**CHANNELS OF RISK SHARING ACROSS SELECTED CARIBBEAN COUNTRIES**

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Abstract

The present uncertainty prevailing in the world economy, as a result of the events in Russia and the countries of the Far East, has led to the consideration of risk sharing between Barbados and the member countries of the OECS. In addition, recent efforts at closer economic integration between the OECS and Barbados could embrace risk sharing as a focus since all these economies are very vulnerable to external shocks due to their openness.

We acknowledge that, just as costs are associated with any form of integration, so will risk sharing across countries. Political risks, which make a fiscal union less likely to succeed, usually increase where there is polarization in the distribution of income. Such polarization may lead to a lack of consensus on important common policies. Thus, the issue of voting rules is important to the reduction of the political risk inherent in any risk sharing venture should the participants be able to enjoy its advantages.

The paper shows that there is evidence of a significant lack of risk sharing between countries of the OECS and Barbados. Though the econometric analysis falls short of quantifying the potential gains, the lack of risk sharing implies that there are gains to be made if the appropriate channels are developed. A tax-transfer policy of a federal fiscal system along credit market smoothing, via lending and borrowing on national credit markets, are suggested as two possible starting points.

## 1. Introduction

The feared detrimental impact of the fall out from the financial and economic crisis of the Asian and Eastern European countries on the economies of the rest of the world has given rise to the consideration of avenues to share risk within and across countries with geographical and economic linkages. Indeed, the emerging economies, like those of Latin America, are under threat and access to finance, at concessionary or reasonable interest rates from the international market, in order to cushion the deleterious effects of either declining commodity prices or a shortage of foreign capital inflows, is rapidly disappearing.

In this paper, we consider the risk related to external shocks experienced by the small open economies of the Caribbean, in particular, those of the Caribbean Community (CARICOM), which are on the threshold of the realization of a Single Market and Economy (SME). We examine the potential for risk sharing among some of these territories, the OECS[a] member-countries and Barbados, with the hope of further stimulating and concretizing thoughts concerning the necessity for a strong and meaningful integration between them. The OECS states consist of Anguilla, St. Kitts and Nevis, Montserrat, Antigua and Barbuda, Dominica, St. Lucia, St. Vincent and the Grenadines and Grenada.

a. OECS = Organization of East Caribbean States

The openness of these economies is characterized by a high import intensity, limited exports (sugar, bananas, cocoa and nutmeg in the OECS and sugar in Barbados) and a growing dependence on tourism and offshore financial services. In addition, the use of monetary policy is limited in its scope and effect, chiefly to "accommodate to private sector expenditure plans" (Worrell,1997) in these countries with a fixed exchange rate regime. Since the maintenance of a viable balance of payments position is the foundation of economic policymaking in small, open, developing countries, fiscal policy is used to achieve macroeconomic stabilization and adjustment. Consequently, the vulnerability of these economies begs for an examination of avenues of risk sharing in order to preclude the effects of externalities on these economies. A basis, indeed, could be established for the suppression of idiosyncratic nationalism to embrace the virtues of a shared experience.

The paper is organized in the following manner: the following section, section two, introduces the notion of risk sharing and provides a literature review which further elucidates the topic. Section three looks at the issues related to the implementation and practice of risk sharing. Section four provides an analysis of some features in the economies of both the OECS and Barbados that increase the likelihood that risk sharing would be beneficial. The fifth section contains the econometric analysis, investigating evidence of risk sharing, using data from the OECS countries and Barbados so as to further press the case for a serious consideration of the vented ideas. The final section is used for concluding remarks.

## 2. Literature Review

Risk sharing may be accomplished through various channels. Among them are: -

(a) a cross-ownership of productive assets by member-countries of a federal arrangement, facilitated by a developed capital market;

(b) a tax-transfer policy of a centralized or federal fiscal system whereby income smoothing can be facilitated across countries; and

(c) credit market smoothing, via lending and borrowing on national credit markets, that results in consumption smoothing through adjustment of asset portfolios.

Since a developed capital market does not presently exist in either the OECS or Barbados, the second and third channels highlighted above will be the focus of this paper.

The focus of most of the literature on risk sharing has been on the achievements of the federal government system of the United States of America. The scope of interstate risk sharing in the U.S. is reflected in state production per capita being more variable than nationwide production per capita. Asdrubali *et al* (1996), using data for the period 1963-1990, found that 13% of shocks to gross state product was smoothed by a federal fiscal system while 23% was smoothed by credit markets. Federal government smoothing was decomposed into three categories: taxes, transfers and federal grants to individuals and states. The major part of income smoothing by the federal system, 6.3% of shocks to gross state product, occurred through federal direct transfers to individuals, exclusive of unemployment benefits. In total, direct tax-transfers smoothed 10.6% of shocks and federal grants to state governments, a further 2.5%. On the other hand, credit market smoothing was found to be considerably lower in states where shocks were highly persistent. In such states, both capital market smoothing and the federal tax-transfer system were more frequently used. Asdrubali *et al* further discovered that, generally, geographic proximity facilitated risk sharing.

Alesina and Perotti (1998) postulated that a federal fiscal system could achieve more efficient outcomes by better internalizing numerous externalities associated with both the expenditure and revenue aspects of fiscal policy, particularly when factors are mobile. According to Lee (1998), mobility of individuals, itself, also functions as insurance against adverse shocks regardless of whether a central or local government redistributes. However, local distributive policies distort the allocation of labour, resulting in an efficiency loss. Though a local redistributive policy allows each jurisdiction to choose its own level of redistribution, a local redistributive policy is not necessarily more efficient than a federal one, even when factors are immobile. A federal policy, according to Sala-i-Martín and Sachs (1992), acts as insurance against jurisdiction-specific shocks since a local policy cannot pool the risk between jurisdictions. They further contended that if the income tax is progressive and the transfer system is counter cyclical, the fraction of the shocks insured by the fiscal system will be larger. Furthermore, fiscal federalism has two distinct advantages: -

1) the ability to redistribute the inter-temporal tax and spending patterns across

regions in response to shocks affecting regional economies. This is much preferred to use of a government policy which attempts to stabilize output by running a counter-cyclical deficit. This is so because fiscal deficits are subsequently repaid by higher taxes or lower spending. In that case, the short-term gains from stabilization may be lost or short-run stabilization could in fact be undermined by a Ricardian equivalence response[1] of consumers to future taxes. A federal fiscal policy is, however, not affected by such a response since it redistributes the tax and spending patterns across regions according to the magnitude of the shock(s) affecting the economies. Thus, an economic region, which paid lower taxes in a recession, is not required, in present value terms, to pay higher taxes in the future. Instead, higher taxes are paid by all regions in the fiscal union; and

2) in a federal fiscal system, the rich countries would not have to pay more taxes, as a percentage of gross income, than the poorer countries. This is best understood with an example: suppose two countries, Barbados (richer country) and St. Vincent (poorer country) form a fiscal union. Assume that Barbados has an annual income of US$1,000 and St. Vincent US$500, and they agreed to pay an income tax of 10% to the central authority. The central authority will subsequently give an annual transfer of US$100 and US$50 to Barbados and St. Vincent, respectively. Let us further assume that, in a subsequent year, St. Vincent suffers an adverse shock that reduces its annual income to US$300 while Barbados' economy experiences a favourable shock resulting in an annual income increase to US$1,200. The taxes paid would be still 10% and so Barbados would pay US$120 and St. Vincent US$30 to the central authority. The transfers received from the authority would still be US$100 and US$50, respectively, and so a transfer of US$20 would have been made from Barbados to St. Vincent. Thus, for a given tax rate, stable tax revenues would result for redistribution, which would insure individuals against country-specific shocks (Persson and Tabellini,1996).

Two possible deficiencies of this system were cited by Alesina and Perotti (1998): the fact that fiscal policy ought to be endogenous or country-specific, and the decision-making process surrounding the specific tax regime to be used, has to be based on a consensus among participating countries. They further recognized that the greater the number of individuals taking part in the decision-making process in a centralized fiscal system, the larger would be the membership/size of the union. Consequently, the diversity of the decision-makers might increase, which might lead to more, not less, uncertainty about the policy instrument and more instability in income and consumption. On the other hand, they affirmed that there were other benefits to be derived from an integrated fiscal system. These include economies of scale in the provision of public goods and greater bargaining power in the extra-regional and global economic arena. In their model, the efficiency of the system depends on the difference in preferences for

redistribution of income and on the correlation between shocks. Because the tax rate is decided on after shocks occur in the model, there is always uncertainty surrounding its choice and the timeliness of the chosen policy. However, Lee (1998) suggests that if the tax rate were chosen *ex ante*, there would be no uncertainty on the tax rate.

There is a critique that views income redistribution as a public good since each locality may have different preferences for redistribution (Pauly,1973; Tresch,1981). Consequently, a federal redistributive policy that provides a uniform level of assistance to the 'unlucky' country cannot be suitable for such different preferences, and so an efficiency loss is experienced. In other words, diversity of preferences to public policy may increase the average difference of each individual's preferred public good from the one that is provided in equilibrium. They recommend, therefore, that local governments should take responsibility for any redistribution functions. This view was shared by Perotti (1997), who further contended that, in the circumstance where differences exist, for example, in labour markets or the administration of fiscal policy, centralized redistribution can result in a more inefficient allocation of resources. Townsend (1995) also pointed out that the insurance provided by pooling resources as in a fiscal federal system can be more limited if shocks are aggregate shocks, affecting in similar fashion all members of the union, as opposed to idiosyncratic shocks.

Credit market smoothing, unlike federal tax transfers, only takes place *ex post*, that is, after shocks occur. Furthermore, credit markets typically smooth only transitory shocks, since lenders in other territories are generally reluctant to grant credit to countries that are impacted by any shock that is expected to persist in the long-run. Moreover, smoothing negative shocks through the sale of assets is more difficult and costly when shocks are permanent since it would require selling or mortgaging numerous, large or very valuable resources. In spite of these shortcomings, the finding of Asdrubali *et al* (1996), namely, 23 percent of shocks to gross state product were smoothed by credit markets in the U.S., is indicative of the usefulness of this approach to sharing risk. Their realization, however, that full risk sharing or full insurance against shocks is not provided via lending and borrowing on national credit markets, is supported by other empirical work done.

Mace (1991) tested the implications of full consumption insurance in the presence of aggregate uncertainty. She used a model with complete markets, including securities and credit markets, with such features as private information or liquidity constraints omitted, in order to ascertain whether market imperfections or lack of completeness is an essential feature in explaining consumption allocations. She discovered that market incompleteness could not explain consumption allocations but the principal implication of risk sharing is that fluctuations in individual consumption are determined by fluctuations in aggregate risk, not to idiosyncratic or personal risk. In the model, aggregate risk was represented by changes in aggregate consumption and idiosyncratic risk by changes in individual income and employment status. Canova and Ravn (1996) also found that aggregate domestic consumption is almost fully insured against

idiosyncratic real, demographic, fiscal and monetary shocks over short business cycles. However, aggregate domestic consumption co-varies with such shocks over medium and long business cycles, thereby reducing the effectiveness of risk sharing. Furthermore, Cochrane (1991) emphasized that the basic idea of consumption insurance is the cross-sectional counterpart to the permanent income hypothesis. Thus, full insurance implies that consumption should not vary across individuals in response to idiosyncratic shocks, just as constant borrowing and lending opportunities imply that consumption should not vary over time in response to shocks that can be forecasted. Cochrane, like Asdrubali, discovered that consumption insurance may hold more closely among groups that are geographically close or work together.

## 3. Related Issues

### *3.1. Tax Policy Choice*

On the issue of the choice of an appropriate tax policy, Persson and Tabellini (1996), under the assumption that union-members are identical to each other, indicated that the sentiments of voters in each territory determine the level of insurance the fiscal union will provide. In their analysis of collective *ex post* decisions in the European Union (EU), where central and local governments are vertically ordered[2], they arrived at the following conclusions. First, when the concept of risk sharing has widespread normative appeal, the choice of tax policy would represent the "utilitarian optimum" of all voters and the expressed cooperation would ensure that national policy coincides with that of the inter-government risk sharing arrangement. Any response to a shock(s) would result in inter-government transfers that improve the targeted economy's adjustment to favourable shocks or reduce the impact of negative shocks. It is clear that consensus building among citizens of union members is critical to the realization of this optimum benefit. Persson and Tabellini referred to this choice as "Cooperative Equilibrium: The First Best" outcome. Secondly, the tax policy, which evolves out of a situation where voters in one or more territories in the union are reluctant to sacrifice national political policies but are yet committed to the fiscal union, would result in an under-provision of public investment, i.e. under-insurance, to shock-affected regions. This represents less than full international risk sharing and is referred to as a "Stackelberg Equilibrium: The Second Best" outcome. Finally, a "Nash Equilibrium: The Third Best" result occurs when the countries involved behave non-cooperatively and do not internalize the effect of domestic policy on another in the union. Neither do they internalize the benefits of public investment to another member. Voters in each member country, however, agree in principal that full international risk sharing is the best policy and on this basis entered the union. In such a scenario, the typical moral hazard problem[3] is exacerbated and even lower public investment or greater under-provision of actual insurance against shocks is realized by needy countries. Persson and Tabellini further argued that, in the case where there are asymmetries across countries, it may be more useful to employ an *ex ante* redistribution system.

*3.2. Political Risks*

The political risk in federal fiscal unions increases as the size of the union increases. The larger the union, the more likely that the distribution of income may be polarised among the member-countries. This makes the union less likely to be beneficial to a majority of individuals, with the result that disagreement on important common issues may derail the union. Here again, consensus building among the citizens of member countries of the union is of significant importance. This fact notwithstanding, Alesina and Perotti (1998) suggest that the choice of voting rules used to arrive at the tax policy may contribute significantly to the elimination of the political risk inherent in the centralized regime while allowing the participants to reap the benefits in terms of reduced economic risk. This is so because certain voting rules are more effective than others. Roberts (1977) showed that a most preferred outcome will exist under a wide class of voting mechanisms if preferences are such that the ordering of individuals by income is independent of the chosen tax schedule. In other words, the ordering of individuals must be such that the pretax income, irrespective of the tax schedule in operation, is monotonically increasing.

*3.3 Mobility of Factors*

The body of literature on international risk sharing has consistently expressed the importance of the mobility of factors, namely capital and labour, to the achievement of higher efficiency gains with respect to income and consumption smoothing.

Brennan and Solnik (1989), in their study of eight OECD countries, found that the variability of national consumption growth rates would have been substantially greater if capital flows had been prohibited, and, as a consequence, there would have been a significant reduction in welfare. Their study of capital mobility related to the level of integration of national capital markets. Since, as previously stated, only Barbados has a capital market, which is yet in its infancy, we shall not focus on this mechanism. Suffice it to say, that the electronic link-up of Barbados' stock exchange with those in Trinidad and Tobago and Jamaica should strengthen the system of capital transfers within the region. Companies in the OECS should be persuaded to list on the Stock Exchange of Barbados so as to share in the benefits that are afforded.

Labour mobility, as stated by Lee (1998), provides income and consumption insurance against adverse shocks whether the fiscal system employed by risk sharing countries is centralized or decentralized. Interestingly enough, in the 1992 Report of the West Indian Commission, the proposition was forwarded that the establishment of a single market for human resources was critical at this point in time in relation to the developmental needs and prospects of each CARICOM member-country. It is also a known fact that small developing countries, like Barbados and the OECS, are extremely vulnerable to exogenous shocks, both economic and natural, due to their openness. Thus, the buffer provided by labour mobility should be seriously considered. The call by the Commission (1992) for the process of creating a market for human resources to be started with the freer movement of professional and skilled people, has been heeded. It

is evident thus far that the process has been approached with caution, and rightly so, since many problems can be created by unrestrained labour mobility. The flow of labour from the countries with less developed economies and fewer job opportunities to those with more developed ones, where jobs are perceived to be available, can create pressures associated with housing, land use and social relationships. LaLonde and Topel (1991), in their study of immigrants in the American labour market during the 1970's and 1980's, identified a number of other problems: -

1) the distributional impact of immigration on natives' welfare. Increased immigration can reduce the earnings and employment prospects of natives to the extent that skills of both immigrants and natives are substitutable; and
2) should new immigrants not recover from their initial earnings disadvantages, the increased immigrant flows can place additional burdens on public welfare systems, while exacerbating other social problems associated with persistent poverty.

In relation to the distributional impact on the welfare of citizens, it was realized that this problem was linked more to less-skilled or unskilled labour. This justifies the decision of CARICOM heads of government to adopt the recommendation of the West Indian Commission with respect to the free movement of skilled labour. In this way social tensions may be minimized or altogether avoided while political and social leaders sell the conceptual benefits of labour mobility. However, as a greater proportion of the labour force becomes skilled in the lesser developed countries through improved and more relevant educational and skills training programmes, along with movement of skilled labour from the more developed to the less developed countries, it would be necessary to lay emphasis on the development of entrepreneurial skills so that new jobs are created in each domicile. By so doing, the benefits of labour mobility would be safeguarded.

*3.4. Economic Convergence*

Economic divergences stifled the growth of the Caribbean Economic Community during the 1970's and 1980's, with economic policies and performances of member countries being very different from each other. Growing economies feared that their progress might be slowed by the poorly performing economies, and so progress towards freedom of movement of capital and labour among members was minimal. Consequently, the issue of economic convergence has sharply come into vogue in recent times with the push towards a Single Market and Economy (SME). The criteria of economic convergence on which we base our contention are the same as expressed by Worrell (1993): -

a) the achievement of reasonable growth rates with a sustainable balance of payments over the medium term;
b) restriction on the size of the fiscal deficit;
c) restriction on the extent of foreign borrowing; and
d) maintenance of a sustainable debt service ratio.

Economic convergence is relevant to the issue of risk sharing for two main reasons: -

1) psychological - the will to enter into a risk sharing arrangement between countries can be weakened or strengthened depending on the degree of divergence or convergence of the economies. The evidence of this may be judged by the extent of ease or difficulty encountered in reaching a consensus on voting rules and an appropriate fiscal policy in a federal system. In addition, the sustainability of the fiscal union could be jeopardised by persistent divergence in economic performance of member countries since the greater the divergence, the greater the perceived risk of damage to healthier economies by the errant behaviour of some union members. Lending and borrowing on national credit markets may be even more sensitive to economic divergence since the commitment to purchase the debt instruments of other members of the union always has its countervailing concern with respect to the creditworthiness of the borrower of funds. Whether, therefore, we are considering a federal fiscal union or borrowing on national credit markets, the adherence to agreed convergence criteria lends to confidence in the success of the system(s) employed; and
2) practical - it represents a *bona fide* basis of a contract of service by each member of the union or credit market arrangement to the other's best interest, and such a contract, if made binding in law, acts as a guide and means of coercion towards the accomplishment of the shared goals in a sustainable fashion.

## 4. Country Features

### *4.1 The OECS Countries*

The potential demand for insurance and credit is high in the OECS. Not only are average incomes low, but they tend to be volatile, primarily due to their dependence on agriculture, in which there are many small farmers, particularly in banana production. Fluctuations in weather conditions and uncertainty surrounding commodity prices on the international market translate into income shocks encountered by farm households, in addition to their vulnerability to business failures and recessions, particularly in their export markets. As the era of preferential markets for bananas and sugar draws to a close, so will agricultural insurance contained in the preferential agreements. In addition, it has not been customary in this region for private insurance companies to offer agricultural insurance against adverse weather. In fact, with the incidence of hurricane activity in recent years, even home insurance has become un-affordable and, in some cases, unavailable for many households. Moreover, it has been customary for island governments to supply some level of insurance, especially against price fluctuations, and to provide financial injections and credit for infrastructural development of the industries. It would be realistic and logical to conclude that, with increased globalization and the lost of preferential access to export markets, the need to pool risks will become a major concern in these territories.

Income and consumption smoothing, which are difficult to disentangle, may also be achieved through diversification of the economy. Diversification is not limited to agricultural activity alone, but involves off-farming activities such as light manufacturing, food processing and tourism, which is now the largest foreign exchange earner in this region. The importance of such activities can be measured by the quantum of public and private investment in education and skills training in the region. Even though larger investments in education will be required in the future, and in spite of its current weaknesses and challenges to its relevance, a reasonably sound education has been sought and provided at the primary, secondary and tertiary levels. Both governments and households make the substantial investment as a means of expanding and diversifying the income base of households in pursuit of steady wage employment. The hope is to reduce the risk of unforeseen hardship along with improving the general standard of living. Permanent labour contracts usually formed the basis of steady wage employment, but, in recent times, there has been a gradual rise in the number of temporary contracts, a feature spurred by globalization. Segal and Sullivan (1997), in their study of the growth of temporary services work in the U.S., observed that temporary services employment is very sensitive to the business cycle because of the need for business organizations to be flexible in order to compete in the global environment. Temporary workers thus find themselves underemployed more often than the permanently employed with the shift of risk from firm to worker and have to endure a lower level of economic security. As a consequence, demand for credit and government-provided income and consumption insurance is growing as a matter of course, notwithstanding the greater demand should there be a significant exogenous shock to these economies. Thus, the opportunity for qualified persons from the University of the West Indies to work in other CARICOM countries, where jobs may be more readily available, might be viewed as additional income and consumption insurance for households. Indeed, for many years, money transfers in the form of gifts and income by citizens of the OECS, who have migrated to developed countries, has been a significant buffer against various shocks encountered by residents of these islands.

*4.2. Barbados*

Though the OECS sees their economic success in wider regional arrangements because of their very small size, Barbados has experienced considerable success and development since its independence, even when regional arrangements were failing. Two major structural changes in the economy facilitated the country's achievements. The first change was the shift from an economy primarily dependent on agricultural exports, chiefly sugar, to one in which tourism became the major foreign exchange earner. The second was the further diversification of the economy into other service-oriented industries, particularly in the offshore sector.

In spite of Barbados' notable success, the economy remains quite vulnerable to events emanating from the international arena. The imminent loss of preferential markets for sugar coupled with the declining world market price of sugar, due to competition from

beet sugar, has increased concern over the future of sugar production. A cloud also hangs over non-sugar agriculture as the implementation date for the removal of all barriers to imports with our major trading partners threatens to drive this sub-sector into oblivion. The manufacturing sector, though small, will also suffer on account of increased competition from extra-regional imports in the domestic market and the regional export market. Furthermore, uncompetitive labour costs are depressing the prospects of growth in the data processing sub-sector of the offshore industry. The resulting impact on output, income and employment is anticipated to be significant. The case, therefore, for some form of income and consumption smoothing through the difficult time envisaged is a valid one.

Barbados, like the OECS, is also very susceptible to economic conditions in its major markets for tourists, namely, the USA, Canada and Europe, in particular Great Britain. Any significant recession in any one or more of these economies will be registered in a contraction of earnings by this industry. The evident threat of global warming and the El Niño phenomenon to the reefs, which provide the country with its attractive beaches in addition to protection for much of its beachfront tourist plant, must be of great concern as well. The fragile nature of this industry coupled with the uncertainty in the global economic and financial arena as generated by the South-East Asian experience and echoed in Brazil of recent, further underlines the need for insurance.

## 5. Evidence of Risk Sharing

### *5.1. Consumption Allocations Under Complete Risk Sharing*

The theory of real business cycles (RBC) predicts that if agents in a country can diversify their country specific shocks to output by holding assets in other countries then one should find that consumption is more highly correlated across countries than output is. Consider a world made up of $n$ countries. Each period the countries receive an endowment of an internationally-traded consumption good, denoted $y_t^i$ . We assume that the

endowments are determined by a stochastic process known by all countries, and that there is no cost in observing the amount of good received by each country. The representative household of country $i$ chooses consumption in each period, to maximize its expected lifetime utility according to:

$$\max E_0 \sum_{t=1}^{\infty} \beta^t \mu(c_t^i) \qquad (1)$$

We further assume that countries have identical rates of time discount, β. The household exchanges claims on global financial markets for delivery of the traded good contingent on each state of nature. The budget constraint for each country $i$ is:

$$\sum_{s=1}^{S} \sum_{t=0}^{\infty} p_{st} y_{st}^i = \sum_{s=1}^{S} \sum_{t=0}^{\infty} p_{st} c_{st}^i \qquad (2)$$

where $p_{st}$ is the price of a claim to the traded good in period $t$ contingent on state $s$.

The first-order conditions imply that the weighted marginal utilities of consumption of the traded good are equalized across all country pairs,

$$\frac{\mu_1(c_{st}^i)}{\lambda^i} = \frac{\mu_1(c_{st}^j)}{\lambda^j} \qquad (3)$$

where the weights, λ, represent the multipliers on the country budget constraints, or the expected marginal utilities of each country's lifetime income. The equilibrium allocations of consumption of the traded good are implied by the set of first-order conditions in (3) for all country pairs and the global market-clearing condition for the traded good in each period:

$$\sum_{i=1}^{n}\sum_{s=1}^{S} y_{st}^i = \sum_{i=1}^{n}\sum_{s=0}^{S} c_{st}^i \qquad (4)$$

If markets are complete, the competitive equilibrium of the economy described above corresponds to a planner's problem in which the planner maximizes a weighted sum of each country's utility:

$$\max E_0 \sum_{i=1}^{n} \omega^i \sum_{t=1}^{\infty} \beta^t \mu(c_t^i) \qquad (5)$$

subject to the market-clearing condition in (4). The first-order condition of the planner's problem implies that the weighted marginal utilities of consumption will be equalized across countries:

$$\omega^i \mu_1(c_{st}^i) = \omega^j \mu_1(c_{st}^j) \qquad (6)$$

The allocations under the planner's problem are identical to the competitive equilibrium described above if the planner's weights are equal to the inverse of the marginal utility of lifetime income in each country, or $\omega^i = 1/\lambda^i$.

The first-order condition in equation (6) implies that between any two periods $t$ and $t + k$, the following equality holds:

$$\frac{\mu_1(c_{t+k}^i)}{\mu_1(c_t^i)} = \frac{\mu_1(c_{t+k}^j)}{\mu_1(c_t^j)} \qquad (7)$$

(State subscripts are dropped in (7) to simplify the notation). If preferences are iso-elastic, consumption growth rates are equalized across countries. In time-series data, the correlations between consumption growth rates should equal one and will obviously exceed the correlations between growth rates of endowments.

One portfolio allocation that supports the competitive equilibrium in this economy is the "perfect pooled" equilibrium in which households hold claims to the world supply of the traded good in proportion to their share of global wealth (Lucas, 1981). All households hold identical portfolios that replicate the market portfolio. For most countries (provided their endowments are not perfectly correlated in autarky), the variability of consumption of the weighted basket of endowments will be lower than the

variability of its own stream of endowments.

Most of the empirical studies on output and consumption correlations usually begin by first de-trending the individual series using Hodrick-Prescott (1980) filter (HP) and then analysising the moments of the series. It has been argued by Harvey and Jeager (1993) and others that the direct application of the HP filter to many macroeconomic series can easily give spurious impression of cyclical behaviour. Harvey (1993) showed that applying the HP filter to a random walk produces de-trended observations which mimic business cycles for quarterly observations. Harvey also provides evidence that the HP filter is tailor-made for extracting the business cycle component from the US GNP series but does not do so well on other series. In many cases either creating spurious cycles and/or distorting the unrestricted estimates of the cycle component. We, therefore, utilised the Structural Time Series (STM) Approach (Harvey et al, 1989) to model the trends and cycles of the series individually and collectively and then analysed the cross correlations. The methodology of STM is outlined below.

*5.2. Econometric Methodology*

The Model

For the purpose at hand, the appropriate STM is one set up in terms of trend plus cycles and is formulated as (see Harvey et al, 1989 for a greater exposition):

$$y_t = \mu_t + \psi_t + \varepsilon_t, \qquad t = 1,\ldots,T \tag{8}$$

$$\begin{array}{lll} (level) & \mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t & \eta_t \sim NID(0,\sigma_\eta^2) \\ (slope) & \beta_t = \beta_{t-1} + \xi_t & \xi_t \sim NID(0,\sigma_\xi^2) \end{array} \tag{9}$$

where $y_t$ is the series being model. The trend $\mu_t$ is modelled in terms of an underlying level and slope given by (2) with their individual disturbances $\eta_t$ and $\xi_t$, which are mutually uncorrelated. NID $(0, \sigma^2)$, denoted normally and independently distributed with mean zero and variance $\sigma^2$. $\varepsilon_t$ is the irregular component. The stochastic cycle component, $\psi_t$, is modelled as:

$$\begin{pmatrix} \psi_t \\ \psi_t^* \end{pmatrix} = \rho \begin{pmatrix} \cos\lambda_c & \sin\lambda_c \\ -\sin\lambda_c & \cos\lambda_c \end{pmatrix} \begin{pmatrix} \psi_{t-1} \\ \psi_{t-1}^* \end{pmatrix} + \begin{pmatrix} \kappa_t \\ \kappa_t^* \end{pmatrix}, \quad t = 1,\ldots,T \tag{10}$$

where $\lambda_c$ is the frequency, in radians, in the range $0 \le \lambda_c \le \pi$, $\rho$ is the damping factor such that $0 < \rho \le 1$. $\kappa_t$ and $\kappa_t^*$ are two white noise disturbances, which are mutually uncorrelated with zero mean and common variance $\sigma_\kappa^2$.

The model is cast in state spaced form and estimates of the hyper-parameters ($\sigma_\eta^2$, $\sigma_\xi^2$, $\lambda_c$, $\rho$, $\sigma_\varepsilon^2$) are obtained by maximum likelihood either in the time domain or frequency domain. Estimates of the trend and cyclical components are obtained from a smoothing algorithm. The software package used in this study is STAMP 5.0. The link across the different series is

through the correlations of the disturbances driving the components. Correlation between cycles would reflect short-term co-movement between the series, while correlation on the slopes would be reflective of a long-run relationship. Almost perfect correlation on the slope indicates co-integration.

Data and Procedure

We used annual data on real per capita output (Y) and real per capita consumption (C) for six OECS countries ( excluding Anguilla and Montserrat due to lack of data) and Barbados over the period 1977 to 1997. Aggregate consumption is defined as both private and government consumption. We preceded by first examining the mean cross-correlation of the variables between two countries for the full sample. The results are reported in Table 1 along with the mean correlation between output and consumption for each country. Hence, $C_i$, $C_j$ ($Y_i$,$Y_j$) refers to the average correlation of consumption (output) of each country with consumption (output) in the other six countries. While $C_i$ ,$Y_i$ refers to the average correlation between consumption and output in each country.

| TABLE 1 | International Correlations | | | Relative Variability | |
|---|---|---|---|---|---|
| | $C_iC_j$ | $Y_iY_j$ | $C_iY_i$ | $sd(c_i)/sd(c_w)$ | $sd(y_i)/sd(y_w)$ |
| Antigua & Barbuda | -0.15 | 0.57 | 0.05 | 1.48 | 1.45 |
| Barbados | 0.21 | 0.23 | 0.75 | 2.41 | 2.16 |
| Dominica | 0.03 | 0.36 | 0.03 | 0.52 | 0.51 |
| Grenada | 0.17 | 0.64 | 0.57 | 0.56 | 0.51 |
| St. Kitts/Nevis | 0.13 | 0.59 | 0.23 | 1.09 | 1.66 |
| St. Lucia | 0.30 | 0.59 | 0.49 | 0.69 | 0.88 |
| St. Vincent | 0.14 | 0.53 | 0.05 | 0.62 | 0.24 |
| Average | 0.12 | 0.50 | 0.31 | 1.05 | 1.06 |
| Standard Error | 0.14 | 0.15 | 0.29 | 0.69 | 0.71 |

*5.2. Results*

In an environment with complete risk sharing and given iso-elastic preferences, the global supply of consumption goods should be allocated to each country in proportion to its wealth; consumption growth in each country should therefore be identical to the growth rate of world consumption (average consumption of the group).

Table 1 indicates that the output correlation in the second column exceeds the consumption correlations in the first column. The findings of lower cross-correlation of consumption can be interpreted as evidence of a lack of intra-temporal risk sharing across the countries, the lack of a developed financial market and other channels of risk sharing to help smooth idiosyncratic or country-specific fluctuations in income . In other words, there is little pooling of risk to insure consumption against prefecture-specific shocks. Shocks may be due to the different composition of economic activities. This lack of risk sharing may not only reflect the limitations on individuals' ability to do so, but may reflect the absence of a need to do so. The reason for this line of thinking is that individuals might be highly dependent on extra-regional sources of personal income and so there is less need to insure against shocks via capital markets. It might also indicate that they perceive the probability of a country-specific shock to be very small; of course, this would depend on the degree of diversification of economic activity across the region. Another possible explanation is the 'home bias problem', in that individuals prefer to keep their assets close at hand, investing only in local industries and economic activities.

The fourth column of Table 1 shows the standard deviation of growth rates of individual country consumption relative to the standard deviations of growth rates of global consumption. The fifth column provides the analogous ratio of output growth rates. To the extent that countries can fully insure risk, domestic consumption growth rates should mirror world growth rates, yielding a ratio of 1. Hence, the evidence is supportive of a lack of risk sharing among the countries at present. Also, the lack of any significant difference between the relative variability of consumption and output is evidence of a lack of inter-temporal risk sharing or the argument of the permanent-income hypothesis (PIH). Individuals, according to the PIH, will choose a consumption path based on their permanent income and use the credit markets to smooth consumption in response to transitory variations in income.

Column 3 shows the correlation between output and consumption for the individual countries. There are some very interesting results here. For three of the countries the correlation between consumption and output is almost zero. How are persons in these countries consumption patterns being sustained? Three possibilities come to mind; borrowing against further earnings, dis-saving and receiving transfers from abroad. The latter may be more indicative of what really happens. Many persons in these countries still rely on families and friends abroad to send a 'barrel' or even monies on a regular basis. Barbados has the highest consumption-output correlation in the sample, a value of .75, which is in line with those reported by other writers for both developed and developing countries, including Hess and Shin (1997) for 17 OECD countries and the USA, and Wincoop (1995) for 47 Japanese prefectures and 20 OECD countries.

## 6. Concluding Remarks

The results lead us to the following conclusions: -

1. there is evidence of a significant lack of both intra-temporal and inter-temporal risk sharing between the OECS countries, themselves, and between Barbados and each of them. Between the OECS countries, this may be somewhat surprising since one would have thought that the establishment of the East Caribbean Central Bank (ECCB), the OECS Secretariat and sister organizations along with the formation of the Windward Islands Crop Insurance Scheme (WINCROP) in the banana-producing countries, would have yielded a higher level of risk sharing;
2. Barbados' consumption is more related to its output than the individual OECS countries. This does not provide a zone of comfort from exogenous shocks to the economy in itself. In fact, it should well indicate that a fall in output resulting from a shock would significantly impact the consumption capability of the average Barbadian;
3. the fact that there is a lack of risk sharing would imply that there are gains to be made from developing the appropriate channels for the members to share risk. The experience of the emerging economies of the Far East and the spill-over effect in the capital markets of the world, resulting in the high cost of capital to borrowing nations, should spur the search for the benefits to be

had. Furthermore, the free movement of labour and capital would provide efficiency gains with respect to income and consumption smoothing. The recently announced lifting of exchange controls on the movement of capital between Barbados and the OECS by January 1, 2001 may be considered a positive step in this direction. We all stand to gain; and

4. further research to actually quantify the potential gains from risk sharing should be pursued.

Notes

1. Ricardian Equivalence Theorem: the response of householders to any inter-temporal rearrangement of their tax liabilities is geared to ensure that they maintain their originally planned current and future consumption by increasing their current savings through the use of savings bonds or other similar financial instruments. However, householders who anticipate future tax increases, may continue on their originally planned path of consumption after the tax change by using the principal and interest on the instrument. This is especially true if relative prices and the level of government spending remain unchanged.
2. The vertical relationship between the central and local governments in the EU is characterized by: -
    - a system of inter-government transfers;
    - the indirect nature of political appointments to the administrative posts of the EU as well as the channels of accountability; and
    - paucity of policy instruments at the disposal of EU administrators. For example, the European Parliament is a relatively powerless body under present arrangements compared to the Council of Ministers, which makes the policy decisions.
3. As more countries are insured, the smaller is the incentive for national governments to enact policies that decrease national risk. This results in lower public investment in measures designed to help the economy to adapt to national shocks.

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