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Three Essays in International Economics: On Intra-Industry Foreign Direct Investment, Exchange Rates and Capital Flows and Economics of Africa

A dissertation submitted in partial satisfaction
of the requirements for the degree of

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in

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by

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TABLE OF CONTENTS

List of Tables

List of Figures

Abstract

Three Essays in International Economics: On Intra-Industry Foreign Direct Investment, Exchange Rates and Capital Flows and Economics of Africa

Maxwell Oteng

This is a three-essay dissertation. Chapter One develops a theoretical model to explain intra-industry direct foreign investment and study its properties. The model yields interestingly intuitive insights despite its simplicity and static nature. It is shown that in order for intra-industry foreign direct investment to occur, a firm's net competitive advantage by producing in the two markets must be at least equal to its net competitive advantage when producing at home for exports. If not the firm will always export. I found that the extent of intra-industry FDI "home-bias" the degree of product differentiation and other industry characteristics.

Chapter Two addresses the relationship between real exchange rates and capital flows in developing countries. I disaggregate capital flows into four types namely, foreign direct investment (FDI), portfolio investment, bank loans, and other capital flows and making use of modern econometric technique of panel cointegration approach. I found that unlike Africa capital flows are a significant determinant of the long run equilibrium real exchange rate in Asia-Pacific and Latin America-Caribbean

regions. Among different types of capital flows, foreign direct investment appears to be the most significant determinant of real appreciation. The findings apparently suggest that different types of capital flows should not be treated as equivalent.

Chapter Three provides a quantitative assessment of the impact of per capita gross domestic products of South Africa and Nigeria on per capita real gross domestic product (GDP) of sub-Saharan Africa and on SADC and ECOWAS sub-regions respectively, using panel data estimation approach. I found that while the impact of South Africa gross domestic product per capita on that of sub-Saharan Africa was statistically significant, that of Nigeria was not. Surprisingly, the GDP per capita of South Africa seemed not to have any statistically significant impact on the GDP per capita of other SADC member countries. However, the impact of South Africa's exports to the SADC region was statistically significant on the GDP per capita of the economies in that region. In the ECOWAS region, the per capita GDP of Nigeria appears to have a significant impact on the per capita GDP of the ECOWAS region.

Dedication

This dissertation is dedicated to my late mother, Abena Akoma, my uncle J.B. Dankwa and my brothers (living and dead) and sisters for their belief in me, and their unwavering support and love throughout the years.

Acknowledgement

The journey towards intellectual enlightenment through graduate-school education has been a challenging but rewarding one in its totality. It sent me through times of low ebbs such as the time I was open-secretly "homeless", living in our graduate students' office because of dire financial constraints and, when I lost two brothers. During those times, I felt greatly challenged mentally, emotionally and to some extent physically. Yet quitting never was an option.

I was lucky to be propped up along the way by so many loving people. Thus my graduate education that has culminated in this dissertation could not have been possible without the generosity and magnanimity of so may people. I thus would like to seize this opportunity to take all these people.

I would like to thank the members of my committee, Professors, K.C. Fung, Michael P. Dooley and Nirvikar Singh. I was really lucky to have the opportunity to draw on the experiences and advice of these great professors. I especially thank them for being patient with me. I would like to specially thank Professor Fung for setting me on course during the trying times by suggesting the first topic.

I owe a special debt of gratitude to my core family – namely my late mother, my two late brothers, my uncle and other brothers and sisters. I cannot find the words to express my true appreciation for all they have done for me. In a lump, they are as much responsible for what I have become as I am. I truly love them all.

I also want to say special thank you to all my friends who have stood by me no matter what, and whose words of encouragement were sometimes all I needed to keep rolling. While it is not possible to list the names of all of them, few people deserve special mention for a lot of reasons: Francis Adjei (Ghana), Evelyn Nelson (London) Tomoko Tamura (Japan) and Sampson Boateng (U.S.A.) for their constant words of encouragement, support and love, and generosity of heart. I thank Ms. Shauna Reisewitz (U.S.A.) for her invaluable friendship and kindness.

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While I benefited from a lot of rich advice, I am solely responsible for all the errors and shortcomings of this dissertation.

Maxwell Oteng

Santa Cruz, California, USA.

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CHAPTER ONE

INTRA-INDUSTRY FOREIGN DIRECT INVESTMENT: A THEORETICAL MODEL.

1.1. INTRODUCTION

Intra-industry direct foreign investment (henceforth IIDFI), and intra-industry multinational sales (henceforth IIMS), like their counterpart intra-industry trade, between the United States and US multinational companies and the advanced industrialized world of Europe, Japan and Canada and their respective multinational companies have increased substantially in the past two decades (see Table 1.1 (a & b), Table 1.2 (a & b)). This increase has been particularly pronounced between the United States and Canada, and especially in the service sectors (wholesale trade, banking, real estate and insurance sectors)[1].

In the light of increasing importance of intra-industry foreign direct investment, and in the face of availability of new data, it is important that further research that throws more light on the determinants of IIMS/IIDFI among the advanced industrialized countries be done to complement the existing studies in this field. This is exactly what this chapter intends to do. I motivate the theoretical model with empirical data on IIMS/IIDFI between the United States and Canada.

Intra-industry direct foreign investment is defined in the literature as the two-way direct foreign investment (DFI) by multinational enterprises (MNEs), based in different countries, in each other's home markets, to produce goods and services that are close substitutes in either consumption or production, and thus can be classified in the same industry. IIDFI is a subset of cross-DFI (CDFI) which can be defined as total two-way DFI, with its constituent one-way DFIs occurring in either the same industry or different industries (Asim Erdilek, 1985 p1). However, Krugman prefers to define IIDFI as an "extension of control" via 'two-way exportation of technological know-how' due primarily to economies of scale and economies of scope (Erdilek ed., 1985 p4). No matter how it is defined, however, there is no question at all that both the determinants and effects of IIDFI raise important policy and economic issues for governments as well as individual economic agents (especially producers).

1.2. MOTIVATION AND OBJECTIVES

This chapter is motivated by three main factors: (1) From the data, it can be discerned that both intra-industry direct foreign investment and intra-industry sales by affiliates of multinational corporations have become increasingly important and thus deserves attention; and (2), as of now no concrete formal mathematical model for this

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[1] See Table 3. I used the Grubel-Lloyd Index to calculate the extent of intra-industry foreign direct investment between the United States and Canada. The closer to one the index comes, the higher the extent (intensity) of intra-industry FDI in that particular sector.

phenomenon exists in the literature – the existing models are more or less descriptive and in most instances diagrammatic in nature.[2] Thus a formal mathematical model based on the theory can be very helpful to understand this interesting phenomenon; and (3) to argue that the phenomenon of "home bias" which remains a puzzle in international economics, can help to explain why intra-industry direct foreign investment takes place.

The main objective of this chapter is to build a formal mathematical model explaining the phenomenon of intra-industry direct foreign investment/intra-industry affiliate sales, incorporating "home-bias" phenomenon in the model.

Using the formal model the chapter will attempt to ask two basic but important questions namely, (1) what circumstances lead a firm to serve a foreign market by exports versus foreign production arrangement?; and (2) what are the welfare effects of intra-industry foreign direct investment or intra-industry affiliate sales?

To evaluate the theoretical literature, and in fact understand its origins, empirical background is needed to provide a context for such evaluation.

---

[2] I review pioneering diagrammatic OLI model of Dunning and Norman (1985) in section 1.5.

Table 1a. Local Sales of US Affiliates in Selected Industries in Canada 1983-1998
(Million Dollars)

Industry/Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Petroleum	23845	24733	19316	13335	14469	13808	16755	19872	16768	15612	15032	16469	17319	21085	24078	21087
Food and Kindred Products	5301	5502	5480	5381	5233	6036	6562	6848	7176	7355	7717	6766	7274	7779	9353	10892
Chemicals and allied products	7827	8447	8301	8412	9621	10693	10302	9154	9663	10341	9777	9758	10796	11438	11785	11100
Primary and Fabricated products	2438	2701	2644	2597	2864	3630	3457	3188	3097	3125	2887	3167	3542	3157	3035	3165
Machinery, except electricals	4088	4420	4253	4112	4428	5234	5643	5164	4274	4081	3941	4615	4849	5330	5688	5658
electric and electronic equipment	3176	3317	3581	3599	4011	4269	4466	4616	4099	4029	4137	3992	4137	4387	4486	4266
Transport equipment	9197	11432	13151	13123	14767	17634	17486	14441	15964	14177	15471	18076	19282	20326	24196	20409
Other Manufacturing	6414	6374	6348	6672	7212	10023	12770	13993	12239	10636	10600	11449	12213	13356	12969	12405
Wholesale trade	7980	8031	8181	9255	9994	11437	15254	17232	17261	17806	20855	25019	27131	28672	30394	28689
Finance(excpet banking), insurance	5964	6114	D	D	8508	9521	10337	11457	11858	11381	11021	11757	11987	13076	12194	13356
Services	2058	1786	1775	2033	2569	3275	4051	4442	4641	4442	4401	4880	5717	6557	7474	7993
Other Industries	13200	13136	D	D	16062	16732	20191	21351	21327	21271	20214	18250	19904	22528	24882	27503

D = figures not disclosed
Source: United States Bureau of Economic Analysis, 2000

Table 1b. Local Sales of Canadian Affiliates in Selected Industries in the US 1983-1997
(Millions of US$)

Industry/Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Mining	1542	1898	1872	1550	1670	2172	2507	2395	2242	2606	2924	2644	2782	4354	3836
Petroleum	2874	2611	2475	1575	1323	3659	4309	5149	5767	6616	6661	7074	8133	12464	177
Food and kindred products	2236	2430	2346	D	3174	3916	5571	5824	5641	5236	5267	6720	6652	7089	D
Machinery	3888	4866	D	5036	4191	5305	6468	6269	6803	6961	7234	8367	8753	11293	1288
Primary and fabricated	3489	4521	5050	5092	5954	7552	7294	7434	6943	8719	9497	10176	10247	9970	9181
Textile products and apparel	285	451	405	443	536	693	1929	1117	1372	1618	1624	1604	1193	1465	1467
Lumber and furniture	198	205	228	291	315	166	198	338	494	442	D	D	D	884	1442
Printing and Publishing	2589	3090	3444	3576	3941	4215	4363	5704	5536	5410	10352	11570	14030	8426	4085
Wholesale trade	7052	8100	8319	9256	8786	10234	8986	8893	8149	9153	10516	11980	20041	20458	32175
Retail trade	5192	6431	7696	13154	13720	17748	19227	19587	19369	9573	9345	6138	8271	7939	6538
Finance except banking	649	517	730	1056	780	1021	1564	2238	2637	1372	1361	1573	2371	3427	5522
Insurance	4314	5503	6054	8711	10849	11911	12270	14740	14912	14671	17564	15421	15245	15496	13260
Real estate	4361	5333	5040	3925	4588	5018	5599	6378	4833	2641	3846	3072	2692	2167	2757
Construction	144	180	225	523	413	474	1697	1469	D	708	173	D	376	354	850
transportation	789	888	1251	1246	1213	4422	4205	3575	3710	1614	7407	D	8279	3773	5172
Services	603	756	967	1094	1267	1577	1850	2309	2548	2626	10767	11694	8605	8605	2642

D=Figures not disclosed
Source: United States Bureau of Economic Analysis, 2000

Table 1.2a. Intra-Industry Foreign Direct Investment Position in the United States, 1970-2000: The Case of Canadian Companies (Millions of US Dollars)

year/ Industry	All Industries	Petroleum	Food and Kindred products	chemicals and allied products	primary and fabricated metals	Machinery except electricals	Other manufacturing	Wholesale Trade	Banking	Finance (except banking), insurance and real estate	Other industries
1977	599	710	D	D	599	971	1036	754	160	289	649
1978	6180	734	786	92	706	1041	588	907	188	352	785
1979	6974	937	838	101	821	1173	684	937	227	412	844
1980	12162	1817	D	116	801	1173	D	1013	377	2393	690
1981	11870	1744	76	96	1022	1064	1005	1099	469	3005	955
1982	11435	1509	96	170	1025	875	1262	1067	524	2969	993
1983	11115	1374	56	144	1302	882	953	984	491	3028	927
1984	15286	1544	84	110	1434	1200	1288	1142	1219	4870	914
1985	17131	1589	206	145	2069	1210	978	1532	1224	5534	1071
1986	20318	1432	355	268	2381	1621	1482	1497	1366	6237	1410
1987	21732	1433	430	399	2555	1876	2218	2393	1388	5433	1617
1988	26566	1181	1031	491	3503	1839	2866	2118	1687	7550	2985
1989	30370	1141	868	460	2124	1762	4552	2236	1716	10524	4675
1990	30037	1394	986	551	1871	1807	4438	2288	1762	10704	4636
1991	30002	913	948	655	1814	1927	4318	1962	1978	11842	4398
1992	37843	2443	D	D	1713	3070	4660	1695	2052	10508	3690
1993	40487	2331	D	D	2183	2611	4331	1471	2142	11659	4379
1994	41219	3097	5877	821	2503	2448	5789	2563	1373	10105	4409
1995	45618	3241	7199	1089	2823	2360	6850	2466	1735	11393	4116
1996	54836	3220	7764	1269	3311	2828	7924	3793	2309	14723	5486
1997	65144	3199	7558	1197	3398	3859	8239	4119	2215	20430	8287
1998	74143	2526	4402	2425	3274	5327	11079	4216	2664	24578	11171
1999	79916	2836	610	2286	3832	5109	14433	4467	2905	30355	10526

D = Figures not disclosed

Source: United States Bureau of Economic Analysis, 2000

Table 1.2b. Intra-industry Foreign Direct Investment in Canada, 1973-1999: The Case of US Companies (Millions US$)

year/ Industry	All Industries	Petroleum	Food and Kindred products	chemicals and allied products	primary and fabricated metals	Machinery except electricals	Other manufacturing including electricals	Wholesale Trade	Banking	Finance (except banking), insurance	Other Industries
1973	25541	5320	1102	1767	779	2325	5781	1606		2752	
1974	28404	5731	1246	2049	916	2682	6557	1844		3160	723
1975	31155	6209	1364	2284	1010	3064	6997	2023		3542	844
1976	33932	7181	1433	2462	1052	3246	7772	2145		3785	885
1977	35398	7722	1519	2350	1114	3420	8254	2249		3700	945
1978	37071	8246	1593	2875	1142	3584	8284	2465		3886	959
1979	41033	9168	1733	3248	1266	3895	9095	2744		4601	1047
1980	44978	10800	1855	3402	1645	1855	10120	3894	350	6116	1891
1981	46957	10705	1928	3721	1632	2166	10217	4146	380	6441	2267
1982	43511	10421	1476	4178	1375	1929	9867	2754	439	5644	4614
1983	44339	10398	1583	4546	1491	2204	9384	2556	496	6002	4968
1984	46730	11156	1634	4777	1672	2491	10411	2439	521	6139	4785
1985	46909	10469	1702	4794	1668	2428	11239	2446	549	5684	5184
1986	49994	10922	2108	4847	1742	2538	12170	2594	575	6429	5212
1987	56879	11931	2276	4916	1862	2923	13823	3178	608	8851	5592
1988	62610	11679	1890	5888	3180	3219	14682	3516	778	10868	5638
1989	63919	11364	1989	6234	2772	3154	16064	3730	953	10986	4975
1990	69508	10494	2538	6056	2839	2986	18856	5368	1076	11661	5450
1991	70711	10050	2818	5304	2927	2417	18574	6848	1078	12040	5615
1992	68832	8170	3172	5712	2883	2131	19170	6144	874	12625	5081
1993	69922	8688	3646	5702	2764	1913	19346	6982	840	11511	5366
1994	74221	10398	4021	5791	2219	2068	19896	6865	904	13029	5780
1995	83498	9875	4498	6587	2934	2481	23254	7390	918	14994	6933
1996	89592	19131	4265	7391	4552	3202	23227	7091	1013	17465	7283
1997	96626	10647	4649	7699	3302	2847	25907	7336	1040	20702	8196
1998	101871	13573	4997	7889	3128	2915	22752	7376	1199	22860	10300
1999	111707	16416	4983	7637	3123	3269	25012	8982	1977	25084	8785

Source: United States Bureau of Economic Analysis, 2000

1.3. SOME STYLIZED FACTS ABOUT DIRECT FOREIGN INVESTMENT [3]

This section attempts to underscore the importance of international production and sale activities of multinational corporations in the world economy.

Table 1.3. Indicators of Production and Importance of Foreign Affiliates: 1982-1995
(Billions of US Dollars)

Year	Assets	Sales	Gross Domestic (Value Added)	Value Added of All Affilaite Sales as Percentage of World GDP	Exports of Foreign Affiliates
1982	1869	2240	559	5.3	
1983	1885	2395	547	5	569
1984	1965	2632	573	5.1	680
1985	2272	2533	604	5.2	698
1986	2878	2842	755	5.5	694
1987	3403	3519	846	4.3	740
1988	4027	4180	1017	5.7	891
1989	4520	4788	1160	6.2	947
1990	5625	5204	1394	6.4	1149
1991	4162	5052	1422	6.2	977
1992	6300	5325	1411	5.8	1241
1993	7132	5975	1371	5.7	1278
1994	8361	6624	1574	6.1	1455
1995	9957	8346	1810	6.3	1961

Source: UNCTAD, 1998.

[3] I consider only the macro facts based on Markusen 1995 and UNCTAD World Investment Report 1998.
For the micro facts see Markusen, 1995.

To get a clear picture of the growing importance of international economic activities by multinational companies and their affiliates, we take a look at some stylized facts about international production by these companies.

The size and distribution of international production by transnational corporations (TNCs) have been growing in recent years (gauged from estimates of the worldwide direct foreign investment (DFI) stock, assets, sales, gross product and exports of these firms (See Table 1.3).

During the past two decades, global integration seems to have proceeded faster through foreign direct investment than through trade. The UNCTAD World Investment Report, 1998 indicates that for the world as a whole, the ratio of DFI stock (inward plus outward) to GDP has increased steadily since 1980; the ratio of world DFI flows (inflows plus outflows) to GDP has also risen, but not steadily. On the other hand the ratio of world trade (imports plus exports) to world GDP has remain relatively constant during the same period.

While there have been recent increases in DFI to developing countries, the data shows that the distribution of DFI stock is heavily tilted to the developed countries, reflecting the fact that the overwhelming proportion of DFI originated from and stayed in the developed countries. Hummels and Stern, 1994 report that in 1985 the developed countries were the source of 97 percent of the direct investment flows and recipients of 75 percent. Similarly, the World Investment Report, 1998 indicates

that the developed countries sent $359 billion abroad in foreign direct investment in 1997 and received $233 billion in DFI in turn. Their share of global outflows of DFI continued to exceed 80 per cent, whereas their share of inflows was significantly lower at 58 per cent.[4]

As observed by Markusen, 1995 there is a great deal of two-way direct foreign investment flows between pairs of developed countries, even at the industry level. Julius, 1990 reports that the share of all direct investment outflows generated by G-5 countries absorbed by other G-5 countries has been rising and amounted to 70 per cent by 1988. The UNCTAD World Investment Report, 1998 also reports that the so-called Triad - the European Union, Japan and the United States - accounted for 87 per cent of DFI flows into and 89 per cent of outflows from developed countries in 1997, slightly less than the about 90 per cent for both in 1996

There is a strong indication that firms use foreign direct investment more than they use exports to service foreign markets. According to the World Investment Report (1998), assets -which indicate the capacity of foreign affiliates to produce goods and services - held by foreign affiliates in 1996 and 1997 were estimated to be $11,156 billions and $12,606 billions respectively. While assets indicate the

[4]While the outstanding positions of the developed countries, particularly the United States and Western Europe in FDI inflows in absolute values are obvious, these countries become less significant compared to others if values of DFI relative to market size (GDP) are considered. However, the developed countries continue to receive much of the DFI in terms of DFI per capita. In addition, these countries continue to be dominant both in absolute values and relative terms with regard to DFI outflows.

potential level of production, turnover or sales indicate the use to which assets have been put. "Sales of goods and services by foreign affiliates - an estimated $9.8 trillion in 1997 - are growing at a faster rate than worldwide exports of goods and services, which amounted to $6.4 trillion in the same year (see for example Table 2 elsewhere in the chapter). Thus firms use foreign direct investment more than they use exports - by a factor of 1.5 - to service foreign markets. Indeed, the importance of sales by foreign affiliates relative to exports is increasing: during the early 1980s the ratio of sales of foreign affiliate to world exports was 1.1 and in 1990 it was 1.2." (UNCTAD World Investment Report, 1998 p.5).

Even though "vertical" DFI has been on the increase in recent years, most foreign investment in production facilities seem to be "horizontal" in the sense that most of the output of foreign production affiliates is sold in the foreign country (Markusen, 1995). For example, Brainard (1993b) reports that foreign affiliates owned by U.S multinationals export only 13 per cent of their overseas production to the United States, while U.S. affiliates of foreign multinational companies export 2 per cent of their U.S. production to their parents.

A significant percentage of world trade, about 30 per cent is now intra-firm trade (UNCTAD 1998; Brainard 1993b). There is some evidence of complimentarity between exports and overseas production (Blomstrom, Lipsey and Kulchycky, 1988; Denekamp and Ferrantino, 1992). It is estimated that foreign affiliates accounted for some one-third of world exports in 1995 compared to about one-quarter during the

latter half of the 1980s, and since the mid-1980s, the export propensity of foreign affiliates (the ratio of exports to total sales) has remained close to one-quarter by 1995 (UNCTAD World Investment Report, 1998).

There is little evidence that direct foreign investment is related to differences in factor endowments across countries (Brainard, 1993b) or to differences in the general return to capital. Besides, there seems to be little support for the idea that risk diversification and tax avoidance are important motives for direct foreign investment (Morck and Yeung, 1991; Wheeler and Mody, 1992). Apparently most firms first choose foreign production locations, and then instruct their tax departments to minimize taxes (Markusen, 1995).

1.4. CHARACTERISTICS OF UNITED STATES FOREIGN DIRECT INVESTMENT

Since the study is motivated by data on intra-industry foreign investment and intra-industry multinational affiliate sales between the US and Canadian companies, I provide a brief description of international production of US affiliates and foreign affiliates in the US[5]. Thus the ensuing exposition reinforces the fact that intra-industry direct foreign investment (or intra-industry multinational affiliate sales) has indeed become an important phenomenon.

---

[5] The figures cited from the US Bureau of Economic Analysis in the ensuing discussion can be obtained from the webpage of that agency at http://www.bea.doc.gov

According to estimates by the United States Bureau of Economic Analysis (2000) estimates, in 1999 the historical-cost position of direct foreign investment in the United States (FDIUS) grew 24 percent, while that of U.S. direct investment abroad (USDIA) grew 12 percent. The difference between the two growth rates was the largest since 1988.

The US continues to be the largest source and recipient of DFI in absolute value terms. In 1997, the United States reported $91 billion in DFI inflows and $115 billion in outflows, far exceeding inflows and outflows of any other country. Both amounts set new records: inflows were 19 per cent higher than in 1996; outflows 53 per cent. As a result, the share of the United States in worldwide DFI rose to 23 per cent for inflows and 27 per cent for outflows. (UNCTAD, World Investment Report, 1998). The US direct investment abroad (USDIA) position increased $118.6 billion, or 12 percent, in 1999, less than the 16-percent increase in 1998 but in line with the 12-percent average increase in the preceding 3 years. The growth in the position reflected reinvested earnings and the global boom in mergers and acquisitions. Capital outflows for USDIA were $138.5 billion in 1999. By account, the largest share of the outflows--41 percent--was accounted for by reinvested earnings. Net equity capital outflows accounted for 38 percent of outflows. Inter-company debt accounted for the remainder. The foreign direct investment in the US (FDIUS) position increased $192.9 billion, or 24 percent, in 1999, the fastest rate of increase since 1981 and well above the 15-percent rate in 1998. The growth in the position

reflected the global boom in merger and acquisition activity, which also affected the growth in the USDIA position. However, the growth in the FDIUS position was particularly large because of several general and industry-specific factors. Propelled by technological innovation and strong gains in productivity, the U.S. economy continued to grow rapidly; real GDP increased more than 4 percent for the third consecutive year. Capital inflows for FDIUS were a record $271.2 billion in 1999 (the previous record was $181.8 billion in 1998). Most of the inflows - 78 percent - were net inflows of equity capital ($212.1 billion). The rest were inter-company debt inflows, which amounted to about $40.2 billion and reinvested earnings of $18.8 billion (The United States Bureau of Economic Analysis, 2000).

For both inflows and outflows, the European Union continues to be the most important investment partner of the United States. However, the European Union's share (and notably Germany's share) in inflows declined markedly in 1997. On the other hand, Switzerland invested heavily in the United States in 1997: according to UNCTAD 1998, inflows from that country more than doubled to $8.3 billion, rivaling France ($8.7) and the United Kingdom ($8.6). However the biggest investors in the United States in 1997 were Germany ($10.7 billion) and the Netherlands ($10.3 billion).

According to the United States Bureau of Economic Analysis (BEA), in the 1990s more than 80 percent of the employment, shipments, and value added by all foreign-owned manufacturing establishments were accounted for by establishments

with ultimate beneficial owners (UBO's) in seven countries: Canada, France, Germany, Japan, the Netherlands, Switzerland, and the United Kingdom. The establishments of these seven countries accounted for 86 percent of the value added by all foreign-owned manufacturing establishments and for 11 percent of the value added by all U.S. manufacturing establishments.

The Bureau of Economic Analysis, 2000 estimates indicate that among establishments of individual investing countries, British-owned establishments accounted for the largest share of production by foreign-owned manufacturing establishments (23 percent), followed by Canadian-owned establishments (15 percent) and Japanese-owned establishments (13 percent).

Investment inflows and outflows in manufacturing as a whole continue to decline significantly in relative importance, accounting for just over a quarter of overall DFI outflows and 40 per cent of FDI inflows in 1997. On the other hand the relative importance of banking, and finance sectors, the latter including insurance and real estate, has been increasing. For example in 1997, finance and insurance industry was the dominant one in outflows, accounting for 42 per cent of the total; finance and insurance was also the dominant industry in inflows followed by chemicals and wholesale (UNCTAD, 1998; BEA, 2000).

In 1990, for example, the United States Bureau of Economic Analysis (BEA) estimates that there were 11,900 foreign-owned manufacturing establishments in the United States. They employed 2 million workers and had shipments of $418 billion.

Their value added, an approximate measure of production, was $177 billion, 13 percent of the value added by all U.S. manufacturing establishments (BEA, 2000).

More than one-half of the value added by foreign-owned manufacturing establishments in 1990 was accounted for by four Standard Industrial Classification (SIC) two-digit industries: Chemicals and allied products ($49 billion), food and kindred products ($20 billion), electronic and other electric equipment ($17 billion), and industrial machinery and equipment ($14 billion). Production in the chemicals industry alone accounted for more than one-fourth of the value added by foreign-owned manufacturing establishments.

Among SIC two-digit industries, the share of total U.S. production accounted for by foreign-owned establishments was largest in chemicals (32 percent), followed by stone, clay, and glass products (25 percent) and primary metals (19 percent). The share was less than 5 percent in four industries: Apparel and other textile products, lumber and wood products, furniture and fixtures, and transportation equipment.

1.5. DETERMINANTS OF INTRA-INDUSTRY DIRECT FOREIGN INVESTMENT.

Various reasons have been suggested for the determinants of IIMS/IIDFI. (I use intra-industry DFI and intra-industry multinational sales interchangeably throughout the paper without loss of generality).

Dunning and Norman (1985) was among the pioneering studies that examined some of the determinants of intra-industry production (IIDFI) within the broader context of a unified (or eclectic) paradigm of international economic involvement. Dunning -Norman OLI - ownership-location-internalization - model is a general-equilibrium theoretical paradigm of IIDFI. Dunning and Norman (1985) provides an analytical framework for evaluating the determinants of forms of international production in a form of a typology.[6] In their taxonomy of international economic involvement of economic agents, Dunning and Norman focus on two sets of variables. The first is the similarity or difference in the nature of outward and inward transactions of a country. The second set of variables relate to the mode or organization of the transactions used by the economic agents. Using the typology of Table B.1 in Appendix B, Dunning and Norman classify international transactions into categories commonly discussed in the literature and thus suggest an analytical framework for identifying the determinants of international transactions.[7] Table B.2 in Appendix B of the typology describes the characteristics of these determinants using a framework of the eclectic paradigm of international involvement provided by Dunning, 1981a.

This model asserts that the extent, structure and form of a nation's international economic involvement would depend on: (1) endogenous competitive

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[6] See Appendix A for the two tables that describe the typology. The tables have been reproduced from Erdilek ed. (1985).

advantages of its firms relative to those of other nationalities - the so-called ownership (O)-specific advantages; (2) the structure of its own resource endowments and other characteristics exogenous to its firms, for example consumer needs and tastes, market structure, government polity etc. - the so-called location (L)-specific advantages; (3) the organization of international transactions, and in particular, the advantages of administering these transactions within the same firm, that is internalization (I) advantages, rather than external markets. While the OLI framework of analysis was mainly used to explain one-way foreign production, Dunning and Norman saw no reason why it could not be used to explain other forms, and the totality, of a nation's international involvement.

At a micro level, for a firm to export or to produce in a foreign country, it must generate output from assets that it is able to acquire and utilize at least, if not more, successfully than its competitors. The literature identifies two kinds of assets, namely, those that are immobile in their use, for example land, and those that are spatially transferable, for example technology and most kinds of human capital. The literature also distinguishes between assets that are exclusive or proprietary to their owners, and those that are accessible to all economic agents. The former are referred to as ownership (O) –specific assets. Cell I of the typology of Table A1.1 describes the phenomenon of intra-industry direct foreign investment.

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[7] For an alternative classification of types of intra-industry trade, see Willmore (1979).

Dunning and Norman argue that at least as far as the industrialized or industrializing countries are concerned, the last stage of the evolvement of international commerce from inter-trade and one-way direct foreign investment to intra-industry trade and finally to intra-industry production is reached when (1) Multinational enterprises (MNEs) emanate from several countries and are multi-product and geographically diversified; (2) similar goods and services are produced in these countries; (3) the Ownership (O) advantages of the MNEs are based less on country-specific than on firm-specific characteristics and have more to do with transaction-cost minimizing than asset (including innovatory) efficiency and (4) there is reasonably free trade between countries.

There are essentially two kinds of intra-industry production. The first is where production is a direct substitute for intra-industry trade. Where for example, there is inter-penetration of markets by oligopolists engaging in trade in similar products, and trade controls are imposed by both the exporting and importing countries, then import-substituting production may replace trade.

Yet there are other reasons for intra-industry trade to arise when goods being transacted are almost perfect substitutes in production and consumption. Such products are unlikely to exist in the early stages of the product cycle. Consequently, the O advantages are liable to be firm-specific and related to factors such as product differentiation, brand image and marketing expertise (Dunning and Norman, 1985).

In such industries, direct foreign investment is likely to arise as an oligopolistic defense against (or in anticipation of) rival's actions that determine the profitability (and feasibility) of market servicing by exports. Essentially, the more geographically diversified are producers of a particular product group, the greater the proportion of transfer costs any one producer will have to absorb in order to export to distant markets. Therefore the weaker the economies of scale or the lower are the additional costs of setting up a foreign operation, and the greater are the transfer costs (including tariff and non-tariff barriers) between home and distant markets, the greater will the incentive to switch from exporting to foreign production.

The other type of intra-industry production arises through the integration of multi-product but geographically diversified activities (Dunning and Norman, 1985). It leads to plant specialization via direct foreign investment and intra-firm trade.

However some economists have criticized the OLI framework of analysis of IIDFI. Vernon, 1985, for example argues that this approach neglects the dynamic, strategic and oligopolistic aspects of IIDFI, that is the " sequential behavior of the firm interacting with other firms". In particular, he stresses the major importance of uncertainty as a motive for IIDFI. Vernon also draws attention to significant intra-firm learning-by-doing in the dynamics of inter-firm rivalry.

Krugman, 1985, on the other hand, criticizes the Dunning-Norman approach, first, for deriving the causes of IIDFI from its effects (instead of the other way round) and second, for defining IIDFI as a two-way investment in industries whose products

are close substitutes in either consumption or production. According to Krugman, IDFI should be viewed as an extension of control via two-way exportation of technological know-how primarily due to economies of scale and economies of scope.

Rugman adopts a micro (firm-level) approach to IIDFI. He treats the location (L) component of the Dunning-Norman OLI theory as an exogenous country specific advantage (CSA) and combines the ownership (O) and internalization (I) components into his firm-specific advantages (FSA). According to Rugman, the emergence of both one-way DFI and IIDFI, as well as their "natural companion" intra-industry trade can be traced to either natural or government-induced market imperfections that increase firms' transaction costs.

Kravis, 1985, however, finds neither the internalization-based theory nor the dynamic oligopolistic-rivalry theory of IIDFI general enough. He argues that a more general theory must explain: (i) the country-location of parent firms, (ii) why parents establish affiliates, that is why some firms become multinational enterprises (MNEs), and (iii) the interactions between home- and host-country characteristics.

In sum, we can infer from the literature that for two countries with different characteristics, namely a developed country and a developing country, the type of international production or direct foreign investment that takes place is likely to be one-way, that is from the developed country to the developing country. In this case direct foreign investment takes place because of differences in factor endowments as

well as for reason of economies of scale. With countries with similar economic characteristics, however, the motivation for intra-industry direct foreign investment (or production) is to take advantage of economies of scale as argued by Krugman, 1985.

In this paper, it is argued that apart from the reasons suggested in the literature and discussed above, firms may be motivated to indulge in direct foreign investment by the well documented so-called "Home Bias" puzzle - why people have such a strong preference for consumption of their home goods - that exists in international economics (McCallum, 1996; Helliwell, 1998; Wei 1998 and Evans 1998).

1.6. THE BASIC MODEL

The model used in this study is a familiar one in the literature on intra-industry trade. Suppose there are two identical countries, one conveniently called "home" and the other "foreign" and that each country has one firm, producing differentiated products X and Y respectively in industry Z. Suppose home firm produces output x for domestic consumption and output x^* for foreign consumption. Similarly, Foreign firm produces output y for the Home country and output y^* for its own market.

Following the literature on the "new trade theory" we assume a constant marginal cost of production, c, (which implies increasing returns to scale) and "iceberg" transport (shipping) costs τ, so that for every unit of home (foreign) good

shipped abroad, only a fraction $1-\tau$ arrives in the foreign country. Thus the marginal cost of exports is c/τ where $0 \leq \tau \leq 1$. Let t and t^* be tariff rate home and foreign countries place on their imports respectively. The foreign-country firm faces similar cost structure. Let p_x and p_x^* be the domestic and foreign prices for good X respectively and p_y and p_y^* the foreign and domestic prices for good Y. Suppose the fixed cost of home and foreign firms are F and F^* respectively.

Also following the international macroeconomic literature on the "home bias", assuming that each home (foreign) firm enjoys some form of "home bias" should be innocuous. For this reason, it is assumed that each home firm has a "home-bias" advantage.[8] For simplicity, I assume a simple linear relation for home and foreign firm respectively in the form of:

$$C_m = (c - \Psi)x \tag{1.1}$$

$$C_m^* = (c^* - \Psi^*)y^*, \tag{1.2}$$

where C_m and C_m^* are the marginal costs for home and foreign firm respectively, the c's are the actual marginal costs and the Ψ's are the "home bias" factors.

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[8] This advantage, while a demand-side phenomenon, is assumed to implicitly lead to a reduction in home firms cost of production. Thus I assume that this "home bias" advantage affects a firm's total profits by reducing its marginal costs. Alternatively, we can add the "home-bias" parameter to the demand equations in (4) and (5) so that we obtain $p_{xi} = \alpha_x + \Psi - \beta_x x_i - \gamma y_i$, and $p_{y^*} = \alpha_{y^*} + \Psi^* - \beta_{y^*} y^* - \gamma x^*$. Either specification would give us the same results.

Given the above assumptions, each firm faces two crucial decisions. For home country firm the decisions are:

1. To produce outputs x and x^* at home and then export x^* abroad;

2. To produce only x for the domestic market and produce x^* abroad for the foreign market via direct foreign investment.

The foreign firm faces similar decisions. Thus the question is under what conditions would a firm choose exports over DFI and vice versa?

As in Dixit, 1979 the inverse demands for the differentiated products in country i (i = *home, foreign)* are assumed to be of the form:

$$p_{xi} = \alpha_x - \beta_x x_i - \gamma y_i , \tag{1.3}$$

$$p_{yi} = \alpha_y - \beta_y y - \gamma x_i , \tag{1.4}$$

Henceforth foreign variables are be denoted by asterisks (*).

The inverse demands in each market can be derived from an aggregate consumer utility of the quadratic form:

$$U_i = W_i + m_1 = \alpha_x x_i + \alpha_y y_i - 1/2\left(\beta_x x_i^2 + 2\gamma x_i y_i + \beta_y y_i^2\right) + m_i , \tag{1.5}$$

where m_i is interpreted as expenditure on all other goods in country i. The use of such additive separable utility function helps to circumvent the problems associated with income effects and also legitimizes the use of partial equilibrium framework.

Now we look at the profit-maximizing conditions of both firms under three regimes, namely, autarky, international trade and intra-industry (reciprocal) multinational foreign affiliate sales (intra-industry direct foreign investment).

I. AUTARKY

Under autarky each firm becomes a monopolist in its own market the relevant prices are $P_x = \alpha_x - \beta_x x$ and $P_{y^*} = \alpha_{y^*} - \beta_{y^*} y^*$ and the respective cost functions are $C^A = cx + F$ and $C^{A^*} = c^* y^* + F^*$, where the c's are constant marginal function per unit and the F's are the fixed costs. Under autarky the "home-bias" advantage is irrelevant.

Given the total cost functions and the prices, the firm's profits under autarky can be written as follows:

$$\pi^A = x(\alpha_x - \beta_x x) - cx - F; \tag{1.6}$$

$$\pi^{A^*} = y^*(\alpha_{y^*} - \beta_{y^*} y^*) - c^* y^* - F^*. \tag{1.7}$$

The profit maximizing first order conditions (assuming positive outputs) for the firms are:

$$\frac{\partial \pi^A}{\partial x} = \alpha_x - 2\beta_x x - c = 0, \tag{1.8}$$

$$\frac{\partial \pi^{A^*}}{\partial y^*} = \alpha_{y^*} - 2\beta_{y^*} y^* - c^* = 0. \tag{1.9}$$

From the above equations, the equilibrium outputs under autarky are:

$$x^{A} = \frac{\alpha_x - c}{2\beta_x}, \text{ and } y^{A^*} = \frac{\alpha_{y^*} - c^*}{2\beta_{y^*}}. \tag{1.10}$$

By substitution, the total profit functions of the firms under autarky are:

$$\pi^{A} = \frac{(\alpha_x - c)^2}{4\beta_x} - F; \quad \pi^{A^*} = \frac{(\alpha_{y^*} - c^*)^2}{4\beta_{y^*}} - F^*. \tag{1.11}$$

II. TRADE

When trade is allowed, the two firms will maximize total profits from the two markets. Substituting for C_m and C_m^* from equations (1) and (2), the firms face the following respective total cost functions:

$$C = c\left(x + \frac{x^*}{\tau}\right) + t^*(x^*) - \Psi x + F, \tag{1.12}$$

$$C^* = c^*\left(y^* + \frac{y}{\tau^*}\right) + ty - \Psi^* y^* + F^*, \tag{1.13}$$

Assuming that the firms perceive country-specific demands, then total revenue functions for home-country firm from home and foreign markets are respectively as follows:

$$p_x = x(\alpha_x - \beta_x x - \gamma y) \tag{1.14}$$

$$p_{x^*}x^* = x^*(\alpha_{x^*} - \beta_{x^*}x^* - \gamma y^*), \tag{1.15}$$

Similarly, the total revenue functions of foreign-country firm in the two markets are:

$$p_y y = y(\alpha_y - \beta_y y - \gamma x), \tag{1.16}$$

$$p_{y^*}y^* = y^*(\alpha_{y^*} - \beta_{y^*}y^* - \gamma x^*), \tag{1.17}.$$

From equations (1.8) - (1.13) we can write the relevant total profit functions for the two firms as:

$$\pi^H_{trade} = x(\alpha_x - \beta_x x - \gamma y) + x^*(\alpha_{x^*} - \beta_{x^*}x^* - \gamma y^*) - \left[c\left(x + \frac{x^*}{\tau}\right) + t^*(x^*) - \Psi x + F\right], \tag{1.18}$$

$$\pi^F_{trade} = y(\alpha_y - \beta_y y - \gamma x) + y^*(\alpha_{y^*} - \beta_{y^*}y^* - \gamma x^*) - \left[c^*\left(y^* + \frac{y}{\tau^*}\right) + ty - \Psi^* y^* + F^*\right] \tag{1.19}$$

where π^H_{trade} and π^F_{trade} denote profits of home-country firm and foreign-country firm respectively.

The first order necessary conditions for the profit-maximization by each firm in both countries are:

$$\frac{\partial \pi^H_{trade}}{\partial x} = \pi^H_x = \alpha_x - 2\beta_x x - \gamma y - c + \Psi = 0, \tag{1.20}$$

$$\frac{\partial \pi^H_{trade}}{\partial x^*} = \pi^H_{x^*} = \alpha_{x^*} - 2\beta_{x^*}x^* - \gamma y^* - c/\tau - t^* = 0, \tag{1.21}$$

$$\frac{\partial \pi^F_{trade}}{\partial y} = \pi^F_y = \alpha_y - 2\beta_y y - \gamma x - c^*/\tau^* - t = 0. \tag{1.22}$$

$$\frac{\partial \pi^{F}_{trade}}{\partial y^{*}} = \pi^{F}_{y^{*}} = \alpha_{y^{*}} - 2\beta_{y^{*}} y^{*} - \gamma x^{*} - c^{*} + \Psi^{*} = 0, \tag{1.23}$$

Rearranging equations (1.14) - (1.17) into a matrix formulation, we have:

$$\begin{bmatrix} 2\beta_{x} & \gamma \\ \gamma & 2\beta_{y} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \theta_{x} + \Psi \\ \theta_{y} - t \end{bmatrix}, \tag{1.24}$$

$$\begin{bmatrix} 2\beta_{x^{*}} & \gamma \\ \gamma & 2\beta_{y^{*}} \end{bmatrix} \begin{bmatrix} x^{*} \\ y^{*} \end{bmatrix} = \begin{bmatrix} \theta_{x^{*}} - t^{*} \\ \theta_{y^{*}} + \Psi^{*} \end{bmatrix}, \tag{1.25}$$

where $\alpha_{x} - c = \theta_{x}$, $\alpha_{y} - c^{*}/\tau^{*} = \theta_{y}$, $\alpha_{x^{*}} - c/\tau = \theta_{x^{*}}$, and $\alpha_{y^{*}} - c^{*} = \theta_{y^{*}}$ and they indicate parameters of competitiveness.

From equations (1.18) and (1.19), and using Cramer's rule we can solve for equilibrium output levels as follows:

$$x_{trade} = \frac{2\beta_{y}(\theta_{x} + \Psi) - \gamma(\theta_{y} - t)}{4\beta_{x}\beta_{y} - \gamma^{2}}. \tag{1.26}$$

$$y_{trade} = \frac{2\beta_{x}(\theta_{y} - t) - \gamma(\theta_{x} + \Psi)}{4\beta_{x}\beta_{y} - \gamma^{2}}. \tag{1.27}$$

$$x^{*}_{trade} = \frac{2\beta_{y^{*}}(\theta_{x^{*}} - t^{*}) - \gamma(\theta_{y^{*}} + \Psi^{*})}{4\beta_{x^{*}}\beta_{y^{*}} - \gamma^{2}}, \tag{1.28}$$

$$y^{*}_{trade} = \frac{2\beta_{x^{*}}(\theta_{y^{*}} + \Psi^{*}) - \gamma(\theta_{x^{*}} - t^{*})}{4\beta_{x^{*}}\beta_{y^{*}} - \gamma^{2}}, \tag{1.29}$$

$$\pi^{H}_{trade} = \beta_{x}(x_{trade})^{2} + \beta_{x^{*}}(x^{*}_{trade})^{2} - F, \tag{1.30}$$

$$\pi^{F}_{trade} = \beta_{y}(y_{trade})^{2} + \beta_{y^{*}}(y^{*}_{trade})^{2} - F^{*}, \tag{1.31}$$

Thus we can write the conditions for intra-industry trade as $x^{\cdot}_{trade} > 0$, and $y_{trade} > 0$, i.e. with associated prices $p_{x^{\cdot}}$ and p_{y} also being positive.[9] Brander and Krugman, 1983 discusses similar conditions in the case of homogenous products with a constant elasticity demand curve. Fung, 1991 also discusses similar conditions for differentiated products. In essence these conditions ensure the existence of Nash equilibrium in both countries. It tells us that in the static case, intra-industry trade is more likely to take place in industries where there is a higher degree of product differentiation (γ smaller), lower tariff rates (smaller t, t^*) and smaller transport costs (smaller c/τ, c^*/τ^* or alternatively higher τ, τ^*). The effects of the "home bias" on demands for home and foreign goods are conspicuous - increasing the demand for home goods and decreasing the demand for foreign goods as expected.

III. INTRA-INDUSTRY DIRECT FOREIGN INVESTMENT

When direct foreign investment takes place in lieu of trade, it should also be noted that now the foreign affiliate also enjoys the "home bias" advantage that home country firm previously enjoyed under trade. In this light, the cost functions that home-country firm and foreign-country firm faces respectively become:[10]

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[9] By specification of this model, the condition $p_{x^{\cdot}} > (c/\tau + t^*)$ and $p_{y} > (c^*/\tau^* + t)$ must hold if intra-industry trade is to take place.

[10] It is well known that governments of various countries (states) attempt to entice direct foreign direct investments into their countries (states) through the provision of all kinds of incentives. In this connection, it is innocuous to assume that one of the factors that may determine direct foreign

$$C = (c - \Psi)x + (c^* - \Psi^*)x^* + F + F^*, \tag{1.32}$$

$$C^* = (c - \Psi)y + (c^* - \Psi^*)y^* + F + F^*. \tag{1.33}$$

Substituting for the costs from equations (1.32) and (1.33) the total profit functions of the firms can be written as follows:

$$\pi^H_{FDI} = x(\alpha_x - \beta_x x - \gamma y) + x^*(\alpha_{x^*} - \beta_{x^*} x^* - \gamma y^*) - (c - \Psi)x - (c^* - \Psi^*)x^* - (F + F^*), \tag{1.34}$$

$$\pi^F_{FDIS} = y(\alpha_y - \beta_y y - \gamma x) + y^*(\alpha_{y^*} - \beta_{y^*} y^* - \gamma x^*) - (c - \Psi)y - (c^* - \Psi^*)y^* - (F + F^*), \tag{1.35}$$

where π^H_{FDI} and π^F_{FDI} denote total profits for home-country firm and foreign-country firm respectively when they undertake direct foreign investment in lieu of exports.

As before the profit-maximizing first order necessary conditions are:

$$\frac{\partial \pi^H_{FDI}}{\partial x} = \alpha_x - 2\beta_x x - \gamma y - c + \Psi = 0, \tag{1.36}$$

$$\frac{\partial \pi^H_{FDI}}{\partial x^*} = \alpha_{x^*} - 2\beta_{x^*} x^* - \gamma y^* - c^* + \Psi^* = 0, \tag{1.37}$$

$$\frac{\partial \pi^F_{FDI}}{\partial y} = \alpha_y - 2\beta_y y - \gamma x - c + \Psi = 0, \tag{1.38}$$

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investment is host country government's policies. For simplicity it is assumed that all government policy can be lumped together as "incentives" which is assumed to be some constant "marginal incentives", g (g^* for foreign country). Given this assumption, the marginal costs functions (equations (1) and (2) can be re-specified as follows:

$$C(c, \Psi, g) + C^*(c^*, g^*, \Psi^*) = [c - (g + \Psi)x] + [c^* - (g^* + \Psi^*)x^*], \tag{i}$$

$$C(c, g, \Psi) + C(c^*, \Psi^*, g^*) = [c - (g + \Psi)y] + [c^* - (g^* + \Psi^*)y^*], \tag{ii}$$

$$\frac{\partial \pi^{F}_{FDI}}{\partial y^{*}} = \alpha_{y^{*}} - 2\beta_{y^{*}} y^{*} - \gamma x^{*} - c^{*} + \Psi^{*} = 0\,, \tag{1.39}$$

As before, we can rearrange equations (1.36) - (1.39) into matrix formulation and solve for output levels via the Cramer's rule.

$$\begin{bmatrix} 2\beta_{x} & \gamma \\ \gamma & 2\beta_{y} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \theta_{x} + \Psi \\ \phi_{y} + \Psi \end{bmatrix}, \tag{1.40}$$

$$\begin{bmatrix} 2\beta_{x^{*}} & \gamma \\ \gamma & 2\beta_{y^{*}} \end{bmatrix} \begin{bmatrix} x^{*} \\ y^{*} \end{bmatrix} = \begin{bmatrix} \phi_{x^{*}} + \Psi^{*} \\ \theta_{y^{*}} + \Psi^{*} \end{bmatrix}, \tag{1.41}$$

where as before $\alpha_{x} - c = \theta_{x}$, $\alpha_{y^{*}} - c^{*} = \theta_{y^{*}}$ and $\phi_{y} = \alpha_{y} - c$ and $\phi_{x^{*}} = \alpha_{x^{*}} - c^{*}$. Our equilibrium profit-maximizing output levels are thus:

$$x_{FDI} = \frac{2\beta_{y}(\theta_{x} + \Psi) - \gamma(\phi_{y} + \Psi)}{4\beta_{x}\beta_{y} - \gamma^{2}}, \tag{1.42}$$

$$y_{FDI} = \frac{2\beta_{x}(\phi_{y} + \Psi) - \gamma(\theta_{x} + \Psi)}{4\beta_{x}\beta_{y} - \gamma^{2}}, \tag{1.43}$$

$$x^{*}_{FDI} = \frac{2\beta_{y^{*}}(\phi_{x^{*}} + \Psi^{*}) - \gamma(\theta_{y^{*}} + \Psi^{*})}{4\beta_{x^{*}}\beta_{y^{*}} - \gamma^{2}}, \tag{1.44}$$

$$y^{*}_{FDI} = \frac{2\beta_{x^{*}}(\theta_{y^{*}} + \Psi^{*}) - \gamma(\varphi_{x^{*}} + \Psi^{*})}{4\beta_{x^{*}}\beta_{y^{*}} - \gamma^{2}}, \tag{1.45}$$

$$\pi^{H}_{FDI} = \beta_{x}(x_{FDI})^{2} + \beta_{x^{*}}(x^{*}_{FDI})^{2} - (F + F^{*}), \tag{1.46}$$

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for home country and foreign country firms respectively. Or as before we can use the demand equations as an alternative specification without loss of generality.

$$\pi^{F}_{FDI} = \beta_{y}(y_{FDI})^{2} + \beta_{y^*}(y^{*}_{FDI})^{2} - (F + F^{*}), \qquad (1.47)$$

As with trade, the conditions for intra-industry multinational sales (IIMS)/direct foreign investment, (IDFI)) are $x^{*}_{FDI} > 0$, $y_{FDI} > 0$ (i.e. $2\beta_{y^*}(\varphi_{x^*} + \Psi^{*}) - \gamma(\theta_{y^*} + \Psi^{*}) > 0$, and $2\beta_{x}(\varphi_{y} + \Psi) - \gamma(\theta_{x} + \Psi) > 0$), $p_{x^*} > 0$, $p_{y} > 0$, $p_{x^*} > c^{*} + F^{*}$ and $p_{y} > c + F$.

For firms to undertake intra-industry direct investment instead of intra-industry trade the following conditions must apply:

$$\pi^{H}_{trade} \leq \pi^{H}_{FDI} \qquad (1.48)$$

$$\pi^{F}_{trade} \leq \pi^{F}_{FDI} \qquad (1.49)$$

These two conditions imply that

$$\beta_{x}(x_{trade})^{2} + \beta_{x^*}(x^{*}_{trade})^{2} - F \leq \beta_{x}(x_{FDI})^{2} + \beta_{x^*}(x^{*}_{FDI})^{2} - (F + F^{*}), \qquad (1.50)$$

$$\beta_{y}(y_{trade})^{2} + \beta_{y^*}(y^{*}_{trade})^{2} - F^{*} \leq \beta_{y}(y_{FDI})^{2} + \beta_{y^*}(y^{*}_{FDI})^{2} - (F + F^{*}) \qquad (1.51)$$

Conditions (1.50) and (1.51) imply that [11]

$$\eta\left\{(2\beta_{y^*})^{-1}\left[(\varphi_{x^*} + \Psi^{*}) - (\theta_{x^*} - t^{*})\right]\right\} - F^{*} \geq \eta\xi\left[(\theta_{x^*} - t^{*}) - (\varphi_{y^*} + \Psi^{*})\right] + \rho \qquad (1.52)$$

where $\rho = -\eta\left\{\gamma^{-1}\left[(\varphi_{y} + \Psi)^{2} - (\theta_{y} - t)^{2}\right] + \zeta\left[(\varphi_{y} + \Psi) - (\theta_{y} - t)\right]\right\}$.

Equation (1.52) can be reduced in to linear equations such as the following (for the left-hand side and right-hand side respectively):

$$M = \sigma\Re - F$$

$$N = -\alpha\Re + \rho$$

where $\Re = \Psi^{*} - \theta_{x^{*}}$.

Equation (1.52) is the necessary condition for intra-industry multinational sales (or IIDFI) to take place. It must be noted that $(\phi_{x^{*}} + \Psi^{*})$ is the competitiveness of home firm in intra-industry production abroad, $(\theta_{x^{*}} - t^{*})$ is its export competitiveness and $(\phi_{v^{*}} + \Psi^{*})$ is foreign firm's competitiveness in its own market. Thus the right-hand side of equation (1.57) indicates the net competitive advantages (incentives) home-country firm has when it undertakes intra-industry production abroad while the left-hand side indicates its net export competitiveness. What this condition says it that in order for intra-industry multinational affiliate sales or intra-industry direct foreign investment to occur a firm's competitiveness (minus the fixed cost of producing abroad) must at least be equal to its export competitiveness (plus a constant).

From the equilibrium condition, Proposition1 is developed:

Proposition 1:

If a firm perceives that the advantage of international production, given by the net effect of "home bias" and production costs abroad, is higher than the advantage of producing at home for exports, then the firm would engage in

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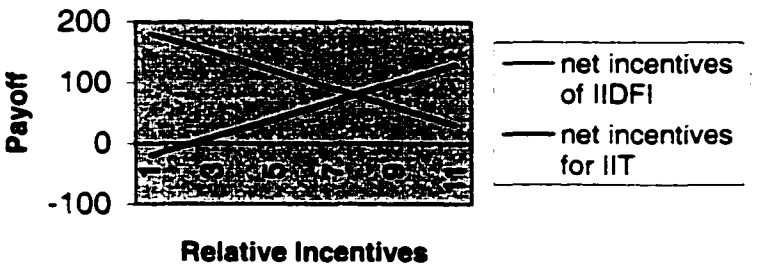
[11] See equation (A6) in Appendix A for the derivation of this equilibrium condition.

international production. The reverse is the case. That is, if a firm's perceived net advantages for producing at home for export is higher than that of international production, then the firm will produce at home for export.

Graphically, the equilibrium condition, given by equation (1.52) can be determined as follows:

Fig 1.1. Equilibrium Relative Incentives/Advantages for Intra-Indutry Direct Foreign Investment (IIDFI) and Intra-Industry Trade (IIT)



Using arbitrary values for variables in equation 1.52, Fig 1.1. shows that there is an optimal point where the relative incentive for the firm to engage in intra-industry foreign direct investment is exactly equal to the relative incentives for engaging in intra-industry trade. Points out the equilibrium point (the point of intersection of the two curves indicate the relative advantage of one production option over the other.

IV. DETERMINANTS OF INTRA-INDUSTRY DIRECT FOREIGN INVESTMENT.

The determinants or intensity of intra-industry direct foreign investment can be calculated using the Grubel-Lloyd index. This index is widely used in the trade literature to measure the extent of trade between two countries. In the case of trade, if the value of exports equals the value of imports, then all trade is intra-industry and thus the Grubel-Lloyd index equals one. On the other hand if either export or import is zero then there is no intra-industry trade and the Grubel-Lloyd index becomes zero.

The same analysis can be extended to intra-industry multinational sales or IIDFI. The Grubel-Lloyd index is calculated as follows:

$$GL = \left[1 - \frac{|x^* - y|}{x^* + y} \right]. \qquad (1.53)$$

In Table 1.3, I used the Grubel-Lloyd Index above to compute the intensity of intra-industry direct foreign investment between the United States and Canada over the period 1977-1999, using data from the US Bureau of Economic Analysis, 2000.

Table 1.4. INTRA-INDUSTRY FDI INTENSITY: THE CASE OF US-CANADA, 1977-1999

year/ Industry	All Industries	Petroleum	Food and Kindred products	chemicals and allied products	primary and fabricated metals	Machinery except electricals	Other manufacturing including electricals and	Wholesale Trade	Banking	Finance (except banking), insurance and real	Other industries
1977	0.033281	0.168406	0	0	0.699358	0.442268	0.223036	0.502165	0	0.144898	0.814304
1978	0.285774	0.163474	0.660782	0.062016	0.764069	0.450162	0.132552	0.53796	0	0.166116	0.900229
1979	0.290541	0.185453	0.651886	0.060317	0.786775	0.462904	0.139892	0.509101	0	0.164373	0.892649
1980	0.425691	0.288024	0	0.065947	0.654947	0.774769	0	0.41288	0.962861	0.562463	0.534676
1981	0.403556	0.280183	0.075848	0.050301	0.770158	0.658824	0.179112	0.419066	0.895171	0.636248	0.5928
1982	0.416227	0.252976	0.122137	0.078197	0.854167	0.624108	0.226795	0.558493	0.911734	0.689423	0.3542
1983	0.400873	0.233435	0.068334	0.061407	0.932331	0.571614	0.184386	0.555932	0.994934	0.670653	0.314504
1984	0.49297	0.24315	0.097788	0.045017	0.923374	0.65023	0.22019	0.637811	0.598851	0.884731	0.320758
1985	0.535009	0.263559	0.215933	0.058716	0.892695	0.665201	0.160105	0.770236	0.619289	0.986629	0.342446
1986	0.577938	0.231828	0.288266	0.10479	0.845016	0.779514	0.217111	0.73185	0.592478	0.984841	0.425853
1987	0.5529	0.214457	0.317812	0.150141	0.843106	0.78183	0.276541	0.859092	0.609218	0.760711	0.448606
1988	0.595811	0.18367	0.705923	0.153943	0.951668	0.727165	0.326647	0.751864	0.631237	0.81985	0.692334
1989	0.64419	0.182487	0.60763	0.137437	0.867647	0.716843	0.441599	0.749581	0.714125	0.978522	0.968912
1990	0.603486	0.234522	0.559591	0.166793	0.79448	0.754016	0.381042	0.597701	0.75828	0.95721	0.919294
1991	0.595792	0.16656	0.503452	0.219836	0.765239	0.887201	0.37725	0.445403	0.705497	0.991709	0.878458
1992	0.709501	0.460379	0	0	0.745431	0.819458	0.391104	0.432453	0.597403	0.908486	0.841409
1993	0.7334	0.423087	0	0	0.882555	0.845712	0.36584	0.348042	0.56338	0.993612	0.898717
1994	0.71412	0.458985	0.812487	0.248336	0.939856	0.915855	0.450769	0.5437	0.794027	0.873606	0.865443
1995	0.70662	0.494206	0.769086	0.283742	0.980719	0.975005	0.455089	0.500406	0.692047	0.863531	0.745045
1996	0.759354	0.28813	0.70912	0.293072	0.842172	0.937977	0.508748	0.696986	0.609874	0.914813	0.859269
1997	0.80539	0.462083	0.761694	0.26911	0.985672	0.84909	0.482575	0.719162	0.639017	0.993387	0.994479
1998	0.842467	0.313808	0.936695	0.470235	0.977195	0.707353	0.654961	0.727398	0.620761	0.963784	0.959434
1999	0.834096	0.294619	0.21813	0.460748	0.898059	0.780377	0.731804	0.664287	0.809914	0.904923	0.909844

Source: I calculated the Intra-Industry FDI Intensity using the Grubel-Lloyd Index. Data is from the BEA, 2000.

From Table 1.3, it can be discerned that the intensity of intra-industry FDI has been increasing over the years for all industries. The index increased from about 0.3 in the 1970s and 1980s to about 0.8 in the 1990s for all industries. The intensity of intra-industry FDI, according to the index, has been particularly strong in primary and fabricated metals, machinery and other manufacturing, wholesale trade and finance industries.

Using the Grubel-Lloyd Index above, and by substituting for x^* and y from equations (1.43) and (1.44), we can calculate the intensity of IDFI as follows:

$$GL = \left[1 - \frac{\left| \frac{2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*)}{4\beta_{x^*}\beta_{y^*} - \gamma^2} - \frac{2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi)}{4\beta_x\beta_y - \gamma^2} \right|}{\frac{2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*)}{4\beta_{x^*}\beta_{y^*} - \gamma^2} + \frac{2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi)}{4\beta_x\beta_y - \gamma^2}} \right], \quad (1.54)$$

Equation (1.54) can be re-written as:

$$GL = \left[1 - \frac{\left| (4\beta_x\beta_y - \gamma^2)(2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*)) - (4\beta_{x^*}\beta_{y^*} - \gamma^2)(2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi)) \right|}{(4\beta_x\beta_y - \gamma^2)(2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*)) + (4\beta_{x^*}\beta_{y^*} - \gamma^2)(2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi))} \right] \quad (1.55)$$

If as before we assume that $(4\beta_x\beta_y - \gamma^2) = (4\beta_{x^*}\beta_{y^*} - \gamma^2)$ then the above equation becomes:

$$GL = \left[1 - \frac{\left| (2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*)) - ((2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi)) \right|}{2\beta_{y^*}(\phi_{x^*} + \Psi^*) - \gamma(\theta_{y^*} + \Psi^*) + 2\beta_x(\phi_y + \Psi) - \gamma(\theta_x + \Psi)} \right] \quad (1.56)$$

Then taking partial derivatives of equation (1.55) with respect to the various parameters, the following conditions are obtained:[12]

(i) $\partial(GL)/\partial\beta_{r} > 0$,

(ii) $\partial(GL)/\beta_{r^*} < 0$,

(iii) $\partial(GL)/\partial\beta_{v} < 0$,

(iv) $\partial(GL)/\partial\beta_{v^*} > 0$,

(v) $\partial(GL)/\partial(\theta_{r}+\Psi) < 0$,

(vi) $\partial(GL)/\partial(\phi_{v} + \Psi) > 0$,

(vii) $\partial(GL)/\partial(\theta_{v^*} + \Psi^*) < 0$,

(viii) $\partial(GL)/\partial(\phi_{r^*} + \Psi^*) > 0$,

(ix) $\partial(GL)/\partial\gamma \gtrless 0$

The determinants of intra-industry multinational affiliate sales (or intra-industry foreign direct investment) can be interpreted from the first order conditions. The first

[12] See the Appendix B for the partial derivatives or first order conditions for the various parameters.

order conditions show that for home firm, a rise in domestic net advantages reduces intra-industry foreign affiliate sales (see condition (v) above). In this case the home firm may consider producing at home for export rather than embarking on international production all things being equal. On the other hand, a rise in its net advantage in foreign market raises intra-industry sales as given by condition (viii). Note that the home firm's net competitive advantage in its own market is given by $(\theta_x + \Psi)$ with $(\alpha_x - c = \theta_x)$ as its cost competitiveness and Ψ as the "home-bias" advantage. The same is true for the foreign firm. Thus if the foreign firm's domestic net advantage – given by increases in $(\theta_{y^*} + \Psi^*)$ where $(\alpha_{y^*} - c^* = \theta_{y^*})$ – then intra-industry foreign affiliate sales decline, while an increase in its competitiveness in foreign market - $(\phi_y + \Psi)$ with $(\phi_y = \alpha_y - c)$ - increases intra-industry foreign affiliate sales.

Equally important are the own-price effects, β's, on GL. A rise in own price of x, $\partial(GL)/\partial\beta_x > 0$, will raise the extent of intra-industry foreign affiliate sales (all things remaining unchanged), because of the substitution effect. On the other hand, a rise in the own price of y, $\partial(GL)/\partial\beta_y < 0$, will decrease the extent of intra-industry foreign affiliate sales. The effect of production differentiation, γ, on the extent of intra-industry affiliate sales is ambiguous. The ambiguity accords with the empirical literature on intra-industry trade where product differentiation as an explanatory

variable of intra-industry trade often has contradictory signs (see Tharakan, 1983). The theoretical explanation may be that product differentiation can lead to a weakening of the "home bias" effect, and thus making firms produce at home for exports knowing that they can act as monopolists and charge monopolists price (and thus enjoy monopoly profits) in foreign-country market to cover trade costs resulting from transport costs, tariffs and other trade barriers. The same reason – the prospect of monopolist profits due to product differentiation - can also lead to intra-industry foreign production.

From the above analysis, the following Proposition 2 is developed:

Proposition 2:

Intra-industry foreign affiliate sales (or intra-industry FDI) is higher, all other things being equal, if:

(a) domestic (foreign) firm's net advantage in foreign (domestic) is higher (than exporting);

(b) domestic (foreign) firm's net advantage in its own market is lower;

(c) in particular, the "home-bias" is high;

(d) own price elasticity of domestic firm's product is higher;

(e) the own price of the foreign affiliate (or foreign firm) in domestic market is lower;

(f) transport costs and tariffs are higher.

V. WELFARE IMPLICATIONS

This section looks at the welfare effects of intra-industry multinational affiliate sales. The objective is to find out whether or not intra-industry multinational affiliate sales are welfare improving or not, both locally and globally. We also compare the welfare effects of intra-industry multinational affiliate sales to that of intra-industry trade. We start with home country, and the analysis should hold true for the foreign country too.

Welfare effects are computed from the difference between consumer's and producer's surpluses when intra-industry multinational affiliate sales vis-à-vis consumer's and producer's surpluses under a regime of autarky.

We derive a measure of consumer surplus (CS) can be derived from equation (1.5) where

$$CS = W_1 - P_x x - P_y y \tag{1.57}$$

Under autarky, y is zero and thus the consumer surplus is

$$CS^A = \frac{1}{2}\beta_x (x^A)^2 = \frac{\theta_x^2}{8\beta_x} \tag{1.58}.$$

With intra-industry multinational sales, the consumer surplus becomes

$$CS^{IIMS} = \frac{1}{2}\left[\beta_x (x_{FDI})^2 + \beta_y (y_{FDI})^2\right] + \gamma (x_{FDI})(y_{FDI}) \tag{1.59}.$$

By substituting the values of x^A, x_{FDI} and y_{FDI} into the above expressions, equation (1.60) is obtained:

$$CS^{IIMS} - CS^A = \frac{1}{2}\left[\beta_x (x_{FDI})^2 + \beta_y (y_{FDI})^2\right] + \gamma (x_{FDI})(y_{FDI}) - \frac{\theta_x^2}{8\beta_x} \qquad (1.60)$$

From equation (60), it can be seen that consumers gain from intra-industry multinational affiliate sales ambiguous. This depends essentially on γ, the degree of product differentiation.[13] In this connection, it is appropriate to compute the gains from intra-industry multinational sales (or intra-industry FDI) when $\gamma = 0$.

If $\gamma = 0$, equilibrium outputs under international production become:

$$x_{FDI}^{NEW} = \frac{(\theta_x + \Psi)}{2\beta_x} \; ; \qquad y_{FDI}^{NEW} = \frac{(\phi_y + \Psi)}{2\beta_y} \qquad (1.61)$$

Thus the consumer surplus becomes:

$$CS^{FDI} = \frac{\beta_x}{2}\left(x_{FDI}^{NEW}\right)^2 + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2. \qquad (1.62)$$

The gains from international production (multinational affiliate sales) then can be computed as:

$$CS^{FDI} - CS^A = \frac{\beta_x}{2}\left(x_{FDI}^{NEW}\right)^2 + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2 - \frac{\beta_x}{2}\left(x^A\right)^2. \qquad (1.63)$$

By substituting for the outputs, we have:[14]

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[13] To see mathematically set $\gamma = 0$ as done in Appendix B section (III).

[14] See Appendix B section III for the derivation.

$$CS^{FDI} - CS^{A} = \frac{\Psi^2 + 2\theta_x \Psi}{8\beta_x} + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2 > 0 \qquad (1.64)$$

This gain is positively related to the volume of goods produced and sold by the foreign affiliate in domestic market. The reasons for this gain from trade are the "variety effect" similar to that discussed in Fung, 1991, as well as the pro-competitive effect as discussed in Brander and Krugman 1983.

Similarly, the gains from international trade when $\gamma = 0$ is positively unambiguous and is given by:

$$CS_{New}^{TRADE} - CS^{A} = \frac{\Psi^2 + 2\theta_x \Psi}{8\beta_x} + \frac{(\theta_y - t)^2}{8\beta_y} > 0 \qquad (1.65)$$

But the question is how do gains from intra-industry FDI or intra-industry sales by foreign affiliates compare to the gains from intra-industry trade $\gamma = 0$? To answer this question we compare the gains from trade to the gains from intra-industry foreign affiliate sales (or intra-industry direct foreign investment). To find this we subtract equation (1.65) from equation (1.64), which gives us

$$CS^{FDI} - CS_{New}^{TRADE} = \frac{\phi_y \Psi + \theta_y t}{4\beta_y} + \left[\frac{\left(\phi_y^2 + \Psi^2\right) - \left(\theta_y^2 + t^2\right)}{8\beta_y}\right] \gtreqless 0 \qquad (1.66).$$

From equation (1.66), it can be seen that whether or not intra-industry multinational sales are more welfare improving than intra-industry trade is ambiguous and it depends largely on domestic tariff rates and the cost-competitiveness of the foreign firm. The reason for this is that two effects seem to be taking place, namely

the pro-competitive effect and the variety effect. As shown in Fung 1991 when trade opens up, the firms still act like monopolists so that the domestic price of good x remains unchanged.

This leads to the following proposition:

Proposition 3:

All things being equal, consumers gain from intra-industry multinational affiliate sales (DFI) the higher the degree of product differentiation (the smaller r is or the closer to zero r gets). In a similar vein, other things being equal, intra-industry foreign affiliate sales or intra-industry foreign direct investment is more welfare improving (from the consumers' perspective) than intra-industry trade if:

(a) tariffs and transport costs are higher ;

(b) the net advantage of the foreign firm in the domestic market is higher than its net advantage of exporting in that market.

Next we consider producer's surplus by comparing the home-country firm's autarky monopoly profits with that of profits in the two markets.

The producer's surplus under autarky, PS^A, is simply given by equation (1.11), and using the definition of θ_x as follows:

$$PS^{A} = \frac{\theta_x^2}{4\beta_x} - F \qquad (1.11^{|})$$

The producer's surplus under intra-industry foreign sales (intra-industry FDI), PS^{IIMS}, is given by equation (1.46) as

$$PS^{IIMS} = \beta_x (x_{FDI})^2 + \beta_{x^*} (x^*_{FDI})^2 - (F + F^*) \qquad (1.46^{|})$$

The producer's surplus can be obtained by subtracting equation ($1.11^{|}$) from equation ($1.46^{|}$) to get:

$$PS^{IIMS} - PS^{A} = \beta_x (x_{FDI})^2 + \beta_{x^*} (x^*_{FDI})^2 - \left(\frac{\theta_x^2}{4\beta_x} + F^* \right) \gtrless 0 \qquad (1.67)$$

Thus, the gains from trade from the producer's perspective is ambiguous. Interestingly, it depends very much on the additional cost of producing in the foreign market. To understand this well, we look further at factors that make home firm more likely to gain from intra-industry foreign affiliate sales or intra-industry direct foreign investment:

(i) $$\frac{\partial (PS^{IIMS} - PS^{A})}{\partial \theta_x} = \frac{8\beta_x^2 \beta_y (x_{FDI}) - \theta_x}{2\beta_x} > 0$$

(ii) $$\frac{\partial (PS^{IIMS} - PS^{A})}{\partial \Psi} = 2\beta_x (x_{FDI}) [2\beta_y - \gamma] \gtrless 0$$

(iii) $$\frac{\partial (PS^{IIMS} - PS^{A})}{\partial \Psi^*} = 2\beta_{x^*} (x^*_{FDI}) [2\beta_{y^*} - \gamma] \gtrless 0$$

(iv) $$\frac{\partial (PS^{IIMS} - PS^{A})}{\partial \phi_y} = -2\beta_x \gamma (x_{FDI}) < 0$$

$$\text{(v)} \qquad \frac{\partial\left(PS^{IIMS} - PS^{A}\right)}{\partial \phi_{x^*}} = 4\beta_{x^*}\beta_{y^*}\left(x^{\cdot}_{FDI}\right) > 0$$

$$\frac{\partial\left(PS^{IIMS} - PS^{A}\right)}{\partial \gamma} = \frac{4\beta_y\gamma(\theta_x + \Psi) - \left[\left(4\beta_x\beta_y + \gamma^2\right)\left(\phi_y + \Psi\right)\right]}{\left(4\beta_x\beta_y - \gamma^2\right)^2} + \frac{4\beta_{x^*}\gamma(\phi_{x^*} + \Psi^*) - \left[\left(4\beta_{x^*}\beta_{y^*} + \gamma^2\right)\left(\theta_{y^*} + \Psi^*\right)\right]}{\left(4\beta_{x^*}\beta_{y^*} - \gamma^2\right)^2} \gtrless 0$$

(vi)

For the home firm, high θ_x and ϕ_{x^*} means that it can make higher profits in both the domestic and foreign markets. If ϕ_y increases, it reduces home firm's producer surplus expectedly. However, the effects of the "home biases", Ψ and Ψ^*, are ambiguous. But this is consistent with the underlying theory. If a particular market's "home bias" advantage increases, while it may increase the producer's surplus of the domestic firm, it is, at the same time, likely to induce production by the foreign firm in that market, and the presence of foreign firm may whittle away the profits (advantages) that the home-country firm would otherwise solely enjoy. As in the case of consumer's surplus, the effect of γ on producer surplus is ambiguous. The preceding analysis leads to the following proposition:

Proposition 4:

Home firm's producer's surplus increases if:

(a) its net advantages in both domestic and foreign markets increase;

(b) increases in "home bias" advantages are accompanied by a decrease in foreign-country's firm's net advantage in the home-country market. The same analysis also holds true for the foreign-country firm.

For the whole country, the change in national welfare, ΔNW, can be calculated from equations (1.63) and (1.67) as follows:

$$\Delta NW = \left(CS^{IIMS} + PS^{IIMS}\right) - \left(CS^{A} + PS^{A}\right) \tag{1.68}$$

By substitution we have:

$$\Delta NW = 3\beta_x (x_{FDI})^2 + 2\beta_{x^*} (x^*_{FDI})^2 + \beta_y (y_{FDI})^2 + 2\gamma (x_{FDI})(y_{FDI}) - \left[\frac{3\theta_x^2}{4\beta_x} + 2F^*\right] \gtrless 0 \tag{1.69}$$

Obviously, equation (1.69) can be positive or negative implying that the effects of intra-industry multinational affiliate sales (intra-industry FDI) on national welfare is ambiguous. Essentially whether or not it is welfare improving depends on the fixed cost of producing in foreign market, the price-competitiveness of the home-country firm and the own price elasticity of demand for the home-country good in home market.

Following the procedure above, we can derive the change in national welfare for foreign country as follows:

$$\Delta NW^* = 3\beta_{y^*} (y^*_{FDI})^2 + 2\beta_y (y_{FDI})^2 + \beta_{x^*} (x^*_{FDI})^2 + 2\gamma (y^*_{FDI})(x^*_{FDI}) - \left[\frac{3\theta_{y^*}^2}{4\beta_{y^*}} + 2F\right] \gtrless 0 \tag{1.70}$$

For the welfare impact of intra-industry multinational affiliate sales on the world, equations (1.69) and (1.70) can be summed up as follows:

$$\Delta NW + \Delta NW^* = 3\left[\beta_x (x_{FDI})^2 + \beta_{x^*} (x^*_{FDI})^2 + \beta_y (y_{FDI})^2 + \beta_{y^*} (y^*_{FDI})^2\right]$$
$$+ 2\gamma\left[(x_{DI}\, y_{FDI}) + (x^*_{FDI}\, y^*_{FDI})\right] - \left[3/2\left(\frac{\theta_x^2}{\beta_x} + \frac{\theta_{y^*}^2}{\beta_{y^*}}\right) + 2(F + F^*)\right] \gtrless 0 \qquad (1.71)$$

Equation (1.71) indicates that the global welfare impact of intra-industry multinational affiliate sales is ambiguous. Whether or not intra-industry multinational affiliate sales is welfare-improving or welfare-reducing depends very much on own price effects, β_x and β_{y^*}, the cost competitiveness of producing at home, θ_x and θ_{y^*} as well as the fixed costs in both markets.

1.7 CONCLUDING REMARKS.

Intra-industry multinational affiliate sales (or intra-industry direct foreign investment) has increased substantially since the 1970s especially between the United States and the other industrialized countries. Given its growing importance, intra-industry multinational sales calls for further theoretical and empirical research. Unfortunately, however, this significant economic phenomenon has not received the attention it probably deserves apart from that normally accorded separately and independently to its constituent one-way foreign direct investment. The existing

theoretical models in the literature used to analyze this phenomenon are diagnostically descriptive in most respects.

The purpose of this study has been to examine a formal model of intra-industry multinational sales (foreign direct investment) and study its properties. To do this, we employ a model framework similar to those used to study intra-industry trade. The model yields interesting intuitive insights despite its simplicity and static nature.

It is shown that in order for intra-industry multinational sales (foreign direct investment) to occur, a firm's net competitive advantage must be at least equal to its net competitive advantage when producing at home for exports. If not the firm will always export.

I find out that the extent of intra-industry multinational sales (or FDI) depends on industry characteristics such as own price elasticities, competitive advantage of the firms, "home-bias" factor, transport costs, tariffs and other trade barriers, fixed costs, and the degree of product differentiation.

With respect to welfare, our analysis shows that the welfare impacts of intra-industry multinational sales both locally and globally are ambiguous. From the consumer's perspective, the gains from IIMS depend largely on the degree of product differentiation. The higher the degree of product differentiation, that is, the closer γ gets to zero, the more unambiguously the gains from intra-industry multinational sales become.

The main shortcoming of the model is that it is static even though its conclusions largely accord with the theoretical literature of intra-industry foreign direct investment.

This model can be extended in a number of ways. A possible extension of this model is obviously to a dynamic framework such as repeated game theoretic framework in which one can analyze phenomenon such as collusive interactions between home- and foreign-country firms.

CHAPTER TWO

DETERMINANTS OF EXCHANGE RATES IN DEVELOPING COUNTRIES: ROLE OF DIFFERENT CAPITAL FLOWS.

2.1. INTRODUCTION

In the last few years, and particularly in the light of the financial crises in the 1990s, exchange rates have re-emerged to take the center stage in debates in international financial economics, [particularly] with respect to the so-called emerging economies. Among the issues that have attracted special attention are, as usual, the "fundamental" determinants of real exchange rates; the relationship between real exchange rate (volatility and misalignment) and growth; the relative performance of alternative exchange rate regimes particularly the feasibility of flexible exchange rate regimes; the role of exchange rate overvaluation in recent economic crises; the role of exchange rates (both nominal and real) in the spreading of crises across countries; the long run behavior of real exchange rates, especially the extent to which purchasing power parity holds in the long run in these countries; the role of nominal exchange rate anchors in stabilization programs; the economics of "dollarization," or optimal currency areas, and others. While the literature is very extensive and a lot of progress has been made in the last few years, a great deal of

issues still remain unresolved[15] especially in emerging economies where data and methodological limitations have hampered empirical work.

The motivation for this study is based on three factors: first, the fact that exchange rates have always been, and will continue to be, the central theme in international finance in particular and international economics in general; second, that capital flows into three geographical regions, namely Africa, Asia and Pacific and Latin America and Caribbean, appears to have distinctive characteristics from one another. In this connection, an empirical study to find out how these different capital flows affect each region seems a very interesting issue; and third, as said earlier, in spite of the volume of work done on exchange rates, not much has been done on the relationship between exchange rate and capital flows in emerging or developing economies to further enhance our understanding of exchange rates dynamics in international economics.

2.2. MOTIVATION AND OBJECTIVES

This chapter addresses the relationship between real exchange rates and capital flows in developing/emerging countries [Throughout the paper I use emerging and developing interchangeably]. The importance of this issue can be seen in the fact that it has become increasingly important in the optimal strategy for economic

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[15] See Edwards, Sabastian and Miguel A. Savastano (1999) for a comprehensive review of the literature on exchange rate in emerging economies as well as a discussion of some of the issues that

reforms in emerging economies. Thus the main objective of this paper is to address the following questions: (i) What are the effects of capital flows – as a determinant - on real exchange rates in developing (emerging) countries? (ii) Do different types of capital flows have different effects on real exchange rates? In particular, this study tests the effects of total capital flows as well as different types of capital flows on the real exchange rate. Four measures of capital flows are tested: foreign direct investment (FDI), portfolio investment, bank loans, and other capital flows; (iii) What are the effects of different capital flows into different geographical regions on real exchange rates in countries in that region? (iv) Besides, the existing empirical studies on real exchange rates in developing or emerging economies have tended to be too narrow in their coverage, with the vast majority of them over-concentrating on the Latin American experiences. Thus this paper broadens the coverage of studies to include other regions such as Africa and Asia and Pacific in addition to Latin America and the Caribbean. This would give us a better picture of the long run behavior of exchange rates in emerging markets.

The rest of the chapter is organized as follows: section 2.3 discusses conceptual and measurement problems of real exchange rates, and 2.4 provide a brief survey of related work as well as the different approaches to estimating equilibrium real exchange rates. Section 2.5 deals with the basic theoretical model underpinning this empirical study. The main empirical methodology used in this study and data

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remain unresolved in this subject area. What we discuss below is based primarily on their study.

description are discussed in section 2.6 and section 2.7 presents the empirical results. The concluding remarks are found in section 2.8.

2.3 THE REAL EXCHANGE RATE: CONCEPTS AND MEASUREMENT.

Analysis of real exchange rate issues presents both conceptual and empirical problems. Conceptually, different analytical frameworks use different conceptual definitions of real exchange rate that may be contextually suitable for particular circumstances. In this light, the existence of multiple definitions poses the problem of how to choose among alternative definitions of the real exchange rate.

There appears to be a substantial degree of agreement on the definition of the "long-run" real exchange rate at the broad conceptual level. As described by Nurkse, 1945 and restated by Edwards (1989), the long-run real exchange rate is that value of the real exchange rate that is consistent with the dual objectives of external and internal balance, for specified values of other variables that may influence these objectives. External balance refers to a situation in which the value of the current account deficit is one that can be financed by a "sustainable" level of capital flows, while internal balance refers to a situation in which the market for nontraded goods is in a "sustainable" equilibrium. As argued by Montiel, 1999, while this broad conceptual definition is helpful, giving precise operational content to the term "sustainable" as well as to the other variables that may influence these objectives is a non-trivial matter, and different approaches to these issues have resulted in markedly

different empirical methodologies for measuring the long-run real exchange rate Empirically, the measurement the real exchange rate in developing countries brings in its trail a lot of practical problems - such as the paucity and unreliability of statistical data, economic structures that do not lend themselves to easy analysis, the existence of parallel foreign exchange markets, substantial struggling and unrecorded trade, large shifts in the terms of trade, trade policy and patterns - that one may not often encounter in the advanced industrial countries.

In the literature, definitional differences of the real exchange rate (RER) have tended to follow the industrial-developing country dichotomy. In the case of the industrial countries, economists have primarily tended to focus on the "external RER for both analytical and empirical purposes. In this context, the RER is a measure of the ratio of the foreign to the domestic values of some broad-based price index such as the consumer price index (CPI) or the deflator for the gross domestic product (GDP Deflator), expressed in a common currency by using the nominal exchange rate to convert the price level in one country into the currency of the country. In the developing-country context, moreover, the RER tends to be defined in two different ways for analytical purposes, namely:

(i) as the relative price of traded goods in terms of non-traded goods (sometimes referred to as the two-good internal real exchange rate or

(ii) as the relative prices of exportable and importable goods in terms of non-traded goods (sometimes referred to as the three-good internal real exchange rates).

However, despite the analytical preference for the use of internal RER concepts, the external RER tends to be used for empirical purposes in the developing-country applications. This undoubtedly complicates the analysis of real exchange rate issues and raises a number of nontrivial issues with regard to the developing countries. For example, when is it appropriate to use one definition rather than another? Are there specific pitfalls to which practitioners should be alerted in formulating hypotheses using one RER concept and testing them using another as empirical proxy?[16]

Theoretically, however, there is a relationship between the external RER and the internal RER for tradables.

Since internal and external RERs are often used to make inferences about a country's competitiveness, there has been a lot of controversies over the relationship between competitiveness, productivity and exchange rates.[17] However what constitutes a "competitive" price and how much prices will be equalized by international trade depends [critically] upon nature of the goods being traded, that is, whether they are (i) homogeneous perfect substitutes such as primary commodities, or (ii) they are differentiated imperfect substitutes like most manufactures. In this connection, there are two basic concepts of competitiveness, namely internal and

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[16] Hinkle, E. Lawrence and Peter J. Montiel, 1999, Exchange Rate Misalignment: Concepts and Measurement for Developing Countries, p5.
[17] For example, see Krugman, 1994.

external, and their contextual importance depends largely upon the nature of the goods being traded.

(i) Homogeneous Goods and the Law of One Price.

For homogeneous goods, external competitiveness is a "yes" or "no" question. Prices are set by international markets and the law of one price. In theory, there should be only one price if one assumes away transportation, tariffs, trade restrictions and other transaction costs. Thus homogeneous goods are either sold at the internationally determined price or they are not sold at all. Complete price equalization should take place; and the empirical evidence shows that it does (Clark and others, 1994).

For homogenous goods, since a small country can sell whatever it produces at the international price, the question of market share becomes one of internal competitiveness - that is, of what quantity can profitably be produced in the home country. Such Internal competitiveness is the internal profitability in the home country of producing tradable goods relative to nontradables.

(ii) Differentiated Goods and Imperfect Competition.

On the other hand, for differentiated goods that are imperfect substitutes, some differences in price should persist depending upon the degree of substitutability and the cross-price elasticities of demand among close substitutes. Accordingly, the empirical evidence suggests that the law of one price is systematically violated (Rogoff, 1996 and Isard 1997).

Thus, external competitiveness for differentiated goods is a matter of degree rather than a "yes" or "no" question. For these imperfect substitutes, external demand is less than perfectly elastic. More can be sold, but only at a lower price. Therefore a key indicator in the pricing of imperfect substitutes is changes in their market shares. Competitive pricing will lead to a stable or increasing market share, whereas noncompetitive pricing will lead to a falling market share. For differentiated traded goods, pricing to market and incomplete pass-through of changes in exchange rates to domestic prices may be common. Hence, external competitiveness is a question of the relative price compared with those of competitor countries at which the home country's traded goods are sold - that is, of the external RER for traded goods.

(x) The Theoretical Relationship Between the Two-Good Internal Real Exchange Rate and External Real Exchange Rate.

Suppose there are two countries, home country and foreign country (rest of the world). Suppose also that both the domestic and foreign country (world) aggregate price indexes are geometric weighted averages of tradable and nontradable prices, with weights α and β for nontradables, then we have:

(a) $$P_{Gd} = P_{Nd}^{\alpha}.P_{Td}^{1-\alpha}, \text{ with } 0<\alpha<1$$

(b) $$P_{Gf} = P_{Nf}^{\beta}.P_{Tf}^{1-\beta}, \text{ with } 0<\beta<1$$

where P_{Gd} and P_{Gf} are domestic and foreign price levels respectively and P_N and P_T denote prices of nontradables and tradables with may be measured by either expenditure or production price indexes. The values of α and β will generally depend on which of these types of price indexes are used.

The bilateral RER between the home and foreign countries defined in foreign currency terms can be written as:

$$\text{(c)} \qquad BRER_{fc} = \frac{E_{fc} \cdot P_{Gd}}{P_{Gf}}$$

where E_{fc} is the exchange rate, that is, units of foreign exchange per unit of domestic currency.

By substituting for P_{Gd} and P_{Gf} from equations (a) and (b) into equation (c) and rearranging, we have:

$$\text{(d)} \qquad BRER_{fc} = \frac{(P_{Nd} / P_{Td})^{\alpha}}{(P_{Nf} / P_{Tf})^{\beta}} \cdot \frac{E_{fc} P_{Gd}}{P_{Gf}}.$$

The ratio P_{Nd}/P_{Td} is the internal RER for the home country, and the ratio P_{Nf}/P_{Tf} is the internal RER of the foreign country, defined in both cases as the relative price of nontradable goods to tradable goods.

2.4. A SURVEY OF THE APPROACHES TO EQUILIBRIUM REAL EXCHANGE RATE DETERMINATION.

The estimation of the long-run equilibrium exchange rate (LRER) and measurement has traditionally followed two main approaches, each with its unique operational advantages. These approaches are a relative purchasing power parity-based (PPP-based) approach that assumes a stationary LRER and a target resource methodology that employs trade equations or elasticities.[18]

2.3a The Purchasing Power Parity Approach

Among the various concepts of equilibrium RER used in the empirical analyses, those related to the theory of Purchasing Power Parity (PPP), have proven to be the most resilient. Thus purchasing power parity (PPP) is one of the most important concepts in international finance, and probably the "grand daddy" of all the theories of equilibrium real exchange rate. More often than not, the condition that PPP holds is considered observationally equivalent to the integration of the goods market. At the same time, however, PPP is a term that has a myriad of interpretations. It can be referred to broad price indices (such as the consumer price index, or GDP deflator) or it can pertain to more narrowly defined, traded price indices (such as the producer price index, or export value index). It can sometimes be meant to refer to a broader theory, so that the basic PPP relation is augmented by other variables such as

productivity. In the literature, PPP can be expressed in one of two ways: (1) in levels (commonly known as absolute PPP) or (2) in rates of change (known in the literature a s relative PPP).

The PPP hypothesis can be expressed in the form of the following equation:

$$\text{(e)}.\ s = \alpha_0 + \alpha_1 (p - p^*) + \varepsilon$$

where s is the (log of) nominal exchange rate, measured as the domestic currency price of foreign currency; p and p^* are (the logs of) the domestic and foreign price levels, respectively (including both traded and nontraded goods; α_0 is a constant, α_1 is the unconditional mean and ε is a stationary random variable. Conventionally the PPP hypothesis is tested by running a regression stated by equation (e) by means of ordinary least squares (OLS). The absolute PPP predicts that $\alpha_0 = 0$ and $\alpha_1 = 1$. The general finding tended to be that, while this hypothesis held up fairly well for high-inflation episodes, it could be rejected for more normal periods.

Recent developments in time-series econometrics, however made it clear that this methodology was inappropriate. Since s, p and p^* are all typically non-stationary, ε can only be stationary if s, p and p^* are cointegrated. If they are not then equation (e) is a spurious regression. Consequently, a few years ago PPP-based models of equilibrium exchange rates were discredited - at least in academic circles -

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[18] The term resource balance is broadly used to refer to the difference between exports of goods and nonfactor services, and imports of goods and nonfactor services. The resource balance equals the current account balance exclusive of net interest and other factor service payments.

because they performed poorly when juxtaposed against data. More recently, however, the notion that PPP provides a meaningful benchmark for assessing RER developments over the (very) long term has resurfaced, at least in the case of industrial countries.

One variant of PPP-based models, which Froot and Rogoff, 1994 label "stage two" focuses on detecting whether the real exchange rate $(s+p-p)$ is stationary as required under equation (e).

Among "fundamentals", the factor that has received a great deal of attention is the Balassa-Samuelson effect.[19] The analysis of this effect is antecedent upon four main assumptions, namely: (a) production in traded- and nontraded-goods sectors is conducted under constant returns to scale, using capital and labor; (b) higher per capita income reflects higher total factor productivity; (c) productivity growth is faster in traded-goods sector of the economy than in the nontraded-goods sector; and (d) capital is highly mobile internationally and inter-sectorally – that is real interest rate parity holds. Rogoff, 1996 reviews the empirical evidence on the Balassa-Samuelson effect. He concludes that "overall there is substantial empirical support for the Balassa-Samuelson hypothesis, especially in comparison between very poor and very rich countries, and in the time-series data for a select number of countries

[19] This effect is a supply-side explanation for the empirical regularity that, when measured in a common currency, the price level tends to be higher in a high-income country than in a low-income-per-capita country. See Kravis and Lipsey (1988). The leading demand-side explanation relies on a high income elasticity of demand for services, which tend to be nontraded goods.

including especially Japan."[20] He adds, however, that "whereas the relationship between incomes and prices is quite striking over the full data set, it is far less impressive when one looks either at the rich (industrialized) countries as a group or at the developing countries as a group."[21]

A number of recent surveys on the subject attribute the resurgence of PPP to three related factors: "looser" interpretations of the PPP doctrine, longer data samples and better (and more powerful) empirical tests.[22] According to these studies the interplay of those factors has helped to produce a body of evidence that exhibits a remarkable degree of conformity with four "stylized facts" of RER behavior in advanced economies: (i) the hypothesis that the (bilateral) RER follows a random walk is strongly rejected when tested over sufficiently long horizons - typically covering 6 or 7 decades; (ii) RER series exhibit strong, but slow, mean reversion properties - with estimates of the half life of PPP deviations falling somewhere between 3 and 5 years; (iii) hypotheses about the existence of a long run equilibrium relationship between the nominal exchange rate and the relative (domestic and foreign) prices are difficult to reject - especially when the tests do not impose

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[20] Rogoff, 1996 p.660. See also Clark and others, 1994 and Bennett, 1995.

[21] Rogoff, 1996 p.662. Also Canzoneri, Cumby and Diba, 1996 and Gordon, 1994 suggest a reason why the Balassa-Samuelson hypothesis may not explain well some medium-term movements in external RERs between industrial countries.

[22] See for example Breuer, 1994, Froot and Rogoff, 1995 and Rogoff, 1996. Breuer, 1994 for instance provides excellent survey of the empirical work on PPP up to about 1993, while Froot and Rogoff, 1995 gives a more technical exposition on testing. Other important surveys on the theory and evidence on PPP include Officer, 1976 (up to the mid-1970s and Dornbusch, 1987 (up to the mid-1980s).

restrictions of symmetry and/or proportionality; and (iv) with the exception of the yen/dollar rate, there is no compelling evidence of "permanent" deviations from PPP that can be accounted for by other (structural) factors - that is the Balassa-Samuelson effect is not borne out by the data (Froot and Rogoff, 1995, Rogoff, 1996).

It is not readily apparent, which, (if any) of the long-run regularities of RER noted above also hold in the case of developing countries. However, as Edwards and Savastano (1999) argue, "this type of information could significantly enhance (and even refocus completely) the myriad of analyses and discussions of equilibrium and disequilibrium RER that are conducted for emerging economies. In particular, knowledge of the relative validity of PPP as a (very) long-run benchmark for the equilibrium RER - or equivalently, the speed of convergence to the long-run PPP - could help refine the horizon for which the standard assessments of RER misalignment are most relevant." (Edwards and Savastano, 1999 p.24).

Unfortunately but not surprisingly, the body of empirical literature on PPP that deals with developing countries is quite thin, both in absolute terms and when compared to that available for the industrial economies (Breuer, 1994). Apparently, two main factors are responsible for the dearth of empirical work on PPP in developing countries: first, this is due in part to the reluctance of the developing economies to adopt floating exchange rates following the collapse of the Bretton Woods system. In this connection, it was virtually meaningless to test PPP-based models of equilibrium exchange rates using data from the developing countries; and

second, the paucity of data in these countries makes empirical work a very tough undertaking.

Since late 1980s, however, a growing number of studies have examined the time series properties in various developing countries for some version of PPP. Edwards and Savastano, 1999 provides a table that contains information from 13 of those studies (a representative but not exhaustive sample). Specifically, the table contains information on countries and time period of the studies, the measures of exchange rates and (relative) prices used, the type of test of PPP conducted, the precise PPP hypothesis tested, and the results obtained.

The table contains some interesting features of the empirical studies of RER and PPP in emerging economies. First, most of the studies covered primarily Latin America (8 out of the 13 studies in the table); only 3 studies focused solely on East Asia and only 2 (Edwards, 1989 and Bahmani-Oskooee, 1995) examined RER data from (a few) developing countries in other regions of the world. Second, the periods covered by the studies are quite short, majority of them conducting tests on data series that covered less than 30 years; four of the studies employed data series that covered less than 15 years; only 3 studies (Leon and Olivia, 1992, Liu, 1992 and Montiel, 1997) used data series that covered 35 years or more. Third, studies have relied more on consumer price indices (CPI) than on whole price indices (WPI) to construct their measure of relative (domestic to foreign) prices. Three studies (Edwards, 1989; Seabra, 1995; and Devereux and Connolly, 1996) used a measure of

relative prices that combined both the CPI (domestic prices) and WPI (foreign prices). Fourth, the majority of the studies relied on some type of univariate ("stage two") test to examine the main properties of the RER - and the PPP hypothesis. Only four of the thirteen studies (McNown and Wallace, 1989; Liu, 1992; Gan, 1994 and Seabra, 1995) conducted bivariate cointegration ("three stage") tests of PPP and just two of the four tested PPP using trivariate cointegration techniques. And fifth, studies were generally unclear about the precise PPP hypothesis that was being tested. While majority of the studies apparently tested for some variant of absolute PPP, only three studies (Leon and Olivia, 1992; Edwards, 1995, and Seabra, 1995) made it clear that they were testing the hypothesis of relative PPP.

A vast majority of the studies employed the univariate (stage two) tests of PPP and thus their findings revolve around the stationarity of various measures of the RER. Generally, the hypothesis that the RER is stationary in developing countries - and thus some form of PPP condition holds in the long-run - is not amply supported by these studies. In 40 of 54 individual country tests of RER stationarity the hypothesis that the RER series contained at least one unit root could not be rejected. However, the hypothesis that the RER series followed a random walk did not do better. In fact Edwards, 1989 and Leon and Olivia, 1992 tested the random walk hypothesis for a combined total of 44 series and rejected it in about two-thirds of the cases.

The few studies that used cointegration tests were somewhat supportive of the PPP hypotheses. The four studies that tested for bivariate cointegration between the nominal exchange rate and the ratio of domestic to foreign prices found that the residuals of the estimated regressions were stationary in about fifty percent (50%) of the cases (15 of 33). The two studies that conducted trivariate tests of cointegration (Liu, 1992 and Seabra, 1995) found even stronger evidence of an equilibrium relationship between the exchange rate and domestic and foreign prices (18 0f 20 cases).

However, most of the studies do not reveal much about mean reversion properties of the RER series they examined and thus, about the speed of convergence of long-run PPP in those economies. Only three studies conducted formal tests of mean reversion - and found some evidence of its presence - and two others simply mention mean reversion as a feature of the RER series they used in their findings.

Lastly, reflecting on the predominance of stage-two tests, the majority of the studies ended up imposing rather than testing the restrictions of proportionality and symmetry of the coefficients of the price terms in the RER - or PPP - equation (Breuer, 1994).

Inferring from the studies in the table, one gets the feeling that our knowledge of the basic time series properties of RER in developing countries, and in particular, of the relevance of PPP as a long-run benchmark for the equilibrium RER in these economies is fairly rudimentary (Edwards and Savastano, 1999).

Few shortcomings characterizing the existing studies contribute to this feeling. Among the shortcomings (and perhaps the most serious) is the low power of the test (especially the stage-two tests) to distinguish among alternative hypotheses in the short periods covered by the studies - a deficiency that cannot be fixed by the common practice of increasing the number of observations through the use of quarterly or monthly data (Froot and Rogoff, 1995 and Oh, 1996).

Further, there is the over-representation of Latin America in the sample of developing countries examined in the studies and this makes it difficult to make any uncontroversial conclusions from the studies. What is more, there is no clarity with regard to the variant of the PPP theory supposedly being tested. And finally there is a dearth of empirical work that aims at testing a well-defined PPP hypothesis using cointegration techniques, both bivariate and trivariate. Obviously at the root of all these shortcomings are the pervasive and severe data problems in many developing countries. However, it must be said that this problem does not distract from the fact that evidence on PPP stationarity and the long-run PPP contained in the studies of individual developing countries makes it difficult to discern which, if any, of the regularities of the long-run RER that have been found for the industrial economies are also applicable to the developing world.

More recently studies using panel data from industrial and developing economies to examine various PPP-related hypotheses have provided additional insights on the time series properties of RER in emerging economies (e.g. Levin and

Lin, 1992, 1993; Frankel and Rose, 1996; Jorion and Sweeney, 1996; MacDonald, 1996; Oh, 1996; Wu, 1996, O'Connell, 1998). Broadly, these studies are supportive of PPP as a long-run benchmark for the RER. In particular the studies reject the hypothesis that the RER follows a random walk in the sample as a whole, as well as in a wide array of sub-samples, and find estimates of convergence to PPP similar to those obtained with long-run horizon data - that is PPP deviations with a half-life of about 3 to 5 years. The link between these findings and the long-run behavior of the RER in developing countries follows directly from the composition of the sample, which is amply dominated by observations from LDCs[23]. In fact, an important question is whether developing countries' data may not be influencing "too much" the overall findings of the studies. Possible sources of bias include the predominance of monetary shocks in many high-inflation developing countries (Rogoff, 1996), the cross-sectional dependence stemming from using the U.S. dollar as the base currency for all calculations (O'Connell, 1998), and the aggregation across (and frequency switches of) nominal exchange rate regimes within the sample. While the influence of those factors is fairly apparent in many of the results reported in the studies (see for example tables 2 and 3 in Frankel and Rose, 1996 and Oh, 1996), the size of the bias that they impart to the overall findings, and hence the extent to which those findings can be deemed representative of the behavior of the RER in developing countries

[23] The share of developing countries' data in the panels goes from 50% of the observations (Oh, 1996) to about 90% (Parsley and Popper, 1998).

remains unclear, and should be addressed in future work (Edwards and Savastano, 1999).

From the above analyses, it can be seen that the evidence in support of various hypotheses related to PPP is generally weaker for developing countries than for the industrial countries. Unlike the industrial countries, for the developing countries a consensus is far from been reached with regards to the (approximate) answer to questions such as: Does PPP hold in the long run? How long is the long run? What is the half-life of PPP deviations? And what are the effects of productivity differentials on the RER? Besides there is the need to broaden the coverage of studies to include other regions of the world rather than the over concentration on the Latin American experiences. In a lump, we need to know more than we currently do about the long-run properties of real exchange rates in emerging markets. This means that more empirical work on the long run behavior of real exchange rate will be very helpful. In particularly there is the need for studies that make use better testing techniques such trivariate cointegration and test for mean reversion.

2.3b. The Partial-Equilibrium "Trade Equations" Approach

This approach (sometimes referred to as the elasticties approach) has been the most frequently used alternative to PPP. Its main attraction is that it allows for the

incorporation of the potential influences of changes in fundamentals in the calculation of long-run RER, retains the virtues of simplicity, and relies on a particular set of behavioral parameters estimates that are readily available for many countries. In the case of the rich industrial countries, the partial-equilibrium approach is based on the standard Mundell-Fleming current account specification:

$$\text{(f).} \qquad CA = RB(RER, Y, Y_F, ...) + rD$$

where CA is the current account of the balance of payments, RB is the resource balance function, D is the country's stock of net international indebtedness and r is the average interest rate paid on external debt. The resource balance is assumed to depend on the real exchange rate, RER, the domestic income (or gross domestic output), Y and foreign income Y_F, as well as potentially on other variables not specified above. The basic external input employed in this procedure is the exogenously determined target value of CA, determined from some estimate of "sustainable" net capital inflows.

Obviously the long-run real exchange rate (LRER) derived from this approach would not be consistent with PPP. The LRER would be changing over time and thus would be different when computed for different years. There are two reasons for this. Firstly, different growth rates and income elasticities in the home and partner countries will cause the value of the resource balance, RB, associated with a given RER to change over time. Secondly, the sustained net capital inflow or outflow will

cause the stock of international indebtedness, D, to change. In addition, changes in world interest rates, or the assumed value of sustainable net capital inflows, will result in discrete changes in the estimated LRER.

The trade equations-elasticities methodology has a number of practical advantages[24] in estimating equilibrium RER in developing countries. First, the date requirements are limited. One needs only data for gross domestic product (GDP), consumer price index (CPI), and balance of payments for the home country. Second, the methodology is fairly transparent and straightforward. Third, in cases of shifts in the fundamentals, the trade equations-elasticities methodology can provide a measure of the new equilibrium RER that cannot be estimated using the PPP-based approach.

However, the trade-equations approach has some significant shortcomings. First, the errors involved in the parameter estimates could be substantial and suggest large confidence intervals around the estimated LRER. The methodology is, in principle, valid only for marginal changes. Second, the three-good framework employed in the developing country version of this methodology assumes that the law of one price (LOP) holds for internationally traded goods. If the law of one price does not hold or hold only loosely, the relationship between domestic and foreign prices will be much looser, and the internal RERs for exports and imports may

[24] The advantages and disadvantages of the trade-equations approach discussed here are based entirely on Ahlers and Hinkle (1999).

change less or more slowly than assumed. Third, this methodology utilizes a recursive partial-equilibrium approach. Given the required changes in the resource balance, it determines new equilibrium values for the RER, imports, and exports but not for other important macroeconomic variables that may also change simultaneously. Nor does it explicitly allow for feedback from the RER to the factors – such as saving, investment, capital flows - that determine the target resource balance. Fourth, the approach is one of comparative static. It projects long-term changes but not the dynamic time path of the adjustment process.[25] Finally, forward-looking analyses of the LRER using the trade-equations approach require projections of fundamental variables determining the LRER. If some important fundamentals such as the terms of trade or private capital flows are completely unpredictable or subject to repeated shocks to their "permanent" values, the LRER will also be unpredictable or volatile.

Apart from the DLR constant-elasticities model afore-mentioned, other empirical studies that have used this methodology include Bayoumi and others (1994), the International Monetary Fund (IMF) (1998) and Wren-Lewis and Driver (1998).

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[25] However by repeated applications of the methodology, year by year, it is also possible to generate a time series for the equilibrium RER as illustrated with the Devarajan, Lewis, and Robinson (1993) constant-elasticities model (DLR Model).

Bayoumi and others (1994, used this approach to assess the Smithsonian realignments of 1971. They estimated dynamic trade volume equations for each of the G-7 countries, and from them derived long-run price and income elasticities and thus estimated the LRER based on the long-run trade balance.

A version of this approach, called "macroeconomic balance" is adopted by the International Monetary Fun (IMF) for industrial countries.[26] An important property of the "macroeconomic balance" approach is the ability of model the effects of changes in a wide variety of fundamentals on the RER. While the "trade equations" approach relies on ad hoc specification of sustainable capital inflows, the "macroeconomic balance methodology can take into account changes in fundamentals – including those that drive the current account such as productivity levels, as well as those that derive the sustainable level of capital inflows such as the medium-term saving-investment balance.

Wren-Lewis and Driver (1998) also apply the trade equations for the estimation of LRER for the G-7 countries for 1995-2000. While their procedure is similar in many ways to Bayoumi and others (1994) and Isard and Faruqee (1998), there is a fundamental difference in their approach. The difference was the calculation of the trade balance target to be reached by adjustments of real exchange rates to their long-run equilibrium values.

2.3c General Equilibrium Models

We live in very a complex world in which different variables interact with one another in very complex ways. In order to understand the complex interaction between different variables, some authors (notably Williamson, 1985, 1991, 1994) have built general equilibrium simulation models (GESM) to analyze the real exchange rate behavior. This approach can handle some of the problems associated with the partial equilibrium approach. There are basically three framework under the general equilibrium approach, namely, the fundamental equilibrium real exchange rate (FEER), the desired equilibrium real exchange rate (DEER) and the natural equilibrium real exchange rate (NATREX).

One of the widely used general equilibrium approach to the estimation of equilibrium real exchange rate is the fundamental equilibrium real exchange rate (FEER). This concept was developed by Williamson (and described in Williamson, 1994) as an alternative to the partial-equilibrium approach. The DEER,[27] on the other hand, is adopted by the International Monetary Fund and the procedure used by the Fund to calculate DEERs is similar to that used by Williamson to compute FEERs.

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[26] See Isard and Faruqee (1998).

[27] Calculations of long-run equilibrium real exchange rates have relied on simulations of the IMF's MULTIMOD econometric model.

Williamson's definition of FEER involves the simultaneous attainment of external and internal balance. Internal equilibrium refers to a situation where output is equal to potential output, while external equilibrium is "defined in terms of a sustainable level of the current account" (Bayoumi et al., 1994 page 23). In addition to using general-equilibrium structural models to stimulate the LRER, Williamson also explicitly adopts a normative perspective. In the same vein, the authors of the Fund's study of DEERs emphasize its normative content.[28] In general the FEER model predicts that (i) a fast growing country tends to experience real exchange rate appreciation, (ii) if a country's income elasticity of imports and domestic growth is greater than the elasticity of exports and foreign growth, its currency will experience depreciation.

In a recent review of RER misalignment analyses for the G-3 countries, Clark and MacDonald, 1998 have characterized the basic GESM model by the following set of equations:

$$\text{(g).} \quad CA = -KA ,$$

$$\text{(h).} \quad CA = b_o + b_1 q + b_2 y_d + b_3 y_f$$

$$\text{(i).} \quad FEER = (-KA^* - b_o - b_2 y_d - b_3 y_f)/b_1 ,$$

[28] See Bayoumi an others (1994) as well as Clark and others (1994).

where CA is the current account, KA* is the *exogenously given* equilibrium capital account, q is the real exchange rate y_d and y_f are the domestic and foreign aggregate demand levels respectively that are compatible with full employment (or internal equilibrium). Equation (9) determines the equilibrium RER as a function of the exogenous capital account and the domestic and foreign aggregate demand. In this setting, more traditional "fundamentals" such as terms of trade, government spending and import tariffs play a role only to the extent that they affect KA*, y_d or y_f. It must be noted that the Clark-MacDonald model presented above is a highly simplified version of the GESM approach, but it does capture some of the important features of most efforts in that tradition.[29]

Devarajan, 1996 developed a small GESM to assess the degree of RER misalignment in Africa's CFA Franc zone in the early 1990s. In this model, the equilibrium RER is defined as the rate "which is consistent with a particular current account target (page 6), and depends basically on the terms of trade. The results suggest that by early 1993, the RER was overvalued in all the CFA countries with the exception of Chad. Fundamentally, Devarajan's model is an extension of the basic elasticities approach and its appeal lies in its simplicity. However, the model has some shortcomings that seriously limit its wider applicability. First, as Devarajan

[29] In most cases, the analyst would have to choose a value for K* on the basis of historical evidence. This means that as in case of the single equation models, many GESM models require defining some type of "base period" (year) linked to the country's past experience.

himself recognizes, the results are highly sensitive to the choice of the base year. In the case of Benin for example, if 1981 is chosen as the base year, the calculations indicate an *undervaluation* of 22 per cent; on the other hand if 1984 is chosen as the base year, the calculations suggest an *overvaluation* of more than 10 per cent. Second as in most GESM analyses, the model ignores stock considerations and focuses exclusively on the role of flows.[30]

Serven and Schmidt-Hebbel, 1996 on the other hand developed a dynamic general equilibrium model to assess the behavior of RER in Chile. Although their main interest was to identify and understand the effects of fiscal policy on the real exchange rate, their model is general enough to address a battery of policy questions, including whether a country's RER is in equilibrium. This model has two basic appeals: first, unlike most of the studies in this tradition, it allows for an explicit interaction between stocks and flows. For example, in the steady state equilibrium the "current account deficit is equal to the exogenous flow of foreign investment which, in turn, is equal to the level required to maintain the stock of foreign-held assets constant" (Serven and Schmidt-Hebbel, 1996 page 99). Second, the model can be used to trace the dynamic adjustment of RER and other variables of interest following a specific shock. Interestingly though, their results are not very different from those obtained in other studies based on different and simpler methodologies.

Two main concerns have been raised about the uniqueness of the FEER (or the DEER). Expectedly, any well-behaved macro-econometric model would reach a steady state featuring full employment. To do so by a stipulated earlier date and with

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[30] Though ignoring asset equilibrium may generate misleading results, the ensuing bias is likely to be relatively small in countries with limited access to international markets (as is the case of most African countries, which continue to rely almost exclusively on official capital flows).

a stipulated current account balance, however requires policy action. "This raises the possibility that if the number of macroeconomic targets is small – as in the case of FEER and DEER calculations – relative to the set of effective instruments available to achieve them, then alternative combinations of policies that can achieve the targets when required may exist. These alternative ways of achieving the targets may have different implications for the exogenous macroeconomic variables, including the equilibrium real exchange rate."[31] The second set of issues concerns the empirical magnitude of the feedback effects of the models. Given that it is obviously costlier to implement general-equilibrium approach than the trade-equations approach, an important question is how much empirical difference the analytical advantages of the general-equilibrium approach make. Bayoumi and others find that, given the internal and external balance targets, the trade-equations and the general-equilibrium approaches often give similar values for DEER.

An alternative approach to the FEER-DEER methodology is the natural equilibrium real exchange rate, NATREX. This approach adopted by Stein, Allen and Associates (1995) attempts to circumvent the problem associated with the normative interpretation of LRER of the FEER-DEER tradition. In this light, the NATREX approach defines LRER in a positive rather than a normative fashion and derives the simulation horizon exogenously. In addition, the approach bases estimation on small medium-term model, rather than large, fully dynamic structural

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[31] Hinkle and Montiel p.249.

models. Stein (1994) and Allen (1995) define "the natural equilibrium real exchange rate" or NATREX, as the exchange rate that would simultaneously be consistent with the domestic unemployment rate being equal to its natural rate, and with the balance of payments being in equilibrium – involving no reserve movements – exclusive of speculative and cyclical factors.

Empirically the estimation of equilibrium LRER usually takes the form of one of the two widely used variants of single-equation approach: the traditional reduced-form version and a more recent cointegration version. The key difference between these two approaches concerns econometric methodology.

Arguably, the best known of the traditional single-equation reduced-form studies are those of Edwards (1989, 1994). The reduced form is similar to Edwards, 1989 in which the equilibrium LRER is estimated as a function of economic fundamentals only:

$$RER^* = f(\text{Fundamentals}),$$

where RER* is the long-run equilibrium value of the real exchange rate.

Edwards (1994) used panel data for 12 developing countries over the period 1962-1984 to estimate a regression in which the actual real exchange rate was the dependent variable and the set of independent variables included both potential fundamentals – such as the rate of growth of total productivity, the terms of trade, the share of government consumption in GDP, a measure of openness of trade regime and a measure of the severity of capital controls – and other variables interpreted as not

affecting LRER, but potentially causing the RER to deviate from the LRER including proxies for temporary aggregate demand shocks and change in the nominal exchange rate.

Since then Edwards (1989, 1994) approach has become a standard approach in the empirical estimation of LRER in the literature, particularly with respect to exchange rate misalignment and policy action of an individual country. Razin and Collins (1997), similar in spirit to Edwards, estimated reduced-form real exchange rate functions for a large country panel, including explanatory variables meant to capture both "fundamentals" that would affect the LRER (defined in their case as the flex-price solution to a Mundell-Fleming model binding capital controls), and variables such as terms of trade and the value of net long-term capital flows as well as a proxy for the exogenous component of the trade balance and excess of money growth over GDP growth.

In recent years, work on developing countries has involved the application of unit-root econometrics to the problem of estimating equilibrium RER similar to the "three stage" research on PPP identified by Froot and Rogoff (1994) in industrial-country application. Most studies of this framework have sought to explain the failure of PPP to explain the behavior of LRER in developing countries by detecting cointegration among real exchange rates and a variety of underlying "fundamentals".

The literature on empirical studies on equilibrium RER shows that a lot of studies usually employ Error Correction modeling econometric technique.

A pioneering work in this respect is Elbadawi, 1994, which employs the Engle-Granger error correction modeling procedure to test Edward's equilibrium real exchange rate approach. Elbadawi, 1994 employs this methodology to estimate the short-run dynamics of the real exchange as well as the long-run equilibrium real exchange rate in which the fundamentals include the terms of trade, a measure of openness (as proxy for commercial policy), the level of net capital inflows relative to GDP, the share of government spending in GDP and the rate of growth of exports rate for Chile, Ghana and India. His estimation was based on annual data spanning the period 1967-1990 and he found out that, in all the three countries, the real exchange rate and all of the fundamentals identified in the model were non-stationary and cointegrated. The qualitative signs of the coefficients in the cointegrating regressions were largely are in tune with the theoretical predictions.

Two extensions of Elbadawi's original specification by Elbadawi and Soto 1994, and 1995 modified the assumption of the actual level net of capital inflows by distinguishing between long-term and short-term inflows. Elbadawi and Soto, 1994 used annual date from 1960-1990 for Chile while Elbadawi and Soto (1995) extended the sample to include Cote d'Ivoire, Ghana, India, Kenya and Mexico in addition to Chile.

Other studies, that have used this procedure to study real exchange rate behavior in individual countries, include Cardenas, 1997 who used quarterly data from the first quarter of 1983 to the third quarter of 1993 for Columbia; Feyzioglu,

1997 in the context of a developing country Finland; Loayza and Lopez, 1997 which uses "fundamentals" quite different from Elbadawi and Soto, 1995 estimated that the Mexican peso had become overvalued by 27 percent by 1994; Mongardini (1998); Nyoni (1998) and Sorsa (1999).

Some empirical regularities have emerged. In general, cointegration relationships are found between the real exchange rate and its fundamentals, and the real exchange rate does adjust towards its long-run level. The postulated fundamentals such as the terms of trade, government expenditure, measures of exchange and trade controls, capital flows, are often found to be significant. Improvement in the terms of trade, and increases in government expenditure and capital flows tend to lead to appreciation of the real exchange rate, but there are exceptions. Liberalizing exchange and trade controls tends to result in equilibrium real exchange rate depreciation. Nominal devaluation is often found to lead to real depreciation. Expansive macroeconomic policy such as excess supply of domestic credit, fiscal deficits *etc.* tends to lead to currency overvaluation.

Interestingly, these studies tend to estimate the long-run equilibrium real exchange rate by taking into consideration the characteristics of the country under analysis, as reflected in the country-specific set of variables included in addition to the standard determinants of fundamentals. For example, Mongardini (1998) finds that the debt service ratio has effects both on the long-run equilibrium and on the short-run movement of Egypt's real exchange rate. The currency value is also affected by the

Gulf War. Noyni (1998) studies the impact of one type of capital flow – foreign aid, on the real exchange rate in Tanzania, and finds that foreign aid caused Tanzania's real exchange rate to depreciate both in the long run and in the short run. Sorsa (1999), studying Algeria considers the impact of oil prices on the real exchange rate in Algeria due to the large share of oil production in the economy. It was found that an increase in the oil price would cause both long-run and short-run appreciation in Algeria.

One modern econometric technique employed by researchers in dealing with LRER is the use of panel data. However, this approach is not very common in the empirical literature.

For example as said earlier, Edwards (1989, 1994) employed panel data for 12 developing countries in 1962-84. Expectedly, he uses a fixed-effect procedure, allowing country specific dummies to account for heterogeneity across the countries. However, Edwards did not use the cointegration approach, and thus was unable to distinguish between the short-run and long-run effects of the determinants of the real exchange rate. In an attempt to overcome this problem, Edwards decomposed the series of some fundamentals such as the terms of trade, government expenditure, capital flows and an index of exchange and trade controls into "permanent" and "temporary" components. Using the panel regression analysis, the decomposed series showed that for some fundamentals, the distinction between the "permanent" and "temporary" components was nontrivial.

Unfortunately, the decomposition approach does not entirely solve the problem of not being able to link the long-run determination of the equilibrium real exchange rate with the short-run movement of the real exchange rate.

Until recently, researchers relied on the Engle-Granger two step procedure. While this technique was appropriate and effective for linking a long-run relationship and short-run dynamics for individual country-specific time series, it was difficult to extend it to a panel setting due to lack of supporting econometric work on panel stationarity and cointegration analysis.

However, with recent developments in econometrics, particularly in panel unit-roots and cointegration tests, studies have been carried out using the Engle-Granger procedure on panel data. For example Chinn and Johnston (1996), using intertemporal model, employed this technique to analyze the effects of productivity and demand shocks on the real exchange rates for 14 OECD countries from 1970-1991. They found cointegration between the real exchange rate, relative productivity in tradables and nontradables, and government spending.

In a separate study Chinn (1997) shows that it is difficult to find a cointegrating relationship between the real exchange rate and sectoral productivity levels when analysis is carried out on a single country basis.

However none of the studies mentioned above deal with the components of capital flows separately. One study that deals with the effect of composition of capital flows on nominal exchange rate depreciation in the context of developing countries is Frankel and Rose, 1996 but their study is more related to statistical

characterization of currency crashes. Shu, 1999 studies the effects of different capital flows in three geographical regions. This study is related and similar to that but differs in scope of countries and regions as well as the variables used.

The composition of capital flows has important implications. For example different components of capital flows come with different degrees of volatility and thus the extent to which they can influence exchange rate volatility of host countries. The hypothesis regarding FDI is that it is safer way to finance investment than is bank borrowing or portfolio investment. One argument is that FDI is directly tied to real investment in plant, equipment and infrastructure and it also enhances technology transfer and managerial know-how; whereas borrowing can go to finance consumption that may not add to the productive capacity of the host countries. In addition, it can be argued that FDI is normally favored because of its stability (or less volatility). In the event of a crash for example, investors can suddenly dump securities and banks can refuse to roll over loans[32], but companies cannot quickly pack up their investments and go home. Chuhan et al., 1995 and Wei, 2000 provide some empirical support for this view. However, Dooley et al. 1994 found that a high level of FDI seems to be associated with higher variability in capital flows, not lower.

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[32] Though one can argue that reputation and the necessity to participate in the international capital markets at some future date may minimizes the probability of this risk.

2.5. THE BASIC THEREOTICAL MODEL

This section describes the theoretical framework for analyzing the determinants of long-run equilibrium real exchange rates. While the analytical framework is intended to provide a broad set of potential influences of the long-run equilibrium real exchange rate, the factor of particular interest to this study is capital flows. In an attempt to address some of the concerns raised by Edwards and Savastano, 1999 the model incorporates features of existing models in international and macroeconomics. In particular, the model embodies features of the traditional Swan-Salter traded and non-traded goods sectors, with monopolistic competition features and intertemporal budget constraints.

Suppose we have a two-country, (home and foreign) two-and two-period economy. The production structure is of the Swan-Salter variety, consisting of traded goods and non-traded sectors, with Blanchard-Kiyotaki monopolistic competition features. Home (Foreign) country is endowed with a total amount of resources $R_t (R_t^*)$, made up of capital K_t and labor, L_t, used to produce output in each sector. Labor, L_t, is supplied inelastically. Let the input prices at home for capital and labor be w and r respectively. We assume international capital mobility in the traded sector but not intra-sector capital mobility. We assume Cobb-Douglas production functions for both the home country and foreign country to be as follows (* denotes foreign country variables):

Home Country Production Function:

$$Y_t^i = A_t^i F\left(R_t^i, R_t^{i*}\right) = \frac{A_t^i\left[\left(\rho K_t^i + (1-\rho) e_t K_t^{i*}\right)^{\sigma}\left(L_t^i\right)^{(1-\sigma)}\right]^{(1/\alpha)}}{1/\alpha} \qquad (2.1)$$

Foreign country production function:

$$Y_t^{i*} = A_t^{i*} F^*\left(R_t^{i*}, R_t^i\right) = A_t^{i*}\left[\frac{\left[\left(\rho^* K_t^{i*} + (1-\rho^*)\left(K_t^i / e_t\right)\right)^{\sigma^*}\left(L_t^{i*}\right)^{(1-\sigma^*)}\right]^{(1/\alpha)}}{1/\alpha^*}\right] \qquad (2.2)$$

where t = 1, 2; i = T, N (T denotes traded goods and N denotes non-traded goods), Y's are output in the two sectors in the two countries $\sigma > 0$ is the elasticity of substitution; $\rho > 0$ is the home-foreign-capital ratio in production in the traded good sector but ρ equals unity in the nontraded goods sector; and α is the inverse of the degree of returns to scale; α -1 is the elasticity of marginal cost with respect to output or simply the "elasticity of marginal cost" (ala Blanchard and Kiyotaki). To ensure the existence of equilibrium we restrict α to be equal to or greater than unity. e_t is the real exchange rate defined generally as a function of the relative amount of domestic resources (R_t) to foreign resources (R_t^*). Thus mathematically,

$$e_t = \frac{E_t R_t^*}{R_t} \qquad (2.3)$$

where E_t is the nominal exchange rate. In currency terms, we define the exchange rate as the amount of domestic currency needed to buy one foreign currency. This means that an increase in the exchange rate constitutes depreciation and a decrease, appreciation.

It should be noted that output of traded and nontraded goods are consumed by the representative consumer and used as inputs in the investment sector. In addition the traded good can be exported. The feasibility constraint for the nontraded sector is:

$$C_t^N + I_t^N \leq \frac{A_t^N \left[\left(K_t^N\right)^{\sigma} \left(L_t^N\right)^{(1-\sigma)} \right]^{(1/\alpha)}}{1/\alpha}, \tag{2.4}$$

where I_t^N is the nontraded input into the investment sector.

On the other hand the feasibility constraint in the traded good sector is given by

$$C_t^T + I_t^T + B_{t+1} \leq A_t^i \left[\frac{\left[\left(\rho K_t^i + (1-\rho) e_t K_t^{i*}\right)^{\sigma} \left(L_t^i\right)^{(1-\sigma)} \right]^{(1/\alpha)}}{1/\alpha} \right] + (1+r_t) B_t \tag{2.5}$$

where r_t is the interest rate; B_t denotes foreign borrowing or lending and that $B_{t+1} - (1+r_t)B_t$ is the trade balance (TB).

On date 1 countries may borrow or lend at the world interest rate, r_t, determined by the equilibrium of investment and savings:

$$S_1^i + S_1^{i*} = I_1^i + I_1^{i*} \tag{2.6}$$

The investment good is produced using inputs in traded good and nontraded good, which can be thought of loosely as equipment and structures, respectively:[33]

$$K_{t+1} - (1-\partial) K_t \leq \nabla_t \left(I_t^T\right)^{\varphi} \left(I_t^N\right)^{(1-\varphi)}, \tag{2.7}$$

where ∂ is the rate of depreciation.

Assets Λ_{t+1} may be purchased in period t and sold in period t+1, earning interest r_{t+1}. We rule out any Ponzi schemes. Assets purchased in period t take the form either of physical capital or of bonds, B_t, denominated in units of traded goods as:

$$\Lambda_{t+1} = q_t K_{t+1} + B_{t+1} \tag{2.8}$$

Here q_t is the price of investment good relative to that of traded good; K_{t+1} is the amount of capital accumulated in period t for use in period $t+1$; and B_{t+1} is the amount of bonds purchased in period t and redeemed in period $t+1$. If B_{t+1} is negative, it means the country is borrowing from the rest of the world.

The representative consumer in home country maximizes the following utility function:

$$\max U_t^i = u(C_1^i) + \beta u(C_2^i) \tag{2.9}$$

subject to the intertemporal budget constraint given by equations (2.4) and (2.5). Foreign country's representative consumer maximizes similar utility function subject to its similar intertemporal budget constraint in equation.

We can rewrite the intertemporal budget constraint of home country as follows:

$$C_1^i + I_1^i + \frac{C_2^i}{1+r} + \frac{I_2^i}{1+r} = Y_1^i + \frac{Y_2^i}{1+r} \tag{2.10}$$

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[33] See de Cordoba and Kehoe (2000) for similar specification.

Assuming no depreciation, we can express investment, as a function of the capital stock as follows:

$$\begin{aligned} I_1^t &= K_2^t - K_1^t \\ I_2^t &= K_3^t - K_2^t \\ K_3^t &= 0 \\ \Rightarrow I_2^t &= -K_2^t \end{aligned} \tag{2.11}$$

K_1^t is given

By substitution, the intertemporal budget constraint becomes:

$$\begin{aligned} & C_1^t + I_1^t + B_{t-1} + \frac{C_2^t}{1+r} - \frac{K_2^t}{1+r} \\ & = A_1^t \frac{\left[\left(\rho K_1^t + (1-\rho) e_1 K_1^{T*}\right)^{\sigma} \left(L_1^t\right)^{(1-\sigma)}\right]^{1/\alpha}}{1/\alpha} + A_2^t \frac{\left[\left(\rho (K_1^t + I_1^t) + (1-\rho) e_2 (K_1^{T*} + I_1^{T*})\right)^{\sigma} \left(L_2^t\right)^{(1-\sigma)}\right]^{1/\alpha}}{(1/\alpha)(1+r_t)} + (1+r_t) B_t \end{aligned} \tag{2.12}$$

where $e_{t+1} = e_t + \varepsilon$ ($e_2 = e_1 + \varepsilon$), ε being a random stochastic variable.

An equilibrium of this economy is sequences of prices $\hat{P}_t^t, \hat{w}_t, \hat{r}, \hat{q}, \hat{e}_t$, of consumption and asset accumulation, $\hat{C}_t^t, \hat{\Lambda}_t$, of capital stocks and net foreign asset positions, $\hat{K}_t^t, \hat{B}_t$, and of sectoral production plans, $\hat{K}_t^t, \hat{L}_t^t, \hat{I}_t^t$, such that the following conditions are satisfied:

(I). Given the prices, producers in the traded sector choose the production plan $\hat{K}_t^T, \hat{K}_t^{T*}, \hat{L}_t^T, \hat{I}_t^T, \hat{I}_t^{T*}$ to minimize costs and to earn zero profits:

$$\hat{w}_1^T \geq (1-\sigma) A_1^T \left[\left(\rho K_1^T + (1-\rho) e_1 K_1^{T*}\right)^{\sigma} \left(L_1^T\right)^{-\sigma}\right]^{\left(\frac{1-\alpha}{\alpha}\right)}, \text{if } \hat{L}_1^t > 0, \tag{2.13}$$

$$\hat{w}_2^T \geq (1-\sigma)A_2^T\left[(\rho(K_1^T + I_1^T) + (1-\rho)e_2(K_1^{T^*} + I_1^{T^*})^{\sigma}(L_2^T)^{-\sigma}\right]^{\left(\frac{1-\alpha}{\alpha}\right)}, \text{if } \hat{L}_2^t > 0, \quad (2.14)$$

$$\frac{A_t^T\left[(\rho K_t^T + (1-\rho)e_t K_t^{T^*})^{\sigma}(L_t^T)^{(1-\sigma)}\right]^{(1/\alpha)}}{1/\alpha} + (1+r_t)B_t \geq C_t^T + I_t^T + B_{t+1}$$

$$\begin{aligned}
\hat{r}_t &= \frac{\partial Y_t^t}{\partial K_t^t} = \sigma\rho A_1^t\left[(\rho K_t^t + (1-\rho)e_t K_t^{t^*})^{(\sigma-1)}(L_t^t)^{(1-\sigma)}\right]^{\left(\frac{1-\alpha}{\alpha}\right)} \\
\hat{r}_t^* &= \frac{\partial Y_t^t}{\partial K_t^{t^*}} = \sigma e_t(1-\rho)A_1^t\left[(\rho K_t^t + (1-\rho)e_t K_t^{t^*})^{(\sigma-1)}(L_t^t)^{(1-\sigma)}\right]^{\left(\frac{1-\alpha}{\alpha}\right)},
\end{aligned} \quad (2.15)$$

The equilibrium conditions in period 2 are similar to that of period 1. Also the equilibrium conditions for foreign country are similar to that of home country in periods.

(II) Given prices, producers in the non-traded goods sector choose the production plan, $\hat{K}_t^N, \hat{L}_t^N, \hat{I}_t^N$ to minimize costs and earn zero profits:

$$\hat{w}_t^N = (1-\sigma)A_t^N\left[(K_t^N)^{\sigma}(L_t^N)^{-\sigma}\right]^{\left(\frac{1-\alpha}{\alpha}\right)} \quad (2.16)$$

$$\hat{r}_t^N = \sigma A_t^N\left[(K_t^N)^{(\sigma-1)}(L_t^N)^{(\sigma-1)}\right]^{\left(\frac{1-\alpha}{\alpha}\right)} \quad (2.17)$$

(III) Consumers maximize utility in equation (2.9) subject to the intertemporal budget constraint given in equation (2.12).

Solving for C_2^t in the budget constraint and substituting the results in the utility function, the maximization problems becomes:

$$\max_{C_1^t, I_1^t} \quad u(C_1^t) + \beta u\left\{(1+r)\left[A_1^t F^t(K_1^t, I_1^t, L_1^t) - C_1^t - I_1^t\right] + A_2^t F^t(K_1^t + I_1^t) + K_1^t + I_1^t\right\}.$$

The first order necessary conditions imply the Euler condition that:

$$u'(C_1^i) = (1+r)\beta u'\{(1+r)[A_1^i F^i(K_1^i, I_1^i, L_1^i) - C_1^i - I_1^i] + A_2^i F^i(K_1^i + I_1^i) + K_1^i + I_1^i\}$$
$$\beta u'(C_2^i)[-(1+r) + A_2^i F^i(K_1^i + I_1^i) + 1] = 0$$

(2.18)

From equation (18) we can derive our downward-sloping investment curves as before as:

$$A_2^i F'(K_1^i + I_1^i) = r$$
$$A_2^{i*} F^{*\prime}(K_1^{i*} + I_1^{i*}) = r^* \qquad (2.19)$$

Differentiating implicitly the Euler condition (for home country) gives us:

$$\frac{dC_1^i}{dr} = \frac{\beta u'(C_1^i) + \beta(1+r)u''(C_2^i)\left\{[A_1^i F(K_1^i, I_1^i, L_1^i) - C_1^i - I_1^i] + [A_2^i F'(.) - r]\frac{dI}{dr}\right\}}{u''(C_1^i) + \beta(1+r)^2 u''(C_2^i)}$$

(2.20)

Suppose utility function is isoelastic. Then we can define the elasticity of substitution as:

$$\sigma = \frac{u'(C_t)}{C_t u''(C_t)} \qquad (2.21)$$

By dividing equation (20) through by $\frac{u'(C_2^i)}{C_2^i}$,

$$\frac{dC_1}{dr} = \frac{A_t^i\left[\left\{\left\{\rho K_t^i + (1-\rho)e_t K_t^{i*}\right\}^{\sigma}\left(L_t^i\right)^{(1-\sigma)}\right\}^{(1/\alpha)} - C_1 - I_1 - \left(\frac{\sigma C_2}{(1+r_t)}\right)\right]}{(1/\alpha)[1 + r_t + (C_2/C_1)]} \qquad (2.22)$$

which can be positive or negative. The foreign country's version of equation (2.22) is

$$\frac{dC_1^*}{dr} = \frac{\left[A_1^* F\left(K_1^*, I_1^*, L_1^*\right) - C_1^* - I_1^*\right] - \dfrac{\sigma C_2^*}{1+r}}{1 + r + (C_2^* / C_1^*)} \tag{2.23}$$

Equation (2.22) is less than zero if capital account in period 1 is deficit i.e. $CA_1^* < 0$.

$$\begin{aligned} \frac{dI_1}{dr} &= \frac{1}{A_2 F''(K_1, I_1, L_1)} < 0 \\ \frac{dI_1^*}{dr} &= \frac{1}{A_2^* F^{*''}(K_1^*, I_1^*, L_1^*)} < 0 \end{aligned} \tag{2.24}$$

Plus the following equilibrium conditions:

$$\begin{aligned} &(i): A_1 F(K_1, I_1, L_1) + A_1^*(K_1^*, I_1^*, L_1^*) = C_1 + C_1^* + I_1 + I_1^* \\ &(ii): S_1 + S_1^* = I_1 + I_1^* \\ &(iii): CA_1 + CA_1^* = 0 \\ &(iv): K_1^T + K_1^N = K_1 \\ &(v): K_1^{T*} + K_1^{N*} = K_1^* \end{aligned} \tag{2.25}$$

The equilibrium exchange rate can be determined from equations (2.13) – (2.15) together with the intertemporal budget constraint.

From equation (2.15),

$$e_t = \frac{r_t^* \rho}{r_t (1 - \rho)} \tag{2.26}$$

Dividing equation (2.13) by equation (2.14), substituting for e_1 using equation (2.26), we obtain

$$\left[\left(\frac{w_1^T}{w_2^T}\right)\left(\frac{A_2^T}{A_1^T}\right)\right]^{(\alpha/\sigma(1-\alpha))} = \left(\frac{L_2}{L_1}\right)\left[\frac{\rho\left(K_1^T + (r^*/r)K_1^{T^*}\right)}{\rho\left(K_1^T + I_1^T\right) + (1-\rho)\left(K_1^{T^*} + I_1^{T^*}\right)e_{t-1}}\right] \tag{2.27}$$

We define

$$\begin{aligned} e_{t+1} &= e_t + \varepsilon_t \\ \varepsilon_t &= e_{t+1} - e_t \end{aligned} \tag{2.28}$$

where ε_t is the exchange rate shock. From equation (2.28) $e_2 = e_1 + \varepsilon_1$. By substituting for $e_{t+1}(e_2)$ in (2.27), we have

$$(1-\rho)(e_t + \varepsilon_t)\left(K_1^{T^*} + I_1^{T^*}\right) = \rho\left[\left(\frac{A_1^T}{A_2^T}\right)^{(\alpha/\sigma(1-\alpha))} \Pi\left(K_1^T + \frac{r^*}{r}(K_1^{T^*})\right) - \left(K_1^T + I_1^T\right)\right] \tag{2.29}$$

where $\Pi = \left(\frac{L_2^T}{L_1^T}\right)\left(\frac{w_2^T}{w_1^T}\right)^{(\alpha/\sigma(1-\alpha))}$.

Thus the equilibrium exchange rate can be derived as:

$$e_t + \varepsilon_t = \left(\frac{\rho}{(1-\rho)}\right)\left[\frac{\left(\frac{A_1^T}{A_2^T}\right)^{(\alpha/\sigma(1-\alpha))} \Pi\left(K_1^T + \frac{r^*}{r}K_1^{T^*}\right) - \left(K_1^T + I_1^T\right)}{\left(K_1^{T^*} + I_1^{T^*}\right)}\right] \tag{2.30}$$

Equation (2.30) shows the relationship between capital flows K_1^*, and the real exchange rate. It shows that capital inflows would appreciate the exchange rate, all things being equal.

Thus equation (2.30) together with the budget constraint in equation (2.12) determine the exchange rate as

$$e_t = e(C_t^i, Y_t^i, r, r^*, B_t, K_1^T, K_1^{T^*}, A_t^T, w_t^T, L_t^T ,.,.,., \varepsilon_t) \qquad (2.31)$$

Thus the exchange rate depends on consumption of traded and non-traded goods, output of traded and non-traded goods, inter-period technological differential progress, inter-period wage rates differential domestic and foreign interest rate, net foreign assets, capita flows and a host of other factors. As said elsewhere, the objective of this study is to investigate the effect of capital flows on exchange rate in developing countries. Accordingly, equation (2.31) is estimated for a group of developing countries in a panel framework similar to Edward 1994.

Among the potential influences identified directly in the model are the domestic supply and demand-side factors including capital and labor market conditions, output production (or income levels), consumption of goods and services, as well as the so-called Balassa-Samuelson effect; and changes in the international economic environment. The aspects of international economic environment considered explicitly in the model include the level of world interest rates and the availability of capital flows. Theoretically, increases in capital flows tend appreciate the equilibrium real exchange rate.. It is not too difficult to add other potential influences, such as government spending (or in general government fiscal policy if the consolidated public sector is added to our budget constraint), terms of trade, and trade openness, on real exchanges rates not directly considered to the reduced form of the model.

2.6 THE EMPIRICAL METHODOLOGY AND ECONOMETRIC ISSUES

Recent econometric innovations, especially the cointegration-based procedures offer a lot of promise for the estimation of LRER for developing countries. However, problems still abound with regard to the use of unit-root econometric techniques.[34] As argues by Montiel (1999), as of now the single-equation, rather than simulations from large macroeconomic models, appears to be the most promising avenue for further research.

As has been the standard procedure in the literature, an error correction model, ECM, has become the suitable technique in the application of Edwards' framework to LRER. Engle and Granger (1987) suggested a two-step approach to modeling cointegrated processes. The first step involves fitting the long-run relationship among variables by estimating the variables in levels by least squares. The hypothesis of cointegration can be tested by applying the Augmented Dickey-Fuller (ADF) test to the residuals from the [above] regression.

The modeling procedure and some related concepts are briefly discussed below[35].

We begin with a *fully specified* regression model, for example:

$$y_t = \beta x_t + \varepsilon_t, \tag{2.32}$$

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[34] See Montiel (1999).

[35] Based essentially on Greene, 1993.

where there is a presumption that the disturbance term, ε_t, is a white noise. By implication, the series ε_t is a stationary series. But this cannot be true if y_t and x_t are integrated of different orders. Thus there must be some kind of inconsistency in the model. If the two series are integrated to different orders, linear combinations of them will be integrated to the higher of the two series. On the other hand if they are of the same integration order, for example, $I(1)$, there must be a β such that their linear combination:

$$\varepsilon_t = y_t - \beta x_t, \tag{2.33}$$

is $I(0)$ – thus equation (1.81) might be stable around a fixed mean. This means that the two series drift upward or downward together at roughly the same rate. Two series that satisfy this requirement are said to be cointegrated, and the vector $[1,-\beta]$ is called a cointegrating vector.

Engle and Granger, 1987 suggested a two-step approach to modeling cointegrated processes. The first step involves fitting the long-run relationship among variables by estimating the variables in levels by least squares. The hypothesis of cointegration can be tested by applying the Augmented Dickey-Fuller (ADF) test to the residuals from the [above] regression. An ADF test takes the form:

$$\Delta y_t = \mu + \gamma^* y_{t-1} + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \varepsilon_t. \tag{2.34}$$

Where $\phi_j = -\sum_{k=j+1}^{p} \gamma_k$ and $\gamma^* = \left(\sum_{i=1}^{p} \gamma_i\right)$.

The advantage of this formulation is that it can accommodate higher-order autoregressive moving average processes in ε_t. ADF null hypothesis, $\gamma^* = 0$ means that the series contains a unit root. When the null hypothesis cannot be rejected, the series follows a random walk. As the variance of a random walk series increases with time, it makes forecasting difficult. In equation 2.34 $\sum_{j=1}^{p-1} \varphi_j \Delta y_{t-j}$ is included to ensure that the resulting error series from the regression is a white noise series.

If the residuals fail the test, the series are taken not to be cointegrated, and the specification would have to be reconsidered. Otherwise, a rejection of the null hypothesis means that there is a cointegrating relationship among the variables. When this is the case Engle and Granger suggest that, as the second step of modeling, the lagged (static) residuals from the previous long-run regression can be used as an error correction term in the dynamic, short-run model estimated in first differences.

Until recently the empirical modeling procedure described above could only be applied on time series. However recent innovations in econometrics have made it possible to follow this approach in a panel setting. One of the innovative ways of extending the Engle-Granger two-step approach to a panel setting was done by Chinn and Johnston, 1996 and Chinn, 1997. It allows specification of both long-run relationships and short-run dynamics. At the same time it takes into account heterogeneity in a panel. Levin and Lin (1992) compile the critical value for the equivalent of ADF statistics in a panel for different lengths of time periods and

different numbers of cross section units. This study largely follows Chinn and Johnston, 1996 and Chinn, 1997.

2.5.1 Long-run relationship

Based on the model described earlier and the econometric issues involved, the empirical model of the long-run equilibrium real exchange rate determination is specified follows:

$$RER = \alpha_i + \beta(CapitalFlows) + \phi_i X_i \text{ for country } i = 1,\ldots n; \qquad (2.35)$$

where RER is the real exchange rate, α_i is the matrix of constants to be estimated for each country I; β is the coefficient of capital flows; ϕ_i is the matrix of parameters to be estimated and X_i is the matrix of independent variables – "fundamentals" – that include standard variables normally used in studies of exchange rate determination. In this study the matrix X_i include fundamentals such as technological progress, terms of trade, openness, trade barriers and fiscal policy.

The real exchange rate is defined as:

$$RER = e = \frac{EP_F}{P} \qquad (2.36)$$

where E is the nominal exchange rate, P_F is the general price level of foreign country (the Consumer Price Index of the United States) and P is the general price level (Consumer Price Index) of domestic country. Defined this way, an increase in real exchange rate represents a depreciation of the domestic currency.

As stated earlier the variable of particular interest is capital flows, particularly how different types of capital flows affect long-run real exchange rates. In this connection, the effect of total capital flows is examined. The capital flows are disaggregated into four different types, namely, foreign direct investment, bank loans, bonds and equity (the last two comprising portfolio investments). Each type of capital flows is tested to find its impact on real exchange rates in developing countries. The measures of capital flows are scaled by GDP. In the literature, capital flows often lead to real appreciation. Consequently, the coefficient of capital flows is expected to have a negative sign. This may, however, not necessarily be the case due to the conflicting supply and demand side effects capital flows bring.

Technological progress is included to test the Balassa-Samuelson hypothesis. In accordance with the literature, two measures, a time trend or real GDP growth of are used alternately as proxies for technological progress. According to Balassa-Samuelson hypothesis, countries experiencing a faster rate of technological progress would experience an equilibrium real exchange rate appreciation. In this light, the coefficient of technological progress is expected to have a negative sign.

For most developing countries, the terms of trade is very crucial and this tends to have significant impact on the exchange rates. It is very difficult to determine the a priori sign of the coefficient of terms of trade because of the counteracting forces of the income and substitution effects. If the income effect of the terms of trade

improvement dominates the substitution effect, the improvement will lead to real appreciation, and thus the coefficient will carry a negative sign.

Two measures, namely "openness" and taxes on trade are normally used to investigate the effect of trade regimes on the equilibrium real exchange rate. In this study, just as in the literature, "openness" is alternately measured by trade as percentage of GDP - sum of exports and imports of goods and services measured as a share of gross domestic product or external balance on goods and services (resource balance), which refers to exports of goods and services minus imports of goods and services (previously nonfactor services). The tax measure used in the study is "taxes on international trade". As argued by Elbadawi, 1994 measures of taxes on trade explicitly measure quantitative distortions in a trade regime, while openness accounts for implicit factors such as quotas and exchange controls. Since changes in taxes can have conflicting income and substitution effects, the sign on a tax measure is ambiguous. However more open regimes are often found in the literature to be associated with more depreciated currency and lowering trade barriers leads to real depreciation. This means that the coefficient of "openness" may be expected to be positive while that of, taxes on international trade may be expected to be negative.

In this study, general government consumption expenditures to GDP ratio is used as a proxy for fiscal policy. The sign of the coefficient of this variable is also ambiguous. In countries where the government tends to have a higher propensity to spend on non-traded goods than the private sector does, an expansion in government

consumption is likely to put upward pressure on non-traded goods and result in real appreciation. In this case, the coefficient is expected to have a negative sign.

Other variables included in the study include real per capita GDP, money and quasi money (M2), and gross international reserves ratio, which essentially represents a countries ability to defend its currency. While the coefficient of M2 is expected to be positive, that of gross international reserves is expected to be negative. Thus if a country has large international reserves, its ability to defend its currency is enhanced. The sign of real per capita income (GDP) may be ambiguous because changes in real per capita income can have conflicting income and substitution effects.

To examine this long-run relationship between real exchange rates and the fundamentals, regressions are estimated in levels using the fixed effects model. The general-to-specific approach is used to select the suitable model. The analysis starts with an over-fitted model that includes all possible fundamentals. Then insignificant variables are eliminated one at a time, according to their statistical significance in explaining the real exchange rate until a final model is reached with all the variables being statistically significant. Then a residual based panel ADF test will be used to find out whether a long-run relationship exists between the real exchange rate and its fundamentals. To determine whether the variables are cointegrated in a panel, the residuals are extracted from the regression, and an equivalent of the ADF is run for the panel:

$$\Delta ECM_{i,t} = \beta ECM_{i,t-1} + \text{currency dummies} + \sum_{i=1}^{p} \phi_i \Delta ECM_{t-i} + \varepsilon_{i,t} \qquad (2.37)$$

The t-statistic on β will be compared with critical values tabulated by Levin and Lin (1992). If the panel ADF statistics is significant, the null hypothesis of no cointegration is rejected. Then a long-run relationship exists between the real exchange rate and its fundamentals, and the equilibrium real exchange rate is determined by the fundamentals that appear in the long-run relation regression.

2.5.2. Short-run determination of real exchange rate movement

If there is a long-run relationship between the real exchange rate and its fundamentals, then short-run dynamics of the real exchange rate movement can then be captured by estimating the following equation:

$$\Delta RER = \lambda_0 + \lambda_1 [ECM(-1)] + \delta_i (\Delta X_i) + \gamma_i \Psi_i + \lambda_2 E \qquad (2.38)$$

where ΔRER represents changes in real exchange rates, EMC(-1) is lagged error correction term ΔX_i is changes in fundamentals used in the study, Ψ_i represents a matrix of other macroeconomic measures and E is the nominal exchange rates. Thus following the Engle-Granger two-step modeling procedure, the short-run dynamics is given as a regression of changes in the real exchange rate on the lagged error correction term, changes in the fundamentals plus other macroeconomic measures

that might have an impact on the real exchange rate, and nominal depreciation. The inclusion of changes in fundamentals enables the model to capture their short-run effects on real exchange rate movement. Again the fixed effects are applied for estimation, and the general to specific approach is used for model selection. The *ECM* term is the deviation of the real exchange rate from its long-run equilibrium level. If the real exchange rate always tends to its long-run value, λ_1 should be negative. The speed at which the real exchange rate returns to the equilibrium value depends on the magnitude of λ_1.

In included in the matrix Ψ_i are changes in debt service as percentage of exports and changes in total debt as well as money and quasi money (M2). The variables used as proxies of macroeconomic policy include excess credit supply, the ratio of deficits to reserve money and changes in debt and changes in debt service.

Nominal devaluation may lead to real depreciation, and thus λ_2 will be positive. If it is the case it can be used as a policy tool when a currency is overvalued to assist speedy adjustment to the equilibrium real exchange rate.

2.5.3 Test the significance of fixed effects

The fixed effects model is chosen for estimation in this chapter. An F test can be applied to examine whether there are significant differences between the individual countries within a group and whether the application of the fixed effects model is justified:

$$F = \frac{(RRSS - URSS)/(N-1)}{URSS/Obs. - N - K} \qquad (2.39)$$

In equation (3.8), RRSS and URSS stand for the sum of squares from the restricted and unrestricted models respectively. The unrestricted regression is the fixed effects model while the restricted model is the pooled regression. In (2.39), Obs. Refers to the total number of observations, N is the number of countries within a group and K is the number of explanatory variables in the regression. Under the null hypothesis, the constant terms are all equal across the countries, *i.e.* the fixed effects of individual countries are not significantly different from each other. If the null hypothesis is accepted, the efficient estimator is the pooled the regression. If the null hypothesis is rejected, the fixed effects model is the preferred estimator. This F test will be applied to the whole sample as well as the three individual groups.

2.5.4 Data Description

The study covers 48 developing countries in three continents and 12 developed countries. The data used are annual and the study covers the period 1970-1999. The countries included in the study can be found in Appendix 2. The variables used in this study include the real exchange rate, and "economic fundamentals" variables for monetary and fiscal policy, and the nominal exchange rate. The real exchange rates are period averages calculated based on the World Bank's World Development Indicators data (CD-Rom 2001). Full description and definitions can be

found in Appendix 1. All the data used in this study are from the World Bank WDI CD-Rom 2001.

2.7. EMPIRICAL RESULTS AND ANALYSIS

Most studies on the determinants of exchange rates in developing countries in the literature have found out that the currencies of most of these countries experienced real depreciation in the 1970s and 1980s but experienced real appreciation in the 1990s. For example, Shu, 1999 found that over the period of 1970-96, currencies in selected Africa, Asia and Latin America countries experienced real depreciation. According to Shu (1999) Asian currencies in her study depreciated by around 3% in 1970-80 and 1981-90, but appreciated mildly in the first half of 1990s. African and Latin American countries, on the other hand, had substantial real depreciation in the 1980s but Latin American currencies experienced the biggest real appreciation in the 1990s.

Table 2.1 provides the summary statistics of economic fundamentals that might be important to explain real exchange rate movement. The figures provided are averages (mean) for the countries used in the respective regions over the sample period of 1970-1999. In all, the figures are for 17 countries in Africa, 13 in Asia and 18 in Latin America and the Caribbean. Prior to the "Asian Crises of the late 1990s, most countries in that region experienced rapid economic growth.

Table 2.1. Summary statistics economic variables used in the study: mean values for 1970-1999.

Variable	Africa	Asia	Latin America and Caribbean
Real GDP Growth	2.67	5.51	3.5
Per Capita GDP	309.81	3496.43	2273.60
Capital Flows	104*	1.39**	1.62**
Government Expenditures	15.73	10.34	11.61
Gross International Reserves	1.12**	8.47**	3.58**
Money and quasi Money (M2)	28.66	41.24	24.27
External Balance	-5.24	-2.52	-3.32
Trade as % of GDP (Openness)	67.96	90.15	49.55
Taxes on International Trade	30.17	21.94	16.34
Total Debt Services	654*	2.99**	2.76**
Debt Services (as % of exports)	22.02	17.14	27.68

*Notes: * indicates million US$ while** indicates figures in billion US $. The rest of the figures are ratios*

The rate of real economic growth in Asia (for the selected countries) averaged 5.51% over the period of 1970-1999, nearly three percentage points above that of Africa, and two percentage points above the growth rate in Latin America and the Caribbean. In addition, income levels were higher in Asia than in the other two regions. The real per capita income in Asia over the sample period was about US$ 3,496, which was more than 10 times higher than the per capita income of the selected African countries in the study.

While Asia has the largest debt service, about 3 billion US dollars, the burden of debt services, measured by total debts as a share of a country's exports was greatest in Latin America and Caribbean regions. About 28% of these regions exports goes into debt servicing compared to only about 17% for Asia and 22 for Africa.

With respect to trade regimes, three measures are used, namely trade as a share of gross domestic product, external balance on goods and services and taxes on international trade. Using trade as a share of GDP to measure openness, Asia was by far the most open regime among the three regions, with trade constituting about 90% of GDP. By this measure Latin America and the Caribbean region was the least outward oriented. The share of trade to GDP was only 50% for the selected countries. Trade as percentage of GDP was about 68% for countries in Africa. If external balance on goods and services is used to measure "openness", it still confirms Asian region as the most outward oriented and Africa as the least outward oriented. On the other hand, taxes on international trade were the higher for Asian countries than for Latin American and Caribbean countries. Taxes on international trade were highest for African countries. This is because generally African countries tend to rely heavily on import tariffs for revenue due to the fact that the domestic tax base is so porous.

In this study general government consumption expenditures are used as a proxy for fiscal policy, and particularly for government consumption of non-traded

goods. Unsurprisingly, Africa had the highest level of both government consumption and government expenditure at about 16% of gross domestic product. However, the growth of government consumption and government expenditure was the highest in Latin America, and lowest in Asia.

Table 2.2 shows capital movement to Africa, Asia and Latin America and the Caribbean during 1970-1999. It can be discerned from Table 2 that there has been a steady of capital to developing countries, especially foreign direct investment in the last two decades. The flow of foreign direct investment to Africa averaged about US$52.2 million during 1970-1999. The decade averages for a country in Africa was US$25.02 million in the 1970s, US$64.45 million in the 1980s and US$68.71million in the 1990s. FDI inflows to Africa in the 1980s were, on average, about three times the levels of the 1970s. The figures also show that FDI flows to Africa have tapered off in the 1990s from the 1980s levels.

It must be observed, however, that the flow of capital has been highly uneven as far as the developing regions of Africa, Asia and Latin and the Caribbean. The inflows of capital especially foreign direct investment have been more pronounced in Asia and Latin America. In the Latin American and Caribbean region, FDI surged by about 3 times in the 1980s from the levels that pertained in the 1970s. The 1990s levels of FDI in that region per country were about 5 times higher than what obtained in the 1980s and were about eleven times the 1970s levels. Asia-Pacific received the highest level of FDI per country, averaging about US$ 1.2 billion in the 1990s. It

must be noted that, on average, an African country only received about 7.5% of the amount of FDI that goes to Asia.

Unlike the trend growth in FDI, the movement in portfolio investment flows (bonds, equity and bank loans) was less predictable. African countries were once again the recipients of the least amount of these types of capital flows. In fact the flow of portfolio investments to Africa has been largely insignificant. This is mainly due to the ill-developed nature of the financial sectors (both banking and the securities/bonds markets) of African countries as well as the perceived corruption and high political risks associated with the continent. Portfolio investment grew steadily in Asia and Latin America and the Caribbean, particularly in the 1990s. The surge in growth of these types of capital flows in Asia and Latin America might have played some role in the financial crises that characterized these two regions and maybe help shed some light on the extent of capital flight in Latin American countries in particular.

Table 2.2. Capital flows to developing countries (US$)

Africa: Foreign Direct Investment Sample:	1970-1980	1981-1990	1991-1999	1970-1999
Mean	25.02	64.45	68.71	52.2
Median	1.34	0.87	2.78	196.33
Std. Dev.	118	226	203	188
Portfolio Investment: Bonds				
Mean	4.91	1.67	-2.94	1.48
Median	0.00	0.00	0.00	0.00
Std. Dev.	25.71	47.02	9.18	5.92
Portfolio Investment: EQUITY				
Mean	0.00	0.00	42.00	12.60
Median	0.00	0.00	0.00	0.00
Std. Dev.	0.00	0.00	193	107
Portfolio investment: OTHER				
Mean	-0.59	15.82	39.06	18.30
Median	0.00	0.00	0.00	0.00
Std. Dev.	5.17	129	259	163
Latin America and Caribbean Foreign Direct Investment Sample:	1970-1980	1981-1990	1991-1999	1970-1999
Mean	41.73	106	493	199
Median	0.89	0.61	2.55	1.045
Std. Dev.	211	502	2160	1240
Portfolio investment: Bonds				
Mean	36.98	-17.72	833	257
Median	0.00	0.00	0.00	0.00
Std. Dev.	145	340	2090	1220
Portfolio investment: Equity				
Mean	0.00	8.52	560	171
Median	0.00	0.00	0.00	0.00
Std. Dev.	0.00	53.23	1600	914
Portfolio investment: Other				
Mean	29.28	105	2400	824
Median	0.00	0.00	61.37	0.00
Std. Dev.	167	1330	7050	4220

Table 2.2. Capital flows to developing countries (US$) (continued from previous page)

Asia				
Foreign Direct Investment				
Sample:	1970-1980	1981-1990	1991-1999	1970-1999
Mean	110	392	1230	614
Median	10.17	103	478	91.31
Std. Dev.	217	704	1940	1320
Portfolio investment: Bonds				
Mean	12.74	69.43	977	322
Median	0.00	0.00	0.00	0.00
Std. Dev.	45.19	338	2250	1320
Portfolio Investment: Equity				
Mean	0.00	48.57	1050	333
Median	0.00	0.00	119	0.00
Std. Dev.	0.00	165	1840	1120
Portfolio Investment: Other				
Mean	23.52	76.37	678	291
Median	0.00	0.00	9.00	0.00
Std. Dev.	58.62	402	3930	2430

Calculated based on data from the World Bank's World Development Indicators, CD-ROM 2001.

2.7.1 The Test For Stationarity

First of all the time series properties of the variables are determined, and then the long run relationships between are the real exchange rate and its fundamentals are estimated for the overall sample, and the three individual groups, namely the Africa, Asia and Pacific and Latin and the Caribbean. After the best specifications for the long-run relationships are chosen, the panel cointegration tests described in Section 4

are performed on the residuals from these equations for individual groups. They reveal that in all cases some long-run relationships have been found for the groups, as the test statistics clearly reject the null hypothesis of no cointegration. The estimates for the long-run relationships are reported for the whole sample and the regional in the tables below.

In order to find long-run relationship between real equilibrium exchange rates and economic fundamentals, it must be established whether or not the variables are stationary or non-stationary. Thus an analysis of panel unit root tests can help to identify the time-series properties of the variables used in the regression. The long-run relationship between real exchange rates and economic fundamentals is estimated using variables in their levels while short-run relationships are established using variables in their first differences. The panel unit root test results are presented in Tables 2.3 and 2.4 for variables entering long-run and short-run equations respectively.

The panel unit root tests in Tables 2.3 and 2.4 (see below) shows that, for the whole sample group, as well as Asian and Pacific and Latin America and Caribbean regions real exchange rates are non-stationary in their levels but stationary in their first differences. This suggests that the real exchange rate exchange rate is an I(1) process, and thus the PPP is refuted.

Capital flows, at least types of it, appear to be I(0) processes. For the whole sample group, all the different types of capital flows series are seemingly stationary in

their levels. For individual regional groups, all the different types of capital flows appear to be I(0) process for Africa. Interestingly, only one type of capital flows, namely capital flows other than FDI, bonds and equity, appears stationary in their levels for all individual groups.

With respect to the economic fundamentals, gross international reserves (GIR), money and quasi-money (M2) real GDP growth (GDPG) are I(0) processes. Other economic fundamentals such as, general government consumption expenditures (GGCE), the terms of trade (TOT), taxes on international trade (TIT), and openness are mostly I(1) processes as they are nonstationary in levels. However these variables are stationary in first differences. The time series properties of general government consumption expenditure (GGCE) indicate that while it is nonstationary in levels for all groups as well as the whole sample, it is also nonstationary even in its first differences for Africa and Latin America and the Caribbean.

Table 2.4 shows that for other variables that enter the short-run regressions, nominal GDP (GDPN), debt services as a share of exports (DEBT) and nominal exchange rates are stationary for the whole sample as well as for individual regional groups.

Table 2.3. Panel unit root tests: Long-Run Relationship

Variable	All Countries	Africa	Asia and Pacific	Latin America and Caribbean
XRATE	-6.31	-5.05**	-5.56	-5.89
GDPG	-15.76***	-10.09***	-8.24***	-11.27***
GGCE	-5.68	-6.14	-8.65**	-3.09
GIR	-6.08**	-5.03	-3.56***	-4.10**
M2	-4.43*	5.16	-9.27**	-7.70
TIT	-3.67	-3.93	-41.4	-3.50
TOT	-6.11	-4.10	-9.99***	-9.05
TRADE	-12.32	-9.02	-13.65	-7.39
FDI	-12.56***	-10.13***	-3.98	-9.44
BONDS	-13.65**	-4.99**	-7.04	4.23
EQUITY	-9.37***	-8.58**	-10.21	-6.03**
OTHER	-12.07***	-7.28***	-9.54***	-8.38**

Notes: *, **, *** indicate that the null hypothesis is rejected at the 10%, 5% and 1% levels respectively.

Table 2.4. Panel Unit Roots: Short-Run Relations

Variable	All Countries	Africa	Asia and Pacific	Latin America and Caribbean
XRATE	-6.07***	-7.08**	-6.54***	-5.13**
GGCE	-82.1**	-6.17	-4.25***	-2.75
GIR	-8.04**	-5.99**	-3.45**	-7.00**
M2	-9.67*	-6.01**	-3.91***	-6.95**
TIT	-8.44**	-7.55**	-6.09**	-9.90***
TOT	-13.11***	-12.10***	-8.89***	-9.22***
TRADE	-12.36***	-9.21***	-6.06***	-7.54***
FDI	-5.69***	-9.08***	-6.19***	-5.36***
BONDS	-17.07***	-8.37***	-9.82**	-6.74***
EQUITY	-11.27***	-9.84***	-11.81***	-5.77
OTHER	-9.72***	-6.20***	-6.74***	-5.43***
DEBT	-10.74 ***	-7.11***	-9.30***	-7.75**
GDPN	-9.55***	-8.18**	-9.29***	-6.39****
EXRATE	-12.51***	-9.11***	-13.28***	-11.58***

Notes: *, **, *** indicate that the null hypothesis is rejected at the 10%, 5% and 1% levels respectively.

Table 2.5. Short run dynamics of the real exchange rate: groups without capital flows

	Africa	Whole
ecm(1)	-0.19***	-0.20***
Technological progress		
trend	-0.025***	
GDPG		0.09***
Openness and trade regimes		
Δ(TRADE)	0.33***	0.37***
Δ(TIT)		0.07**
Fiscal and other macroeconomic policy		
Δ(GGCE)	-0.05*	-0.19***
	-0.15***	
Changes in debt service	0.45***	0.33***
Δ(terms of trade)		-0.03*
EXRATE	-0.53**	
R-bar squared	0.87	0.76
Test of fixed effects	9.35***	5.03***

Table 2.6. Short run dynamics of the real exchange rate: Latin America[36]

Variable	ECM1	ECM2	ECM3	ECM4
Capital Flows:				
Δ(BONDS)	-0.18***	-0.17***	-0.17***	-0.17***
Δ(EQUITY)		-1.08**		-1.20**
Δ(CFLOWS)			-1.15**	
Technological Progress				
Trend	-0.013**			
Openness and Trade Regimes:				
Δ(TRADE)	0.39***	0.39***	0.39***	0.39***
Δ TIT	0.07***	0.07**	0.07**	0.07**
Fiscal and Macroeconomic Policy Variables:				
Δ(GGCE)	-0.19***	-0.19***		
Δ(M2)	0-0.08***		-0.19***	-0.19***
Δ(DEBT)		0.63**		
Δ(EXRATE)	0.45*		0.63**	0.63**
R-Bar Squared	0.69	0.64	0.63	0.64
Total Effects	1.30	4.29***	4.29***	4.31***

[36] The *, **, *** indicate that the coefficient is significant, or the null hypothesis is rejected in the case of the test of fixed effects, at 10%, 5% and 1% levels respectively.

Table 2.7. Short-run dynamics of the real exchange rate: Asia[37]

Variable	ECM1	ECM2	ECM3	ECM4
Capital Flows:	-0.17***	-0.17***	-0.17***	-0.18***
Δ(OTHER)	-0.34**		-0.24**	-0.23**
Δ(CFLOWS)		-0.288*8*	-0.24***	
Technological Progress Trend	0.018**	0.018**	0.018**	0.018**
Openness and Trade Regimes:				
Δ(TRADE)	0.19***	0.19***	0.25***	0.25***
ΔTIT		0.06**	0.06**	0.06**
Fiscal and Macroeconomic Policy Variables:				
Δ(GGCE)	-0.27***	-0.27***	-0.27***	-0.27***
Δ(DEBT)	-0.03**	-0.03**	-0.03***	-0.03***
Δ(EXRATE)	0.20***	0.22***	0.20***	0.20***
R-Bar Squared	0.47	0.47	0.48	0.51
Total Effects	1.20	1.19	0.83	0.83

[37] The *, **, *** indicate that the coefficient is significant, or the null hypothesis is rejected in the case of the test of fixed effects, at 10%, 5% and 1% levels respectively.

In testing the short-run dynamics for the different regions, the lagged residuals from the cointegration relationship are used as error correction terms. In addition changes in the fundamentals, measures of macroeconomic policy and nominal devaluation are included to explain short-run real exchange rate movement. The short run dynamics are reported in Tables 2.5 –2.7.

In the tables, different ECM terms refer to the long-run cointegration vectors with different types of capital flows. ECM1, ECM2, ECM3 and ECM4 refer to the cointegration vectors that contain portfolio investment (BONDS), EQUITY, capital flows other than foreign direct investment (OTHER), and total capital flows (CFLOWS) respectively. For Asia and Latin America, with each long-run cointegration vector, different types of capital flows enter into the short-run specification one at a time. This gives rise to several possible short-run specifications for the two groups. The estimates of the different specifications are fairly consistent for both Asia and Latin America.

For all the three regions of Africa, Asia and Pacific and Latin America and the Caribbean as well as for the whole sample, the error correction terms have been found to be highly significant and carry the expected negative sign. This means real exchange rates did tend to adjust to their long-run values. The speed of adjustment was highest in Africa, and lower for Asia and Latin America. In Africa, the deviation of the actual real exchange rate from the equilibrium real exchange rate determined by the fundamentals could be corrected 20% in a year. In Asia and Latin America,

misalignment would be reduced by about 17% per annum. These rates of mean reversion are similar to those found by Frankel and Rose (1995), which is -0.15, and by Chinn (1997) and Johnston and Chinn (1996), which is -0.17.

Similar to the long-run findings, changes in capital flows did not affect the short run real exchange rate movement in Africa either. This seems to confirm the earlier message that for countries that were not exposed to large capital movement, capital flows were not important in affecting the real exchange rate, not even in the short run. In addition to their long-run effects, changes in capital flows also led to a short-run real appreciation of the real exchange rate of Asia and Latin America in the short run.

Consistently, all changes in the fundamentals seem to lead to changes in short-run real exchange rates. In Asia and Pacific and Latin America and Caribbean regions changes in nominal exchange rates lead directly to changes in real exchange rates.

2.7.2 *Regression Results*[38]

Table 2.8. Determinants of Real Exchange Rates[39]

Dependent Variable: Real Exchange Rate
Method: Pooled Least Squares
Sample (adjusted): 1970 1999
Included observations: 30 after adjusting endpoints
Number of cross-sections used: 52
Total panel (unbalanced) observations: 1038

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-10.75625	2.787982	-3.858077	0.0001
TREND	10.07888	1.441039	6.994174	0.0000
TOT	3.56E-11	3.42E-12	10.41942	0.0000
GIR	-1.70E-09	7.87E-10	-2.163634	0.0307
TRADE	2.601676	0.752465	3.457540	0.0006
TIT	4.562116	1.372444	3.324081	0.0009
M2	-1.920096	1.088860	-1.763400	0.0781

R-squared	0.879790	Mean dependent variable	289.1163
Adjusted R-squared	0.872669	S.D. dependent var	664.0165
S.E. of regression	236.9443	Sum squared resid	54963629
F-statistic	1194.186	Durbin-Watson stat	0.382736
Prob (F-statistic)	0.000000		

[38] Detailed explanation of variables can be found in Appendix B. Note that "var" indicates variable, "resid" indicates residuals, "stat" for statistic and "prob" represents probability.

[39] This includes all countries including selected developed countries. In this regression trend is used as a proxy to measure the Balassa-Samuelson effect (technological progress).

Table 2.9. Determinants of Real Exchange Rates

Dependent Variable: Real Exchange rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 52

Total panel (unbalanced) observations: 1037

Variable	Coefficient	Std. Error	t-Statistic	Prob.
—				
GGCE	-10.59539	2.858805	-3.706228	0.0002
TOT	3.53E-11	3.50E-12	10.09773	0.0000
GIR	-1.88E-10	7.73E-10	-0.242822	0.8082
TRADE	4.223812	0.736574	5.734404	0.0000
TIT	1.261420	1.344817	0.937987	0.3485
M2	1.120200	1.078749	1.038425	0.2993
GDPG	-0.090046	0.054877	-1.640864	0.1011

R-squared	0.874199	Mean dependent var	289.0729
Adjusted R-squared	0.866739	S.D. dependent var	664.3354
S.E. of regression	242.5154	Sum squared resid	57519828
F-statistic	1132.700	Durbin-Watson stat	0.360459
Prob(F-statistic)	0.000000		

Notes: All countries using growth of GDP as a proxy for technological countries

Table 2.10. Determinants of Real Exchange Rates: Effect of Capital flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 46

Total panel (unbalanced) observations: 908

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-2.835421	2.806476	-1.010314	0.3126
TOT	1.19E-11	4.51E-12	2.646496	0.0083
GIR	2.88E-09	2.09E-09	1.376303	0.1691
M2	-2.430151	1.309391	-1.855940	0.0638
TREND	8.334539	1.601131	5.205406	0.0000
TRADE	2.113831	0.708115	2.985151	0.0029
CFLOWS	-5.27E-09	2.39E-09	-2.207737	0.0275

R-squared	0.882416	Mean dependent var	314.9345
Adjusted R-squared	0.875265	S.D. dependent var	697.5150
S.E. of regression	246.3473	Sum squared resid	51887362
F-statistic	1069.402	Durbin-Watson stat	0.424562
Prob(F-statistic)	0.000000		

Note: All Countries (both developed and developing) included in regression

Table 2.11. Determinants of Real Exchange Rates in Developing Countries

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 46

Total panel (unbalanced) observations: 893

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-10.51632	3.057381	-3.439650	0.0006
GIR	-2.39E-09	2.21E-09	-1.078319	0.2812
TRADE	2.481211	0.841064	2.950085	0.0033
TIT	4.894717	1.485391	3.295238	0.0010
TOT	3.75E-11	3.81E-12	9.854134	0.0000
M2	-2.108375	1.356914	-1.553802	0.1206
TREND	11.46871	1.700842	6.742959	0.0000

R-squared	0.878219	Mean dependent var	331.2766
Adjusted R-squared	0.870680	S.D. dependent var	706.5190
S.E. of regression	254.0718	Sum squared resid	54224081
F-statistic	1009.604	Durbin-Watson stat	0.385383
Prob(F-statistic)	0.000000		

Table 2.12 Determinants of Real Exchange Rates in Developing Countries: Effects of Capital Flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1971 1999

Included observations: 29 after adjusting endpoints

Number of cross-sections used: 42

Total panel (unbalanced) observations: 678

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-1.67E-09	1.93E-09	-0.867792	0.3858
GIR	-3.66E-10	3.00E-09	-0.122176	0.9028
TRADE	3.159003	1.054846	2.994754	0.0029
TIT	8.666732	1.831615	4.731743	0.0000
TOT	2.53E-11	6.24E-12	4.047744	0.0001
M2	-3.190167	1.675249	-1.904294	0.0573
TREND	15.71654	2.323961	6.762823	0.0000
CFLOWS	-4.46E-09	2.75E-09	-1.620844	0.1056

R-squared	0.882151	Mean dependent var	347.4245
Adjusted R-squared	0.872956	S.D. dependent var	727.1507
S.E. of regression	259.1805	Sum squared resid	42185610
F-statistic	671.5488	Durbin-Watson stat	0.444459
Prob (F-statistic)	0.000000		

Table 2.13. Determinants of Real Exchange Rates in Developing Countries: Effects of FDI

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 46

Total panel (unbalanced) observations: 887

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-10.18848	3.065729	-3.323347	0.0009
GIR	-1.14E-09	2.29E-09	-0.498191	0.6185
TRADE	2.647345	0.849430	3.116613	0.0019
TIT	5.099318	1.491268	3.419450	0.0007
TOT	3.70E-11	3.83E-12	9.658496	0.0000
M2	-2.633477	1.379664	-1.908782	0.0566
TREND	11.95627	1.719445	6.953565	0.0000
FDI	-2.35E-08	1.36E-08	-1.723731	0.0851

R-squared	0.878349	Mean dependent var	327.2335
Adjusted R-squared	0.870609	S.D. dependent var	707.1810
S.E. of regression	254.3800	Sum squared resid	53902761
F-statistic	859.2070	Durbin-Watson stat	0.387041
Prob (F-statistic)	0.000000		

Table 2.14 Determinants of Real Exchange Rates in Developing Countries: Effects of Portfolio Investment (Bonds)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 45

Total panel (unbalanced) observations: 892

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-10.01766	3.085538	-3.246649	0.0012
GIR	-1.05E-09	2.49E-09	-0.421145	0.6738
TRADE	2.447311	0.841351	2.908788	0.0037
TIT	4.905380	1.485063	3.303145	0.0010
TOT	3.70E-11	3.84E-12	9.625733	0.0000
M2	-2.229699	1.360455	-1.638936	0.1016
TREND	11.56339	1.702315	6.792744	0.0000
BONDS	-1.12E-08	9.50E-09	-1.183834	0.2368

R-squared	0.878392	Mean dependent var	331.6464
Adjusted R-squared	0.870855	S.D. dependent var	706.8289
S.E. of regression	254.0111	Sum squared resid	54133656
F-statistic	865.7478	Durbin-Watson stat	0.383104
Prob (F-statistic)	0.000000		

Table 2.15. Determinants of Real Exchange Rates in Developing Countries: Effects of Equity

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample(adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 45

Total panel (unbalanced) observations: 892

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-10.40628	3.062530	-3.397935	0.0007
GIR	-1.43E-09	2.61E-09	-0.548739	0.5833
TRADE	2.443274	0.843137	2.897837	0.0039
TIT	4.931871	1.486841	3.317014	0.0009
TOT	3.74E-11	3.82E-12	9.783878	0.0000
M2	-2.168478	1.360154	-1.594288	0.1112
TREND	11.51332	1.702614	6.762144	0.0000
EQUITY	-9.08E-09	1.32E-08	-0.687307	0.4921

R-squared	0.878258	Mean dependent var	331.6464
Adjusted R-squared	0.870712	S.D. dependent var	706.8289
S.E. of regression	254.1516	Sum squared resid	54193567
F-statistic	864.6582	Durbin-Watson stat	0.385831
Prob (F-statistic)	0.000000		

Table 2.16. Determinants of Real Exchange Rates in Developing Countries: Effects of other capital flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1971 1999

Included observations: 29 after adjusting endpoints

Number of cross-sections used: 44

Total panel (unbalanced) observations: 703

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-8.562996	3.640309	-2.352272	0.0190
GIR	-2.40E-09	2.69E-09	-0.891655	0.3729
TRADE	2.849259	0.986030	2.889628	0.0040
TIT	8.165453	1.724611	4.734664	0.0000
TOT	2.63E-11	6.11E-12	4.307372	0.0000
M2	-2.221134	1.640043	-1.354314	0.1761
TREND	14.37333	2.210158	6.503307	0.0000
OTHER	-2.35E-09	3.70E-09	-0.636548	0.5246

R-squared	0.882999	Mean dependent var	335.1797
Adjusted R-squared	0.873833	S.D. dependent var	716.9310
S.E. of regression	254.6535	Sum squared resid	42216308
F-statistic	701.8672	Durbin-Watson stat	0.453943
Prob (F-statistic)	0.000000		

Table 2.17. Determinants of Exchange Rates in Africa

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 17

Total panel (unbalanced) observations: 285

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-12.37853	4.373994	-2.830028	0.0050
TREND	14.05936	2.648921	5.307581	0.0000
GIR	-6.06E-09	8.00E-09	-0.757185	0.4496
M2	-4.852781	2.175755	-2.230389	0.0266
TOT	-1.29E-09	4.44E-10	-2.903378	0.0040
TIT	14.82791	2.313997	6.407920	0.0000
TRADE	3.872760	1.389089	2.787985	0.0057

R-squared	0.897149	Mean dependent var	272.2591
Adjusted R-squared	0.888086	S.D. dependent var	713.8412
S.E. of regression	238.8056	Sum squared resid	14884332
Log likelihood	-1952.422	F-statistic	379.4426
Durbin-Watson stat	0.396819	Prob (F-statistic)	0.000000

Table 2.18. Determinants of Exchange Rates in Africa: Effects of Total Capital Flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1974 1999

Included observations: 26 after adjusting endpoints

Number of cross-sections used: 14

Total panel (unbalanced) observations: 194

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-8.865906	5.514137	-1.607850	0.1097
TREND	23.13370	4.356272	5.310436	0.0000
GIR	-1.40E-08	1.13E-08	-1.239267	0.2169
M2	-7.540105	3.460225	-2.179079	0.0307
TOT	-7.80E-10	5.50E-10	-1.419539	0.1576
TIT	18.68864	2.753420	6.787425	0.0000
TRADE	2.581156	1.921703	1.343161	0.1810
CFLOWS	-3.90E-09	7.33E-08	-0.053146	0.9577

R-squared	0.907206	Mean dependent var	287.0465
Adjusted R-squared	0.895876	S.D. dependent var	781.2609
S.E. of regression	252.0987	Sum squared resid	10931248
Log likelihood	-1336.384	F-statistic	240.2238
Durbin-Watson stat	0.457229	Prob (F-statistic)	0.000000

Table 2.19. Determinants of Exchange Rates in Africa: Effects of FDI

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 16

Total panel (unbalanced) observations: 257

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TREND	17.10393	3.293155	5.193781	0.0000
GGCE?	-10.05265	4.794436	-2.096732	0.0371
GIR	-6.69E-09	8.74E-09	-0.765543	0.4447
M2	-6.627820	2.603307	-2.545923	0.0115
TIT	14.51893	2.446332	5.934981	0.0000
TOT	-1.25E-09	4.68E-10	-2.676562	0.0080
TRADE	3.440798	1.533352	2.243971	0.0258
FDI	5.22E-08	1.36E-07	0.384438	0.7010

R-squared	0.897196	Mean dependent var	301.5155
Adjusted R-squared	0.887047	S.D. dependent var	746.0275
S.E. of regression	250.7280	Sum squared resid	14647436
Log likelihood	-1771.832	F-statistic	290.4912
Durbin-Watson stat	0.391326	Prob (F-statistic)	0.000000

Table 2.20. Determinants of Exchange Rates in Africa: Effects of Portfolio Investments (Bonds)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 16

Total panel (unbalanced) observations: 257

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TREND	17.15263	3.286253	5.219509	0.0000
GGCE	-10.42024	4.759885	-2.189180	0.0296
GIR	-6.88E-09	8.73E-09	-0.788774	0.4310
M2	-6.316515	2.426843	-2.602771	0.0098
TIT	14.83854	2.468835	6.010341	0.0000
TOT	-1.25E-09	4.67E-10	-2.670099	0.0081
TRADE	3.348555	1.517662	2.206390	0.0283
BONDS	2.83E-07	3.14E-07	0.899843	0.3691

R-squared	0.897487	Mean dependent var	301.5155
Adjusted R-squared	0.887367	S.D. dependent var	746.0275
S.E. of regression	250.3728	Sum squared resid	14605969
Log likelihood	-1771.468	F-statistic	291.4105
Durbin-Watson stat	0.400387	Prob (F-statistic)	0.000000

Table 2.21. Determinants of Exchange Rates in Africa: Effects of Portfolio Investments (Equity)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 16

Total panel (unbalanced) observations: 257

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TREND	17.14800	3.291246	5.210184	0.0000
GGCE	-10.25292	4.763938	-2.152195	0.0324
GIR	-4.72E-09	1.07E-08	-0.440940	0.6597
M2	-6.330878	2.437763	-2.597002	0.0100
TIT	14.55672	2.449697	5.942256	0.0000
TOT	-1.25E-09	4.68E-10	-2.681801	0.0078
TRADE	3.347730	1.520580	2.201614	0.0287
EQUITY	-4.82E-08	1.51E-07	-0.319725	0.7495

R-squared	0.897175	Mean dependent var	301.5155
Adjusted R-squared	0.887025	S.D. dependent var	746.0275
S.E. of regression	250.7525	Sum squared resid	14650300
Log likelihood	-1771.857	F-statistic	290.4279
Durbin-Watson stat	0.388988	Prob(F-statistic)	0.000000

Table 2.22. Determinants of Exchange Rates in Africa: Effects of Other Capital Flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1974 1999

Included observations: 26 after adjusting endpoints

Number of cross-sections used: 14

Total panel (unbalanced) observations: 194

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TREND	23.15650	4.358333	5.313155	0.0000
GGCE	-8.880168	5.515391	-1.610070	0.1092
GIR	-1.38E-08	1.10E-08	-1.257497	0.2103
M2	-7.565402	3.451114	-2.192162	0.0297
TIT	18.67826	2.754833	6.780180	0.0000
TOT	-7.82E-10	5.50E-10	-1.422221	0.1568
TRADE	2.578845	1.915321	1.346430	0.1799
OTHER	-1.90E-08	1.53E-07	-0.123722	0.9017

R-squared	0.907213	Mean dependent var	287.0465
Adjusted R-squared	0.895884	S.D. dependent var	781.2609
S.E. of regression	252.0896	Sum squared resid	10930455
Log likelihood	-1336.377	F-statistic	240.2430
Durbin-Watson stat	0.457873	Prob (F-statistic)	0.000000

Table 2.23. Determinants of Real Exchange Rates in Asia and the Pacific: Effects of Total Capital Flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1974 1999

Included observations: 26 after adjusting endpoints

Number of cross-sections used: 11

Total panel (unbalanced) observations: 207

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-76.60183	15.94743	-4.803396	0.0000
TREND	15.71179	6.345673	2.475985	0.0142
TIT	11.81310	4.121532	2.866192	0.0046
TOT	2.62E-11	7.06E-12	3.710779	0.0003
TRADE	-3.775894	1.978218	-1.908735	0.0578
M2	6.005787	4.035660	1.488180	0.1384
GIR	1.00E-09	5.47E-09	0.183546	0.8546
CFLOWS	-1.60E-08	7.42E-09	-2.154310	0.0325

R-squared	0.874679	Mean dependent var	320.8577
Adjusted R-squared	0.862680	S.D. dependent var	754.0726
S.E. of regression	279.4349	Sum squared resid	14679764
Log likelihood	-1449.739	F-statistic	187.4488
Durbin-Watson stat	0.976662	Prob (F-statistic)	0.000000

Table 2.24 Determinants of Real Exchange Rates in Asia and the Pacific: Effects of FDI

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 12

Total panel (unbalanced) observations: 262

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-64.52408	12.39682	-5.204888	0.0000
TREND	12.20141	4.418171	2.761642	0.0062
TIT	10.44100	3.596426	2.903159	0.0040
TOT	3.55E-11	4.17E-12	8.514053	0.0000
TRADE	-4.402596	1.788987	-2.460943	0.0146
M2	11.74859	3.344856	3.512435	0.0005
GIR	-5.12E-09	3.88E-09	-1.319317	0.1883
FDIG	-42.64008	20.75058	-2.054886	0.0410

R-squared	0.865792	Mean dependent var	304.3447
Adjusted R-squared	0.855255	S.D. dependent var	710.2014
S.E. of regression	270.1991	Sum squared resid	17667834
Log likelihood	-1828.339	F-statistic	223.0237
Durbin-Watson stat	0.867585	Prob (F-statistic)	0.000000

Table 2.25 Determinants of Real Exchange Rates in Asia and the Pacific: Effects of Portfolio Investment (Bonds)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 11

Total panel (unbalanced) observations: 267

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-63.60282	12.26812	-5.184399	0.0000
TREND	12.49116	4.182237	2.986718	0.0031
TIT	10.45641	3.488144	2.997699	0.0030
TOT	3.58E-11	4.16E-12	8.606607	0.0000
TRADE	-5.832704	1.658623	-3.516595	0.0005
M2	10.97210	3.204036	3.424462	0.0007
GIR	-2.40E-09	4.42E-09	-0.542242	0.5881
BONDS	-2.34E-08	1.56E-08	-1.494294	0.1364

R-squared	0.866384	Mean dependent var	319.5161
Adjusted R-squared	0.856686	S.D. dependent var	709.3375
S.E. of regression	268.5326	Sum squared resid	17883217
Log likelihood	-1862.325	F-statistic	229.7237
Durbin-Watson stat	0.866851	Prob (F-statistic)	0.000000

Table 2.26 Determinants of Real Exchange Rates in Asia and the Pacific: Effects of Portfolio Investment (Equity)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 11

Total panel (unbalanced) observations: 267

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-65.46637	12.27382	-5.333820	0.0000
TREND	12.39969	4.176914	2.968624	0.0033
TIT	10.68716	3.494039	3.058684	0.0025
TOT	3.64E-11	4.10E-12	8.869700	0.0000
TRADE	-5.832558	1.660086	-3.513406	0.0005
M2	11.60917	3.153356	3.681529	0.0003
GIR	-2.61E-09	4.38E-09	-0.595184	0.5523
EQUITY	-3.54E-08	2.45E-08	-1.447148	0.1491

R-squared	0.866310	Mean dependent var	319.5161
Adjusted R-squared	0.856607	S.D. dependent var	709.3375
S.E. of regression	268.6070	Sum squared resid	17893134
Log likelihood	-1862.399	F-statistic	229.5768
Durbin-Watson stat	0.887032	Prob (F-statistic)	0.000000

Table 2.27 Determinants of Real Exchange Rates in Asia and the Pacific: Effects of Portfolio Investment (Other)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1974 1999

Included observations: 26 after adjusting endpoints

Number of cross-sections used: 12

Total panel (unbalanced) observations: 208

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-76.13845	16.06723	-4.738741	0.0000
TREND	15.20322	6.350714	2.393938	0.0177
TIT	11.79489	4.134410	2.852858	0.0048
TOT	2.62E-11	7.18E-12	3.643984	0.0003
TRADE	-3.820304	2.006533	-1.903933	0.0584
M2	6.411071	4.031853	1.590105	0.1135
GIR	-8.78E-10	5.21E-09	-0.168681	0.8662
OTHER	-2.55E-08	1.37E-08	-1.854661	0.0652

R-squared	0.874001	Mean dependent var	319.3220
Adjusted R-squared	0.861267	S.D. dependent var	752.5750
S.E. of regression	280.3102	Sum squared resid	14771880
Log likelihood	-1456.892	F-statistic	186.2971
Durbin-Watson stat	1.005774	Prob (F-statistic)	0.000000

Table 2.28 Determinants of Real Exchange Rates in Latin America and the Caribbean: Effects of Total Capital Flows

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 18

Total panel (unbalanced) observations: 397

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	0.581631	3.678784	0.158104	0.8745
TOT	-6.94E-11	6.00E-11	-1.156694	0.2481
M2	-2.241566	1.735837	-1.291346	0.1974
GIR	-3.20E-09	2.39E-09	-1.335555	0.1825
TRADE	4.348713	0.904123	4.809870	0.0000
CFLOWS	-6.44E-10	2.07E-09	-0.311579	0.7555
TREND	7.106797	1.619208	4.389058	0.0000

R-squared	0.923107	Mean dependent var	331.1594
Adjusted R-squared	0.918146	S.D. dependent var	631.5993
S.E. of regression	180.7011	Sum squared resid	12146875
Log likelihood	-2613.555	F-statistic	744.3165
Durbin-Watson stat	0.333195	Prob (F-statistic)	0.000000

Table 2.29 Determinants of Real Exchange Rates in Latin America and the Caribbean: Effects of FDI

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 18

Total panel (unbalanced) observations: 368

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-11.40755	3.678718	-3.100959	0.0021
TOT	-8.59E-11	6.37E-11	-1.347771	0.1786
M2	-1.355059	1.796930	-0.754097	0.4513
GIR	-2.22E-09	2.89E-09	-0.768073	0.4430
TRADE	6.836269	1.260028	5.425488	0.0000
TREND	2.715126	2.082159	1.303996	0.1931
TIT	-10.38803	1.911185	-5.435385	0.0000
FDI	-2.62E-08	1.15E-08	-2.280339	0.0232

R-squared	0.923525	Mean dependent var	361.4899
Adjusted R-squared	0.917935	S.D. dependent var	677.0478
S.E. of regression	193.9537	Sum squared resid	12865368
Log likelihood	-2447.171	F-statistic	590.0100
Durbin-Watson stat	0.438077	Prob (F-statistic)	0.000000

Table 2.30 Determinants of Real Exchange Rates in Latin America and the Caribbean: Effects of Portfolio Investment (Bonds)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 18

Total panel (unbalanced) observations: 368

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-11.39014	3.759657	-3.029569	0.0026
TOT	-8.38E-11	6.42E-11	-1.305564	0.1926
M2	-0.996195	1.804008	-0.552212	0.5812
GIR	-4.28E-09	2.95E-09	-1.447544	0.1487
TRADE	6.086933	1.227189	4.960062	0.0000
TREND	2.949300	2.095228	1.407627	0.1601
TIT	-10.34532	1.925501	-5.372793	0.0000
BONDS	-2.92E-09	1.01E-08	-0.289238	0.7726

R-squared	0.922382	Mean dependent var	361.4899
Adjusted R-squared	0.916708	S.D. dependent var	677.0478
S.E. of regression	195.3987	Sum squared resid	13057785
Log likelihood	-2449.903	F-statistic	580.5957
Durbin-Watson stat	0.415226	Prob (F-statistic)	0.000000

Table 2.31. Determinants of Real Exchange Rates in Latin America and the Caribbean: Effects of Portfolio Investment (Equity)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1970 1999

Included observations: 30 after adjusting endpoints

Number of cross-sections used: 18

Total panel (unbalanced) observations: 368

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-11.62459	3.708680	-3.134429	0.0019
TOT	-8.32E-11	6.42E-11	-1.296446	0.1957
M2	-0.977495	1.805825	-0.541301	0.5887
GIR	-5.14E-09	3.17E-09	-1.622843	0.1055
TRADE	6.067049	1.222098	4.964455	0.0000
TREND	2.967167	2.094918	1.416364	0.1576
TIT	-10.37508	1.926664	-5.384996	0.0000
EQUITY	4.05E-09	1.27E-08	0.318138	0.7506

R-squared	0.922386	Mean dependent var	361.4899
Adjusted R-squared	0.916712	S.D. dependent var	677.0478
S.E. of regression	195.3937	Sum squared resid	13057115
Log likelihood	-2449.893	F-statistic	580.6280
Durbin-Watson stat	0.414305	Prob (F-statistic)	0.000000

Table 2.32. Determinants of Real Exchange Rates in Latin America and the Caribbean: Effects of Portfolio Investment (Other)

Dependent Variable: Real Exchange Rates

Method: Pooled Least Squares

Sample (adjusted): 1971 1999

Included observations: 29 after adjusting endpoints

Number of cross-sections used: 18

Total panel (unbalanced) observations: 301

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGCE	-8.484662	4.448642	-1.907248	0.0575
TOT	-7.27E-11	6.49E-11	-1.120698	0.2634
M2	-0.395592	2.059825	-0.192051	0.8478
GIR	-6.52E-09	3.30E-09	-1.975203	0.0492
TRADE	6.502104	1.317904	4.933672	0.0000
TREND	5.421398	2.507695	2.161905	0.0315
TIT	-7.184525	2.260241	-3.178654	0.0016
OTHER	2.80E-09	3.10E-09	0.901235	0.3683

R-squared	0.917693	Mean dependent var	377.1605
Adjusted R-squared	0.910211	S.D. dependent var	644.8496
S.E. of regression	193.2281	Sum squared resid	10267699
Log likelihood	-1997.930	F-statistic	438.0233
Durbin-Watson stat	0.447585	Prob (F-statistic)	0.000000

2.7.3 Analysis of Regression Results

Tables 2.8-2.32 show the various regression results for the determinants of real exchange rates for selected countries in different geographical regions. Table 2.8 and 2.9 present the regression results without capital flows. The basic difference between the two tables is that in Table 2.8 trend is used as a proxy for technological progress while in Table 2.9, GDP growth (GDPG) is used as a proxy for technological progress. Interestingly, the coefficients of these two variables carry different signs of positive and negative for trend and GDP growth respectively. Thus in terms of theory, the use of GDP growth confirms the Balassa-Samuelson hypothesis that countries with high technological progress seem to have real currency appreciation. Table 4a shows that all the economic fundamentals used in the regression are statistically significant while in Table 2.9 taxes on international trade, M2 and gross international reserves are not statistically significant in explaining long-run real exchange rates.

Table 2.10 reports the regression results of the determinants of real exchange rates including capital flows. The regression results show that total capital flows are statistically significant (at 5% significance level) in explaining long-run real exchange rates for the selected countries used in this study. In fact the results show that total capital flows lead to real appreciation of the long-run equilibrium exchange rate. Almost all the other economic fundamentals are also statistically significant, with the exception of gross international reserves.

Tables 2.11-2.16 present the regression results for selected developing countries. The results show that for developing countries total capital flows as well as different types of capital flows with the exception of foreign direct investment (FDI) are not statistically significant in explaining real exchange rates in these countries. At a significance level of 10%, however, FDI appears to affect the long-run real exchange rates in developing countries. This seems to confirm Shu's (1999) finding that "in the long-run relationship between the real exchange rate and the economic fundamentals for the whole sample which includes the countries in Africa, Asia and Latin America, capital flows do not feature at all in the relationship." . In tandem with findings from the existing literature, the coefficients of all different types of capital flows are all found to be negative. This has confirmed the emerging consensus that capital flows tend to appreciate currency.[40]

Among other economic fundamentals, the coefficients of general government consumption expenditures consistently have a negative sign. This means that in most of these countries governments tend to spend on nontradables and this in turn seems to lead to currency appreciation.

Tables 2.17-2.22 show the regression results of the determinants of real exchange rates in selected Africa countries. The long-run relationship for the countries in Africa shows that capital flows are not a significant determinant in the

[40] See for example Calvo, Leiderman and Reinhart (1993) and Edwards (1998).

equilibrium real exchange rate of this group In fact the coefficients of FDI and such portfolio investments as bonds and other capital flows have positive signs, suggesting that these types of capital flows lead to real exchange rates depreciation in Africa.

In contrast to countries in Africa, capital flows seem to play a significant role in determining the equilibrium real exchange rate in Asia and Latin America. Tables 2.23-2.27 present the regression results of the determinants of long-run real exchange rates in Asia and Pacific region. Table 2.23 shows that total capital flows is statistically significant at 5% significance level and they lead to real appreciation of exchange rates in that region. This is not particularly surprising as the region receives a great deal of capital flows among all developing countries. For the different types of capital flows, FDI and other types of capital flows such as bank seem to play very important role in the determination of long-run real equilibrium exchange rates in countries in the Asian and Pacific region. This apparently contradicts Shu, 1999 which intimates that FDI "on its own never enters any of the long-run relationships, even for Asia and Latin American groups where capital flows are an important factor in determining the equilibrium real exchange rate." However, portfolio investments such as bonds and equity, while their coefficients have the expected negative sign, are not statistically significant in explaining long-run real exchange rates and this collaborates Shu, 1999's findings that "in Asia, portfolio investment is not significant in the long run relationship either." In the Asia and Pacific region, the other economic fundamentals, besides gross international reserves, are statistically

significant, particularly government consumption expenditures which lead to real currency appreciation.

Tables 2.28-2.32 show the regression results f the determinants of real exchange rates in the Latin American and Caribbean region. For Latin America and the Caribbean, total capital flows are not statistically significant in explaining long-run real exchange rates of countries in that region. However, unlike Africa, foreign direct investment is statistically significant and it leads to real currency appreciation in that region. This finding contradicts that of Shu, 1999. She found that among the categories of capital flows only portfolio investment enters significantly on its own in the long-run relationship in Latin America.

In a lump, capital flows are important determinants of long-run real exchange rates in most developing countries, except maybe for countries in Africa. Capital flows generally lead to currency appreciation. And among the different types of capital flows, foreign direct investment seems to have the most significant impact in all the three regions considered in this study. Foreign direct investment has both demand and supply side effects. On one hand FDI leads to technological progress through technology transfer. On the other hand, by leading to real appreciation of the domestic currency, FDI may in turn lead to loss of a country's external competitiveness. However real appreciation may strengthen a developing country to import the necessary capital for economic development. This may explain the fact

that FDI seems to be more beneficial to developing countries than the other forms of capital flows.

It must also be observed that capital flows to Latin America appear to lead to a much stronger appreciation than in Asia. The magnitude of the coefficient of FDI in Latin for countries in Latin America and the Caribbean region is about six times that of countries in the Asia and pacific region. This may, in part, account for the volatile nature of real exchange rate movements and capital markets as well as unstable macroeconomic environment in general in Latin America.

As the regression results show, for all regional groups as well as the whole sample, technological progress is found to be an important determinant for the equilibrium real exchange rate. When trend is used as a proxy for technological progress estimated coefficients are positive, implying that faster technological improvement actually leads to real depreciation of the equilibrium real exchange rate. This does not support the Balassa-Samuelson hypothesis, and is at odds with Feyzioglu, 1997 who found that productivity improvement leads to real appreciation of the equilibrium real exchange rate in Finland. However when GDP growth is used as a proxy, the coefficients are negative, affirming the Balassa-Samuelson effect, and lending support to Edwards, 1989 and 1994.

The estimates for the terms of trade are fairly consistent across different groups and for different specifications. Its coefficients tend to have a negative sign and largely statistically significant. This finding is consistent with most studies in the

existing literature, such as Shu, 1999 Edwards (1989, 1994), Feyzioglu, 1997, and Elbadawi 1994. The implication of this is that an improvement in the terms of trade tended to appreciate currencies. It must however be noted that theoretically the sign of the terms of trade on the equilibrium real exchange rate is ambiguous. This finding suggests that the income effect might dominate the substitution effect.

Two proxies have been used in this study to measure "openness". These are trade as a share of GDP and taxes on international trade. The regression results show that "openness" is an important determinant of real exchange rates. The coefficients of both measures consistently have positive sign, implying that openness leads to currency depreciated. The positive coefficient of TRADE to measure openness supports theory because an open economy needs a depreciated currency in order to be competitive externally (all other things being equal). This result is similar to Elbadawi, 1994 and Shu, 1999. However, the positive sign of the coefficient of taxes on international trade is a bit surprising but supports Shu, 1999 but contradicts the results from Edwards' (1989, 1994). This implies that raising barriers on trade actually leads to real appreciation. This suggests that trade liberalization in an environment of prevalent distortions may have highly conflicting effects, and not lead to the desired depreciation.

With regard to the effect of fiscal policy on the equilibrium real exchange rate, the coefficients have the expected negative sign, suggesting that a rise in the level of total government expenditure leads to appreciation. In this study general government

consumption expenditures have been used as a proxy for fiscal policy and it is statistically significant for all the regional groups as well as the whole sample. This result implies that in these countries there appears to be "home bias" in government consumption. As Latin America's level of government consumption is the highest among the groups, this might have contributed to real appreciation, leading to difficulties in macroeconomic management.

2.8. CONCLUDING REMARKS

In this chapter the determinants of real exchange rates, with particular reference to the role of capital flows has been examined, using panel data for selected countries in three regions, namely, Africa, Asia and Pacific and Latin America and the Caribbean regions respectively. The econometric results show that there are long-run relationships between real exchange rates and their fundamentals for the selected countries in all the three regions. For all countries used in sample as a group, total capital flows seem to have a statistically significant impact in the determination of long-run real exchange rates. But total capital flows are not statistically significant in explaining real exchange rates in developing countries as a whole.

However and not surprisingly, capital flows are not particularly significant in determining the long-run equilibrium exchange rates in countries where capital flows

have not been substantial as in those countries in Africa used in the study. Contrarily, in Asia and Latin America where capital flows have been relatively substantial, they lead to real appreciation of the long-run equilibrium exchange rates. Capital flows appear to lead to higher appreciation in Latin America and Caribbean than in Asia Pacific. However, among different types of capital flows, foreign direct investment is statistically significant in explaining the appreciation of the exchange rates in those regions. For the different types of capital flows, FDI and other types of capital flows such as bank seem to play very important role in the determination of long-run real equilibrium exchange rates in countries in the Asian and Pacific region.

This study thus reinforces the findings from earlier studies that capital flows are mixed blessings. On the one hand, they bring to developing countries much needed financial resources, technology transfer and managerial know-how. But on the other hand, they can be highly volatile, especially in the case of non-FDI capital flows and this can pose significant difficulties to exchange rate and macroeconomic management. However, the findings apparently suggest that different types of capital flows should not be treated as equivalent. The regression results suggest that capital flows, especially FDI in particular appears to lead to real appreciation, (for most countries in the regions considered). This study does not test for volatility of capital flows. However, as other studies such as (Shu 1999) have shown, it tends to be less volatile than the other types of capital flows, and this provides a strong argument for a larger share in the capital flows to developing countries.

Some other important factors in explaining real exchange rate movements include openness, technological progress, restrictions on trade, government consumption expenditures, and terms of trade.

CHAPTER THREE

THE IMPACT OF PER CAPITA GROSS DOMESTIC PRODUCT OF SOUTH AFRICA AND NIGERIA ON PER CAPITA GROSS DOMESTC PRODUCT IN SUB-SAHARAN AFRICA.

3.1 INTRODUCTION

Economic growth in Sub-Saharan Africa has been a puzzle to students and researchers of that sub-continent. This puzzle has led to a number of studies about the determinants of economic growth in Sub-Saharan Africa[41]. Several factors have been identified as being responsible for the apparent lack of growth in the sub-Saharan African region. These factors include low rate of investment, the high rate of illiteracy of the workforce, and poor macroeconomic policies that have resulted in high inflation, severe budget deficits and strangulating debt services. Other problems identified for the economic growth problems in sub-Saharan Africa include the small and fragmented nature of markets, the lack of openness of some of the economies, capital flight (both human and financial) the tropical nature of the climate of the continent, political instability, ethnic conflicts, and ill-developed social, political and financial institutions. However, despite all these problems and difficulties, some sub-

Saharan African countries have been making significant progress in economic growth in the last few years (see Table 3.1 below).

While there have been numerous studies on Sub-Saharan African economic growth, very little has been written about the impact of regional economic integration as well as the interaction between the economies of the region on the growth of the countries in that region. Since political independence in the 1950s and 1960s African countries have embraced economic cooperation and regional integration as a part of the strategy of the structural transformation of Africa. The desire to over the economic disadvantages market fragmentation has led to the establishment of a number of regional economic groupings, including the Southern African Development Community and the Economic Community of West African States. However, our understanding of how the economic interaction among member countries in these regional economic groupings impacts the groupings is far from being complete. This chapter attempts to enhance our understanding in this area by providing quantitative assessment of

a. the impact, if any, of the per capita gross domestic product South Africa and Nigeria on the rest of the sub-Saharan Africa;

b. the impact, if any, of the gross domestic product of South Africa and Nigeria on the gross domestic product of other members of the

[47] See Appendix for the countries that belong to the Sub-Saharan African region as well as the members of the various sub-regional economic groupings.

South African Development Community (SADC) and the Economic Community of West African States (ECOWAS) respectively;

c. the impact, if any, of the gross domestic product of selected member countries of SADC and ECOWAS on other members of these two regional economic groupings respectively.

South Africa's economy, given its position as the biggest (in terms of gross domestic product; see Table 3.1 below) in sub-Saharan Africa, could potentially have significant impact on the economies of the countries in that region, particularly the SADC[42] countries. Unfortunately, however, the quantitative assessment of the impact of South Africa's economy on the rest of the SADC has been neglected in the economic growth and regional economics literature.

Similarly, the potential significance of Nigeria's economy in West Africa cannot be underestimated. By size alone, Nigeria has the largest GDP and population among the ECOWAS[43] member countries. Besides, the role of Nigeria as a major oil-producing country in the world in general should be noted. In fact, Nigeria is the main supplier of petroleum and petroleum-related products to most countries in West Africa. In this connection, it is important both intellectually and for regional

[42] SADC refers to the Southern African Development Community and comprises 15 countries namely Angola, Botswana, Democratic Republic of Congo (D.R.C), Lesotho, Malawi Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[43] ECOWAS refers to the Economic Community of West African States. It has a membership of 15 countries namely Benin, Burkina Faso, Cape Verde, Cote D'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo.

economic integration and policy reasons that the impact of economic growth in Nigeria on the economic growth of other West African countries be assessed quantitatively. However, this has been missing in the literature and in this paper.

It has been recognized that South Africa, especially after its emergence from apartheid, could become a "growth pole" for the southern African region, by contributing positively to the development of its neighbors, especially the SADC members through trade and foreign direct investment (FDI). With gross domestic product (GDP) of over US$ 164 billions in 1999 (see Table 3.4 below), South Africa's economy is about four times larger than the combined GDP of the other 13 SADC member countries. Since 1995, most SADC countries experienced recovery in their respective economic growth rates. GDP growth rates have been particularly impressive in countries such as Mozambique (6 percent), Tanzania (4.8 percent), Angola (3.8 percent), Malawi (3.4 percent) and Swaziland (3.1 percent). The average economic growth rate for the region was estimated at 5 percent during 1999/2000.[44] One area of significant economic progress in the last decade has been intra-regional-trade. Despite incomplete data, there are indications of steady growth in intra-SADC trade. For example, as indicated by the Tables 3.2, 3.3, 3.5 and 3.6, comparable figures between 1996 and 1997 for South Africa with Botswana, Malawi, Zambia and Zimbabwe, show a significant increase in bilateral trade.

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[44] See "The CCBG Recent Economic Development and Statistics for SADC Countries, September 2000.

Given this backdrop, the question of intellectual interest is what is the impact of South African economy on the economic growth of the other countries in the SADC region? Given its size and geo-political position in the sub-region, there are possible channels through which the South Africa economy can impact economic activity in the SADC region. One obvious channel of transmission is trade linkages with the rest of the SADC countries. For example, a rise in economic growth in South Africa can contribute to increased import demand by South Africa from the other countries and therefore increase the contribution of net exports to growth in those countries. Related to this is the fact that trade linkages can also lead to technology transfers and spillover effects. Tables 3.2 and 3.3 show that intra-African trade has shown steady growth in the last few years, and most of it occurs through regional economic groupings Another channel through which South Africa can impact on the economic activity of the SADC region is financial linkages in the form of capital flows, especially South African foreign direct investment in the region.

The rest of the chapter is organized as follows: in section 3.2 the potential impact of South Africa and Nigeria's economies is discussed. This section, in particular, discusses the role of South Africa as a trading partner and also as an investor in the other Southern Africa Development Community countries, and that of Nigeria in other Economic Community of West African States. In section 3.3, the methodology, as well as econometric issues employed, in this study are discussed.

The regression results and possible extensions of the study are discussed in section 3.4 while section 3.5 presents concluding remarks.

Table 3.1. Output and Per Capita Income in Africa (at Current Prices)

Country	GDP at market prices / PIB au prix du marché (Millions of $) (Millions de $)		Ann. Percentage change % Variation annuelle Annee/Mesy.		Per Capita GDP / PIB par habitant Current $ $ Courants		Per Capita GNP / PNB par habitant Current $, Atlas method $ Courants, méthode atlas	
	1988	1989	1981-1988	1988	1988	1989	1988	1989
Algeria	61 902	47 857	-2.6	1.0	2 482	1 555	2 400	1 550
Angola	10 260	8 545	-0.8	12.5	1 112	685	840	570
Benin	1 845	2 414	4.7	4.6	396	407	360	380
Botswana	3 489	6 024	4.3	25.0	2 734	3 771	2 730	3 240
Burkina Faso	2 765	2 580	0.3	0.0	305	322	290	240
Burundi	1 132	714	-2.8	-18.6	208	109	220	120
Cameroon	11 152	9 187	-1.9	5.6	972	625	970	600
Cape Verde	339	581	6.3	7.6	993	1 389	980	1 350
Central Afr. Rep.	1 488	1 053	-2.7	0.4	506	297	470	290
Chad	1 739	1 530	0.7	-9.0	303	205	280	210
Comoros	250	193	-2.0	-2.3	475	285	540	350
Congo	2 799	2 217	-2.4	13.7	1 261	774	980	550
Congo Dem. Rep.	9 348	5 334	-3.0	-23.4	250	106	220	...
Côte d'Ivoire	10 796	11 206	1.6	-0.3	928	771	800	710
Djibouti	425	537	2.6	3.5	822	854	...	...
Egypt	43 130	88 781	8.9	7.3	766	1 321	810	1 390
Equatorial Guinea	132	696	21.3	52.6	376	1 575	350	1 170
Eritrea	...	645	8.1	-5.1	...	174	...	200
Ethiopia	6 842	6 439	0.5	-1.9	142	105	160	100
Gabon	5 952	4 594	-2.2	-0.5	6 369	3 839	4 750	3 300
Gambia	317	393	3.5	-5.6	344	310	320	330
Ghana	5 886	7 774	3.4	4.0	389	395	390	390
Guinea	2 818	3 733	3.8	-1.3	490	507	460	510
Guinea Bissau	244	218	-1.5	6.2	251	184	220	160
Kenya	8 533	10 638	6.4	-7.2	362	360	370	360
Lesotho	622	923	5.0	3.6	361	438	590	550
Liberia	384	...	...	...	149	...	...	...
Libya	28 587	29 712	1.5	-0.4	6 474	5 431	...	...
Madagascar	3 081	3 721	3.3	-0.5	265	240	240	250
Malawi	1 803	1 810	5.0	4.2	193	170	190	180
Mali	2 421	2 608	3.1	-1.0	274	238	270	240
Mauritania	1 020	958	0.3	-4.4	503	369	540	390
Mauritius	2 642	4 228	5.8	3.7	2 500	3 678	2 430	3 550
Morocco	25 821	34 998	4.4	-1.9	1 079	1 256	1 030	1 190
Mozambique	2 512	3 981	6.5	2.1	177	206	170	220
Namibia	2 340	3 458	5.1	1.2	1 734	2 040	1 800	1 890
Niger	2 481	2 018	-1.0	-2.8	321	194	310	190
Nigeria	28 472	35 045	3.7	6.2	327	322	270	260
Rwanda	2 584	1 956	4.5	-3.3	370	270	370	250
Sao T. & Principe	50	47	-2.0	15.0	421	326	410	270
Senegal	5 698	4 801	-1.2	2.9	778	620	720	510
Seychelles	369	545	4.9	1.9	5 303	7 116	5 070	6 540
Sierra Leone	897	669	-2.6	-0.4	225	142	260	130
Somalia	917	...	...	...	118	...	120	...
South Africa	112 014	130 220	2.4	-2.1	3 293	3 264	2 890	3 170
Sudan	13 167	9 718	-0.3	-3.0	547	336	610	330
Swaziland	860	1 223	4.8	0.2	1 142	1 248	1 200	1 360
Tanzania	4 259	8 636	9.4	3.0	167	263	190	260
Togo	1 628	1 405	-0.2	-0.7	464	311	430	310
Tunisia	12 291	20 888	6.5	5.2	1 507	2 208	1 430	2 090
Uganda	4 304	6 411	7.6	-5.4	262	303	340	320
Zambia	3 288	3 150	0.3	-2.8	454	351	490	330
Zimbabwe	8 784	5 608	-2.3	-17.2	891	486	920	530
Africa	**466 877**	**545 088**	**2.0**	**0.9**	**760**	**712**	**680**	**677**

Source: African Development Bank (http://www.afdb.org)

Table 3.2 Intra-African Trade (Selected Years)

Country	Exports / Exportations				Imports / Importations			
	Millions $		Percentage / pourcentage		Millions $		Percentage / pourcentage	
	Annz./Moy. 1990-98	1998	Annz./Moy. 1990-98	1998	Annz./Moy. 1990-98	1998	Annz./Moy. 1990-98	1998
Algeria	239.66	192.09	2.15	1.58	242.61	189.76	2.66	1.98
Angola	26.12	15.22	0.75	0.39	179.97	242.97	9.29	13.48
Benin	39.14	16.98	25.64	8.20	64.49	216.66	14.22	25.70
Botswana	...	...	...	...	...	...	...	...
Burkina Faso	32.99	25.21	22.52	16.58	145.18	240.21	28.30	39.07
Burundi	9.60	1.16	12.11	2.11	30.04	28.07	15.24	23.86
Cameroun	152.98	130.47	8.91	8.15	170.36	270.96	14.01	20.57
Cape Verde	1.72	0.83	14.84	4.23	11.36	10.60	5.30	3.45
Cent. Afr. Rep.	24.83	4.57	16.16	2.15	27.58	27.38	17.71	17.31
Chad	9.84	6.46	10.17	6.86	27.74	50.35	18.59	34.57
Comoros	0.26	0.45	1.51	3.90	18.55	11.64	17.46	21.58
Congo	84.01	17.24	6.28	1.52	288.28	364.41	27.62	52.56
Congo, Dem. Rep.	28.61	27.96	2.21	1.60	52.55	80.40	6.92	11.23
Cote d'Ivoire	920.14	1 229.59	26.42	27.53	534.27	450.23	21.51	13.61
Djibouti	63.46	75.42	61.40	53.66	38.65	62.61	9.93	10.41
Egypt	169.49	151.36	5.10	4.28	203.32	276.53	1.88	1.73
Equatorial Guinea	16.16	8.86	11.82	1.48	26.81	15.76	20.78	3.89
Eritrea	...	...	...	...	...	...	...	...
Ethiopia	36.91	66.58	9.99	14.77	56.73	53.78	5.68	3.28
Gabon	72.34	53.05	2.81	1.69	119.07	148.29	12.28	10.85
Gambia	7.33	1.48	8.28	18.06	29.63	16.57	10.95	8.71
Ghana	206.42	378.50	14.44	19.51	522.49	938.26	22.60	28.90
Guinea	40.20	56.80	6.20	7.70	110.36	90.61	15.52	12.34
Guinea Bissau	2.64	3.03	4.74	3.77	10.58	13.60	8.96	16.39
Kenya	554.35	782.98	34.62	36.11	203.02	344.08	7.81	10.83
Lesotho	...	...	...	...	...	...	...	...
Liberia	6.46	7.94	0.74	1.49	48.12	188.59	0.95	4.37
Libya	456.72	413.30	4.86	5.16	425.66	575.97	8.21	13.00
Madagascar	20.35	28.97	6.95	4.18	42.73	52.22	8.40	6.91
Malawi	90.74	107.41	19.49	23.17	313.13	380.07	53.48	66.08
Mali	25.98	26.31	10.59	11.24	228.21	317.60	25.57	25.31
Mauritania	43.70	50.57	8.90	9.93	52.57	35.72	9.35	6.39
Mauritius	57.94	173.58	4.02	10.44	284.64	577.64	14.93	22.17
Morocco	328.33	238.58	7.11	2.97	487.01	325.37	5.88	2.79
Mozambique	47.81	122.50	23.52	45.20	337.54	358.60	36.59	29.89
Namibia	...	...	...	...	...	...	...	...
Niger	32.53	56.73	16.00	32.84	63.37	104.98	16.76	33.31
Nigeria	1 012.62	1 247.03	8.43	10.64	231.28	329.16	3.55	4.46
Rwanda	2.63	7.34	2.36	9.20	82.21	108.69	28.30	36.25
Sao T. & Principe	0.42	0.24	3.50	2.02	1.95	3.22	4.53	6.27
Senegal	184.25	220.78	25.73	27.04	184.35	226.62	15.00	14.10
Seychelles	1.21	1.82	2.47	1.68	43.15	61.60	16.63	14.21
Sierra Leone	0.82	1.28	0.45	0.98	41.46	26.95	17.70	9.29
Somalia	1.96	1.69	1.37	1.41	84.85	120.29	31.00	40.97
South Africa	397.09	3 483.96	1.48	11.17	626.13	702.66	2.35	2.97
Sudan	24.69	121.86	5.51	17.67	255.65	90.49	19.28	6.22
Swaziland	...	...	...	...	...	...	...	...
Tanzania	75.54	72.89	13.74	12.44	216.21	302.86	14.86	19.15
Togo	64.45	127.87	20.57	30.53	232.11	406.25	28.25	36.56
Tunisia	373.54	512.18	7.83	6.88	381.64	532.41	5.37	5.09
Uganda	15.23	25.76	4.30	6.74	231.81	445.68	36.98	51.57
Zambia	116.42	151.69	13.15	19.50	375.04	517.99	46.59	64.85
Zimbabwe	570.35	562.76	33.44	29.81	846.42	890.05	36.60	46.04
Africa	**6 [illegible]**	**11011.33**	**8.69**	**9.53**	**8 674.13**	**11 825.74**	**9.83**	**9.31**

Source: African Development Bank (http://www.afdb.org)

Table 3.3 Intra-African Trade By Economic Grouping in 1999[45]

Exports to ===>	AMU	CAEMC	COMESA	ECCAS	ECOWAS	FRANC ZONE	SADC	WAEMU	AFRICA	WORLD
					Millions of US Dollars / Millions de dollars EU					
AMU	1 068.5	21.6	124.9	21.8	209.3	158.2	9.6	136.6	1 406.7	36 169.8
CAEMC	38.6	120.0	36.8	150.5	30.8	136.4	39.1	16.3	231.4	7 402.8
COMESA	120.4	27.1	1 418.6	233.8	40.8	44.1	1 173.5	11.9	2 364.5	18 697.5
ECCAS	38.8	127.1	54.6	167.0	39.4	147.2	49.0	20.0	272.6	12 554.4
ECOWAS	209.5	344.9	113.7	426.5	2 687.1	1 926.8	204.6	1 581.9	3 450.9	22 149.7
FRANC ZONE	172.3	234.5	60.1	267.2	1 423.4	1 082.9	106.7	848.3	1 938.3	13 962.5
SADC	88.0	57.7	3 202.1	498.6	392.2	154.7	3 578.4	81.8	4 709.1	41 943.3
WAEMU	133.7	114.5	22.8	116.6	1 392.6	946.5	67.6	832.0	1 706.5	6 548.0
AFRICA	1 510.4	539.1	4 397.2	1 222.0	3 308.1	2 159.9	4 125.2	1 801.7	11 011.3	115 494.3
					Percentage / Pourcentage					
AMU	3.0	0.1	0.3	0.1	0.6	0.4	0.0	0.4	3.9	100.0
CAEMC	0.5	1.6	0.5	2.0	0.4	1.8	0.5	0.2	3.1	100.0
COMESA	0.6	0.1	7.6	1.3	0.2	0.2	6.3	0.1	12.6	100.0
ECCAS	0.3	1.0	0.4	1.3	0.3	1.2	0.4	0.2	2.2	100.0
ECOWAS	0.9	1.6	0.5	1.9	12.1	8.7	0.9	7.1	15.6	100.0
FRANC ZONE	1.2	1.7	0.4	1.9	10.2	7.8	0.8	6.1	13.9	100.0
SADC	0.2	0.1	7.6	1.2	0.9	0.4	8.5	0.2	11.2	100.0
WAEMU	2.0	1.7	0.3	1.8	21.3	14.5	1.0	12.7	26.1	100.0
AFRICA	1.3	0.5	3.8	1.1	2.9	2.0	3.6	1.6	9.5	100.0

Imports from ===>	AMU	CAEMC	COMESA	ECCAS	ECOWAS	FRANC ZONE	SADC	WAEMU	AFRICA	WORLD
					Millions of US Dollars / Millions de dollars EU					
AMU	1 200.9	41.9	169.9	42.1	191.6	152.1	73.0	110.3	1 659.2	36 706.9
CAEMC	25.1	135.3	29.1	143.4	374.8	257.9	67.3	122.6	593.1	4 109.7
COMESA	123.6	40.1	1 519.9	59.7	123.5	70.3	3 500.2	30.1	4 811.4	35 349.9
ECCAS	25.4	169.1	258.0	187.4	458.0	294.1	555.0	125.0	1 340.5	7 074.6
ECOWAS	193.0	43.1	65.1	52.6	2 947.4	1 543.2	437.0	1 500.1	3 612.9	26 171.7
FRANC ZONE	143.4	161.7	53.4	173.9	2 137.3	1 198.8	154.6	1 037.0	2 580.9	13 300.3
SADC	11.2	44.3	1 196.8	55.3	214.8	119.9	3 791.3	75.6	4 398.9	35 290.3
WAEMU	118.4	26.4	18.9	30.5	1 762.6	940.8	80.4	914.4	1 976.2	9 136.7
AFRICA	1 522.6	266.8	2 489.3	312.5	3 736.9	2 073.2	4 919.5	1 806.3	11 825.7	126 990.5
					Percentage / Pourcentage					
AMU	3.3	0.1	0.5	0.1	0.5	0.4	0.2	0.3	4.5	100.0
CAEMC	0.6	3.3	0.7	3.5	9.1	6.3	1.6	3.0	14.4	100.0
COMESA	0.3	0.1	4.3	0.2	0.3	0.2	9.9	0.1	13.6	100.0
ECCAS	0.4	2.4	3.6	2.6	6.5	4.2	7.8	1.8	18.9	100.0
ECOWAS	0.7	0.2	0.2	0.2	11.3	5.9	1.7	5.7	13.8	100.0
FRANC ZONE	1.1	1.2	0.4	1.3	16.1	9.0	1.2	7.8	19.4	100.0
SADC	0.0	0.1	3.4	0.2	0.6	0.3	10.7	0.2	12.5	100.0
WAEMU	1.3	0.3	0.2	0.3	19.3	10.3	0.9	10.0	21.6	100.0
AFRICA	1.2	0.2	2.0	0.2	2.9	1.6	3.9	1.4	9.3	100.0

Source: African Development Bank (http://www.afdb.org)

[45] See Appendix C for definition and members of the various Regional Economic Groupings

3.2. THE IMPACT OF THE ECONOMIES OF SOUTH AFRICA AND NIGERIA ON SUB-SAHARAN AFRICA.

A. The Impact of South Africa's economy on other SADC countries

I. Its Role as a Trading Partner for other African Countries

South Africa's gross domestic product (GDP), $126,bn in 2000, is bigger than that of Finland, Portugal, Ireland or Greece, and the economy of Gauteng (a region in South Africa) alone is bigger than that of any country in Africa except Egypt. South Africa's GDP is 23% of Africa's total. It also has one of the largest GDP per capita in Africa (see figures 1 and 2). This means that a small increase in South Africa's imports from its neighboring countries can have a significant impact on their economies.

During the apartheid regime, South Africa's trade with its neighbors remained very modest because of the political and economic isolation. However, the post-apartheid regime has witnessed a significant increased in trade relations between South Africa and other countries in the region (see Tables 3.2, 3.3, 3.5 and 3.6), with its wine and food now a common sight on supermarket shelves in African countries. However, trade relationship with other African countries is largely one-sided given the overwhelming size of South Africa's economy. Exports to the rest of Africa are four-and-a-half times greater than imports. In contrast to exports to Europe, which

are mainly primary and intermediate goods, exports to other African countries are mostly manufactured products.

According to the South African Trade and Industry Department, part of the global trade strategy of South Africa is to "deliberately focus in growing our trade with the developing world, particularly a clear focus on promoting trade on the African continent and in the (14-nation) Southern African Development Community (SADC) region."[46]

In 1994 trade with Nigeria was worth just $12m. In 2001, it was up to $400m. But even with Nigeria, the relationship is lopsided; oil accounts for 99% of Nigeria's exports to South Africa. In 1999 Zimbabwe was South Africa's biggest trading partner in Africa, with two-way trade totaling $644m. But Mozambique is overtaking it. Trade with Kenya last year amounted to $124m in exports and 3,7m in imports. This included the export of vehicles, which amounted to about $8,4m. South Africa is also expanding into francophone Africa, exporting boilers and machinery worth $1,1m to Algeria last year, vehicles worth $2,6m to Senegal, and construction of a tourist complex in Gabon. Total trade with Africa excluding the Southern African Customs Union amounted to $856m last year in imports and $3,7bn in exports, according to the trade and industry department.

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[46] According to Edwin Smith, a spokesman for the department of trade and industry, Sapa-AFP and Business Day news, 2002/04/17, at http://www.isa.org.za/default_ns.htm.

Regional mechanisms include the establishment of the Southern African Customs Union with neighboring Botswana, Namibia, Lesotho and Swaziland. It is a free-trade union in which no customs or excise duties are paid.

However, Europe remains South Africa's biggest trading partner, with 40% of its total two-way trade, followed by Asia at 19%. Trade with the rest of Africa comes to 14%.

Table 3.4. Real GDP in the SADC Region

(1995 Billions US$)

	1994	1995	1996	1997	1998	1999
SADC12	35.99	37.18	39.5	40.8	42.21	37.84
South Africa	146.55	151.11	157.39	161.36	162.37	164.37
SADC	182.54	188.29	196.89	202.16	204.58	202.21

Source: Based on data from the World Bank's World Development Indicators CD Rom 2001 edition. SADC refers to real GDP of 13 members of the SADC excluding Namibia and SADC12 refers to the real GDP of SADC members excluding Namibia and South Africa.

Table 3.5. Intra-SADC Trade 1997 as Reported By Importing Country (US$ '000)

Importing Country	Angola	Botswana	Lesotho	Malawi	Mauritius	Mozambique	Namibia	South Africa	Swaziland*	Tanzania*	Zambia	Zimbabwe	Total SADC Imports	World Imports
Angola		.	.	.	.	.	1,930	.	.	.	40	.	1,970	1,983,000
Botswana	.		900	14,100	200	600	8,800	516,600	600	1,100	5,500	135,600	647,000	2,224,000
Lesotho*	.	400		10	45	2,260	.	.	.	200	20	200	875	967,000
Malawi	170	4,100	10		53	.	140	67,960	2	7,280	4,950	32,800	116,905	595,000
Mauritius	.	530	.	3,300		40	10	6,890	.	920	790	12,360	24,840	2,087,000
Mozambique	.	100	.	3,500	967		30	.	.	5,000	390	22,300	32,287	782,600
Namibia	.	6,600	.	230	400	.		.	.	100	1,240	8,300	16,870	34,748
South Africa*	.	2,059,900	.	160,460	274,780	.	1,030,300		.	94,100	350,710	1,099,000	5,069,250	27,406,000
Swaziland	.	100	.	6,200	4,600		130	.		8,800	6,100	11,000	36,930	.
Tanzania	100	.	.	5,400	1,400	300	.	7,900	200		1,600	16,700	33,600	1,394,000
Zambia	1,020	3,000	.	19,610	720	80	2,240	43,300	430	5,110		29,310	104,820	1,198,000
Zimbabwe	7,300	93,800	300	78,700	2,200	70,700	19,500	254,500	1,300	13,300	116,000		657,600	2,834,000
Total	8,590	2,165,710	1,210	281,510	285,365	73,980	1,063,080	897,150	2,532	135,910	487,340	1,367,570	6,761,357	41,755,000

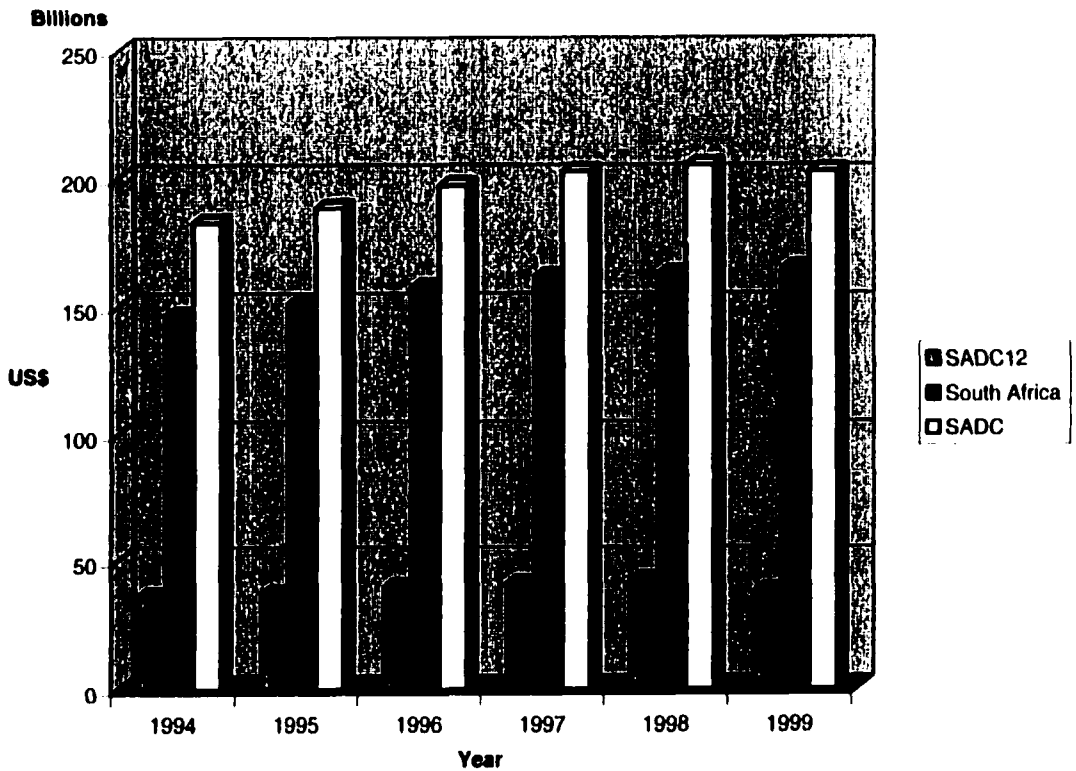
Note. - indicates figures not available, 0 denotes amounts between 0 and ± 0 5, * Angola, Lesotho, South Africa and Swaziland couldn't provide the trade flow data As such figures are derived from partners' trade statistics: Source http //www sadcreview com/sectoral%20reports202001/industry htm

Table 3.6. Intra-SADC Trade 1997 as reported by Exporting Country (US$ '000)

Exporting Country	Angola	Botswana	Lesotho	Malawi	Mauritius	Mozambique	Namibia	South Africa	Swaziland*	Tanzania*	Zambia	Zimbabwe	Total SADC Imports	World Exports
Angola		.	.	170	.	.	.	.	.	100	1,020	7,300	8,590	5,077,000
Botswana	.		400	1,800	800	100	6,600	2,059,900	100	300	8,600	127,100	2,205,700	3,230,800
Lesotho*	.	900		10	.	.	.	.	.	.	.	300	1,210	184,600
Malawi	.	2,870	10		5,520	3,500	230	160,460	6,200	1,410	5,600	55,440	241,240	436,000
Mauritius	.	15	45	75		967	400	274,780	4,600	950	1,480	4,570	287,882	1,593,000
Mozambique	500	0	0	1,400	.		.	43,800	100	3,597	106	9,828	59,331	226,000
Namibia	1930	1,300	0	45	4	30		1,030,300	130	15	480	5,390	1,039,624	1,239,000
South Africa*	.	516,600	.	67,690	6,890	.	.		.	7,900	43,300	254,500	896,880	29,734,000
Swaziland	.	600	.	2	.	.	.	.		200	430	1,300	2,532	896,000
Tanzania	.	100	200	2,700	500	5,000	100	94,100	8,800	4,000	4,000	4,600	120,100	762,000
Zambia	40	4,130	20	3,430	1,240	390	1,240	350,710	6,100	2,410		69,720	439,430	1,189,000
Zimbabwe	.	59,600	200	15,600	15,000	22,300	8,300	1,099,000	11,000	14,900	26,400		1,272,300	2,118,433
Total		586,115	875	92,922	29,954	32,387	16,870	5,113,050	37,030	31,782	91,416	540,048	6,574,819	**46,685,833**

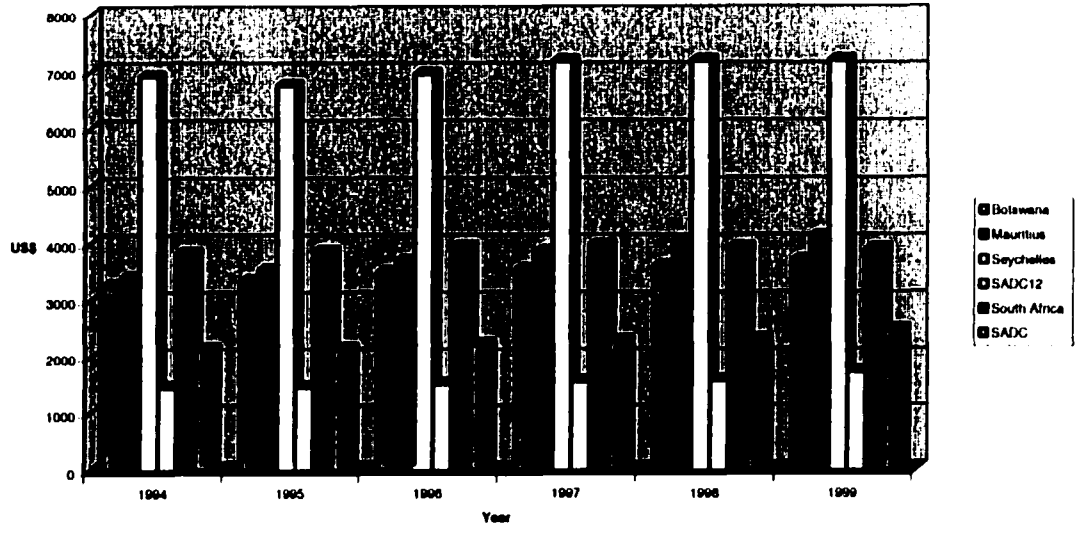
Note. - indicates figures not available, 0 denotes amounts between 0 and ± 0 5 *Angola, Lesotho, South Africa and Swaziland couldn't provide the trade flow data As such figures are derived from partners' trade statistics Source http //www sadcreview com/sectoral%20reports202001/industry htm

Fig. 3.1. Real GDP in the SADC Region (1995 US$): South Africa compared to the rest of SADC



Notes: Chart is made based on data from the World Bank's World Development Indicators CD Rom 2002 edition. SADC refers to real GDP of 13 members of the SADC excluding Namibia and SADC12 refers to the real GDP of SADC members excluding Namibia and South Africa.

Fig. 3.2. Real GDP Per Capita in the SADC Region (1995 US$)



Notes: Chart is made based on data from the World Bank's World Development Indicators CD Rom 2002 edition. SADC refers to real GDP of 13 members of the SADC excluding Namibia and SADC12 refers to the real GDP of SADC members excluding Namibia and South Africa.

II. South Africa's Role as an Investor in Other African Countries

With respect to FDI, the expectation has been that South Africa's multinational corporations (MNCs) "could help economic growth in its neighboring countries through the provision of FDI capital, technology transfer, and contributions to human resource development and to export revenues to these economies. In addition, FDI flows could offset the rising trade deficits in many of South Africa's neighbors and fuel trade further" (UNCTAD, 1999, Foreign Direct Investment in Africa: Performance and Potential, p13).

As with Sub-Saharan African countries, there is very little information on the actual role of South African MNCs in the development of the region. According the UNCTAD, "in terms of capital contribution, Southern African FDI in southern African had already increased significantly before 1994. Most of these investments were by mining companies, often accompanied by investments by financial firms providing financial services to farmers" (UNCTAD, 1999 p14). Table 3.7 below gives a bird's eye-view of some of South Africa's FDI in selected African countries. In recent times, FDI by South Africa's MNCs has been in the areas of food processing, retailing and other services. For example, South African Breweries purchased Cervejas de Mocambique when it was privatized in 1995 and is investigating the Nigerian market. All in all, the company operates in 11 countries in Africa. Also, Mobile Telephone Networks (MTN) is investing about 1bn in the Nigerian telephone network. Eskom, a South African energy company, has won

contracts to produce electricity in Lesotho, Libya, Malawi, Mali, Zambia and Zimbabwe. Other successful South African MNCs rolling out across the African continent include M-Net, Africa's largest pay television service, delivering crystal-clear 24-hour programming to dozens of countries across the continent and Pick'n Pay (South Africa), supermarket chain. Thus, in sum, South Africa's potential to be a regional economic growth pole cannot be underestimated even though this potential is yet to be fully realized.

Table 3.7. South Africa's FDI Stock in Selected African Countries, 1993-1997

(Millions of US$)

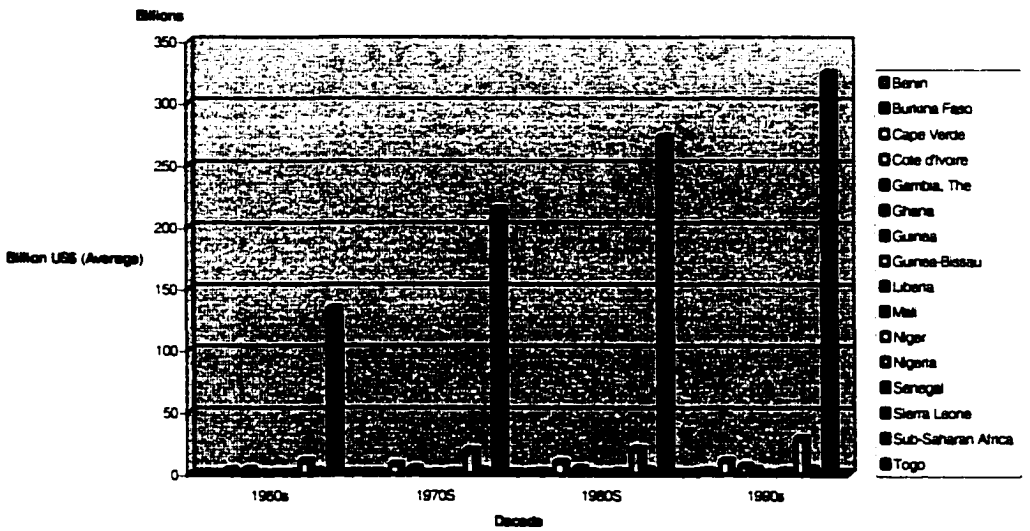
Country	1993	1994	1995	1996	1997
Botswana	34	38	73	65	60
Lesotho	17	16	42	30	40
Namibia	32	37	204	180	191
Swaziland	26	28	48	48	113
Zimbabwe	35	35	43	30	46
Others	663	746	657	643	860
Total	806	900	1067	996	1310

Source: UNCTAD 1999
Note: FDI Stock denominated in South African rand increased much more than in dollars because of significant devaluation of the rand against the US dollar.

B. The Impact of Nigeria's Per Capita GDP on ECOWAS Countries

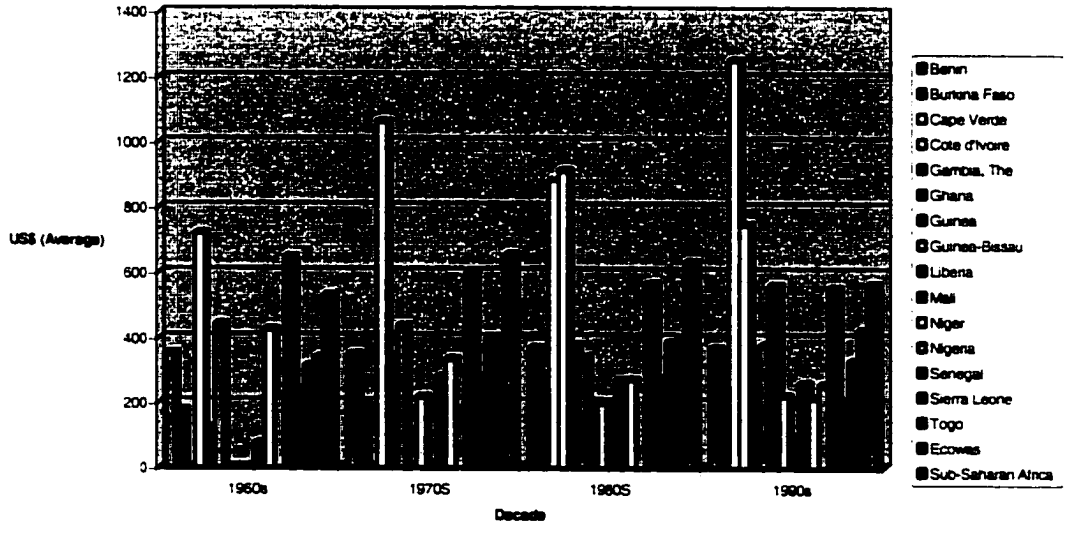
The economic picture in the ECOWAS region has been mixed at best. Figures 3.3 – 3.5 provide a bird's eye-view of the economic situation in that region in the last four decades. The average annual growth rates of gross national product per capita for the region were 0.65%, 0.70%, -0.76% and 0.08% for the 1960s, 1970s, 1980s and 1990s respectively. Real gross domestic product per capita averaged $340, $400, $395 and $425 for the four decades respectively in the ECOWAS region. During the last four decades, average annual output growth rates were 3.3%, 3.8%, 1.9% and 2.5% (these figures were computed using data from the World Bank World Development Indicators CD-ROM 2002. Also see Fig 3.5 below). In essence, the 1980s was a "period of loss" for the ECOWAS region. The comparative figures for Nigeria show a similar pattern. For example, the average annual growth rates of gross national product per capita for Nigeria for the last four decades were 2.24%, 4.17%, -0.66% and 0.66% respectively. Nigeria did far better than the average for the region. In terms of real gross domestic product per capita, however, the average annual figures for Nigeria were below the region's averages. The average per capita real gross domestic product for Nigeria was $219, $304, $245 and $257 for the 1960s, 1970s, 1980s and 1990s respectively. Nigeria's output grew on average 2.6%, 7.0% 0.9% and 3.1% in the 1960s, 1970s, 1980s and 1990s respectively (see figures 3.3, 3.4 and 3.5).

Fig 3.3. Real GDP in ECOWAS Countries (1995 US$)



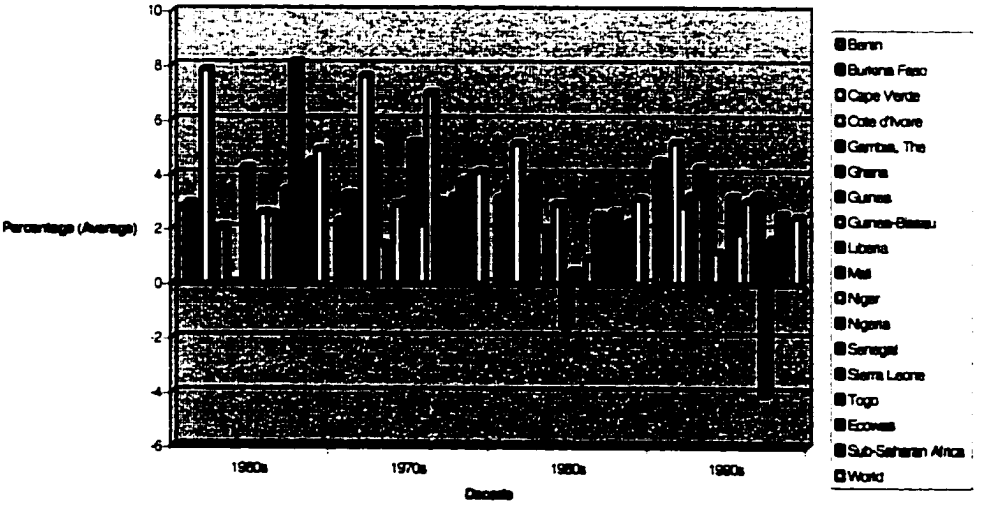
Notes: Chart made using data from the World Bank's World Development Indicators CD Rom 2002 edition

Fig. 3.4 Real GDP Per Capita in ECOWAS Region (1995 US$)



Notes: Chart made using data from the World Bank's World Development Indicators CD Rom 2002 edition

Fig 3.5. Annual GDP Growth in ECOWAS Countries



Notes: Chart made using data from the World Bank's World Development Indicators CD Rom 2002 edition

It is very hard to gauge the importance of Nigeria on the economic growth of other West African countries, particularly members of the Economic Community of West African States (ECOWAS). This is because it is very hard to get relevant data on Nigeria's economic relations with other West African countries. Having said that, however, Nigeria has the potential to significantly impact the economic growth of other countries in the region through trade relations. Available trade statistics show that Nigeria trades mostly with the industrialized region of the world. About 75% of Nigeria's exports goes to this region while about 25% goes to developing countries (See Table 3.8 below). Of the 25% that goes to developing countries, about 9.1% of Nigeria's exports goes to African countries. Ghana and Cote d'Ivoire account for more than two-thirds of Nigerian exports to Africa (see Table 3.10 below). Nigeria imports about 66% of its goods and services from the industrialized world with the developing world accounting for the remaining 34%. Of Nigeria imports from the developing world, a greater part of it (about 10.2% of all imports) is imported from developing countries in Asia, particularly, China, Hong Kong, India, Indonesia and South Korea. Imports from Africa accounts for only about 5% of the Nigeria's total imports. Most of Nigeria's imports from Africa are from countries in West Africa particularly Cote d'Ivoire and Ghana (these two countries account for more that 50% of Nigeria's imports from Africa) as well as Niger, Senegal and Togo (see Table 3.11 below). It most be noted that while trade with the industrialized world is the most

important for Nigeria, its trade with other developing countries (including those in Africa) has been increasing steadily.

Table 3.8. The Direction of Nigeria's Trade: Percentage Distribution of Exports

Region/Year	1993	1994	1995	1996	1997	1998	1999	2000
Industrial Countries	81.0	82.6	78.4	75.7	73.6	66.9	65.2	73.4
Developing Countries	18.9	17.4	21.6	24.3	26.4	33.1	34.8	26.6
Africa	7.5	6.7	8.9	9.1	9.6	10.9	11.0	8.7
Asia	6.7	5.1	7.4	11.0	11.1	13.6	15.0	11.6
Europe	0.3	0.5	0.4	0.5	0.5	0.5	0.3	0.8
Middle East	...	...	0.1	...	...	...	0.1	...
Western Hemisphere	4.5	5.1	4.7	3.6	5.1	8.0	8.4	5.6

Source: IMF Direction of Trade Statistics Yearbook, 2000. Figures for the year 2000 were computed by the author using exports figures from the Direction of Trade Statistics Yearbook 2000.

Table 3.9. The Direction of Nigeria's Trade: Percentage Distribution of Imports

Region/Year	1993	1994	1995	1996	1997	1998	1999	2000
Industrial Countries	72.9	68.5	68.8	68.5	66.2	62.5	62.1	58.9
Developing Countries	27.0	31.3	31.0	31.3	33.5	37.3	37.7	40.9
Africa	2.8	5.4	5.3	5.0	3.8	4.6	4.5	4.9
Asia	16.7	15.4	17.6	16.1	20.3	22.5	25.5	26.9
Europe	2.2	4.7	2.4	1.5	3.3	4.0	2.8	4.4
Middle East	1.5	2.4	0.6	3.3	1.2	0.9	0.7	0.9
Western Hemisphere	3.8	3.5	5.1	5.5	5.0	5.3	4.1	4.0

Sources: IMF Direction of Trade Statistics Yearbook 2000. Figures for the year 2000 were computed by the author using imports figures from the Direction of Trade Statistics Yearbook 2000.

Table 3.10. The Direction of Nigeria's Exports (Millions of US Dollars)

Region/Year	1993	1994	1995	1996	1997	1998	1999	2000
World Total	**11,590**	**11,299**	**11,916**	**15,651**	**15,818**	**11,364**	**11,668**	**21,279**
Industrial Countries	**9,393**	**9,331**	**9,347**	**11,854**	**11,637**	**7,599**	**7,611**	**15,609**
United States	5,099	4,278	4,595	5,610	6,107	4,135	4,220	9,409
France	683	987	734	1,260	653	673	691	1,055
Germany	790	807	626	643	786	289	189	463
Spain	690	972	1,036	1,509	1,416	876	877	2,189
United kingdom	152	173	259	420	183	211	190	166
Developing Countries	**2,19**	**1,967**	**2,568**	**3,796**	**4,180**	**3,764**	**4,056**	**5,668**
Africa	865	752	1,066	1,426	1,518	1,235	1,284	1,850
Cote d'Ivoire	341	275	338	484	390	290	282	601
Ghana	303	315	352	388	430	443	439	545
Niger	3	3	32	28	27	29	23	29
Senegal	59	36	71	64	80	84	103	129
Sierra Leone	7	7	8	9	10	10	10	13
Asia	775	574	884	1,728	1,756	1,548	1,751	2,464
China (Mainland)...	1	54	6	10	25	166	265	
India	701	415	572	1,248	1,086	1,014	1,005	1,246
Indonesia	1	24	157	136	129	50	54	401
Korea	49	107	...	...	...	240	216	270
Europe	37	59	49	76	87	61	29	164
Middle East	**2**	**4**	**8**	**7**	**6**	**5**	**6**	**6**
Western Hemisphere	**519**	**579**	**561**	**559**	**813**	**914**	**986**	**1,184**
Argentina	...	37	31	21	28	5	27	33
Brazil	128	357	284	253	560	630	738	738
Chile	332	122	151	140	128	165	119	284
European Union	**3,711**	**4,454**	**4,038**	**5,584**	**4,641**	**2,952**	**2,680**	**5,405**
Oil Exporting Countries	*2*	*27*	*161*	*139*	*132*	*52*	*57*	*406*
Non-oil Developing Countries	**2,194**	**1,940**	**2,407**	**3,657**	**4,047**	**3,712**	**3,999**	**5,262**

Source: IMF Direction of Trade Statistics Yearbook, 2000.

Table 3.11. The Direction of Nigeria's Imports (Millions of US Dollars)

Region/Year	1993	1994	1995	1996	1997	1998	1999	2000
World Total	**7,594**	**5,392**	**5,599**	**6,695**	**6,921**	**7,582**	**7,469**	**8,849**
Industrial Countries	**5,535**	**3,692**	**3,853**	**4,585**	**4,584**	**4,739**	**4,637**	**5,209**
United States	980	560	662	898	896	902	709	789
France	616	488	461	556	500	624	630	746
Germany	757	543	631	721	801	714	740	635
Spain	110	89	88	181	99	136	176	190
United kingdom	1,046	770	749	752	771	854	819	930
Developing Countries	**2,048**	**1,690**	**1,734**	**2,097**	**2,322**	**2,827**	**2,814**	**3,621**
Africa	216	292	298	332	266	349	339	415
Cote d'Ivoire	83	140	87	73	40	69	69	44
Ghana	47	53	52	65	65	71	69	86
Niger	5	5	22	51	40	47	51	64
Senegal	5	8	20	8	3	6	2	2
Togo	13	13	15	16	18	20	19	24
Asia	1,265	831	984	1,075	1,402	1,708	1,907	2,383
China (Mainland)	133	99	168	188	384	393	436	618
Hong Kong	321	195	262	242	216	180	195	187
India	134	124	152	158	202	217	211	264
Indonesia	59	36	56	60	75	136	148	260
Korea	129	73	.	.	.	170	185	229
Europe	168	253	135	101	228	302	212	390
Middle East	**111**	**127**	**33**	**218**	**84**	**65**	**53**	**81**
Western Hemisphere	**289**	**186**	**284**	**370**	**343**	**403**	**303**	**351**
Argentina	8	9	...	55	48	36	49	61
Brazil	264	164	268	302	274	361	249	271
Chile	...	...	..	...	...	...	...	...
European Union	**3,780**	**2,767**	**2,858**	**3,193**	**3,281**	**3,450**	**3,516**	**3,939**
Oil Exporting Countries	138	130	75	262	140	161	172	330
Non-oil Developing Countries	**1,910**	**1,560**	**1,660**	**1,835**	**2,182**	**2,666**	**2,642**	**3,291**

Source: IMF Direction of Trade Statistics Yearbook. 2000.

3.3 METHODOLOGY, ECONOMETRIC ISSUES AND EXTENSIONS

A. Methodology

The objective of this study is to investigate the long-run economic growth of sub-Saharan African economies and the methodology employed in this study is similar to Arora and Vamvakidis (2001) in their study of the impact of U.S. economic growth on the rest of the world. They used fixed effects panel regression, which is more appropriate for long-run growth. This approach allows for the analysis of a cross-section of countries over time. The fixed effects estimator allows the constant term to differ across cross-section units. In addition, with fixed-effects panel approach, it is possible to control for other explanatory variables in the growth regression and to test for robustness of the estimated South African and Nigerian growth impact to changes in model specification. Apart from capturing the time series dimension, this approach can provide additional information by using longer time period. Arora and Vamvakidis (2001) found a significantly positive impact of U.S. growth on growth in the rest of the world, especially developing countries during the past few decades. Their evidence suggests that the impact of U.S. growth on other countries could be explained by the significance of the U.S. as a global trading partner. Other related studies tend to focus mainly on the impact of foreign output fluctuations on domestic business cycle. These include Ahmed and Loungani (2001) who employed vector error-correction model to estimate the impact of foreign output

shocks on domestic output for several groups of emerging market economies in Asia and Latin America based on annual data for the period 1973-1996. They found the impact of foreign output shock on domestic output to be roughly one-for-one, after controlling for other external and domestic shocks. Also, Agenor, McDermott and Prsad (1999) estimated cross correlations using seasonally adjusted and de-trended quarterly data to determine the stylized facts of business cycles in developing countries and found that output fluctuations in industrial countries were transmitted at or near, lag zero to most developing countries.

It is often argued that growth regressions are very sensitive to the variables included in the regression and that outliers may drive the results.[47] To address these concerns, I follow Arora and Vamvakidis (2001) by adding the independent variables in states, starting with a simple regression that includes only South African growth to more general specifications. In addition, estimating the growth regression for alternative country samples and time periods tests the robustness of the results.

B. Econometric issues

The empirical framework for growth regression in the literature[48] takes the form of the standard specification:

$$(Real\ GDP\ per\ capita\ growth)_i = c_i + \beta X_i + \varepsilon, \text{ for country i = 1, ..., n.} \quad 1$$

[47] See for example Temple, 2000.

Thus the dependent variable is the average per capita GDP growth rate; c_i is the matrix of constant terms for each country i; β is the matrix of parameters to be estimated and ε is the error term. X_i is the matrix of independent variables that includes some of the standard variables used in growth studies. In this study, because regression results using growth rates provided wholly statistically insignificant results and wrong *a priori* signs, I modified equation 1 above to use levels rather than growth rates. The matrix of independent variables used in the regressions include:

- Human capital (secondary school enrollment);
- Investment in physical capital (gross domestic investment as percentage of GDP). I use gross fixed capital formation as a proxy for this variable;
- Domestic credit to the private sector;
- Macroeconomic policies (inflation, government spending). Inflation is represented by consumer price index and government spending by general government final consumption expenditures;
- Financial sector development variable (M2);
- Terms of trade; and

[48] See for example Barro and Sala-i- Martin (1995) and Levine and Renelt (1992).

- Trade Openness (the share of external trades in GDP).[49]

In addition to the above measures, the following variables also included in X_t:

- The real per capita GDP growth of South Africa and Nigeria;
- The real per capita GDP growth of other major trading partners of the SADC and ECOWAS regions, especially the United States and United Kingdom. This helps to distinguish the impact of economic growth of South Africa and Nigeria from that of the growth of other major non-African countries.

Apart from Nigeria and South Africa, I investigate the dynamic of economic interactions between the economies of the two economic groupings by also looking at the impact of the growth of other economies on the growth of others in the respective regional groupings. All African countries with available data are included in the regressions.[50] The time period is 1970-1999, using annual observations. If the regressions were growth rates, it would not have been necessary to test for unit roots and co-integration relationship in the data. However, since the variables used are in levels, it is necessary to test for unit roots and co-integration in the data. The use of fixed rather than random effects model is justified by a Hausman test, which rejects

[49] Different measures of trade openness have been used in the literature. This is one of the broadly used measures. Where not encumbered by data, I use alternative measures of trade openness such as taxes on international trade.

[50] All the data are from the World Bank's World Development Indicators.

the hypothesis that the individual effects are uncorrelated with the other regressors for most specifications.

3.4. ESTIMATION RESULTS AND ANALYSIS

Table 3.12 represents the regression results of the determinants of per capita gross domestic product in sub-Saharan Africa. As reported elsewhere, the method of estimation was a Pooled Least Squares and the sample period was 1960-1997. The number of countries included was 37. Tables C1 to C9 in Appendix C present the regression results of the impact of the per capita gross domestic product of the world, United States, Japan and selected members of SADC on the economic growth of the SADC region. Tables C10 to C29 report the regression results of the impact of economic growth of the world, selected West African countries, the United State and the United Kingdom on the economic growth of the ECOWAS region.

From Table 3.12 it can be seen that the some of the important determinants of per capita gross domestic product in sub-Saharan Africa are credit to the private sector (CPS), investments or gross fixed capital formation (GFCF), secondary school education (SCHSG), financial sector development, using M2 as a proxy in this study (in an alternative model whose results are not reported here, I used liquid liabilities as a proxy for financial sector development and this variable was equally statistically significant), openness (using external balance, EXTERB, as a proxy.

Table 3.12 Determinants of per capita gross domestic product in Sub-Saharan Africa

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 37
Total panel (unbalanced) observations: 479

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.163304	0.441388	0.369977	0.7116
CPS	4.188938	1.514123	2.766577	0.0059
GGCE	2.943852	2.405245	1.223930	0.2216
GFCF	13.61103	1.867058	7.290092	0.0000
SCHSG	12.75947	1.640023	7.780054	0.0000
M2	8.926538	1.762650	5.064271	0.0000
EXTERB	12.49349	1.416100	8.822461	0.0000
TDEBTS	-2.333002	0.895772	-2.604460	0.0095

R-squared	0.975307	Mean dependent var	780.9481
Adjusted R-squared	0.972804	S.D. dependent var	987.2089
S.E. of regression	162.8038	Sum squared resid	11503205
F-statistic	2448.839	Durbin-Watson stat	0.362206
Prob(F-statistic)	0.000000		

It must be noted that using trade as percentage of GDP as a proxy yielded equally statistically significant results) and total debts service as percentage of gross domestic product, (TDEBT). All these factors are statistically significant and this is consistent with other studies on African economies as well as the economic growth literature in general. To make an in-depth investigation of the role of the financial

sector development, particularly the equity market, on economic growth in sub-Saharan Africa (henceforth SSA), I followed earlier studies and included two variables, namely the stock market turnover ratio and the stock market value in the regression. Unfortunately but unsurprisingly, these variables were not statistically significant. The reason for this is that apart from South Africa, stock markets in sub-Saharan Africa are ill-developed and in some cases at their infant stages of development. This means that data on the equity markets are non-existent for most countries and where they exist, they are so porous and scanty that they are virtually of no use for any serious econometric work.

Tables 3.13 and 3.14 report of the impact of Nigeria and South Africa's per capita gross domestic product on the per capita gross domestic product in sub-Saharan Africa. The only difference between the regression results reported in the two tables is that in Table 3.13, M2 is used as a proxy for financial sector development while in Table 3.14, liquid liabilities (widely used in the growth and finance literature for a broader representation of financial sector development) is used a s proxy for the sector.

Table 3.13 The Impact of Nigeria and South Africa's per capita GDP on per capita GDP in Sub-Saharan Africa (Using M2 as a proxy for financial sector development)

Dependent Variable: Gross Domestic Product Per capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 35
Total panel (unbalanced) observations: 462

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.609449	0.524074	1.162906	0.2455
CPS	3.361188	1.574160	2.135227	0.0333
GGCE	2.987821	2.455813	1.216632	0.2244
GFCF	12.91251	1.924761	6.708632	0.0000
M2	10.38099	1.862228	5.574501	0.0000
SCHSG	14.04372	1.722146	8.154778	0.0000
TDEBTS	-1.932538	0.958420	-2.016380	0.0444
EXTERB	12.53609	1.463793	8.564112	0.0000
GDPPZAF	0.081812	0.040035	2.043500	0.0416
GDPPNGA	0.450783	0.384321	1.172934	0.2415

R-squared	0.974561	Mean dependent var	784.9262
Adjusted R-squared	0.971877	S.D. dependent var	980.0849
S.E. of regression	164.3598	Sum squared resid	11264899
F-statistic	1775.021	Durbin-Watson stat	0.362037
Prob(F-statistic)	0.000000		

Table 3.14 The Impact of Nigeria and South Africa's GDP per capita on GDP per capita in SSA: Using Liquid Liabilities as a proxy for financial sector development

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1969 1996
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 34
Total panel (unbalanced) observations: 431

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.763475	0.572099	1.334515	0.1828
CPS	5.299177	1.604512	3.302673	0.0010
EXTERB	11.80384	1.479009	7.980917	0.0000
GFCF	13.43429	2.037366	6.593949	0.0000
GGCE	1.952719	2.456279	0.794991	0.4271
SCHSG	16.52807	1.793374	9.216185	0.0000
LIQUID	1019.281	170.6066	5.974453	0.0000
TDEBTS	-2.395776	0.943892	-2.538189	0.0115
GDPPZAF	0.086903	0.040968	2.121223	0.0345
GDPPNGA	0.563973	0.392553	1.436679	0.1516

R-squared	0.977981	Mean dependent var	807.6301
Adjusted R-squared	0.975535	S.D. dependent var	1004.478
S.E. of regression	157.1140	Sum squared resid	9553016.
F-statistic	1909.888	Durbin-Watson stat	0.425405
Prob(F-statistic)	0.000000		

Interestingly both variables used as proxies for financial sector development are statistically significant in the respective regressions. As expected, almost all the other exogenous variables with the surprised exception of inflation (CPI) and government general consumption expenditures (GGCE) have the right signs and are statistically significant. In both regressions, the gross domestic product per capita of

South Africa is statistically significant whereas that of Nigeria is not statistically significant.

Next, I investigate the geo-politico-economic impact of these two countries in their respective sub-regions. Thus I look at the impact of South African per capita GDP on the per capita GDP of the SADC member countries. I do the same for Nigeria and the other ECOWAS member countries. Tables 3.15 – 3.17 show the regression results of the impact of South Africa's per capita gross domestic product in the Southern African Development Community region. The impact of Nigeria's gross domestic product or income and trade in the sub-region of the Economic Community of West African States is reported in Tables 3.18 – 3.20.

Table 3.15 represents the regression results of the determinants of per capita gross domestic product in the Southern African Development Community (SADC). Because of data limitations, the sample period was adjusted. Thus data was available for only 23 years from 1975 to 1997 for only 8 member countries of SADC.

Though the variable for inflation, CPI, has the expected sign, it is not statistically significant in explaining per capita gross domestic product in the SADC region according to the regression results. Apart from that, all the other factors used in the regression, namely, credit to the private sector (CPS), real gross fixed capital formation (RGFCF), real general government consumption expenditures (RGGCE), financial sector development (M2), total debt services as percentage of gross domestic product (TDEBT), secondary school education (SCHSG) and openness

(TIT) are statistically significant. In this regression, I used taxes on international trade (TIT) instead of trade as percentage of GDP used I the earlier regressions as a proxy for openness because the latter was not statistically significant when used in the model (whether separately or in conjunction with the former).

Table 3.15 Regression Results of determinants of GDP per capita in the SADC region

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-1.040150	1.367410	-0.760672	0.4491
CPS	21.10188	6.152542	3.429782	0.0010
RGFCF	1.70E-07	7.59E-08	2.238948	0.0279
RGGCE	2.60E-07	9.63E-08	2.696765	0.0085
M2	15.23284	3.436609	4.432520	0.0000
TDEBT	-4.93E-07	2.62E-07	-1.877867	0.0640
SCHSG	15.46615	3.618002	4.274776	0.0001
TIT	-10.84850	3.715760	-2.919591	0.0046

R-squared	0.983534	Mean dependent var	1255.348
Adjusted R-squared	0.980447	S.D. dependent var	1219.182
S.E. of regression	170.4804	Sum squared resid	2325084.
Log likelihood	-620.7742	F-statistic	682.6582
Durbin-Watson stat	0.746461	Prob(F-statistic)	0.000000

Table 3.16. Regression results of the impact of South Africa 's per capita gross domestic product in SADC region.

Dependent Variable: Gross Domestic Product Per Capita

Method: Pooled Least Squares

Sample (adjusted): 1975 1997

Included observations: 19 after adjusting endpoints

Number of cross-sections used: 7

Total panel (unbalanced) observations: 94

_Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-1.427646	1.443801	-0.988811	0.3258
CPS	21.39716	6.114737	3.499277	0.0008
RGFCF	1.17E-07	8.95E-08	1.307505	0.1949
RGGCE	4.14E-07	1.50E-07	2.757059	0.0073
M2	15.07294	3.448193	4.371258	0.0000
SCHSG	12.27207	4.031582	3.043984	0.0032
TDEBT	-4.55E-07	2.63E-07	-1.730297	0.0875
TIT	-10.83752	3.695200	-2.932864	0.0044
GDPPZAF	-0.103225	0.093841	-1.100001	0.2747

R-squared	0.982457	Mean dependent var	1200.240
Adjusted R-squared	0.979083	S.D. dependent var	1170.910
S.E. of regression	169.3456	Sum squared resid	2236879.
Log likelihood	-607.0132	F-statistic	546.0161
Durbin-Watson stat	0.823525	Prob(F-statistic)	0.000000

Table 3.17. Regression Results of the impact of South Africa's Trade on other SADC Members

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 7
Total panel (unbalanced) observations: 94

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-4.058375	2.178467	-1.862950	0.0663
CPS	21.34158	6.124366	3.484700	0.0008
RGFCF	1.22E-07	8.86E-08	1.373576	0.1736
RGGCE	4.81E-07	1.52E-07	3.172507	0.0022
M2	15.44100	3.419487	4.515590	0.0000
SCHSG	10.25697	4.120142	2.489469	0.0150
TDEBT	-4.04E-07	2.65E-07	-1.525553	0.1312
TIT	-9.402018	3.719865	-2.527516	0.0135
REXPZAF	2.89E-08	1.38E-08	2.092574	0.0397
RIMPZAF	-4.41E-09	7.86E-09	-0.561306	0.5762

R-squared	0.983169	Mean dependent var	1200.240
Adjusted R-squared	0.979672	S.D. dependent var	1170.910
S.E. of regression	166.9441	Sum squared resid	2146015.
Log likelihood	-605.0642	F-statistic	499.7739
Durbin-Watson stat	0.829321	Prob(F-statistic)	0.000000

Tables 3.16 and 3.17 show the regression results of the impact of South Africa's gross domestic product per capita on the gross domestic product per capita in the SADC region. In Table 3.16, the regression results the per capita gross domestic product (income) of South Africa seemingly has no impact on the per capita gross

domestic product in this region because the variable GDPPZAF (which represents the per capita GDP of South Africa) is not statistically. In fact this variable even has the wrong expected sign. In a similar vein, the regression results indicate that inflation (CPI) is not statistically significant in explaining per capita GDP in that region. The other variables, namely, real gross fixed capital formation (RGFCF), real government consumption expenditures, education, debt service and taxes on international trade, however, are statistically significant in both regression results.

In Table 3.17, I used the real exports and real imports of South Africa in order to find the impact of South Africa's trade on the gross domestic product per capita in the SADC region. Interestingly, real exports from South Africa, represented by the variable REXAZF, seemingly have a significant impact on per capita gross domestic product in the SADC region. South Africa's exports may impact the economies of the other SADC countries through technology transfer as most of South Africa's exports to the countries in the region are manufactured goods. Surprisingly, real imports of South Africa (RIMPZAF) do not seem to have any impact on the growth of the economies in that region according to the regression results in Table 3.17.

Besides South Africa, I also investigated the impact of the per capita real gross domestic product of selected SADC member countries as well as those of three of the world's richest countries on per capita real gross domestic product in the SADC region. The regression results of the impact of these selected countries have been reported in Appendix C.

Tables C1 to C8 in Appendix C show the impact of the real GDP per capita of Botswana, Tanzania, Zambia, Zimbabwe, United Kingdom, Japan, United State and the World respectively on real income in the SADC region. Table C9 provides a summary of the impact of these countries' real gross domestic product per capita on real GDP per capita in the SADC region. Among these countries, the real gross domestic product per capita of Botswana, Zimbabwe, United Kingdom, United States and the world appear to have statistically significant impact on real incomes in the SADC region while that of Japan, Tanzania and Zambia appear not. The impact of the real income per capita of United Kingdom is not surprising given its historical ties to the region. The results suggest that as income per capita in the United Kingdom increases, real-income-enhancing economic activities (potentially through trade and FDI, which have positive effects on the SADC) between the United Kingdom and the SADC member countries also increases. On the other hand, the apparent lack of impact of Japan's real gross domestic product per capita on the SADC region is not entirely surprising because historically, Japan's economic ties with sub-Saharan Africa in general has been peripheral.

Just as in the SADC region, the variables included in the regressions for the ECOWAS region were inflation (CPI), credit to the private sector (CPS), real gross fixed capita investment (RGFCF), real government general consumption expenditures (RGGCE), trade as percentage of gross domestic product (TRADEG) and the terms of trade (TOT). Here taxes on international trade and debt burden were not used

because data was porous (and available, the periods very short) for most countries in the ECOWAS region. Similarly, M2 (a proxy for financial sector development) was not included because in all regressions its coefficient was not statistically significant consistently. Tables 3.18 and 3.19 show the regression results of the determinants of real gross domestic product per capita in the ECOWAS region and the impact of Nigeria's per capita real gross domestic product on per capita real gross domestic product in region respectively.

Table 3.18 Determinants of per capita real gross domestic product in the ECOWAS region

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	10.25271	4.403344	2.328391	0.0209
CPS	11.15996	7.627599	1.463102	0.1450
RGFCF	-1.76E-09	4.76E-09	-0.369436	0.7122
RGGCE	3.10E-08	5.11E-09	6.077852	0.0000
SCHSG	42.57175	9.357809	4.549329	0.0000
TRADEG	9.164287	8.922524	1.027096	0.3056
TOT	2.22E-09	9.14E-10	2.433816	0.0158

R-squared	0.991739	Mean dependent var	10151.61
Adjusted R-squared	0.990892	S.D. dependent var	11199.86
S.E. of regression	1068.892	Sum squared resid	2.23E+08
Log likelihood	-1801.910	F-statistic	3901.594
Durbin-Watson stat	0.166514	Prob(F-statistic)	0.000000

Table 3.19. Impact of Nigeria's real GDP Per Capita on real per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1991 1997
Included observations: 7 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 73

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-18.66982	4.599434	-4.059157	0.0002
CPS	-18.88996	5.983576	-3.156968	0.0027
RGFCF	4.34E-09	3.33E-09	1.305363	0.1976
SCHSG	29.97495	5.188412	5.777288	0.0000
RGGCE	-1.42E-08	9.79E-09	-1.447827	0.1538
TOT	1.04E-09	1.56E-09	0.665517	0.5087
TRADEG	-1.424556	7.150878	-0.199214	0.8429
GDPPNGA	0.702396	0.160875	4.366110	0.0001

R-squared	0.999378	Mean dependent var	10175.21
Adjusted R-squared	0.999122	S.D. dependent var	12019.66
S.E. of regression	356.0640	Sum squared resid	6465859.
F-statistic	11713.66	Durbin-Watson stat	1.074533
Prob (F-statistic)	0.000000		

Tables C10 – C27 in Appendix C show the regression results of the impact of the real gross domestic product of selected ECOWAS member countries as well as that of the world, Japan, United Kingdom and United States on the real GDP in the ECOWAS sub-region. Table C28 presents the summary results of the impact of the per capita real GDP of each member country of ECOWAS as well as that of the

world, United Kingdom, Japan and United States on per capita real income in that region.

As can be inferred from the tables, in the ECOWAS region, three factors consistently seem to influence real GDP per capita. These factors are real government general consumption expenditures (RGGCE), terms of trade improvement (TOT) and secondary school education (SCHSG). The impact of terms of trade improvement and secondary school education is consistent with the growth literature. The impact of government expenditures can be explained by the fact that in most West African countries, the government sectors and their roles are big – in some cases the government sector is the largest employer of employment besides the agricultural sector, and until recently government sectors in these countries participated directly in production via state-owned enterprises (SOEs). Among the ECOWAS member countries, the regression results suggest that the per capita real GDP of Cape Verde, Guinea Bissau and Liberia have no statistically significant impact on the per capita real GDP of the ECOWAS region. Interestingly the coefficients of the per capita real GDP of Cape Verde (GDPPCPV) and Liberia (GDPPLBR) have negative signs. Also, while the coefficient of the per capita real GDP of Togo (GDPPTGO) is statistically significant, it has a negative sign, suggesting that as per capita GDP of Togo increases that of other members of ECOWAS seems to decline. It is hard to find any economic argument for this, but it

can be speculated that maybe as Togolese become wealthier, they tend to spend their wealth on imported goods rather than on goods from other ECOWAS countries.

Among the developed countries of United States, United Kingdom and Japan, the coefficients of the per capita real GDP of the first two were statistically significant while that of Japan was not and even has a negative sign.

3.5. CONCLUDING REMARKS AND EXTENSION

This chapter provides a quantitative assessment of the impact of the per capita real gross domestic products of South Africa and Nigeria on the economic growth of sub-Saharan Africa. It does this using a panel data estimation approach, covering the period 1960 – 1999 adjusted accordingly for the Southern African Development Community and the Economic Community of West African States. All sub-Saharan African countries for which data is available is included in the study. The data used in the study are annual and are all obtained from the World Bank's World Development Indicators (WDI) CD-ROM 2002 edition.

The study was motivated by fact that by sheer size alone, Nigeria and South Africa are two of the biggest economies in sub-Saharan Africa and thus their [potential] role on the continent, through intra-African trade and intra-African foreign direct investment, needs attention. Other variables used in the study include consumer price index (for inflation), credit to the private sector, government spending, gross fixed capital formation (for investments), trade as percentage of gross

domestic product, taxes on international trade external balance (these three factors used interchangeably as measures of openness), terms of trade, financial sector development indicator (M2) and secondary school education.

Apart from looking at the potential impact of the per capita real gross domestic products of South Africa and Nigeria on real income per capita of the whole of sub-Saharan Africa, the study also investigates the impact of per capita real incomes of these two countries on the per capita real incomes in the SADC and ECOWAS economic groupings respectively. In addition, in order to capture the dynamics of economic interaction among the members of these two economic groupings, the paper investigates quantitatively which country or countries' per capita real gross domestic product significantly impacts the per capita real gross domestic products of the other members of that particular regional grouping.

It is found that while the impact of South Africa gross domestic product per capita on that of sub-Saharan Africa was statistically significant, that of Nigeria was not. Surprisingly, the real GDP per capita of South Africa seemed not to have any statistically significant impact on the real GDP per capita of other SADC member countries. However, the impact of South Africa's exports to the SADC region was particularly statistically significant on the real GDP per capita of the economies in that region. Countries in the SADC region whose per capita real gross domestic products have statistically significant impact on the region are Botswana and Zimbabwe.

In the ECOWAS region, the per capita GDP of Nigeria appears to have a significant impact on the per capita GDP of the ECOWAS region. Apart from Cape Verde, Guinea Bissau and Liberia the rest of the ECOWAS member countries' per capita GDP has statistically significant coefficients. In this region, three factors seem to consistently have significant impact on per capita GDP are government spending, terms of trade and secondary school education.

Other factors that seem to consistently determine per capita real gross domestic products in sub-Saharan Africa in general and the SADC in particular include incomes of the rest of the world, particularly the advanced industrialized countries like the United States and United Kingdom, credit to the private sector, investments, secondary school education, openness (to trade), financial sector development, and the debt burden.

Like most studies on sub-Saharan Africa, this study is likely to be affected by the quality of the data used. Data limitations considerably scaled down the period of coverage as well as the number of countries covered in both the ECOWAS and SADC regions. Also, in order to test for the stability of the variables used, a panel co-integration test should have been performed. This would be the objective of any subsequent study. Notwithstanding these problems, this study offers some insights into the interactions of the various member countries of two important economic groupings in sub-Saharan Africa, namely SADC and ECOWAS. Naturally, this study can be extended to other regional economic groupings in the sub-region. It is hoped

that such studies would help to identify countries within each geographical area that can act as growth poles in sub-Saharan Africa.

APPENDIX A: DATA SOURCE AND DEFINITIONS

The data used in chapter 1 are from the United States Bureau f Economic Analysis, Survey of Current Business, various issues. A great deal of the data was taken from the Bureau's website at http://www.bea.gov.

All the data used in chapters 2 and 3 are from the Work Bank's World Development Indicators CD-ROM 2001. In chapter 3 data on direction of trade were taken from the International Monetary Fund's Direction of Trade Statistics Yearbook 2000.

Variables used in one form or another include:

BANK: Bank liquid reserves to bank assets ratio (FD.RES.LIQU.AS.ZS)

Ratio of bank liquid reserves to bank assets is the ratio of domestic currency holdings and deposits with the monetary authorities to claims on other governments, nonfinancial public enterprises, the private sector, and other banking institutions. For more information, see WDI table 5.4.

CPI: Consumer price index (1995 = 100) (FP.CPI.TOTL)

Consumer price index reflects changes in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. For more information, see WDI table 4.14.

DANK: Domestic credit provided by banking sector (% of GDP)
(FS.AST.DOMS.GD.ZS)

Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan

institutions and building and loan associations. For more information, see WDI table 5.4.

EXTERB: External balance on goods and services (% of GDP) (NE.RSB.GNFS.ZS)
External balance on goods and services (resource balance) equals exports of goods and services minus imports of goods and services (previously nonfactor services). For more information, see WDI table 4.9.

FDI: Foreign direct investment, net (BoP, current US$) (BN.KLT.DINV.CD)
Foreign direct investment is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows total net, that is, net FDI in the reporting economy less net FDI by the reporting economy. Data are in current U.S. dollars.

GGCE: General government final consumption expenditure (% of GDP) (NE.CON.GOVT.ZS)
General government final consumption expenditure (general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. For more information, see WDI table 4.9.

GDP: Real Gross domestic product (1995 Constant US$);

GDPG: Annual Growth of real GDP (1995 Constant US$). Used as a proxy for Technological Progress.

GIR: Gross international reserves (includes gold, current US$) (FI.RES.TOTL.CD)
Gross international reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is

valued at year-end (December 31) London prices. Data are in current U.S. dollars. For more information, see WDI table 4.15.

INFLATION: Inflation, consumer prices (annual %) (FP.CPI.TOTL.ZG)

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. For more information, see WDI table 4.14.

MKTCAP: Market capitalization of listed companies (% of GDP) (CM.MKT.LCAP.GD.ZS)

Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. For more information, see WDI table 5.3.

EXRATE: Official exchange rate (LCU per US$, period average) (PA.NUS.FCRF)

Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). For more information, see WDI table 5.6.

M2: Money and quasi-money.

XRATE: Real exchange rate. Calculated based on data from the WDI.

BONDS: Portfolio investment, bonds (PPG + PNG) (NFL, current US$) (DT.NFL.BOND.CD) .

Portfolio bond investment consists of bond issues purchased by foreign investors. Data are in current U.S. dollars. For more information, see WDI table 6.7.

EQUITY: Portfolio investment, equity (DRS, current US$) (BX.PEF.TOTL.CD.DT)

Portfolio investment flows are net and include non-debt-creating portfolio equity flows (the sum of country funds, depository receipts, and direct purchases of shares

by foreign investors). Data are in current U.S. dollars. For more information, see WDI table 6.7.

OTHER: Portfolio investment, excluding LCFAR (BoP, current US$) (BN.KLT.PTXL.CD).

Portfolio investment excluding liabilities constituting foreign authorities' reserves covers transactions in equity securities and debt securities. Data are in current U.S. dollars.

CFLOWS: total capital flows including the sum of FDI bonds, equity and other capital flows.

STOCKS: Stocks traded, total value (% of GDP) (CM.MKT.TRAD.GD.ZS)

Stocks traded refers to the total value of shares traded during the period. For more information, see WDI table 5.3.

TURNOVER: Stocks traded, turnover ratio (%) (CM.MKT.TRNR)

Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period. Average market capitalization is calculated as the average of the end-of-period values for the current period and the previous period. For more information, see WDI table 5.3.

TIT: Taxes on international trade (% of current revenue) (GB.TAX.INTT.RV.ZS)

Taxes on international trade include import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes. Current revenue includes all revenue from taxes and nonrepayable receipts (other than grants) from the sale of land, intangible assets, government stocks, or fixed capital assets, or from capital transfers from nongovernmental sources. It also includes fines, fees, recoveries, inheritance taxes, and nonrecurrent levies on capital. Data are shown for central government only. For more information, see WDI table 4.13.

DEBT Total debt service (TDS, current US$) (DT.TDS.DECT.CD).

Total debt service is the sum of principal repayments and interest actually paid in foreign currency, goods, or services on long-term debt, interest paid on short-term

debt, and repayments (repurchases and charges) to the IMF. Data are in current U.S. dollars. For more information, see WDI table 4.17.

TRADE: Trade (% of GDP) (NE.TRD.GNFS.ZS) TO MEASURE OPENNEESS

Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. For more information, see WDI table 4.9.

TOT: Terms of trade (Constant 1995 prices).

The variables included in chapter 3 are described as follows:

CPI	Consumer price index (1995 = 100);
CPS	Credit to private sector (% of GDP);
EXTERB	External balance on goods and services (%of GDP);
GDPG	Annual growth of gross domestic product (%);
GDPP	GDP per capita (Constant 1995 US$); The corresponding variables for individual countries' GDP per capita is obtained by adding the country codes to GDPP. For example, GDPPGHA means the per capita GDP of Ghana.
GGCE	General government final consumption expenditure (%of GDP)
GGCEG	Annual % growth of general government final consumption expenditure;
GCFG	Annual % growth of gross capital formation;
GFCF	Gross fixed capital formation (% of GDP);
LIQUID	Liquid liabilities;
M2	Money and quasi-money as % of GDP;
POP	Population growth (annual %);
SCHSG	Secondary school enrollment (% gross);
SCHSN	Secondary school enrollment (% net);
STOCKV	Total value of stock traded (% of GDP);
STOCKT	Turnover ratio of stock traded (%);
TDEBTS	Total debt service (% of exports of goods and services);

TDEBT Total debt service (% of GDP);

TRADEG Trade as % of GDP.

II. Countries included in the chapter 2 and their Country Codes are:

Country	Country Code	Country	Country Code
Angola	DZA	Argentina	ARG
Australia	AUS	Bangladesh	BGD
Bolivia	BOL	Brazil	BRA
Botswana	BWA	Canada	CAN
Chile	CHL	Columbia	COL
Costa Rica	CRI	Dominican Republic	DOM
Ecuador	ECU	Egypt	EGY
Fiji	FJI	France	FRA
Germany	DEU	Ghana	GHA
The Gambia	GMB	Great Britain	GBR
Guatemala	GTM	Honduras	HND
Hong Kong	HKG	India	IDN
Indonesia	IND	Italy	ITA
Jamaica	JAM	Japan	JPN
Kenya	Ken	Korea	KOR
Luxembourg	LUX	The Netherlands	NLD
New Zealand	NZL	United States	USA
Morocco	MAR	Madagascar	MDG
Mexico	MEX	Mauritius	MUS
Malawi	MWI	Malaysia	MYS
Nigeria	NGA	Nicaragua	NIC
Nepal	NPL	Pakistan	PAK
Peru	PER	The Philippines	PHL
Paraguay	PRY	Singapore	SGP
Sierra Leone	SLE	Sri Lanka	LKA
Switzerland	SWZ	Thailand	THA
Tanzania	TZA	Uganda	UGA
Uruguay	URY	Venezuela	VEN
Zambia	ZMB	Zimbabwe	ZWE

III. REGIONAL ECONOMIC GROUPINGS IN AFRICA

CFA ZONE MEMBERS:

Benin	Burkina Faso	Cameroon	Central African Republic
Chad	Republic of Congo	Cote D'Ivoire	Equatorial Guinea
Gabon	Guinea	Bissau	Mali
Niger	Senegal	Togo	

WEST AFRICAN MONETARY AND ECONOMIC UNION (WAEMU) MEMBERS:

Benin	Burkina Faso	Cote D'Ivoire	Guinea Bissau
Mali	Niger	Senegal	Togo

CENTRAL AFRICAN ECONOMIC AND MONETARY UNION (CAEMC) MEMBERS:

Cameroon	Central African Republic	Chad
Republic of Congo	Equatorial Guinea	Gabon

COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA (COMESA) MEMBERS:

Angola	Burundi	Comoros	Democratic Republic of Congo	
Djibouti	Egypt	Eritrea Ethiopia	Kenya	Madagascar
Malawi	Mauritius	Namibia	Rwanda	Seychelles
Sudan	Swaziland	Uganda	Zambia	Zimbabwe

ECONOMIC COMMUNITY OF CENTRAL AFRICAN STATES (ECCAS) MEMBERS:

Angola Burundi Cameroon Central African Republic Chad Republic of Congo Democratic Republic of Congo Equatorial Guinea Gabon Rwanda Sao Tome and Principe

ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS) MEMBERS:

Benin	Burkina Faso	Cape Verde	Cote D'Ivoire	The Gambia
Ghana	Guinea	Guinea Bissau	Liberia	Mali
Niger	Nigeria	Senegal	Sierra Leone	Togo

AMU (ARAB-MAGHREB UNION) MEMMBERS:

Algeria	Mauritania	Morocco	Tunisia

SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC) MEMBERS

Angola	Botswana	Democratic Republic of Congo		Lesotho
Malawi	Mauritius	Mozambique	Seychelles	South Africa
Swaziland	Tanzania	Zambia	Zimbabwe	

APPENDIX B: TABLES AND MATHEMATICAL DERIVATIONS FOR CHAPTER ONE.

I. MATHEMATICAL DERIVATIONS FOR CHAPTER ONE[51]

A. DERIVING THE EQUILIBRIUM CONDITION FOR INTRA-INDUTRY DIRECT FOREIGN INVESTMENT

$$\beta_x\left[\frac{2\beta_y(\theta_x+\Psi)-\gamma(\theta_y-t)}{4\beta_x\beta_y-\gamma^2}\right]^2+\beta_{x^*}\left[\frac{2\beta_{y^*}(\theta_{x^*}-t^*)-\gamma(\theta_{y^*}+\Psi^*)}{4\beta_{x^*}\beta_{y^*}-\gamma^2}\right]^2-F\le$$
$$\beta_x\left[\frac{2\beta_y(\theta_x+\Psi)-\gamma(\phi_y+\Psi)}{4\beta_x\beta_y-\gamma^2}\right]^2+\beta_{x^*}\left[\frac{2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)}{4\beta_{x^*}\beta_{y^*}-\gamma^2}\right]^2-F-F^* \quad \text{(B1)}$$

$$\frac{\beta_x}{\Omega^2}\left\{\left[2\beta_y(\theta_x+\Psi)\right]^2+\left[\gamma(\theta_y-t)\right]^2-4\beta_y(\theta_x+\Psi)\gamma(\theta_y-t)\right\}$$
$$+\frac{\beta_{x^*}}{\Omega^{*2}}\left\{\left[2\beta_{y^*}(\theta_{x^*}-t^*)\right]^2+\left[\gamma(\theta_{y^*}+\Psi^*)\right]^2-4\beta_{y^*}(\theta_{x^*}-t^*)\gamma(\theta_{y^*}+\Psi^*)\right\}\le$$
$$\frac{\beta_x}{\Omega^2}\left\{\left[2\beta_y(\theta_x+\Psi)\right]^2+\left[\gamma(\phi_y+\Psi)\right]^2-4\beta_y(\theta_x+\Psi)\gamma(\phi_y+\Psi)\right\} \quad \text{(B2)}$$
$$+\frac{\beta_{x^*}}{\Omega^{*2}}\left\{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)\right]^2+\left[\gamma(\theta_{y^*}+\Psi^*)\right]^2-4\beta_{y^*}(\phi_{x^*}+\Psi^*)\gamma(\theta_{y^*}+\Psi^*)\right\}-F^*$$

where $\Omega=4\beta_x\beta_y-\gamma^2$ and $\Omega^*=4\beta_{x^*}\beta_{y^*}-\gamma^2$

Suppose $\Omega = \Omega^*$, then equation (A2) can be reduced to

$$\begin{aligned}&[\gamma(\theta_v - t)]^2 + [2\beta_{v*}(\theta_{x*} - t^*)]^2 - 4\beta_v\gamma(\theta_x + \Psi)(\theta_v - t) - 4\beta_{v*}\gamma(\theta_{x*} - t^*)(\theta_{v*} + \Psi^*) \le \\ &[\gamma(\phi_v + \Psi)]^2 + [2\beta_{v*}(\phi_{x*} + \Psi^*)]^2 - 4\beta_v\gamma(\theta_x + \Psi)(\phi_v + \Psi) \\ &-4\beta_{v*}\gamma(\phi_{v*} + \Psi^*)(\theta_{v*} + \Psi^*) - (\Omega^2/\beta_x)F^*\end{aligned} \tag{B3}$$

We can rearrange the above condition as:

$$\begin{aligned}&\{\gamma^2[(\phi_v + \Psi)^2 - (\theta_v - t)^2]\} + \{(2\beta_{v*})^2[(\phi_{x*} + \Psi^*)^2 - (\theta_{x*} - t^*)^2]\} \\ &-4\beta_v\gamma(\theta_x + \Psi)[(\phi_v + \Psi) - (\theta_v - t)] \\ &-4\beta_{v*}\gamma(\theta_{v*} + \Psi^*)[(\phi_{v*} + \Psi^*) - (\theta_{x*} - t^*)] - \left(\frac{\Omega^2}{\beta_{x*}}\right)F^* \ge 0\end{aligned} \tag{B4}$$

Letting $\eta = \left(\frac{\Omega^2}{\beta_{x*}}\right)$, $\zeta = -4\beta_v\gamma(\theta_x + \Psi)$ and $\xi = -4\beta_{v*}\gamma(\theta_{v*} + \Psi^*)$, we can further rewrite the above equation as:

$$\eta\left\{\begin{array}{l}\gamma^2[(\phi_v + \Psi)^2 - (\theta_v - t)^2] + (2\beta_{v*})^2[(\phi_{x*} + \Psi^*) - (\theta_{x*} - t^*)] \\ +\zeta[(\phi_v + \Psi) - (\theta_v - t)] + \xi[(\phi_{v*} + \Psi^*) - (\theta_{x*} - t^*)]\end{array}\right\} - F^* \ge 0 \tag{B5}$$

which can be reduced to:

$$\eta\{(2\beta_{v*})^2[(\phi_{x*} + \Psi^*) - (\theta_{x*} - t^*)]\} - F^* \ge \eta\xi[(\theta_{x*} - t^*) - (\phi_{v*} + \Psi^*)] + \rho \tag{B6}$$

where $\rho = -\eta\{\gamma^2[(\phi_v + \Psi)^2 - (\theta_v - t)^2] + \zeta[(\phi_v + \Psi) - (\theta_v - t)]\}$.

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[51] I used Maple for the mathematical derivations.

B. DETERMINANTS OF INTRA-INDUSTRY DIRECT FOREIGN INVESTMENT.

$$\frac{\partial(GL)}{\partial\beta_{y*}} = \frac{2(\phi_{x*}+\Psi^*)\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}{\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2}$$
$$-\frac{\left[(2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]2(\phi_{x*}+\Psi^*)}{\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} > 0 \quad \text{(B7)}$$

$$\frac{\partial(GL)}{\partial\beta_x} = \frac{-2(\phi_y+\Psi)\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}{\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2}$$
$$-\frac{\left[(2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]2(\phi_y+\Psi)}{\left[2\beta_{y*}(\phi_{x*}+\Psi^*)-\gamma(\theta_{y*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} => 0 \quad \text{(B8)}$$

$$\frac{\partial(GL)}{\partial\gamma} = \frac{-(\theta_{y*}+\Psi^*)+(\theta_x+\Psi)}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}$$
$$-\frac{\left[-(\theta_{y*}+\Psi^*)-(\theta_x+\Psi)\right]\left[(2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**}))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} \gtrless 0 \quad \text{(B9)}$$

$$\frac{\partial(GL)}{\partial\phi_{x*}} = 2\frac{\beta_{y*}}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}$$
$$-2\frac{\left[(2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**}))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]\beta_{y*}}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} > 0 \quad \text{(B10)}$$

$$\frac{\partial(GL)}{\partial\theta_x} = \frac{\gamma}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}$$
$$+\frac{\left[(2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**}))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]\gamma}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} < 0 \quad \text{(B11)}$$

$$\frac{\partial(GL)}{\partial\Psi^*} = \frac{2\beta_{y*}-\gamma}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]}$$
$$-\frac{\left[(2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**}))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right](2\beta_{y*}-\gamma)}{\left[2\beta_{y*}(\phi_{x*}+\Psi^{**})-\gamma(\theta_{y*}+\Psi^{**})+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} \gtrless 0 \quad \text{(B12)}$$

$$\frac{\partial(GL)}{\partial\Psi} = \frac{(-2\beta_x+\gamma)}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]} - \frac{\left[(2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right](2\beta_x-\gamma)}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} < 0 \quad \text{(B13)}$$

$$\frac{\partial(GL)}{\partial\theta_{y^*}} = -\frac{\gamma}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]} + \frac{\left[(2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]\gamma}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} < 0 \quad \text{(B14)}$$

$$\frac{\partial(GL)}{\partial\phi_y} = -2\frac{\beta_x}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]} - 2\frac{\left[(2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*))-((2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi))\right]\beta_x}{\left[2\beta_{y^*}(\phi_{x^*}+\Psi^*)-\gamma(\theta_{y^*}+\Psi^*)+2\beta_x(\phi_y+\Psi)-\gamma(\theta_x+\Psi)\right]^2} > 0 \quad \text{(B15)}$$

C. CONSUMER'S SURPLUS (For $\gamma = 0$)

If $\gamma = 0$, equilibrium outputs under international production become:

$$x_{FDI}^{NEW} = \frac{(\theta_x+\Psi)}{2\beta_x} \; ; \qquad y_{FDI}^{NEW} = \frac{(\phi_y+\Psi)}{2\beta_y} \quad \text{(B16)}$$

Thus the consumer surplus becomes:

$$CS^{FDI} = \frac{\beta_x}{2}\left(x_{FDI}^{NEW}\right)^2 + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2. \quad \text{(B17)}$$

The gains from international production (direct foreign investment) then can be computed as:

$$CS^{FDI} - CS^{A} = \frac{\beta_x}{2}\left(x_{FDI}^{NEW}\right)^2 + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2 - \frac{\beta_x}{2}\left(x^{A}\right)^2. \quad \text{(B18)}$$

By substituting for the outputs, we have:

$$CS^{FDI} - CS^{A} = \frac{\beta_x}{2}\left(\frac{\theta_x+\Psi}{2\beta_x}\right)^2 + \frac{\beta_y}{2}\left(\frac{\phi_y+\Psi}{2\beta_y}\right)^2 - \frac{\beta_x}{2}\left(\frac{\theta_x}{2\beta_x}\right)^2 \quad \text{(B19)}$$

$$CS^{FDI} - CS^{A} = \frac{\theta_x^2 + \Psi^2 + 2\theta_x\Psi}{8\beta_x} + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2 - \frac{\theta_x^2}{8\beta_y}.$$

$$CS^{FDI} - CS^{A} = \frac{\Psi^2 + 2\theta_x\Psi}{8\beta_x} + \frac{\beta_y}{2}\left(y_{FDI}^{NEW}\right)^2 > 0 \qquad \text{(B20)}$$

And the gains from trade when $\gamma = 0$ is

$$CS_{New}^{TRADE} - CS^{A} = \frac{\Psi^2 + 2\theta_x\Psi}{8\beta_x} + \frac{(\theta_y - t)^2}{8\beta_y} > 0 \qquad \text{(B21)}$$

Is intra-industry direct foreign investment more welfare improving than trade when $\gamma = 0$? To find this we subtract equation (B21) from equation (B20), which gives us

$$CS^{FDI} - CS_{New}^{TRADE} = \frac{\phi_y\Psi + \theta_y t}{4\beta_y} + \left[\frac{\left(\phi_y^2 + \Psi^2\right) - \left(\theta_y^2 + t^2\right)}{8\beta_y}\right] \gtrless 0 \qquad \text{(B22).}$$

From equation (B22), it can be seen that whether or not intra-industry multinational sales is more welfare improving than intra-industry trade is ambiguous.

II. TYPOLOGICAL MODEL OF INTRA-INDUSTRY FOREIGN DIRECT INVESTMENT

Table B1. A Typology of Two-way International Economic Transactions

		Organization of Transactions					
		Spot Markets		Contracts		Hierarchies	
Competition		Perfect	Imperfect Competition	Perfect	Imperfect Comp	Perfect	Imperfect
		A		B		C	
Inter-industry	Assets	Arm's-length transactions No cross-hauling Portfolio Investment		Contract transactions No cross-hauling (e g of similar kinds of technology) Licensing, management contracts, etc		Internalized transactions See general theories of DFI and international production	Direct foreign investment JVs
	Products	H-O-S Neo-factor trade	Neo-technology product-cycle trade	Subcontracting	(See explanations of Watanabe et al.)		Intra-firm trade
		D		E		F	
Inter-Intra-Industry	Assets	some cross hauling of broadly similar assets/products		As above (see explanations of Lall, Telessio, Contractor, Alchian and Demsetz et al)		Moving towards plant specialization within hierarchies	Vertical and horizontal direct foreign investment
	Products		Mixture of H-O-S trade (Burenstam-Linder, Dreze, Gray, Krugman, Barker explanations)				Intra-firm trade (Helleiner and Lavergne, Lall)
		G		H		I	
	Assets	cross-hauling of identical or closely similar assets/products	cross-hauling of identical or closely similar assets/products	Some control/influence exerted in contract		Importance of economies of synergy and transaction-cost minimizing (See explanations of Williamson, Caves ,Teece, Casson etc)	Horizontal direct foreign investment MNE oligopolies Intra-firm trade
	Products	Trading Oligopolies	(Dreze et al and Grubel & Lloyd, Brander, Finger, Hesse et al explanations)	Cross-licensing, e g in chemical industry	Cross-subcontracting as in auto industry		

Source:Erdilek, Asim ed. (1985), Multinational as Mutual Invaders: Intra-industry Direct Foreign Investment, p11

Table B2 Two-way International Economic Transactions: Significance of OLI Determinants (See Illustrations)

Competition		Spot Markets: Perfect	Spot Markets: Imperfect Competition	Contracts: Perfect	Contracts: Imperfect Comp.	Hierarchies: Perfect	Hierarchies: Imperfect
Inter-industry	Assets	Oa Ot^{0} L+ I^{0}	Oa* Ot^{0} L*** I^{0}		Oa* ** Ot^{0} L** *** I^{0}		O** *** Ot^{0} L** *** I* **
Inter-intra-Industry	Assets	Oa* Ot^{0} * L*** I^{0}		Oa* ** Ot^{0} * L** I^{0} *			
							Oa** Ot* *** L* *** I* ***
Intra-industry	Assets	Oa* Ot** L* *** I^{0}			Oa* ** Ot** L* *** I*		Oa* *** Ot** *** L* *** I** ***

Source:Erdilek, Asim ed. (1985), Multinational as Mutual Invaders: Intra-industry Direct Foreign Investment, p13

Notes: 0 = zero influence; + = exclusive influence; *s = degree of influence between 0 and +; Oa = asset advantage of ownership; Ot = transactions advantage of ownership (including scale economies); L = location advantages; I = internalization advantage

APPENDIX C: REGRESSION RESULTS OF THE DETERMINANTS OF PER CAPITA GROSS DOMESTIC PRODUCT IN SUB-SAHARAN AFRICA.

Table C1. The impact of per capita GDP of Botswana on per capita GDP in the SADC region

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 97
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-3.692858	1.403054	-2.632014	0.0102
CPS	32.34305	5.075056	6.372944	0.0000
GFCF	-3.958543	2.928049	-1.351939	0.1802
GGCE	-4.532374	6.732707	-0.673187	0.5028
SCHSG4.453189	4.097372	1.086840	0.2804	
M2	12.26106	2.949341	4.157221	0.0001
TIT	-11.09784	3.030831	-3.661648	0.0004
TDEBT2.56E-07	1.86E-07	1.378041	0.1720	
GDPPBWA	0.136860	0.048743	2.807806	0.0063
Fixed Effects				
LSO—C	79.85755			
MUS—C	1199.727			
MWI—C	-560.2670			
SWZ—C	534.9127			
ZAF—C	-1634.758			
ZAR—C	12.11858			
ZMB—C	-188.8807			
ZWE—C	-577.8775			

R-squared	0.979482	Mean dependent var	983.0979
Adjusted R-squared	0.975378	S.D. dependent var	1000.616
S.E. of regression	157.0093	Sum squared resid	1972154.
Log likelihood	-618.7534	F-statistic	477.3778
Durbin-Watson stat	0.793660	Prob(F-statistic)	0.000000

Table C2. The impact of per capita GDP of Tanzania on per capita GDP in the SADC region

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1988 1997
Included observations: 10 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.260147	0.995080	0.261433	0.7955
CPS	7.568891	5.418520	1.396856	0.1724
M2	13.79513	4.644001	2.970526	0.0057
RGGCE	1.23E-07	5.07E-08	2.427021	0.0212
RGFCF	1.19E-07	6.75E-08	1.758443	0.0885
SCHSG	17.98416	2.688892	6.688315	0.0000
TDEBT	-1.00E-07	2.52E-07	-0.398305	0.6931
TIT	-7.801320	3.585770	-2.175633	0.0373
GDPPTZA	3.864562	3.469057	1.114009	0.2738
Fixed Effects				
BWA—C	1037.665			
LSO—C	-993.4897			
MUS—C	439.3160			
MWI—C	-1007.666			
ZAF—C	-5945.056			
ZAR—C	-963.0627			
ZMB—C	-970.9621			
ZWE—C	-1542.482			

R-squared	0.998146	Mean dependent var	1623.876
Adjusted R-squared	0.997189	S.D. dependent var	1421.133
S.E. of regression	75.34725	Sum squared resid	175993.4
Log likelihood	-265.0771	F-statistic	2086.108
Durbin-Watson stat	1.811267	Prob(F-statistic)	0.000000

Table C3. The impact of per capita GDP of Zambia on per capita GDP in the SADC region

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 7
Total panel (unbalanced) observations: 92

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-1.585764	1.607861	-0.986257	0.3271
CPS	21.54590	6.228177	3.459422	0.0009
M2	14.70203	3.496568	4.204703	0.0001
RGFCF	1.84E-07	7.80E-08	2.353055	0.0212
RGGCE	2.63E-07	9.99E-08	2.628679	0.0104
SCHSG	14.96084	3.930914	3.805944	0.0003
TDEBT	-5.45E-07	2.73E-07	-1.998210	0.0493
TIT	-11.52014	3.884899	-2.965364	0.0040
GDPPZMB	-0.347842	0.601339	-0.578446	0.5647
Fixed Effects				
BWA—C	1763.075			
LSO—C	-25.66746			
MUS—C	1028.451			
MWI—C	-217.9216			
ZAF—C	-10393.88			
ZAR—C	-30.81750			
ZWE—C	-619.7672			

R-squared	0.983828	Mean dependent var	1287.886
Adjusted R-squared	0.980637	S.D. dependent var	1235.334
S.E. of regression	171.8992	Sum squared resid	2245751.
Log likelihood	-595.2694	F-statistic	577.9515
Durbin-Watson stat	0.721513	Prob(F-statistic)	0.000000

Table C4. The impact of per capita GDP of Zimbabwe on per capita GDP in the SADC region

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sampl e(adjusted): 1975 1996
Included observations: 18 after adjusting endpoints
Number of cross-sections used: 7
Total panel (unbalanced) observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	1.470842	1.620718	0.907525	0.3676
CPS	20.48727	5.485932	3.734511	0.0004
M2	15.96550	2.995042	5.330643	0.0000
RGFCF	2.20E-08	8.02E-08	0.274085	0.7849
RGGCE	2.68E-07	8.82E-08	3.044176	0.0034
SCHSG	20.06872	4.391213	4.570200	0.0000
TDEBT	3.98E-07	2.90E-07	1.369474	0.1758
TIT	-2.891820	3.129328	-0.924103	0.3590
GDPPZWE	1.299479	0.647445	2.007088	0.0491

Fixed Effects	
BWA—C	258.2610
LSO—C	-1834.148
MUS—C	-906.3556
MWI—C	-1525.011
ZAF—C	-11552.75
ZAR—C	-1541.385
ZMB—C	-1499.737

R-squared	0.991985	Mean dependent var	1393.238
Adjusted R-squared	0.990046	S.D. dependent var	1315.663
S.E. of regression	131.2657	Sum squared resid	1068303.
Log likelihood	-482.1473	F-statistic	959.1632
Durbin-Watson stat	0.936978	Prob(F-statistic)	0.000000

Table C5. The impact of per capita GDP of United Kingdom on per capita GDP in the SADC region.

Dependent Variable: Gross Domestic Product Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
—				
CPI	-2.723456	1.573956	-1.730326	0.0875
CPS	23.19017	6.119978	3.789256	0.0003
RGFCF	1.75E-07	7.45E-08	2.350470	0.0212
RGGCE	2.78E-07	9.49E-08	2.934731	0.0044
M2	14.13483	3.412985	4.141488	0.0001
TDEBT	-5.06E-07	2.57E-07	-1.965359	0.0529
SCHSG	13.38169	3.692079	3.624432	0.0005
TIT	-9.806731	3.679679	-2.665105	0.0093
GDPPGBR	0.036408	0.017821	2.042997	0.0444
Fixed Effects				
BWA—C	1056.653			
LSO—C	-818.1480			
MUS—C	296.0130			
MWI—C	-1007.853			
ZAF—C	-11521.19			
ZAR—C	-828.7466			
ZMB—C	-802.5985			
ZWE—C	-1375.316			

R-squared	0.984361	Mean dependent var	1255.348
Adjusted R-squared	0.981193	S.D. dependent var	1219.182
S.E. of regression	167.1960	Sum squared resid	2208407.
Log likelihood	-618.3029	F-statistic	621.5453
Durbin-Watson stat	0.755478	Prob(F-statistic)	0.000000

Table C6. The impact of per capita GDP of Japan on per capita GDP in the SADC region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-2.393990	1.549555	-1.544954	0.1264
CPS	21.25164	6.071791	3.500061	0.0008
RGFCF	1.67E-07	7.49E-08	2.233861	0.0283
RGGCE	2.76E-07	9.54E-08	2.891075	0.0050
M2	15.00354	3.393632	4.421086	0.0000
TDEBT	-4.41E-07	2.61E-07	-1.690869	0.0948
SCHSG	13.01922	3.826511	3.402374	0.0011
TIT	-9.914724	3.704100	-2.676689	0.0090
GDPPJPN	0.012104	0.006811	1.777037	0.0794

Fixed Effects

BWA—C	1248.071
LSO—C	-632.2957
MUS—C	498.1800
MWI—C	-809.5977
ZAF—C	-11092.07
ZAR—C	-642.2501
ZMB—C	-603.1681
ZWE—C	-1176.277

R-squared	0.984167	Mean dependent var	1255.348
Adjusted R-squared	0.980961	S.D. dependent var	1219.182
S.E. of regression	168.2266	Sum squared resid	2235716.
Log likelihood	-618.8929	F-statistic	613.8325
Durbin-Watson stat	0.733454	Prob(F-statistic)	0.000000

Table C7. The impact of per capita GDP of United States on per capita GDP in the SADC region.

Dependent Variable: GDP per capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-2.610628	1.566228	-1.666825	0.0995
CPS	22.69899	6.102188	3.719812	0.0004
RGFCF	1.77E-07	7.47E-08	2.368108	0.0203
RGGCE	2.78E-07	9.51E-08	2.926217	0.0045
M2	14.44613	3.401671	4.246773	0.0001
TDEBT	-5.10E-07	2.58E-07	-1.974374	0.0518
SCHSG	13.31239	3.723128	3.575593	0.0006
TIT	-9.626159	3.705353	-2.597906	0.0112
GDPPUSA	0.026031	0.013330	1.952780	0.0544

Fixed Effects	
BWA—C	1019.902
LSO—C	-864.2058
MUS—C	254.1150
MWI—C	-1039.610
ZAF—C	-11534.81
ZAR—C	-865.3830
ZMB—C	-836.7755
ZWE—C	-1403.393

R-squared	0.984293	Mean dependent var	1255.348
Adjusted R-squared	0.981111	S.D. dependent var	1219.182
S.E. of regression	167.5595	Sum squared resid	2218020.
Log likelihood	-618.5114	F-statistic	618.8087
Durbin-Watson stat	0.749506	Prob(F-statistic)	0.000000

Table C8. Impact of per capita GDP of the world on per capita GDP in the SADC region.

Dependent Variable: GDP per capita
Method: Pooled Least Squares
Sample (adjusted): 1975 1997
Included observations: 19 after adjusting endpoints
Number of cross-sections used: 8
Total panel (unbalanced) observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-2.545750	1.545147	-1.647578	0.1034
CPS	22.41211	6.080765	3.685738	0.0004
RGFCF	1.69E-07	7.46E-08	2.270253	0.0259
RGGCE	2.79E-07	9.51E-08	2.933436	0.0044
M2	14.69106	3.387342	4.337047	0.0000
TDEBT	-4.87E-07	2.58E-07	-1.890380	0.0624
SCHSG	13.24726	3.728214	3.553245	0.0006
TIT	-9.525299	3.711575	-2.566376	0.0122
GDPPWLD	0.202362	0.102611	1.972121	0.0521
Fixed Effects				
BWA—C	696.9443			
LSO—C	-1196.546			
MUS—C	-75.89010			
MWI—C	-1364.686			
ZAF—C	-11744.97			
ZAR—C	-1186.063			
ZMB—C	-1160.554			
ZWE—C	-1728.889			

R-squared	0.984307	Mean dependent var	1255.348
Adjusted R-squared	0.981129	S.D. dependent var	1219.182
S.E. of regression	167.4828	Sum squared resid	2215989.
Log likelihood	-618.4674	F-statistic	619.3850
Durbin-Watson stat	0.742774	Prob(F-statistic)	0.000000

Table C9. Summary of the impact of the per capita GDP of selected countries on per capita GDP in the SADC region after accounting for other factors.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPWLD	0.202362	0.102611	1.972121	0.0521
GDPPUSA	0.026031	0.013330	1.952780	0.0544
GDPPJPN	0.012104	0.006811	1.777037	0.0794
GDPPGBR	0.036408	0.017821	2.042997	0.0444
GDPPZAF	-0.103225	0.093841	-1.100001	0.2747
REXPZAF	2.89E-08	1.38E-08	2.092574	0.0397
RIMPZAF	-4.41E-09	7.86E-09	-0.561306	0.5762
GDPPBWA	0.136860	0.048743	2.807806	0.0063
GDPPTZA	3.864562	3.469057	1.114009	0.2738
GDPPZMB	-0.347842	0.601339	-0.578446	0.5647
GDPPZWE	1.299479	0.647445	2.007088	0.0491

Table C10 Impact of Benin's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 197

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-10.81439	7.229424	-1.495885	0.1365
CPS	2.506855	8.534731	0.293724	0.7693
RGFCF	1.00E-09	4.89E-09	0.205442	0.8375
RGGCE	2.46E-08	5.50E-09	4.475410	0.0000
SCHSG	39.88805	15.53308	2.567943	0.0111
TOT	2.67E-09	9.58E-10	2.788829	0.0059
TRADEG	9.922186	9.087420	1.091859	0.2764
GDPPBEN	0.358976	0.110980	3.234599	0.0015
Fixed Effects				
BFA—C	11579.79			
CPV—C	-7141.116			
CIV—C	-7833.958			
GMB—C	-6204.506			
GHA—C	4725.651			
GIN—C	-6491.850			
GNB—C	-10228.98			
LBR—C	-5645.440			
MLI—C	18365.08			
NER—C	-8541.840			
SEN—C	5990.703			
SLE—C	-7227.361			
TGO—C	-7400.642			

R-squared	0.992092	Mean dependent var	9374.346
Adjusted R-squared	0.991193	S.D. dependent var	11415.30
S.E. of regression	1071.247	Sum squared resid	2.02E+08
Log likelihood	-1642.814	F-statistic	3154.317
Durbin-Watson stat	0.148241	Prob(F-statistic)	0.000000

Table C11. Impact of Burkina Faso's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 199

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-7.430953	5.745149	-1.293431	0.1975
CPS	1.482333	7.582654	0.195490	0.8452
RGFCF	3.17E-09	4.63E-09	0.685587	0.4939
RGGCE	2.40E-08	5.33E-09	4.509632	0.0000
SCHSG	30.98663	9.462380	3.274719	0.0013
TOT	2.77E-09	9.73E-10	2.848841	0.0049
TRADEG	0.135082	8.859861	0.015247	0.9879
GDPPBFA	0.258845	0.063771	4.058987	0.0001
Fixed Effects				
BEN—C	7810.310			
CPV—C	-6488.218			
CIV—C	-7287.230			
GMB—C	-5824.739			
GHA—C	6045.643			
GIN—C	-5674.306			
GNB—C	-9592.750			
LBR—C	-4664.718			
MLI—C	19945.95			
NER—C	-7326.173			
SEN—C	6953.327			
SLE—C	-5910.232			
TGO—C	-6593.063			

R-squared	0.992441	Mean dependent var	8973.135
Adjusted R-squared	0.991592	S.D. dependent var	10863.40
S.E. of regression	996.1159	Sum squared resid	1.77E+08
Log likelihood	-1645.141	F-statistic	3338.750
Durbin-Watson stat	0.132282	Prob(F-statistic)	0.000000

Table C12. Impact of Cote d'Ivoire's GDP per capita on per capita GDP in the ECOWAS region

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 199

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	9.589818	4.928735	1.945696	0.0533
CPS	22.17295	8.671682	2.556938	0.0114
RGFCF	-1.27E-08	4.88E-09	-2.610306	0.0098
RGGCE	4.68E-08	5.93E-09	7.886066	0.0000
SCHSG	28.88566	9.064430	3.186705	0.0017
TOT	2.88E-09	8.59E-10	3.350903	0.0010
TRADEG	3.675125	8.303550	0.442597	0.6586
GDPPCIV	0.832104	0.244971	3.396749	0.0008
Fixed Effects				
BEN—C	8267.586			
BFA—C	13630.33			
CPV—C	-4883.554			
GMB—C	-4590.155			
GHA—C	4937.183			
GIN—C	-4524.159			
GNB—C	-8197.090			
LBR—C	-3709.770			
MLI—C	20059.10			
NER—C	-5950.062			
SEN—C	3781.119			
SLE—C	-4659.400			
TGO—C	-4292.608			

R-squared	0.993546	Mean dependent var	10664.35
Adjusted R-squared	0.992821	S.D. dependent var	11525.84
S.E. of regression	976.6061	Sum squared resid	1.70E+08
Log likelihood	-1641.205	F-statistic	3914.362
Durbin-Watson stat	0.210636	Prob(F-statistic)	0.000000

Table C13. Impact of Cape Verde's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample(adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 212

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	10.34927	4.531960	2.283620	0.0235
CPS	12.37235	7.666928	1.613729	0.1082
RGFCF	-1.75E-09	4.86E-09	-0.360437	0.7189
RGGCE	3.15E-08	5.19E-09	6.071830	0.0000
SCHSG	43.43272	9.597555	4.525394	0.0000
TOT	2.27E-09	8.97E-10	2.525998	0.0123
TRADEG	11.07983	9.065634	1.222179	0.2231
GDPPCPV	-3.355811	5.247850	-0.639464	0.5233
Fixed Effects				
BEN—C	11849.12			
BFA—C	16247.09			
CIV—C	-1714.609			
GMB—C	-247.7488			
GHA—C	8964.431			
GIN—C	-440.6500			
GNB—C	-4541.666			
LBR—C	148.6883			
MLI—C	23218.45			
NER—C	-2414.916			
SEN—C	9304.170			
SLE—C	-1078.156			
TGO—C	-549.3397			

R-squared	0.991496	Mean dependent var	10387.19
Adjusted R-squared	0.990605	S.D. dependent var	11200.94
S.E. of regression	1085.655	Sum squared resid	2.25E+08
Log likelihood	-1771.625	F-statistic	3181.268
Durbin-Watson stat	0.171621	Prob(F-statistic)	0.000000

Table C14. Impact of Ghana's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 199

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-5.344211	5.301426	-1.008071	0.3148
CPS	38.91365	9.226323	4.217677	0.0000
TOT	3.19E-09	8.71E-10	3.664675	0.0003
RGGCE	2.35E-08	5.18E-09	4.531809	0.0000
RGFCF	1.11E-09	4.71E-09	0.235018	0.8145
TRADEG	6.706918	8.758284	0.765780	0.4448
GDPPGHA	0.355900	0.077807	4.574135	0.0000
Fixed Effects				
BEN—C	6593.212			
BFA—C	11790.33			
CPV—C	-7022.906			
CIV—C	-7677.275			
GMB—C	-6512.117			
GIN—C	-6665.681			
GNB—C	-10322.60			
LBR—C	-5416.015			
MLI—C	18317.72			
NER—C	-8508.473			
SEN—C	6106.151			
SLE—C	-7087.229			
TGO—C	-7369.785			

R-squared	0.992738	Mean dependent var	9432.319
Adjusted R-squared	0.991922	S.D. dependent var	11437.00
S.E. of regression	1027.961	Sum squared resid	1.88E+08
Log likelihood	-1651.404	F-statistic	3475.940
Durbin-Watson stat	0.162244	Prob(F-statistic)	0.000000

Table C15. Impact of Guinea's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1981 1997
Included observations: 17 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 183

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-20.18066	4.736144	-4.260989	0.0000
CPS	-0.564887	5.811355	-0.097204	0.9227
RGFCF	7.75E-09	3.62E-09	2.142135	0.0337
RGGCE	1.96E-09	5.02E-09	0.390520	0.6967
SCHSG	35.48489	7.226061	4.910682	0.0000
TOT	3.13E-09	7.72E-10	4.050604	0.0001
TRADEG	-4.649121	7.348280	-0.632682	0.5278
GDPPGIN	5.971211	0.852868	7.001326	0.0000
Fixed Effects				
BEN—C	9698.800			
BFA—C	16462.61			
CPV—C	-5590.309			
CIV—C	-4509.227			
GMB—C	-4754.472			
GHA—C	9367.738			
GNB—C	-8261.532			
LBR—C	-3496.514			
MLI—C	22408.40			
NER—C	-6755.610			
SEN—C	14067.86			
SLE—C	-4891.726			
TGO—C	-6644.050			

R-squared	0.996253	Mean dependent var	10526.04
Adjusted R-squared	0.995790	S.D. dependent var	11483.73
S.E. of regression	745.1228	Sum squared resid	89943691
Log likelihood	-1458.792	F-statistic	6152.516
Durbin-Watson stat	0.319465	Prob(F-statistic)	0.000000

Table C16. Impact of Gambia's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 205

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-1.672768	5.199932	-0.321690	0.7481
CPS	6.839372	7.588683	0.901259	0.3686
RGFCF	2.32E-09	4.79E-09	0.483514	0.6293
RGGCE	2.41E-08	5.30E-09	4.545304	0.0000
SCHSG	39.18476	9.251667	4.235428	0.0000
TOT	2.82E-09	9.10E-10	3.092913	0.0023
TRADEG	8.971542	8.807991	1.018568	0.3097
GDPPGMB	35.72048	8.579861	4.163293	0.0000
Fixed Effects				
BEN—C	4245.676			
BFA—C	9179.473			
CPV—C	-9140.676			
CIV—C	-9904.256			
GHA—C	2118.429			
GIN—C	-8825.478			
GNB—C	-12826.46			
LBR—C	-7839.909			
MLI—C	15925.87			
NER—C	-10652.51			
SEN—C	3191.914			
SLE—C	-9317.228			
TGO—C	-9270.340			

R-squared	0.992121	Mean dependent var	10683.95
Adjusted R-squared	0.991264	S.D. dependent var	11252.05
S.E. of regression	1051.689	Sum squared resid	2.04E+08
Log likelihood	-1706.226	F-statistic	3309.678
Durbin-Watson stat	0.266392	Prob(F-statistic)	0.000000

Table C17. Impact of Guinea Bissau's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 206

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	3.879413	6.164776	0.629287	0.5299
CPS	15.44361	6.793118	2.273419	0.0241
RGFCF	4.76E-08	7.82E-09	6.086488	0.0000
RGGCE	8.29E-09	5.68E-09	1.460620	0.1458
SCHSG	27.50735	9.759677	2.818470	0.0054
TOT	1.71E-09	7.98E-10	2.141114	0.0336
TRADEG?	14.34771	8.059381	1.780250	0.0767
GDPPGNB	1.428488	1.318662	1.083286	0.2801
Fixed Effects				
BEN—C	9828.569			
BFA—C	15190.10			
CPV—C	-2016.032			
CIV—C	-5850.610			
GMB—C	-1538.566			
GHA—C	7372.772			
GIN—C	-1597.678			
LBR—C	-1409.665			
MLI—C	22952.07			
NER—C	-3470.625			
SEN—C	3600.855			
SLE—C	-2569.390			
TGO—C	-1610.282			

R-squared	0.993400	Mean dependent var	10674.66
Adjusted R-squared	0.992687	S.D. dependent var	11233.80
S.E. of regression	960.6784	Sum squared resid	1.71E+08
Log likelihood	-1695.961	F-statistic	3978.113
Durbin-Watson stat	0.138737	Prob(F-statistic)	0.000000

Table C18. Impact of Liberia's GDP per capita on per capita GDP in the ECOWAS region

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 197

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	6.328903	5.608407	1.128467	0.2607
CPS	11.19918	8.030560	1.394571	0.1649
RGFCF	-8.75E-10	5.23E-09	-0.167391	0.8673
RGGCE	3.05E-08	5.70E-09	5.350677	0.0000
SCHSG	38.47864	9.985146	3.853588	0.0002
TOT	4.62E-09	2.32E-09	1.990991	0.0480
TRADEG	14.55657	10.18131	1.429734	0.1546
GDPPLBR	-1.770869	1.216384	-1.455846	0.1472
Fixed Effects				
BEN—C	12818.46			
BFA—C	17327.45			
CPV—C	-271.4163			
CIV—C	-1156.224			
GMB—C	148.2207			
GHA—C	9943.696			
GIN—C	-9.762082			
GNB—C	-3950.225			
MLI—C	24218.02			
NER—C	-1795.135			
SEN—C	10490.66			
SLE—C	-870.9274			
TGO—C	-46.95442			

R-squared	0.991287	Mean dependent var	11099.50
Adjusted R-squared	0.990296	S.D. dependent var	11307.66
S.E. of regression	1113.882	Sum squared resid	2.18E+08
Log likelihood	-1650.502	F-statistic	2860.383
Durbin-Watson stat	0.162951	Prob(F-statistic)	0.000000

Table C19. Impact of Mali's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 200

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-9.632782	4.731345	-2.035950	0.0432
CPS	17.75266	5.776798	3.073097	0.0024
RGFCF	4.24E-09	3.62E-09	1.169604	0.2437
RGGCE	2.66E-08	4.05E-09	6.572839	0.0000
SCHSG	33.62458	7.335467	4.583837	0.0000
TOT	2.02E-09	6.71E-10	3.010779	0.0030
TRADEG	13.54235	6.614718	2.047306	0.0421
GDPPMLI	0.147178	0.046559	3.161081	0.0018
Fixed Effects				
BEN—C	8011.828			
BFA—C	12643.54			
CPV—C	-5099.350			
CIV—C	-7118.788			
GMB—C	-4670.118			
GHA—C	5298.050			
GIN—C	-4876.240			
GNB—C	-9918.522			
LBR—C	-4562.825			
NER—C	-6922.883			
SEN—C	5440.209			
SLE—C	-5923.804			
TGO—C	-5546.617			

R-squared	0.994223	Mean dependent var	8329.739
Adjusted R-squared	0.993577	S.D. dependent var	9825.285
S.E. of regression	787.4173	Sum squared resid	1.11E+08
Log likelihood	-1606.446	F-statistic	4400.674
Durbin-Watson stat	0.242406	Prob(F-statistic)	0.000000

Table C20. Impact of Niger's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 197

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-5.945643	6.388083	-0.930740	0.3533
CPS	6.273028	7.486798	0.837879	0.4032
RGFCF	3.73E-09	4.73E-09	0.788817	0.4313
RGGCE	1.76E-08	5.23E-09	3.362255	0.0009
SCHSG	31.00751	9.220024	3.363061	0.0009
TOT	3.64E-09	8.87E-10	4.101187	0.0001
TRADEG	-8.186318	9.672144	-0.846381	0.3985
GDPPNER	6.632991	1.153036	5.752631	0.0000
Fixed Effects				
BEN—C	8426.221			
BFA—C	15419.69			
CPV—C	-6095.951			
CIV—C	-6265.981			
GMB—C	-5465.908			
GHA—C	7107.265			
GIN—C	-5143.400			
GNB—C	-9295.204			
LBR—C	-3655.568			
MLI—C	20835.62			
SEN—C	8991.375			
SLE—C	-4715.771			
TGO—C	-5924.278			

R-squared	0.992961	Mean dependent var	11043.87
Adjusted R-squared	0.992161	S.D. dependent var	11335.69
S.E. of regression	1003.636	Sum squared resid	1.77E+08
Log likelihood	-1629.971	F-statistic	3546.776
Durbin-Watson stat	0.184577	Prob (F-statistic)	0.000000

Table C21. Impact of Senegal's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 199

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-10.03287	5.695783	-1.761455	0.0799
CPS	7.191377	8.255264	0.871126	0.3849
RGFCF	4.37E-09	5.02E-09	0.870759	0.3851
RGGCE	2.12E-09	7.89E-09	0.269002	0.7882
SCHSG	35.23370	9.253624	3.807557	0.0002
TOT	3.90E-09	8.86E-10	4.397662	0.0000
TRADEG	7.592190	8.453951	0.898064	0.3704
GDPPSEN	0.332158	0.060231	5.514703	0.0000
Fixed Effects				
BEN—C	6511.301			
BFA—C	11877.54			
CPV—C	-8584.398			
CIV—C	-6560.509			
GMB—C	-7849.775			
GHA—C	5513.993			
GIN—C	-7981.918			
GNB—C	-11110.61			
LBR—C	-6516.880			
MLI—C	18095.24			
NER—C	-9715.002			
SLE—C	-8488.645			
TGO—C	-8620.353			

R-squared	0.992217	Mean dependent var	8817.904
Adjusted R-squared	0.991343	S.D. dependent var	10798.06
S.E. of regression	1004.705	Sum squared resid	1.80E+08
Log likelihood	-1646.850	F-statistic	3241.818
Durbin-Watson stat	0.156224	Prob(F-statistic)	0.000000

Table C22. Impact of Sierra Leone's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 198

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	18.10861	4.740183	3.820235	0.0002
CPS	4.944520	7.633790	0.647715	0.5180
RGFCF	-2.17E-09	4.77E-09	-0.456005	0.6489
RGGCE	2.79E-08	5.05E-09	5.518844	0.0000
SCHSG	47.04379	9.360003	5.026044	0.0000
TOT	3.26E-09	9.22E-10	3.530941	0.0005
TRADEG	19.78597	10.14370	1.950568	0.0527
GDPPSLE	22.60441	5.474334	4.129162	0.0001
Fixed Effects				
BEN—C	1679.161			
BFA—C	5104.825			
CPV—C	-10877.72			
CIV—C	-10817.67			
GMB—C	-10812.58			
GHA—C	-928.7374			
GIN—C	-11088.07			
GNB—C	-14066.78			
LBR—C	-9937.413			
MLI—C	12620.47			
NER—C	-12808.30			
SEN—C	406.0782			
TGO—C	-10639.85			

R-squared	0.992237	Mean dependent var	11040.96
Adjusted R-squared	0.991360	S.D. dependent var	11285.32
S.E. of regression	1049.011	Sum squared resid	1.95E+08
Log likelihood	-1647.060	F-statistic	3231.849
Durbin-Watson stat	0.241328	Prob(F-statistic)	0.000000

Table C23. Impact of Togo's GDP per capita on per capita GDP in the ECOWAS region

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1965 1997
Included observations: 21 after adjusting endpoints
Number of cross-sections used: 13
Total panel (unbalanced) observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	9.267905	4.370162	2.120724	0.0353
CPS	5.549897	7.601854	0.730072	0.4663
RGGCE	2.73E-08	5.08E-09	5.364155	0.0000
RGFCF	1.60E-09	4.76E-09	0.337073	0.7364
SCHSG	50.40233	9.560410	5.271985	0.0000
TOT	3.06E-09	8.81E-10	3.472038	0.0006
TRADEG	2.611624	9.774575	0.267185	0.7896
GDPPTGO	-11.66346	2.559885	-4.556244	0.0000

Fixed Effects	
BEN—C	14864.96
BFA—C	20106.72
CPV—C	3000.311
CIV—C	1597.876
GMB—C	2999.222
GHA—C	12538.89
GIN—C	3059.884
GNB—C	-1239.591
LBR—C	4219.536
MLI—C	26497.08
NER—C	812.9870
SEN—C	13175.89
SLE—C	2917.183

R-squared	0.992143	Mean dependent var	10780.69
Adjusted R-squared	0.991284	S.D. dependent var	11237.50
S.E. of regression	1049.101	Sum squared resid	2.01E+08
Log likelihood	-1697.343	F-statistic	3301.244
Durbin-Watson stat	0.222864	Prob(F-statistic)	0.000000

Table 24. Impact of United Kingdom's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-10.75326	6.048929	-1.777713	0.0770
CPS	6.725780	7.289095	0.922718	0.3573
RGFCF	3.03E-09	4.63E-09	0.655306	0.5130
RGGCE	2.17E-08	5.22E-09	4.160380	0.0000
SCHSG	32.86383	9.098186	3.612130	0.0004
TRADEG	10.56318	8.462765	1.248195	0.2135
TOT	2.78E-09	8.74E-10	3.183425	0.0017
GDPPGBR	0.388631	0.080999	4.797995	0.0000

Fixed Effects	
BEN—C	7182.554
BFA—C	12174.63
CPV—C	-7112.529
CIV—C	-7605.966
GMB—C	-6322.982
GHA—C	5236.928
GIN—C	-6578.018
GNB—C	-10485.60
LBR—C	-5628.694
MLI—C	18971.75
NER—C	-8249.366
SEN—C	6638.732
SLE—C	-7230.286
TGO—C	-7137.285

R-squared	0.992615	Mean dependent var	10151.61
Adjusted R-squared	0.991816	S.D. dependent var	11199.86
S.E. of regression	1013.212	Sum squared resid	1.99E+08
Log likelihood	-1789.800	F-statistic	3725.165
Durbin-Watson stat	0.143629	Prob(F-statistic)	0.000000

Table C25. Impact of Japan's GDP per capita on per capita GDP in the ECOWAS region

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	7.979326	5.016299	1.590680	0.1133
CPS	10.98616	7.631827	1.439519	0.1516
RGFCF	-8.02E-10	4.87E-09	-0.164626	0.8694
RGGCE	2.99E-08	5.26E-09	5.676990	0.0000
SCHSG	41.27399	9.460081	4.362964	0.0000
TRADEG	10.05051	8.973821	1.119981	0.2641
TOT	2.11E-09	9.22E-10	2.290688	0.0231
GDPPJPN	-0.346430	0.365837	-0.946951	0.3448
Fixed Effects				
BEN—C	12592.42			
BFA—C	17139.53			
CPV—C	-204.3194			
CIV—C	-1154.793			
GMB—C	223.0824			
GHA—C	9941.067			
GIN—C	80.02280			
GNB—C	-3989.832			
LBR—C	612.9266			
MLI—C	24038.23			
NER—C	-1828.298			
SEN—C	10352.73			
SLE—C	-545.6428			
TGO—C	-127.1594			

R-squared	0.991777	Mean dependent var	10151.61
Adjusted R-squared	0.990887	S.D. dependent var	11199.86
S.E. of regression	1069.175	Sum squared resid	2.22E+08
Log likelihood	-1801.412	F-statistic	3342.581
Durbin-Watson stat	0.166036	Prob(F-statistic)	0.000000

Table C26. Impact of the United States' GDP Per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-12.52688	5.972205	-2.097530	0.0372
CPS	5.615166	7.227720	0.776893	0.4382
RGFCF	4.05E-09	4.60E-09	0.879950	0.3800
RGGCE	2.04E-08	5.20E-09	3.916630	0.0001
SCHSG	30.90847	9.047061	3.416411	0.0008
TRADEG	8.216894	8.366907	0.982071	0.3273
TOT	2.96E-09	8.68E-10	3.406727	0.0008
GDPPUSA	0.305954	0.057964	5.278307	0.0000
Fixed Effects				
BEN—C	6666.846			
BFA—C	11977.10			
CPV—C	-7882.513			
CIV—C	-8331.339			
GMB—C	-7074.739			
GHA—C	4878.425			
GIN—C	-7219.539			
GNB—C	-11178.61			
LBR—C	-6178.560			
MLI—C	18598.45			
NER—C	-8848.003			
SEN—C	6360.919			
SLE—C	-7777.673			
TGO—C	-7876.859			

R-squared	0.992776	Mean dependent var	10151.61
Adjusted R-squared	0.991994	S.D. dependent var	11199.86
S.E. of regression	1002.100	Sum squared resid	1.95E+08
Log likelihood	-1787.418	F-statistic	3808.858
Durbin-Watson stat	0.151411	Prob(F-statistic)	0.000000

Table C27. Impact of World's GDP per capita on per capita GDP in the ECOWAS region.

Dependent Variable: GDP Per Capita
Method: Pooled Least Squares
Sample (adjusted): 1970 1997
Included observations: 20 after adjusting endpoints
Number of cross-sections used: 14
Total panel (unbalanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-12.66836	5.751586	-2.202585	0.0288
CPS	3.909291	7.198011	0.543107	0.5877
RGFCF	4.14E-09	4.55E-09	0.911491	0.3632
RGGCE	1.97E-08	5.15E-09	3.832770	0.0002
SCHSG	32.14721	8.882709	3.619077	0.0004
TRADEG	7.051143	8.294306	0.850119	0.3963
TOT	3.24E-09	8.67E-10	3.737017	0.0002
GDPPWLD	2.323042	0.409926	5.666974	0.0000
Fixed Effects				
BEN—C	3185.961			
BFA—C	8620.344			
CPV—C	-11309.13			
CIV—C	-11729.65			
GMB—C	-10529.18			
GHA—C	1507.749			
GIN—C	-10660.48			
GNB—C	-14540.95			
LBR—C	-9465.896			
MLI—C	15146.56			
NER—C	-12328.04			
SEN—C	3128.450			
SLE—C	-11141.33			
TGO—C	-11393.74			

R-squared	0.992912	Mean dependent var	10151.61
Adjusted R-squared	0.992145	S.D. dependent var	11199.86
S.E. of regression	992.6284	Sum squared resid	1.91E+08
Log likelihood	-1785.366	F-statistic	3882.423
Durbin-Watson stat	0.144349	Prob(F-statistic)	0.000000

Table C28. Summary of the impact of per capita GDP of selected countries on per capita GDP in the ECOWAS region after accounting for other factors.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPBEN	0.358976	0.110980	3.234599	0.0015
GDPPBFA	0.258845	0.063771	4.058987	0.0001
GDPPCIV	0.832104	0.244971	3.396749	0.0008
GDPPCPV	-3.355811	5.247850	-0.639464	0.5233
GDPPGHA	0.355900	0.077807	4.574135	0.0000
GDPPGIN	5.971211	0.852868	7.001326	0.0000
GDPPGMB	35.72048	8.579861	4.163293	0.0000
GDPPNGA	0.702396	0.160875	4.366110	0.0001
GDPPGNB	1.428488	1.318662	1.083286	0.2801
GDPPLBR	-1.770869	1.216384	-1.455846	0.1472
GDPPMLI	0.147178	0.046559	3.161081	0.0018
GDPPNER	6.632991	1.153036	5.752631	0.0000
GDPPSEN	0.332158	0.060231	5.514703	0.0000
GDPPSLE	22.60441	5.474334	4.129162	0.0001
GDPPTGO	-11.66346	2.559885	-4.556244	0.0000
GDPPWLD	2.323042	0.409926	5.666974	0.0000
GDPPUSA	0.305954	0.057964	5.278307	0.0000
GDPPJPN	-0.346430	0.365837	-0.946951	0.3448
GDPPGBR	0.388631	0.080999	4.797995	0.0000

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