decreases real growth.

Asymmetry in the output response to positive and negative demand shocks will verify the possibility of inflationary and contractionary bias.[11] A larger output contraction during cyclical downturns and smaller expansion during booms would be supported by a larger a_{3n} relative to a_{3p}.

The empirical model for price inflation replicates that for output growth:

$$Dp_t = b_0 + b_1 E_{t-1} Dn_t + b_2 E_{t-1} Do_t + b_{3p} posn_t + b_{3n} negn_t + b_{4p} poso_t + b_{4n} nego_t + \mu_t \quad (2)$$

Aggregate price inflation is denoted by Dp_t**.** As demand shocks are absorbed in real growth and price inflation, $b_{3p} = 1 - a_{3p}$, $b_{3n} = 1 - a_{3n}$. If prices are more flexible upward, $b_{3p} > b_{3n}$ and inflationary pressures are higher during booms, relative to moderation during recessions. Price rigidity will be measured by the negative response to positive demand shocks (upward rigidity) and/or negative response to negative demand shocks (downward rigidity).

To understand the propagation mechanism from aggregate demand to the real economy, the analysis considers possible asymmetry in specific demand variables during booms and recessions. To that end, empirical models are estimated using specific demand variables as dependent variables: private consumption growth, Dc_t, private investment growth, Dv_t, export growth, Dx_t, import growth, Dim_t, and the change in trade balance, $Dtbal_t$.

[11] The asymmetric impact of demand shocks on real output growth is not addressed in the context of mainstream business-cycle theories, which include the equilibrium explanation pioneered by Lucas (1973) and neo-Keynesian models emphasizing nominal wage rigidity (e.g., Fischer (1977), Gray (1978)) or price rigidity (e.g., Ball, Mankiw, and Romer (1988)).

Empirical Methodology

To estimate the empirical model in (1), proxies for forecasted growth in domestic demand and the energy price are needed. The growth of aggregate demand, Dn_t, is endogenous according to Engle's (1982) test. To form a proxy of agents' forecasts, the growth of aggregate demand is regressed on the lags of selected variables (see footnote 7) based on the results of a formal causality test. Lags of statistically significant variables are included in the forecast equation. In addition, the forecast equation accounts for significant structural break dummies that mark years of natural disasters (see Ramusen (2006)). Dummy variables are introduced following the results of a formal test suggested by Dufour (1982).

The predicted values are a proxy of agents' forecasts of aggregate demand. The residual of the forecast equation is a proxy for unanticipated random shock to demand growth. To satisfy rationality (see footnote 9), the residual in the forecast equation is a pure white noise with a zero mean and a constant variance. Hence, shocks are distributed symmetrically around the steady state forecasted trend.

Following the suggestions of Cover (1992), positive and negative shocks to demand growth are defined for the joint estimation as follows:

$$neg_t = -\frac{1}{2}\{abs(shock_t) - shock_t\}$$

$$pos_t = \frac{1}{2}\{abs(shock_t) + shock_t\}$$

Where a*bs(.)* is the absolute value operator and *shock* is the surprise component to the specific variable, as described above.

The energy price is exogenous. Accordingly, agents' forecast of the energy price is modeled as a second-order autoregressive, or AR (2). The proxy for energy price surprises is then formed by subtracting these forecasts from the actual change in the log value of the energy price. Energy price shocks have zero mean and a constant variance.

Pagan (1984 and 1986) showed that the use of regression proxies requires an adjustment of the covariance matrix of estimators of the parameters of the model containing constructed variables. As suggested by Mishkin (1982), a simple alternative is to estimate the expectation equations *jointly with the equations explaining the dependent variables for output and price using 3SLS*. To account for the endogeneity of aggregate demand, instrumental variables are introduced. The instrument list includes two lags of the log first difference of real growth, price inflation, the energy price, the real effective exchange rate, government spending, and the money supply.[12]

[12] Joint estimation takes into account correlations across equations in the empirical model. Alternatives include the estimation of a vector autoregressive model, which is often specified using distributed lags of an adhoc selection of random variables. The approach of this paper compares more favorably as it relies on rational forecasts to specify steady state equilibrium. Concurrently, shocks are introduced into the final model specification to test theory's

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The results of Engle's (1982) test for the presence of serial correlation in a simultaneous-equation model indicate that the error terms of the empirical models follow an autoregressive process of order one for some countries. For these countries, the estimated empirical models are multiplied through by the filter $(1 - \rho L)$ where ρ is the serial correlation parameter and L is the lag operator. The serial correlation parameter is estimated jointly with the rest of the model's parameters.[13]

V. Analysis of the Time-Series Results

All data under investigation are annual and taken from the IMF's International Financial Statistics and World Economic Outlook databases.

The empirical model in (1) is estimated using data for various dependent variables under investigation. The empirical investigation includes data for the following countries: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent, Suriname, and Trinidad and Tobago. The sample period extends from 1980–2010, except in a few cases where data availability constrained the sample period.

The results are organized in two tables. The tables summarize the parameters that measure the responses of each of the dependent variables to anticipated domestic demand shifts, and the positive and negative shocks to domestic demand.[14]

Real Output Growth

The results of estimating the empirical model of real output growth are presented in Table 2 across the sample of Caribbean countries under investigation. The discussion below will focus on asymmetry in the effects of aggregate demand shocks on real output growth during cyclical upturns and downturns. Evidence of this asymmetry will determine the net effect of demand variability on trend real output growth.

During economic booms, an expansionary shock to aggregate demand stimulates real output growth significantly in The Bahamas, Jamaica, St. Kitts and Nevis and St. Vincent. This is evident by the positive and statistically significant effects of expansionary shocks to

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prediction regarding the distinction between anticipated and unanticipated movements in demand and supply shifts, as well as possible asymmetry in the effects of positive and negative demand shocks. The theory underling the model specification is based on Kandil and Mirzaie (2002). For similar empirical investigations, see Kandil (2008).

[13] Experiments that introduce country-specific variables in the model specification are constrained by data availability. Such experiments, where possible, confirm the qualitative results of the paper. To facilitate comparison of the results across countries, the paper presents a uniform model specification while ensuring the random error is purely white noise. This approach builds on the specification in Kandil (2008) to avoid random selection of explanatory variables that could bias estimated parameters and hinder cross country comparison.

[14] Details of estimated parameters are available upon request.

aggregate demand on real output growth. The positive response of real growth indicates capacity to expand the supply during boom periods. Capacity to grow output during expansion has contributed to higher trend growth in St. Kitts and Nevis and in St. Vincent and the Grenadines where output growth has far exceeded the average growth across the sample of countries under investigation. In all other countries, there is no evidence of significant real output growth in the face of expansionary demand shocks, implying binding capacity constraints that necessitate fast adjustment of price inflation to demand expansion. This point will be further illustrated by the results of estimating the empirical model for price inflation.

The contractionary effects of aggregate demand shocks are more pervasive across Caribbean countries, as evident by the positive and significant response to negative demand shocks. In all but four countries (Dominican Republic, Guyana, Haiti, and Jamaica) real output growth shrinks significantly during economic downturns.

The difference in the response of real output growth to positive and negative aggregate demand shocks measures the direction and significance of asymmetry. A negative and significant difference indicates that output contraction exceeds expansion with respect to symmetric fluctuations in aggregate demand shocks. Accordingly, higher variability of aggregate demand, a higher probability of realizing positive and negative shocks, is likely to have a net negative effect, shrinking real output growth, on average, over time. Statistical significance supports this scenario in Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, St. Lucia, Suriname, and Trinidad and Tobago. In four of these countries trend growth has fallen below the average across the sample of countries under investigation, attesting to the negative bias created by asymmetric adjustments to aggregate demand shocks on trend real growth over time.

Where the response of real growth to positive demand shocks exceeds the response to negative shocks, the difference is not statistically significant. This evidence indicates there is no country in the group in which the growth expansion from a positive demand shock exceeds the contraction as a result of a negative shock. Output fluctuations appear to be symmetric, indicating a neutral effect of fluctuations in aggregate demand on real output growth, on average over time, in The Bahamas, Dominican Republic, Guyana, Haiti, Jamaica, St. Kitts and Nevis, and St. Vincent. In these countries, institutional and structural constraints are similar during booms and recessions, resulting in similar effects of demand shocks on output expansion and contraction. Hence, the effect of demand variability is neutral on real growth in these countries.[15]

In sum, there appears to be evidence of asymmetric responses to demand variability in many Caribbean countries. Specifically, contractionary shocks to aggregate demand are

[15] The evidence is robust with respect to a number of experiments that vary with the selection of variables and the lag length in the forecast equation and/or the instruments' list, as well as the introduction of country-specific variables in the final model specification. In all these experiments, the pervasive significant positive response of price inflation to demand shocks is dominant while the significant positive response of output growth to contractionary shocks is more prevalent. Such an allocation indicates asymmetric allocation of aggregate demand shocks that increases the inflationary bias and the contractionary bias during economic cycles.

mostly absorbed in output growth, implying an output contraction that exceeds the expansion resulting from a symmetrical distribution of demand shocks.

Price Inflation

The results of estimating the empirical model for price inflation are consistent with the evidence above. In support of asymmetry, the pervasive significant response of price inflation to expansionary demand shocks indicates fast adjustment of prices to demand pressures, implying capacity constraints that limit real expansion during economic booms and upward price flexibility. In contrast, the limited significant positive response, or negative response of price inflation to contractionary demand shocks indicates downward rigidity of prices, exacerbating output contraction during economic downturns.[16]

The asymmetric impact on inflation is a mirror image of the real output response, as both variables combine to nominal GDP (the corresponding coefficients add up to one). Thus, the evidence of asymmetry, supported by the output response, implies an inflationary bias in the face of demand variability.

In Table 2, the difference in the response of price inflation to positive and negative aggregate demand shocks measures the direction and significance of asymmetry. A positive and significant difference indicates that price inflation exceeds deflation with respect to symmetric fluctuations in aggregate demand shocks. Accordingly, higher variability of aggregate demand is likely to have a net positive effect, increasing price inflation, on average, over time.[17] Statistical significance supports this scenario in Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, St. Lucia, Suriname and Trinidad and Tobago. It is worth noting that Suriname has the highest trend inflation across the sample of countries under investigation. While other factors may have contributed to trend inflation, asymmetric adjustment to demand variability may have further exacerbated the inflationary bias over time.

Implications of Exchange Rate Variability on Demand Variability

Having documented the impact of demand variability on aggregate performance, it is important to draw a link between the exchange rate system and demand variability. The relationship between exchange rate volatility and economic growth has received a relatively little attention from both theoretical and empirical perspectives. This is because, the exchange rate is considered as nominal variable and not related to the long-term real growth performance (see, e.g., Levy-Yeyati and Sturzenegger (2002), Bayoumi and Eichengreen (1994), and Grier and Hernandez-Trillo (2004)). However, the general consensus between economists is that the impact of exchange rate volatility on economic growth depends on the type of the exchange rate

[16] An index of wage determination flexibility indicates low wage flexibility in the Caribbean. Based on World Economic Forum Global Competitiveness Report, see Appendix Table for details.

[17] In support of this evidence, in a cross-country regression, trend inflation increases significantly the higher the variability of aggregate demand.

regime which the economy adopts. Economists who are in favor of fixed exchange rate regime (e.g. McKinnon (1963), Mundell (1973), Rose (2000) and Frankel and Rose (2002)) argue that the exchange rate stability is conducive to economic growth through its positive impact on trade and investment. In their view, a stable exchange rate reduces price uncertainty and real interest rates volatility by increasing the efficiency of price mechanisms at international level; hence, contributing significantly to economic stability and growth (De Grauwe and Schnabl, 2004). By contrast, the supporters of flexible exchange rate (e.g. Meade (1951), Friedman (1953), Fischer (2001) and Levy-Yeyati and Sturzenegger (2002)) argued that the volatility of exchange rate reduces the negative impact of real asymmetric shocks on local and external disequilibrium. That is, in a case of real asymmetric shocks, if prices and wages adjust slowly, flexible exchange rates can adjust relative international prices to compensate for output losses (Mundell, 1961 and Arratibel et al. 2011). Moreover, Ghosh et al. (1996) show that a pegged exchange rate may distort price signals in the economy by creating misalignment of the real exchange rate, and in turn leads to inefficient allocation of resources across sectors.

Empirical evidence on the other hand, also offers mixed findings regarding the impact of exchange rate volatility on growth. For example, Ghosh et al. (1997) studied the growth performance under alternative regimes in 145 IMF-member countries and found that there are no significant differences in output growth across exchange regimes. They argued that pegged regimes increase investment and volatility of growth and employment but reduce productivity growth and inflation. Previous investigations have considered the impact of exchange rate fluctuations in developing countries, demonstrating varying effects of the anticipated and unanticipated components on real growth and price inflation (see, e.g., Kandil (2004)).

Developing countries in the Caribbean are subject to high variability of the exchange rate due to movements in bilateral nominal exchange rates and/or relative price inflation compared to major trading partners. Regardless of the exchange rate system, fluctuations in the real effective exchange rate capture movements in relative prices and market-driven or pegged-induced movements in the nominal exchange rate. Focusing on the experiences of countries in Latin America and the Caribbean to provide a larger sample for cross-country analysis, the paper investigates the potential cyclical biases of exchange rate variability on macroeconomic performance. The evidence will contribute to the debate regarding the pros and cons of exchange rate flexibility and the role of policy makers in managing expectations and limiting the adverse effects of deviations in the exchange rate from steady-state equilibrium on aggregate uncertainty.

To formalize the evidence, the analysis considers the effects of exchange rate variability on the trends of variables under consideration. The variability of the real exchange rate is measured by the standard deviation of movement in the exchange rate around steady-state equilibrium to capture movements in relative prices and bilateral exchange rates with major trading partners. Table 3 summarizes the coefficients measuring the relationship across the sample of 32 countries in Latin America and the Caribbean. In addition to exchange rate variability, the cross-section regression includes an interactive dummy for variability in countries with floating exchange rate systems. The coefficient of the interactive dummy

measures the effect of variability in the exchange rate in countries that adhere to a floating exchange rate regime.[18]

Consistent with dominant inflationary effects, exchange rate variability increases trend price inflation significantly across countries. The dominant contractionary effect is consistent with a significant reduction in trend real growth with respect to exchange rate variability across countries. Both channels are exacerbated in countries with floating exchange rate regimes, implying nominal flexibility is an important channel of transmitting exchange rate variability, and ultimately aggregate demand variability, to the macro-economy.

Consistent with the dominant increase in imports, exchange rate variability accelerates import growth significantly across countries. This channel is exacerbated in countries with floating exchange rate system. The implication is nominal flexibility supports higher demand for imports. For other variables-- consumption, investment, exports, the trade balance, and the current account balance-- asymmetry is not pronounced to yield significant effects of exchange rate variability on trends over time. However, in countries with a floating exchange rate system, the trends of consumption, investment and exports are indeed higher, relative to countries with fixed exchange rate systems. The implication is nominal flexibility increases competitiveness, facilitating higher trend export growth that avails resources for higher trend growth of consumption and investment, relative to countries with pegged exchange rate systems.

Variability increases aggregate uncertainty impinging on the economic system. To formalize the relationship, Table 3 presents coefficients that summarize the effects of exchange rate variability on the variability of economic variables across countries. Higher variability of the exchange rate has a significant positive effect that increases the variability of price inflation, real growth, consumption growth, export growth, and import growth across countries. Countries with floating exchange rate systems exhibit even higher variability of price inflation, private consumption, and imports, compared to countries with pegged systems, implying limited capacity for countercyclical policies to weather the consequences of external shocks that are exacerbated by frequent variability in the nominal exchange rate. The implication is nominal flexibility exacerbates real exchange rate variability around its underlying equilibrium and aggregate uncertainty,[19]exacerbating the adverse effects associated with the asymmetric allocation of demand variability between real and nominal magnitudes over the business cycle in light of limited capacity to invoke countercyclical policies in the face of external shocks. Aligning the real exchange rate with underlying fundamentals would help stem the variability attributed to movements in relative prices and bilateral exchange rates with major trading partners and the associated cyclical biases in the transmission of these shocks to the macro-economy.

[18] Appendix Table contrasts average indicators across countries based on the exchange rate system. Classification of countries based on the exchange rate system is based on IMF (2011).

[19] Graphs that track movements in trends and variability of real growth, inflation, consumption growth, import growth, and export growth with the variability of exchange rate shocks across the sample of 32 countries in Latin America and the Caribbean are available upon request.

Determinants of Asymmetry

Among theoretical explanations of asymmetric effects of demand variability, the sticky price explanation suggests higher incentives to adjust prices upward, relative to downward adjustment, in countries that have experienced a history of high inflation. In a high inflationary environment, agents are more inclined to pay the menu cost and adjust prices upward to prevent a relative deterioration in their product prices. In contrast, high trend inflation reduces incentives to pay the menu cost and adjust prices downward, as agents contemplate a fast reversal of the cycle.

A sticky-wage explanation also suggests higher incentives to adjust wages upward in countries with high trend inflation and/or higher aggregate uncertainty. Cost of living clauses are likely to be specified to ensure workers adequate compensation in the face of higher inflation and/or more uncertainty. By contrast, wages are likely to be sticky-downward in countries with higher trend inflation and/or demand variability. Workers are likely to factor in the impact of higher uncertainty on real wages and resist a slowdown in nominal terms during cyclical downturns.

Asymmetry could be a function of institutions, demand variability and/or trend inflation. The implications of higher trend inflation and/or demand variability may provide an explanation for the observed asymmetry. Cross-country regressions attempt to establish the validity of theory's predictions regarding the endogeneity of observed asymmetry with respect to trend inflation and/or demand variability. Countries with higher trend inflation and/or frequent and large demand variability are likely to exhibit a stronger evidence of asymmetry, implying higher inflation during upturns and a larger output contraction during downturns.

To verify the validity of this theoretical hypothesis, cross-country regressions are estimated. To increase the sample size and establish quality statistical inference, estimation is conducted using time-series parameter estimates that include a larger country sample, specifically 32 countries in Latin America and the Caribbean (LAC). The parameters measuring asymmetry in output and price in the face of demand shocks are regressed on trend price inflation or demand variability across the sample of Latin American and Caribbean countries. The evidence, in Table 4, does not support theory's implications. Across countries, higher trend inflation significantly increases output expansion relative to contraction. This evidence suggests that countries with higher trend inflation have taken more serious steps to fight inflation, which moderates the contractionary effect of demand shocks on real growth during cyclical downturns.[20] Similarly, an increase in demand variability across countries increases incentives to moderate output contraction, relative to expansion. This is consistent with rigidity to raise price inflation, as evident by the negative relationship between upward price flexibility and higher demand variability across countries.

In light of these results, the empirical evidence rejects possible endogeneity of asymmetric price flexibility with respect to trend price inflation and/or demand variability across

[20] This evidence supports the analysis in Kandil (1995) using data across industrial countries.

countries. Determinants of asymmetric price flexibility are likely to be the result of structural rigidities in labor and product markets that constrain capacity during a boom and downward adjustments in inflation, even when the trend rate and demand variability is low. Unveiling structural and institutional impediments governing product and labor markets, particularly in the case of small Caribbean countries, is worthy of future research, focusing on the specifics of individual countries.

Implications of Asymmetry

Demand variability does not differentiate asymmetry in the output and price adjustments during expansions and contractions. However, structural and institutional constraints differentiate the allocation of demand variability between price inflation and output growth over economic cycles. Given asymmetric allocations, symmetric demand shocks are likely to create inflationary bias and lower real growth as demand variability increases across countries.

In the next step, cross-country regressions verify the implications of asymmetry on output growth and trend inflation. Regardless of the source of asymmetry, higher output expansion, relative to contraction, in the face of demand shocks, should establish that higher demand variability, i.e., higher probability of realizing positive and negative demand shocks, would have a negative impact on trend real growth over time. Likewise, given evidence of asymmetry, higher demand variability would increase price inflation, relative to deflation, with a positive effect on trend price inflation. The cross-country regressions seek to test the impact of demand variability on trend real growth and price inflation, given evidence of asymmetry, across countries.

To verify the validity of these implications, Table 5 presents the cross-country regression results, where trends for each of price inflation and real growth vary with demand variability across countries. The inflationary bias implied by the evidence of asymmetry in the face of demand variability is highly supported across countries. An increase in demand variability, a higher probability of realizing positive and negative shocks, increases trend price inflation, as evident by the positive and significant parameter estimate across countries. Consistently, higher demand variability moderates real output growth, as evident by the negative, although insignificant, parameter estimate across countries.

Asymmetry in Specific Demand

Table 6 presents the evidence for export growth, import growth, and the change in the trade balance. To shed some light on the propagation of aggregate demand shocks to the real economy, Box 1 highlights major features of asymmetric adjustments in the specific components of aggregate demand over the business cycle.

To summarize, asymmetric cyclical fluctuations are also evident in the behavior of demand components over the business cycle. Private consumption increases significantly during economic booms, further accelerating price inflation in some countries. In other countries, significant reduction in private consumption during recessions exacerbates real output contraction. Asymmetric cyclical fluctuations of private investment appear even more

pronounced compared to private consumption, further exacerbating the inflationary effect and output contraction over the business cycle. In general, cyclicality in exports and imports cancel out during booms and recessions, moderating cyclical fluctuations in the trade balance.

VI. Summary and Conclusion

In an empirical model that differentiates responses to positive and negative demand shocks, the paper investigates asymmetry in the allocation between real output growth and price inflation. The results indicate that the majority of Caribbean countries are characterized by asymmetry in the response of output growth and price inflation to equal size expansionary and contractionary demand shocks. Asymmetry, in most cases, reveals capacity constraints in the face of expansionary demand shocks, compared to contractionary shocks. Consequently, relative to the underlying trend, output contraction exceeds expansion and price inflation exceeds deflation over the business cycle. Demand variability creates a negative growth and a positive inflation bias, on average, over time. Variability of the real exchange rate in relation to relative price variability and bilateral movements in nominal exchange rates with respect to major trading partners exacerbates demand variability and potential cyclical biases associated with asymmetric adjustments to the shocks. These channels appear more pronounced in countries with floating exchange rate systems, as nominal flexibility exacerbates the transmission channel of external shocks to the domestic economy in light of limited scope to invoke countercyclical policies. Aligning the real exchange rate with underlying fundamentals would help stem uncertainty and potential adverse effects attributed to frequent variability of the exchange rate around its equilibrium.

Two major policy implications emerge from this analysis. First, the evidence warrants a careful analysis of institutional and structural rigidities that underlie capacity constraints in the face of expansionary demand shocks and nominal rigidity in the face of contractionary shocks in many of the countries under investigation. A review of constraints to factor mobility and institutions for price adjustments would be helpful in identifying the precise factors responsible for asymmetry. Priorities should then be established to reduce such structural rigidities in the factor and product markets responsible for downward biases on growth and upward biases on inflation implied by asymmetric responses in the face of demand variability.

A parallel policy track should aim at smoothing demand variability. Demand variability can be exacerbated by procyclical macroeconomic policies that amplify the impact of external shocks. In particular, additional fiscal spending during economic booms further accelerates price inflation while a slowdown in government spending during a recession exacerbates the contactionary effects. As a result, pro-cyclical policies only serve to worsen the growth-reducing and inflationary bias associated with uneven distribution of demand variability between output growth and price inflation during economic cycles. Equally important, is the need to increase fiscal space to invoke necessary countercyclical policies to mitigate the effects of external shocks and smooth asymmetric effects attributed to demand variability. To that end, policy priorities should be focused on reforming public finances and building the necessary buffers for policy interventions to smooth excessive vulnerability of Caribbean economies in the face of external shocks.

Box 1. Asymmetry in the Behavior of Specific Demand Components

Private Consumption:

- *During a boom*, private consumption growth increases significantly and correlates with higher price inflation in Dominica, Dominican Republic, Guyana, Haiti, Jamaica, St. Lucia, Suriname, and Trinidad and Tobago.
- *During a recession*, private consumption growth decreases significantly and correlates with output contraction in Barbados, Belize, St. Kitts and Nevis, St. Lucia, and Suriname.
- *During a recession*, private consumption growth decreases significantly and correlates with price deflation in Dominican Republic, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, and Suriname.
- In Barbados, the reduction in consumption growth during a recession exceeds the increase during a boom.
- In Guyana, the increase in private consumption growth during a boom dominates the reduction during a recession.

Private Investment

- *During a boom*, private investment growth increases significantly and correlates with higher price inflation in Dominica.
- *During a recession*, private investment growth decreases significantly and correlates with larger output contraction in Barbados, Belize, and Suriname.

Exports

- *During a boom*, export growth increases significantly and correlates with higher price inflation in Barbados.
- *During a recession*, export growth decreases significantly and correlates with larger output contraction in Belize, Dominica, Guyana, St. Lucia, and Trinidad and Tobago.

Imports

- *During a boom,* import growth increases significantly and correlates with higher price inflation in Antigua and Barbuda, Grenada, St. Kitts and Nevis, and Suriname.
- *During a recession,* import growth decreases significantly and correlates with larger output contraction in Guyana and St. Lucia.

Trade Balance

- *During a boom***,** the increase in imports dominates the increase in exports, resulting in significant reduction in the trade balance in Antigua and Barbuda and in Grenada.
- *During a recession,* the reduction in exports dominates the reduction in imports, resulting in significant deterioration in the trade balance in Antigua and Barbuda.

Table 1. Caribbean Real Growth and Price Inflation

Country	Real GDP Growth		Inflation of GDP Deflator	
	Average (In percent)	Std Dev (In percent)	Average (In percent)	Standard Deviation
Antigua and Barbuda	4.2	3.5	7.2	9.9
The Bahamas	2.4	4.8	3.9	2.8
Barbados	1.9	3.5	4.6	4.5
Belize	5.4	5.3	2.8	6
Dominica	2.7	5.3	5.2	4.5
Dominican Republic	4.1	3.5	14.2	1.3
Grenada	3.6	3.9	5.5	5.8
Guyana	0.67	4.8	18.6	2.6
Haiti	0.64	3.8	11.2	8
Jamaica	1.2	2.8	16.6	11
St. Kitts and Nevis	4.5	2.5	5.7	6.7
St. Lucia	4.8	4.6	4.6	5.2
St. Vincent and the Grenadines	4.5	3.2	4.7	4
Suriname	1.8	5.9	25.9	39
Trinidad and Tobago	2.5	5.6	7.3	8

Table 2. Fluctuations in Real Output Growth, Price Inflation, and Private Spending

Country	Output Growth			Price Inflation			Growth of Private Consumption			Growth of Private Investment		
	Posn	Negn	Asyem	Posn	Negn	Asyem	Posn	Negn	Asyem	Posn	Negn	Asyem
Antigua and Barbuda	0.01	0.90*	-0.89*	0.99*	0.099*	0.89*	...	...	...	...	...	...
	(0.02)	(3.60)	(-3.36)	(4.11)	(0.40)	(3.80)	...	...	...	...	...	...
The Bahamas	0.54*	0.78*	-0.24	0.46*	0.22	0.24	1.54	-0.039	1.58	-6.96	3.36	-10.32
	(2.75)	(3.50)	(-1.22)	(2.38)	(1.01)	(1.40)	(0.75)	(-0.07)	(0.76)	(-1.07)	(1.61)	(-1.58)
Barbados	-0.032	0.89*	-0.92*	1.03*	0.11	0.92*	0.05	1.57*	-1.52*	0.14	5.46*	-5.32*
	(-0.19)	(4.93)	(-5.47)	(6.04)	(0.63)	(5.40)	(0.10)	(2.92)	(-2.98)	(0.06)	(2.47)	(-2.28)
Belize	0.041	1.17*	-1.13*	0.96*	-0.17	1.13*	0.63	1.14*	-0.51	0.63	7.16*	-6.53*
	(0.18)	(3.48)	(-4.96)	(4.20)	(-0.50)	(4.94)]	(1.62)	(1.98)	(-1.31)	(0.47)	(3.62)	(-4.87)
Dominica	0.13	1.28*	-1.15*	0.87*	-0.28*	1.15*	1.73*	1.28	0.45	9.85*	-3.02	12.87*
	(0.33)	(3.69)	(2.92)	(2.18)	(-0.80)	(2.88)	(1.97)	(1.68)	(0.51)	(2.24)	(-0.79)	(2.93)
Dominican Republic	-0.17	-0.10	-0.27	1.17*	1.10*	0.07	0.85*	0.93*	-0.08	0.77	0.42	0.35
	(-1.02)	(0.57)	(-1.62)	(6.93)	(6.06)	0.41	(3.68)	(3.77)	(-0.34)	(1.30)	(0.66)	(0.59)
Grenada	-0.20	1.01*	-1.21*	1.20*	-0.009	1.21*	...	...	...	...	...	...
	(-0.90)	(4.80)	(-5.44)	(5.39)	(-0.04)	(5.13)	...	...	...	...	...	...
Guyana	-0.12	0.11	-0.23	1.12*	0.89*	0.23	1.52*	0.62	0.90*	5.16*	2.43	2.73**
	(-0.87)	(0.85)	(-1.67)	(8.20)	(6.54)	(1.68)	(4.32)	(1.36)	(2.56)	(3.31)	(1.20)	(1.75)
Haiti	-0.16	-0.19	0.03	1.16*	1.19*	-0.03	1.03*	0.88**	0.15	-0.008	-0.65	0.67
	(-0.69)	(-0.56)	(0.13)	(4.99)	(3.54)	(-0.13)	(2.96)	(1.75)	(0.43)	(-0.01)	(-0.33)	(0.80)
Jamaica	0.20**	0.083	0.12	0.80*	0.92*	-0.12	0.92*	0.90**	0.02	1.48	2.69	-1.21
	(1.77)	(0.44)	(1.04)	(7.29)	(4.84)	(-1.09)	(3.41)	(1.94)	(0.07)	(1.50)	(1.59)	(-1.22)
St. Kitts and Nevis	0.31*	0.21*	0.10	0.69*	0.79*	-0.10	0.41	1.15**	-0.74	2.20	-4.72*	6.92*
	(2.81)	(2.72)	(0.91)	(6.15)	(10.13)	(-0.89)	(0.48)	(1.92)	(-0.87)	(1.11)	(-3.41)	(3.49)
St. Lucia	0.09	0.70*	-0.61*	0.91*	0.30**	0.61*	1.59*	0.99*	0.60	-0.79	2.37	-3.16
	(0.54)	(3.89)	(-3.52)	(5.33)	(1.69)	(3.57)	(4.29)	(2.54)	(1.62)	(-0.10)	(0.78)	(-0.40)
St. Vincent and the Grenadines	0.59*	0.85*	-0.26	0.41*	0.15	0.26	0.43	-0.20	0.63	1.20	2.11	-0.91
	(2.80)	(3.21)	(-1.23)	(1.99)	(0.56)	(1.26)	(1.08)	(-0.39)	(1.58)	(0.65)	(0.89)	(-0.49)
Suriname	-0.03	0.17**	-0.20*	1.03*	0.83*	0.20*	1.02*	1.05*	-0.03	1.27*	1.26**	0.01
	(0.49)	(1.89)	(-3.27)	(16.61)	(9.10)	(3.22)	(8.78)	(5.94)	(-0.28)	(2.73)	(1.78)	(0.02)
Trinidad and Tobago	-0.27	0.78*	-1.05*	1.27*	0.22	1.05*	1.04**	0.42	0.62	1.28	1.86	-0.58
	(-0.93)	(2.21)	(-3.62)	(4.33)	(0.63)	(3.58)	(1.74)	(0.59)	(1.04)	(0.76)	(0.92)	(-0.34)

Notes:
Edn: Anticipated aggregate demand growth.
Posn: Expansionary shocks to aggregate demand during a boom.
Negn: Contractionary shocks to aggregate demand during a recession.
Asyem: difference in the response to expansionary and contractionary shocks.
Coefficients measure the response of each variable to demand shifts. Bracketed magnitudes are t-statistics, where * and ** denote statistical significance at the 5 and 10 percent levels.

Table 3. Variation in Indicators of Macroeconomic Performance with Variability of Exchange Rate Shocks Across Countries

Dependent Variable	Explanatory Variables			Explanatory Variables		
	Constant	Exchange Rate Variability	Interactive Dummy	Constant	Exchange Rate Variability	Interactive Dummy
Trend Price Inflation	0.082*	0.20*	0.89*			
	(2.69)	(3.60)	(3.23)			
Variance of Price Inflation				0.076	0.52*	1.60*
				(1.15)	(4.28)	(2.70)
Trend Real Growth	0.039*	-0.009*	-0.04*			
	(16.35)	(-2.00)	(-2.03)			
Variance of Real Growth				0.04	0.013*	0.0034
				(14.81)	(2.64)	(0.14)
Trend Consumption Growth	0.13*	0.11	0.59**			
	(3.32)	(1.60)	(1.75)			
Variance of Consumption Growth				0.13**	0.35*	1.62*
				(1.73)	(2.65)	(2.49)
Trend Investment Growth	0.095*	0.029	0.85*			
	(2.25)	(0.40)	(2.34)			
Variance of Investment Growth				1.07*	-0.43	-1.11
				(5.63)	(-1.29)	(-0.67)
Trend Export Growth	0.13*	0.11**	0.74*			
	(3.66)	(1.82)	(2.40)			
Variance of Export Growth				0.19*	0.25*	0.85
				(2.90)	(2.25)	(1.53)
Trend Import Growth	0.13*	0.11*	0.69*			
	(4.42)	(2.12)	(2.68)			
Variance of Import Growth				0.17*	0.28*	0.84**
				(3.07)	(2.81)	(1.72)
Trend Trade Balance	-2.82	1.41	580.4			
	(-0.03)	(0.01)	(0.73)			
Variance of Trade Balance				172.4	-101.5	2637.9
				(0.61)	(-0.21)	(1.09)
Trend Current Account Balance	0.012	-0.018	0.31			
	(0.34)	(-0.28)	(0.98)			
Variance of Current Account Balance				0.50	-0.036	5.98
				(1.10)	(-0.05)	(1.54)

Notes:
Trend: average time-series.
Variance: standard deviation of time series.
Interactive dummy captures relative variability in countries with flexible exchange rate systems.
Coefficients measure the relationship across 32 countries in Latin America and the Caribbean.
Exchange Rate Variability: standard deviation of shocks to real effective exchange rate, misalignment relative to equilibrium.
t-ratio is in parentheses. * and ** denote statistical significance at the five and ten percent levels.

Table 4. Determinants of Asymmetry Across Countries of Latin America and the Caribbean

	Explanatory Variables		Explanatory Variables	
Dependent Variable	Constant	Demand Variability	Constant	Trend Inflation
Upward Price Flexibility	1.05*	-0.27**	1.04*	-0.36
	(16.91)	(-1.89)	(14.25)	(-1.19)
Downward Price Flexibility	0.50*	-0.035	0.42*	0.35
	(5.13)	(-0.16)	(3.89)	(0.78)
Upward minus Downward Price Flexibility	0.55*	-0.23	0.62*	-0.71
	(5.11)	(-0.94)	(5.09)	(-1.42)
Output Expansion	0.0068	0.19	0.026	0.18
	(0.07)	(0.85)	(0.24)	(0.40)
Output Contraction	0.56*	-0.30	0.63*	-0.89*
	(5.81)	(-1.37)	(6.05)	(-2.08)
Output Expansion minus Contraction	-0.60*	0.46**	-0.65*	1.03*
	(-5.68)	(1.92)	(-5.54)	(2.12)

Notes:

Upward price flexibility is measured by the time-series response to expansionary demand shocks in model (2).
Downward price flexibility is measured by the time-series response to contractionary demand shocks in model (2).
Output expansion is measured by the time-series response to expansionary demand shocks in model (1).
Output contraction is measured by the time-series response to contractionary demand shocks in model (1).
Demand variability is standard deviation of nominal GDP growth.
Trend inflation is the average inflation of the GDP deflator.
t-ratios are in parantheses.
* and ** denote statistical significance at the five and ten percent levels.

Table 5. Implications of Asymmetry Across Countries of Latin America and the Caribbean

	Explanatory Variables		
Dependent Variable	Constant	Demand Variability	R^2
Trend Inflation	0.050*	0.46*	0.88
	(3.76)	(15.03)	
Trend Growth	0.044*	-0.0047	0.002
	(4.97)	(-0.24)	

Notes:
Trend inflation is the average rate of inflation of the GDP deflator.
Trend growth is the average growth of real GDP.
t-ratios are in parantheses.
* and ** denote statistical significance at the five and ten percent levels.

Table 6. Fluctuations in Export Growth, Import Growth, and the Trade Balance

	Export Growth			Import Growth			Change in Trade Balance		
Country	EDn	posn	negn	EDn	posn	negn	EDn	posn	negn
Antigua & Barbuda	2.58*	0.54	0.018	1.50*	3.04*	-1.09	0.54	-1.83*	1.60*
	(2.30)	(0.32)	(0.01)	(1.90)	(2.52)	(-0.87)	(1.44)	(-3.16)	(2.68)
The Bahamas	1.23*	3.08	1.19	1.28*	-3.15	1.59**	-0.21	13.06	-1.04
	(2.38)	(0.87)	(1.05)	(3.10)	(-1.11)	(1.74)	(-0.13)	(1.13)	(-0.28)
Barbados	0.58	1.80*	-0.031	0.71*	1.033**	1.14*	-0.62	1.28	-2.16
	(1.54)	(2.73)	(-0.04)	(2.27)	(1.85)	(1.95)	(-0.90	(1.05)	(-1.68)
Belize	1.52*	0.72**	3.41*	-0.01	0.49	0.99	0.082	0.21	-0.16
	(2.29)	(1.91)	(6.18)	(-0.01)	(1.01)	(1.16)	(0.12)	(0.65)	(-0.33)
Dominica	1.54*	-0.29	2.68*	1.00*	1.77**	1.22	-0.021	-0.036	-0.38
	(3.82)	(-0.19)	(2.01)	(3.64)	(1.70)	(1.35)	(-0.27)	(-0.12)	(-1.45)
Dominican Republic	-0.69	1.47	1.55	-0.21	0.75	1.33**	1.48	12.18	21.79
	(-1.05)	(1.58)	(1.55)	(-0.41)	(1.04)	(1.72)	(0.05)	(0.31)	(0.52)
Grenada	1.02*	0.87	0.94	0.30	2.17*	0.37	0.58*	-0.97*	0.11
	(2.00)	(1.11)	(1.27)	(0.64)	(3.01)	(0.54)	(2.16)	(-2.32)	(0.29)
Guyana	1.45*	0.48**	1.70*	1.38*	0.39	1.41*	-1.16	6.7	-9.03
	(12.72)	(1.91)	(6.82)	(8.97)	(1.15)	(4.20)	(-0.18)	(0.46)	(-0.63)
Haiti	1.59*	0.95	1.76	0.98**	0.80	1.04	-10.28	-15.99	-11.11
	(2.35)	(0.91)	(1.17)	(1.93)	(1.03)	(0.93)	(-0.91)	(-0.92)	(-0.44)
Jamaica	1.55*	2.41	0.50	1.68*	0.055	1.50	-4.95	51.89	-23.60
	(2.69)	(1.38)	(0.49)	(3.09)	(0.06)	(0.92)	(-0.24)	(1.44)	(-0.38)
St. Kitts & Nevis	-0.089	1.14*	0.71*	0.44	0.88	-0.22	-0.29	-0.05	0.16
	(-0.14)	(2.21)	(1.98)	(0.60)	(1.54)	(-0.56)	(-0.92)	(-0.22)	(0.92)
St. Lucia	0.99*	-0.15	1.55*	1.19*	0.46	1.28*	-0.21	-0.22	-0.067
	(2.45)	(-0.27)	(2.71)	(3.79)	(1.10)	(2.89)	(-0.87)	(-0.67)	(-0.20)
St. Vincent	2.07*	2.67*	2.81*	0.75**	1.18	-0.33	0.67	-0.051	0.85
	(4.69)	(2.59)	(2.15)	(1.75)	(1.18)	(-0.26)	(1.51)	(-0.08)	(1.02)
Suriname	0.88*	1.17*	1.12*	0.93*	1.14*	0.82*	-13.63	82.99	-117.04
	(10.44)	(7.65)	(4.96)	(6.56)	(4.48)	(2.21)	(-0.19)	(0.65)	(-0.63)
Trinidad & Tobago	0.70	-0.48	1.54*	1.62*	0.04	0.68	9.39	-30.85	32.85
	(1.60)	(-0.63)	(1.70)	(3.20)	(0.05)	(0.65)	(0.78)	(-1.48)	(1.32)

EDn: Anticipated aggregate demand growth.
posn: Expansionary shocks to aggregate demand during a boom.
negn: Contractionary shocks to aggregate demand during a recession.
Coefficients measure the response of each variable to demand shifts.
Bracketed magnitudes are t-statistics, where * and ** denote statistical significance at the five and ten percent levels.

Annex 1. Data Definition and Sources

1. GDP: Gross domestic product, current prices, WEO, NGDP.
2. Real GDP: Gross domestic product, constant prices, WEO, NGDP_R.
3. Consumer Price Index: WEO, PCPI.
4. Money: Broad Money, WEO, FMB.
5. Private Consumption: Private consumption expenditure, current prices, WEO, NCP.
6. Private Investment: Gross private capital formation, current prices, WEO, NIP.
7. Private Fixed Investment: Gross private fixed capital formation, current prices, WEO, NFIP.
8. Total Investment: Gross fixed capital formation, current prices, WEONFI.
9. Exports: Exports of goods and services, current prices, WEO, NX.
10. Imports: Imports of goods and services, current prices, WEO, NM.
11. Trade Balance: Exports minus imports of goods and services.
12. Current Account Balance: WEOBCA.
13. Government Spending: General government total expenditure and net lending, WEO, GGENL.
14. Exchange Rate: Real effective exchange rate, the real price of domestic currency with respect to currencies of major trading partners, WEO, reer.
15. Caribbean GDP: Sum of gross domestic product, current prices, U.S. dollars, WNGDPD.
16. U.S. GDP: Gross domestic product, current prices, U.S. dollar, W111NGDPD.
17. Interest Rate: various representatives of interest rates as follows:
    - Discount Rate: IFS, 60..ZF
    - Money Market Rate: IFS, 60..BZF
    - Treasury Bill Rate: IFS, 60..CZF
    - Savings Rate: IFS, 60K..ZF
    - Deposit Rate: IFS, 60L..ZF
    - Lending Rate: IFS, 60P..ZF

    Data are available from *World Economic Outlook*, WEO, or *International Financial Statistics,* IFS, available from the IMF.

Appendix Table **Averages of Economic Indicators across Countries based on Exchange Rage Regime**

Exchange Rate System	Trend Inflation	Trend Growth	Avg. Con. Growth	Avg. Inv. Growth	Avg. Exp. Growth	Avg. Imp. Growth	Output Variability	Price Variability	Consumption Variability	Investment Variability	Export Variability	Import Variability
Pegged	0.12	0.04	0.13	0.08	0.14	0.14	0.21	0.04	0.23	0.95	0.24	0.22
Antigua & Barbuda												
Argentina												
Bahamas, The												
Barbados												
Belize												
Dominica												
Dominican Republic												
Ecuador												
El Salvador												
Grenada												
Honduras												
Nicaragua												
Panama												
St. Kitts & Nevis												
St. Lucia												
St. Vincent & the Grenadines												
Trinidad & Tobago												
Floating	0.24	0.03	0.25	0.25	0.27	0.26	0.36	0.04	0.40	0.88	0.36	0.34
Bolivia												
Brazil 1/												
Chile 1/												
Colombia 1/												
Costa Rica												
Guatemala 1/												
Guyana												
Haiti												
Jamaica												
Mexico 1/												
Paraguay												
Peru 1/												
Suriname												
Uruguay												
Venezuela												

1/ Countries that follow inflation targeting.

Caribbean: Wage Determination Flexibility

	Score (1-7)	Rank (out of 144)
Barbados	4.7	98
Guyana	5.3	47
Jamaica	4.9	84
Suriname	5.0	76
Trinidad and Tobago	4.2	119

Source: World Economic Forum, Global Competitiveness Report 2012-2013.

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