AN EMPIRICAL ANALYSIS OF THE IMPACTS OF FOREIGN DIRECT INVESTMENT ON CHINA'S ECONOMIC GROWTH

by

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Abstract

This study investigates the relationship among domestic capital, employment, trade, and foreign direct investment (FDI) on China's aggregate output in terms of real gross domestic product. Assuming a causal relationship between these factors and output, the empirical results estimated by ordinary least square regressions reveals that China's real gross domestic product (GDP) is significantly affected by domestic capital, employment and inflow of foreign direct investments. The estimated real GDP-domestic capital elasticity is 0.145 , and the real GDP-employment elasticity is 2.81. The estimated real export-FDI elasticity is 0.45, the rate of growth of real GNP-exports elasticity is .57, and the rate of growth of real GNP-FDI elasticity is 0.266. These elasticities imply that when domestic capital changes by 1 percent, China's real GDP changes in the same direction by 0.14 percent and as employment changes by 1 percent, real GDP changes in the same direction by 2.8 percent. The impact of foreign direct investment on real GDP without contributions from other variables indicates a GDP-foreign direct investment elasticity of 0.27. The significant relationship between China's output and these factors supports the neoclassical theory of economic growth. These relationships imply that China's probable membership in the World Trade Organization (WTO) along with her recent permanent classification under most favored nation (MFN) status with the United States enhances China's openness to external trade and increases inflows of foreign direct investment in China, thus, fostering higher economic growth for the country.

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Chapter I

I.1 Introduction

During the last two decades China sustained double digit economic growth mainly due to its openness to world markets, specifically resulting from its exports of labor intensive products. During the same period, foreign direct investment (FDI) in China increased such that China became the second largest FDI recipient in the world and the largest in East Asia (World Investment Report (WIR), 1998a). Theories of economic development predict a positive relationship between economic development in terms of economic growth (measured by the growth rate of GDP) and openness to international trade via imports and exports (Michaely, 1977; Krueger, 1978; Tyler, 1981; Kavoussi, 1984; Feder, 1985; Balassa, 1985; Mbaku, 1989; Moschos, 1989; Salvatore and Hatch, 1991; Yaghmaian, 1994).

During the last quarter of the past century many developing countries including several East Asian countries improved their economic growth by resorting to market economy activities through linkages with transnational corporations (TNCs). These linkages increased the inflow of capital, technology, financial services and managerial services into those economies. In fact, foreign investment rather than domestic savings allowed those countries to produce their products of comparative advantage for exports which ultimately have financed much of the economic development in those countries.

I.2 Background

Lack of external investment funds in developing countries constrains their economic development to the limits of their domestic savings. Inadequate production technologies, unskilled labor force and absence of modern management limits the

production possibilities to a handful of low value-added labor intensive goods. Low value added production provides low wages and hence low income. High rates of population growth accompanied by low income drains most income revenues into consumption rather than savings and investment opportunities. Thus developing countries are in need of foreign investments to fill the gap between domestic savings and required investment for a healthy rate of economic progress.

There are four main sources of foreign capital. Generally foreign capital can be obtained through foreign governmental non-refundable aid (FGNA), foreign commercial borrowing (FCB) where governments or institutions in developing countries borrow from foreign commercial banks, financial portfolio investment (FPI) when foreign investors invest in a developing country's bonds and other financial assets, or through foreign direct investment (FDI).

The 1998 World Investment Report (p.14) defines foreign direct investment as "an investment involving a long-term relationship and reflecting a lasting interest and control of a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate). Foreign direct investment implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates, both incorporated and unincorporated. Foreign direct investment may be undertaken by individuals as well as business entities."

The FGNA form of foreign capital is the least effective (productive) type of capital for improving a country's economic condition. FGNA usually involves capital used to produce consumption goods and services rather than production goods. Examples include water pumps, bridges etc. Funds obtained through FCB are loans with interest expenses to be paid over the life of the loan. Due to the lack of technical ability and accumulation of interest payments along with mismanagement of these loans through corruption and misallocation, this form of foreign capital has not been able to help economic development in many developing countries. The financial leverage that is accompanied by these types of loans increases volatility creating a more unstable environment which is detrimental to economic development. Some obvious examples include the debt crisis associated with less developed countries such as Mexico and others.

The inflow of FPI into a developing country is very hard due to inadequate financial infrastructure and reliable banking centers. Compared to all these alternatives, FDI has been the most important source of investment funds for developing countries. Supply of FPI to developing countries is more volatile than FDI, since unlike FDI, it is attracted not so much by the prospect for long-term growth (return) as by the prospect for immediate gains. In contrast, FDI helps to import foreign technology, foreign research and development, managerial skills, and it does not involve payments of interest expenses. TNCs are normally more interested in longer term profits from the production of goods and services, while portfolio investors are normally more interested in quick

financial returns on their investments (WIR, 1998b). Most importantly FDI provides a positive and less risky image for further investment in host countries.

Over the past two decades China has enjoyed consistent growth in FDI inflows. In recent years China has gained and maintained the position of second largest recipient of FDI inflows in the world and the single largest among developing countries (WIR, 1998b). However, although during the last six years China has had the largest part of its FDI boom, the financial crisis in Asia has negatively impacted the flow of FDI to China. Chinese FDI inflows have been increasing substantially each year but that growth rate has declined in the past few years. This decline may be due to any number of factors. China has had a decline in its level of economic growth, which tends to have a positive correlation with FDI. Gross Domestic Product (GDP) projections for China call for a further slow down. China may also be faced with an excess of FDI capacity, especially in its eastern coastal areas in which FDI has been concentrated historically (WIR, 1998b).

TNCs have reduced their FDI in China due to China's higher wages, reduction in exports due to barriers and devaluation of the currencies of China's competitors after the East Asian crisis, the economic crisis in East Asian countries who used to supply FDI to China, and the lack of infrastructure in China's interior. These factors will mainly affect short and medium-term Chinese FDI inflows. In the long run China can be expected to remain an attractive recipient for FDI and should continue to have high FDI growth rates compared to regional and international rates (WIR, 1998b).

FDI has been a very important source of capital for growth in China but FDI does more than provide countries with needed capital. FDI also provides more linkages with

the outside world. Since the end of the Cultural Revolution and the implementation of China's "Open Door" policy, FDI has been a major factor in the further opening and liberalization of China's economic policies. Through the provision of linkages with the outside world, the increase in FDI in China has led to increases in exports which has fueled economic growth in China.

I.3 Theory and Empirical Testing On Economic Growth and Openness

Openness of any country may be defined or measured in terms of its trade activities in international markets through the exports and import of goods, services and financial assets. Many empirical studies attempted to test the relationship between different measures of openness and economic growth. The results of these empirical tests are mixed and currently there is no consensus regarding such a relationship. Two major methodologies are employed for discovering the relationship between growth and openness: reduced forms of production approach (Michaely, 1977; Krueger, 1978; Tyler, 1981; Kavoussi, 1984; Feder, 1985; Balassa, 1985; Mbaku, 1989; Moschos, 1989; Salvatore and Hatch, 1991; Yaghmaian, 1994) and direct causal relationship between GDP growth and exports or imports (Jung and Marshall, 1985; Chow, 1987; Kunst and Marin, 1989; Sheehey, 1990; Bahmani-Oskooee et al., 1991; Bahmani-Oskooee and Alse, 1993; Dodaro, 1991, 1993; Sharma and Dhakal, 1994; Serletis, 1992; Shartey, 1993; Gordon and Sakyi-Bekoe, 1993; Arnade and Vasavada, 1995; Abhayaratne, 1996; Doraisami, 1996).

The reduced form production function seeks to measure the impacts of productive inputs such as domestic capital, labor, and material on GDP, while the direct causal

relationship approach measures relationships between GDP and production inputs as well as exports and imports. Researchers seldom incorporate the impacts of foreign capital in terms of FDI on GDP growth.

I.4 Objectives

Currently there is no empirical consensus among economic researchers regarding the relationship between trade variables (exports and imports) and economic growth (growth rate of GDP) (Krueger ,1985; Feinberg, 1989; Li, 1994; Sharma and Dhakal 1994; Arnade, 1995; JinJun, 1995; Hasan, 1996). This study attempts to examine the relationship between economic development and export promotions led by foreign direct investment in China. Almost all previous studies have not considered FDI as a factor affecting economic growth. Compared to previous studies, which focused entirely on exports and imports, this study focuses on exports, imports and FDI and hypothesizes that economic growth in China has been affected through openness to trade led by FDI.

I.5 Methodology

This study employs simple correlation and ordinary least square (OLS) regression analysis to test the relationship between China's economic growth and its inputs of capital, labor, exports, imports and inflow of FDI.

I.6 Organization of This Study

The remainder of this study is organized as follow: Chapter II reviews theory and the empirical models of economic growth. Chapter III provides an overview of China's economy. Chapter IV describes a conceptual model for measuring the impacts of economic variables on China's economic growth and explains the data sources used in

the study. Chapter V analyzes the empirical results and Chapter VI provides conclusions and suggestions for future research.

Chapter II

FACTORS AFFECTING ECONOMIC GROWTH: LITERATURE REVIEW[1]

II.1 Review of Modern Growth Theory

Basic ingredients of modern theories of economic growth are provided by the neoclassical economists' view of macroeconomic formulation of national aggregate production function. From the neoclassical economist's point of view two distinct models emerge. First is the structural aggregate two gap model (saving-gap, trade-gap), which relates growth of a nation's gross national product (GNP) or growth of the non-export portion of its GNP to the foreign inflow of capital and exports. Second are the production models which link the growth rate of goods and services produced in the export sector (X) and non-export sector (N) to productive inputs of labor, capital, research and development expenditures (R & D), and other primary inputs. Thus growth in GNP is related to the growth rates of inputs including exports.

II.1.1 Aggregate Macroeconomic Models

The aggregate macroeconomic models are associated with Chenery and Bruno (1962), Chenery and Strout (1966), McKinnon (1964), Maizeles, Boross and Rayment (1968), Williamson (1978), and Fajana (1979). The following section briefly describes the structure of an aggregate macroeconomic two-gap model known as the savings gap-trade gap model. These models are based on the argument that the growth of exports and foreign capital reduces the foreign exchange constraint, thereby facilitating imports of capital goods and faster growth.

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[1] This Chapter is heavily drawn from Emami, A., Cornelius, J. and Zhang, J., "Determinants of Economic Growth in China" Working Paper, Department f Finance, Lundquist College of Business, University of Oregon. March 2000.

II.1.1a Savings-gap, Trade-gap Models

The aggregate economy may be represented by the following four national accounting identities:

(1) $Y+M \equiv C+I+G+X$,

(2) $C+S \equiv Y$,

(3) $I \equiv S+F$,

(4) $X+F \equiv M$.

Where, Y = gross national product (GNP), C= private consumption, I = gross domestic investment, G= government expenditures, S=gross domestic saving, X=exports of goods and services, M=imports of goods and services, F= net inflow of foreign capital.

Equations (1) and (2) yield:

(5) $I - S \equiv M-X$

Equation (5) implies that the difference between domestic investments and savings ("savings-gap") is equal to the difference between imports and exports ("trade-gap"). Equations (3) and (4) reveal that both savings-gap and trade-gap are equal to net inflow of foreign capital, F. Equation (4) implies that $M-X \equiv F$, that is, borrowing amount F (i.e., capital inflow of F) will allow imports to exceed exports.

Following Maizeles, Boross and Rayment (1968, p. 52),

> "Thus, the foreign capital inflow into a capital-importing country plays a dual role: it fills the gap between the imports the country requires for its development and the earnings it derives from its

exports and at the same time it supplements the supply of domestic savings in financing the required level of investment."

According to Chenery and Strout (1966), the two *ex ante* financing gaps are generated when the national planning authorities set a target growth rate for a country. In the Chenery-Strout model, the savings-gap (where the demand for investment (I) is in excess of the supply of savings (S)) is generated due to constraints imposed on investment by the supply of domestic savings (i.e., not enough savings to support domestic investment). The trade-gap exists because of the limits set on imports and net borrowing. These constraints, along with constraints on the supply of skilled labor limit economic growth.

Two forces may impact the amount saved domestically and hence generate the savings-gap. First, savings is a function of real income, thus income affects the amount saved. Second, the amount of investment is affected by the growth in real output through changes in the capital-output ratio. Exports are determined exogenously by foreign income. Thus the trade-gap (M-X) is solely generated via changes in the imports of capital goods and consumption goods and services. The imports of capital goods are used as capital input in production of capital goods which increases investment and hence economic growth. Functionally, imports are determined by income growth.

A computable growth model emerges from the model described above. Assume that production of one additional unit of output requires σ units of capital investment (I_t). Let Q_t be the GDP at time t and assume the rate of growth in GDP is equal to r. Then, at

rate r total change in GDP is r Q_t. The capital investment (I_t) needed to produce rQ_t is: $I = \sigma r Q_t$. Thus, at time (t) the GDP (Q_t) is related to investment as follows:

$$(6) \qquad Q_t = I_t/(\sigma r)$$

Assume that both exports (X_t) and net capital inflows (F_t) are exogenously determined and these two jointly determine the level of imports (M_t):

$$(7) \qquad M_t = X_t + F_t$$

Assume that total imports (M_t) consist of imports of goods for consumption (M^C_t) and imports of capital goods for investment (M^I_t). Then we have,

$$(8) \qquad M^c_t = M_t - M^I_t$$

Assume that imports of capital goods, M^I_t, vary with the capacity to import, which is set by sum of the earnings from exports and net foreign capital inflow at time (t-1), that is:

$$(9) \qquad M^I_t = \beta + \gamma (X_{t-1} + F_{t-1})$$

Assume that domestic investment (I_t) is determined by the quantity of imports of capital goods (M^I_t) as follows:

$$(10) \qquad I_t = \delta + \lambda M^I_t = (\delta + \beta \lambda) + \gamma \lambda (X_{t-1} + F_{t-1}).$$

Substituting (10) in (6) we have,

$$(11) \qquad Q_t = (1/(\sigma r))(\delta + \lambda M^I_t) = (\delta + \beta \lambda) + \gamma \lambda (X_{t-1} + F_{t-1}).$$

From (11) the relationship between the growth rate of GDP (r) and one year lagged values of exports and net foreign capital inflow can be stated as:

$$(12) \qquad r = [1/(\sigma Q_t)] [(\delta + \beta \lambda) + \gamma \lambda (X_{t-1} + F_{t-1})].$$

Equation (12) reveals the functional relationship between growth rate, and exports and foreign capital inflows as a proportion of total GDP. Collecting constant terms, (12) simplifies to:

$$(13) \quad r = A\,Q_t + B\,(X_{t-1}/Q_t) + C\,(F_{t-1}/Q_t).$$

Empirical estimation of (13) creates multicolliniarity problems since each independent variable on the right hand side is divided by the same variable Q_t, hence the linear relationship among them. One way to get around this problem is to redefine (13) for empirical purposes. For example,

$$(14) \quad r = a + b\,(X_{t-1}/Q_t) + c\,F_{t-1},$$

$$(15) \quad r = a + b\,X_{t-1} + c\,F_{t-1},$$ or in terms of growth rates of independent variables:

$$(16) \quad r = a + b\,x_{t-1} + c\,f_{t-1},$$ where lower case variables indicate rate of growth of that variable.

In summary, the main hypothesis underlying the model described above is that in many developing countries, the major constraint on economic growth is the lack of enough foreign earnings from exports (X) and capital inflow (F) to finance imports of capital goods (M^I_t) necessary for increasing economic growth.

Many economists estimated modified versions of equations (14), (15), and (16) to test the validity of relationship between growth and export. Among others, Emery (1967) tested the relation between per capita real GNP and exports and concluded that "higher rates of economic growth tend to be associated with higher rates of export growth." (P. 483). Michaely (1977) advanced the argument that exports are part of national products,

therefore a prior autocorrelation in regressing GNP against exports exist. He proposes to run growth in GNP against the growth of export proportion in national product, that is to test:

$$(17) \quad r = a + b\ [\text{growth of } (X/GNP)].$$

Heller and Porter (1977), criticized Michaely's argument based on the grounds that there exist a linear relation between GNP growth rate and (X/GNP) as follow: the GNP (Y) of any nation is given as $Y = C + G + I + X - M$. Let H represents the final demand in the nation ($H = C + G + I$) and P indicates the population, then

$$(18) \quad Y = H + X$$

In per capita term,

$$Y/P = (H/P) + (X/P)$$

$$\log (Y/P) = \log [(H/P) + (X/P)]$$

$$\log Y - \log P = \log [(H/P) + (X/P)]$$

$$(19) \quad d\log Y - d\log P = d \log [(H/P) + (X/P)]$$

we know that:

$$d\log Y = dY/Y = \% \Delta \text{ in } Y = \text{growth rate of } Y = y$$

$$d\log P = dP/P = \% \Delta \text{ in } P = \text{growth rate of } P = p$$

$$d\log H = dH/H = \% \Delta \text{ in } H = \text{growth rate of } H = h$$

$$d\log X = dX/X = \% \Delta \text{ in } X = \text{growth rate of } X = x.$$

Substituting rate of growth of variables in (19), we have:

$$y - p = d \log [(H/P) + (X/P)] = d \log[(H+X)/P] = d\,(H+X)/[(H+X)/P]$$

$$y - p = (1 - X/Y)(h - p) + (X/Y)(x - p)$$

where,

(y-p) = rate of growth of per capita output

(x-p) = rate of growth of per capita exports

(h-p) = rate of growth of per capita total demand

(20) $y-p = (h-p) + ([X/Y]/[1-(X/Y)])\ (x-y)$,

where (x-y) is the growth rate of the share of exports in the national product. Equation (20) reveals the linear relation between the growth rate of per capita output (y-p) and the growth rate of the share of exports in national product (x-y). Heller and Porter suggest that the appropriate test is to find out whether there is any relation between the growth rate of exports (x-p) and the growth rate of the nonexport components of output (h-p). Their research indicates strong relation between growth rate of total demand and the growth rate of exports. Balassa (1978), estimated the Spearman rank correlation coefficients between exports and GNP growth in eleven selected developing countries over 1960-1973 period for the following regression specifications:

1. Export growth vs. the growth of GNP.
2. Export growth vs. the growth of GNP net of exports.
3. Incremental export-output ratios vs. the growth rate of GNP.
4. Incremental export-output ratios vs. the growth rate of GNP net of exports.
5. Increments in export-output ratios vs. the growth rate of GNP.
6. The average ratio of exports to GNP vs. the growth of GNP.

He found that correlation for export growth vs. the growth of GNP was the strongest. Also, similar to Michalopoulos and Jay (1973), Balassa estimated the relation between GNP and production inputs such as K_D (the average difference between gross fixed capital formation and current account balance), K_F (average current account balance during the period), L (labor force), current dollar value of exports (X), purchasing power value of exports (PPX) calculated by deflating current value of exports (X) by the index of unit values of manufactured exports of developed countries, incremental export-GNP ratio (IXR) calculated by finding the ratio of the absolute change in export levels to absolute change in the GNP (unlike export growth rates, which are sensitive to the choice of the initial base year, IXR is independent from the choice of initial base year). The GNP and L were calculated each as the absolute change between the initial and the terminal year divided by the initial year values. His empirical results suggest that:

- a one percent increase in the rate of growth of exports is related to 0.04 percent increase in the rate of growth of GNP.
- a one percent increase in the rate of growth of foreign capital is related to 0.12 percent increase in the rate of growth of GNP.
- a one percent increase in the rate of growth of labor force is related to 0.60 percent increase in the rate of growth of GNP.
- a one percent increase in the rate of growth of domestic capital is related to 0.24 percent increase in the rate of growth of GNP.

Other studies estimating- the linkage between exports and economic growth include: Edwards (1993), which utilizes export growth to measure openness in trade. He

correlates this measure with per capita income growth rates to test the linkage between exports and economic growth. Chow (1987) utilizing Sims' (1972) causality test, found strong causal relationship from exports to income growth. Feder (1982), and Ram (1987) used regression methods to explain income growth rates in terms of export growth.

Serletis (1992) employed the following equation for testing the relationship between export (X), imports (M) and GNP in Canada.

$$(21) \quad \log (GNP) = a + b \log (X) + c \log (M),$$

the result of Serletis study indicates strong causality from export to GNP but not from imports. Also, this study found that imports did not depended on exports since the advanced stage of economic development in Canada attracted capital inflows, which in turn supported imports.

Xue Jinjun (1995) calculated the correlation coefficients between China's GNP growth and exports growth for period of 1980-1994. According to Jinjun's study, export growth rate made a great contribution to China's GNP growth rate with an average coefficient of correlation of 1.25, while imports' growth rate contribution was much lower, 0.54.

II.I.2 Neoclassical Aggregate Production Function Growth Accounting Models

Another approach to testing the relationship between output growth and export growth is based on the neoclassical aggregate production function. Following Solow (1957) and other researchers discussed in Griliches (1994), the growth rate of aggregate output could be decomposed into contributions from growth of production inputs such as labor, capital and technology. Assume the following neoclassical production function:

$$(22) \quad Y(t) = A(t) \,.\, F[K(t), L(t)],$$

where A(t) is an index of the level technology, called *total factor productivity* or TFP. The rate of growth of output is calculated by taking time derivatives of both side of (22)

$$(23) \quad [\partial Y(t))/\,\partial t]dt = ([\partial A(t))/\partial t]dt)$$

$$F+A.[(\partial F/\partial K).(\partial K/\partial t)dt]+A.[(\partial F/\partial L).(\partial L/\partial t)\,dt].$$

$$(24) \quad [\partial Y(t)/\,\partial t] = [\partial A(t))/\partial t] \,.\, F + A \,.\, [F_K \,.(\partial K/\partial t) + A \,.\, [F_L \,.(\partial L/\partial t)]$$

Let:

y = growth of output = $\partial Y(t)/\,\partial t$, and (y/Y) = rate of growth of output,

a= growth of technology = $\partial\,(A(t))/\partial t$, and (a/A) = rate of growth of technology,

F_K = marginal productivity of capital = $\partial F/\partial K$

F_L = marginal productivity of labor = $\partial F/\partial L$

k= growth of capital = $\partial K/\partial t$, and k/K = rate of growth of capital,

l= growth of labor = $\partial L/\partial t$, and *l*/L = rate of growth of labor,

Dividing both sides of (24) by Y, we have:

$$(25) \quad y/Y = a/A + (A \,.\, F_K \,.\, k)/Y + (A \,.\, F_L \,.\, l)/Y,$$

Multiplying the second and third term on the right hand side of (25) by K/K, and L/L respectively yields:

$$(26) \quad y/Y = a/A + [(A \,.\, F_K \,.\, K)/Y]\,(k/K) + [\,(A \,.\, F_L \,.\, L)/Y]\,(\,l/L).$$

Under the assumption of constant return to scale, the sum of the capital share of output $((A.F_K \,.\, K)/Y)$ and the labor share of output $(\,(A.F_L \,.\, L)/Y)$ equals unity. That is, if $\alpha(t)$ is the capital share, then equation (26) may be written as:

$$(27) \quad r_{GDP} = r_{Tech} + \alpha(t)\, r_K + [1 - \alpha(t)] \,.\, r_L.$$

Where, r_{GDP} = rate of growth of output (GDP), r_{Tech} = growth rate of total factor productivity (TFP), r_K = rate of growth of capital, and r_L= rate of growth of labor. Assuming that we have data on the quantities of Y, K, and L and on factor (K, L) prices wage (W) and rental rate on capital (R), then we can compute $\alpha(t)$ and $1 - \alpha(t)$, as well the growth rates, y/Y, k/K, and l/L. The growth rate of technology or total factor productivity growth rate (TFP=(a/A)) may be estimated indirectly from equation (27) as:

$$(28) \quad r_{Tech} = r_{GDP} - \alpha(t)\, r_K - [1 - \alpha(t)] \,.\, r_L,$$

or it may be estimated directly as the constant term of the regression equation (27).

One may modify equation (27) to incorporate foreign direct investment by decomposing capital into domestic capital K^D and foreign capital K^F, with prices of R^D and R^F and growth rates of r^F_K and r^D_K respectively. Then, rate of growth of output can be written as:

$$(29) \quad r_{GDP} = r_{Tech} + \alpha^D(t)\, r^D_K + \alpha^F(t) \,.\, r^F_K + \alpha^L(t)\, r_L\,,$$

where, $\alpha^D(t)$, $\alpha^F(t)$, and α^L are domestic capital, foreign capital and labor share of output respectively.

Empirical work on the relationship between rate of growth of output and rate of growth of inputs and exports has been carried out by many researchers. Among others, Balassa (1978), Kavoussi (1984), Ram (1987) and Esfahani (1991) supported that capital, labor and exports significantly affected economic growth.

II.1.3 New Growth Theory: Increasing Return to scale (IRS) Models

The modern version of neoclassical growth theory or "new growth theory" is associated with and Romer (1986), Grossman and Helpman (1990), and Lucas (1988). This theory emphasizes the important role of increasing return to scale (IRS) in the production of technology-intensive products and the dynamic spillover effects of growth of the export sector, which diffuses modern technology across other sectors and industries. According to this theory, openness to trade increases economic growth via the externality effects of the export (Technology and R&D intensive) sector on the non-export sector.

This approach follows the economic base theory in which the economy is divided into two sectors of exports (base) sector and non-exports (non-base) sector. The major assumption is that since the exports sector competes in a large, more competitive market it has more efficient management and production technology, hence it generates positive externalities and spills over to the non-exports sector. This assumption implies that the export sector is more productive than the non-exports sector. Feder (1983) formulated the following model:

Let X and N denote production functions of exports and non-exports sectors respectively. The production functions are:

$$(30) \qquad N = F(K^N, L^N, X)$$

$$(31) \quad X = G(K^x, L^x)$$

where K^i, and L^i are capital and labor utilized in the production of the i (i=N, X) sector. The assumption of productivity differential between two sectors implies:

$$(32) \quad (G_K/F_K) = (G_L/F_L) = 1+\delta$$

where G_K (F_K) is marginal productivity of capital in sector X (N), and G_L (F_L) is marginal productivity of labor in sector X (N). Here, δ measures the productivity differential. The positive externality of exports sector on non-exports sector is presented by marginal productivity of exports (F_X). If exports do not affect N, then F_X=0.

Total GDP (Q) is given by:

$$(33) \quad Q = N+X.$$

Assuming that the marginal productivity of labor is equal to β (Q/L), where β is a constant, Feder (1983) derives the rate of growth of output as follows:

$$(34) \quad q/Q = \alpha (I/Q) + \beta (l/L) + [F_X + (\delta/(1+\delta))]X/Q)(x/X),$$

where,

q = growth of GDP = $\partial Q(t)/ \partial t$, and (q/Q) = rate of growth of GDP,

$\alpha = [\partial Q(t)/ \partial K] = F_K$,

I/Q = investment ratio,

l= growth of labor = $\partial L/\partial t$, and l/L = rate of growth of labor,

x = growth of exports = $\partial X(t)/ \partial t$, and (x/X) = rate of growth of exports,

F_X = export related externality on GDP.

Note that in the absence of productivity differentials, (i.e. $\delta=0$) and export externality effect (i.e. $F_X = 0$), the last term in equation (34) drops and equation (34) reduces to a standard neoclassical growth model described in previous section, equation (27).

II.1.4 Extensions of New Growth Theory

Sengupta (1991) pointed out two basic limitations associated with the new growth theory models mentioned above:

> "These methods however have two basic limitations from an economic viewpoint. One is that they do not refer to the structural forces like resource reallocation between sectors and the productivity improvements that must accompany the dynamic process of income growth. Second, they fail to capture the dynamic characteristics of the disequilibrium process, [Benassy, 1982] underlying rapid economic growth. ... If D and S denote aggregate demand and supply of national output, which of the two disequilibriating pressures: excess demand (ΔD-ΔS) or, excess supply (ΔS-ΔD) has played a prominent role in the dynamic process? This question is closely related to the theory underlying the two gap models [Fox, Sengupta and Torbecke, 1973); Bacha, 1984], which emphasizes inadequate savings and insufficient foreign exchange as the limiting constraints on augmenting the LDC growth rate to a substantially higher rate." (Sengupta, 1991, pp. 562-3)

Sengupta (1991) measures the externality effect of the base (export) sector on non-base sector by a simple two sector model which considers the structural change and dynamic growth process for Korea and other newly industrialized countries (NICs). Here, a modified version of such model is presented as follows:[2]

Consider a country that produces two outputs, X (for base sector (exports)), and N (for all other non-export sectors) produced by two inputs labor (L) and capital ($K=K^D+K^F$). Where, K^D stands for domestic capital and K^F stands for capital associated with inward foreign direct investments in the country. Equations (35) and (36) shows the production functions for each sector with the assumption that each production function is affected by production activities in other sector.

$$(35) \quad X = X(L_X, K_X^D, K_N^F, N)$$

$$(36) \quad N = N(L_N, K_N^D, K_N^F, X)$$

$$(37) \quad L = L_X + L_N;\ K = K_X + K_N;\ K_X = K_X^D + K_X^F;\ K_N = K_N^D + K_N^F$$

$$(38) \quad Q = X + N$$

Where, L_i and K_i (i= X, N) denotes labor and capital in X and N respectively. Q represents total output. K_i^D and K_i^F represents capital in production of sector i (i=X and N) acquired from domestic and foreign direct investment respectively. The growth of production in each sector is,

$$(39) \quad x = X_L \cdot l_X + X_D \cdot k_X^D + X_F \cdot k_X^F + X_N \cdot n$$

$$(40) \quad n = N_L \cdot l_N + N_D \cdot k_N^D + N_F \cdot k_N^F + N_X \cdot x$$

---

[2]Sengupta assumes that the capital is domestic capital and not the capital in the forms of foreign direct investment. However, it is more realistic to allow for the possibility of foreign direct investment as long as the country is open to external trade.

where, X_L, X_D, X_F, and X_N respectively denote the marginal productivities of labor, domestic capital, foreign capital and non-export sector in the production of export sector, and N_L, N_D, N_F, and N_X respectively denotes the marginal productivities of labor, domestic capital, foreign capital, and export sector in the production of the non-export sector. The variables in lower case indicate the time derivative (growth) of the same variables in upper case. So, l_X, k_X^D, k_X^F respectively represent the growth of labor, domestic capital, and foreign capital in export sector, and l_N, k_N^D, k_N^F respectively represent the growth of labor, domestic capital, and foreign capital in non-base (non-export) sector. Growth of sector N and X are presented by n and x respectively. The externality of the export sector on the non-export sector may be estimated by a sectoral dominance ratio (SDR), a static export externality coefficient (SEEC), or a dynamic export externality coefficient (DEEC) all described below.

II.1.4a Sectoral Dominance Ratio (SDR)

Since N_X represents the externality of the export sector on the non-export sector, and X_N represents the externality of non-export sector on the export sector, then the empirical estimates of N_X and X_N can be used to form a sectoral dominance ratio (SDR) as N_X/X_N to measure the dominance of one sector over the other sector. If this ratio is greater than one then the export sector dominates the non-export sector and vice versa.

II.1.4b Static Export Externality Coefficient (SEEC)

When we include export sector X in the production function of N in equation (36), $N=(L_N,K_N^D,K_N^F,X)$, to represent the technical progress, then the externality effect of the export sector X on the aggregate production of the region may be measured by X's static diffusion effect on the aggregate production Q and its growth q as follows:

(41) $Q = Q(K^D, K^F, L, X)$

(42) $q = Q_D \cdot k^D + Q_F \cdot k^F + Q_L \cdot l + Q_X \cdot x,$

where, Q_X denotes the static export externality coefficient (SEEC), Q_D, Q_F, Q_L represent the marginal productivities of domestic capital, foreign capital, and labor in the aggregate production, k^D, k^F and l represent the growth of domestic capital, foreign capital and labor. The dominance effect of the export sector can be measured by ratios: Q_X/Q_D, Q_X/Q_F, Q_X/Q_L, or $Q_B/(Q_D+Q_F)$. These ratios measure the dominant effects of the export sector as the leading sector in the diffusion of technological and managerial innovations and improving economic growth.

II.1.4c Dynamic Export Externality Coefficient (DEEC)

The dynamic effects of export externality on country's total production can be measured by incorporating the combined effects of export share and export growth on the aggregate growth rate of production. To calculate this coefficient (DEEC), equation (42) may be reformulated as follows:

(43) $q/Q = (Q_D).(k^D/Q)+(Q_F).(k^F/Q)+(Q_L).(l/Q)+(Q_X.x)/Q$

Multiply and divide the numerator of the last term on the right hand side of (43) by X.Q, and let α, β and δ represent Q_D, Q_F, and Q_L respectively. Then,

(44) $q/Q = \alpha\,(k^D/Q) + \beta\,(k^F/Q) + \delta\,(l/Q) + [Y_B.x.X.Q/(X.Q)]/Q$

let X_{gs} denote the product of export growth (x) and export share (X/Q), i.e., $X_{gs} = (x.X/Q)$, and let the average unit contribution of X to Q, $(Q_X.Q/X)$, to be represented by λ, then

(45) $q/Q = \alpha\,(k^D/Q) + \beta\,(k^F/Q) + \delta\,(l/Q) + \lambda\,(X_{gs}/Q)$

The estimate of λ represents the magnitude of the dynamic export externality coefficient (DEEC).

II.2 Summary of Models

In summary, according to the theory of economic growth, the following empirical models have been advanced (Table 1).

Table 1

Equation Number	Equation
14	$r_{GNP} = a + b\ (X_{t-1}/Q_t) + c\ F_{t-1}$
15	$r_{GNP} = a + b\ X_{t-1} + c\ F_{t-1}$
16	$r_{GNP} = a + b\ x_{t-1} + c\ f_{t-1},$
17	$r_{GNP} = a + b$ [growth of (X/GNP)]
21	$\log (GNP) = a + b \log (X) + c \log (M)$
27	$r_{GDP} = a(r_{Tech}) + b(\alpha(t)\ r_{K}) + c([1 - \alpha(t)]\ .\ r_{L.})$
29	$r_{GDP} = a(r_{Tech}) + b(\alpha^{D}(t)\ r^{D}_{K}) + c(\alpha^{F}(t)\ .r^{F}_{K}) + d(\alpha^{L}(t)\ r_{L})$
34	$r_{GDP} = \alpha\ (I/Q) + \beta\ (l/L) + [F_X + (\delta/(1+\delta))]X/Q)(x/X)$
42	$q = Q_D\ .k^{D} + Q_F\ .\ k^{F} + Q_L\ .\ l + Q_X\ .\ x$
45	$r_{GDP} = \alpha\ (k^{D}/Q) + \beta\ (k^{F}/Q) + \delta\ (l/Q) + \lambda\ (X_{gs}/Q)$

Chapter III

OVERVIEW OF CHINA'S ECONOMY

III.1 National Output and Trade

Since 1976, there have been significant changes in China's agriculture, education and population policy. Just two years after Mao's death (September 9, 1976), his successor, Deng Xiaoping, announced free-market reforms that have slowly been expanded, including the opening of the country to foreign investment. The reforms began in 1979 when Deng Xiaoping and the rest of the new Chinese leadership passed a series of laws promoting their open door policy. A Sino-Foreign ventures law was passed just before the first Special Economic Zone (SEZ) was created in the east coast provinces of Guangdong and Fujian. Since then foreign investment has had a relative boom and current analysts predict even greater increases.

Going much further than merely importing technology from the West, new ways of thinking are being brought into China as students are returning having been sent abroad to the United States and Europe to study the sciences as well as business management. The government now stresses "the *economic* role of education and priority is placed on the training of a scientific and technological elite in selective colleges and universities" (Bailey, 1988). Nearly every Chinese province contains at least one or two universities of technologies adding to the ever-growing external and internal diversification of the provinces.

International trade has been a major contributor to this new provincial diversification and new provincial wealth. Growth has occurred with the permission of the central government but not under its close supervision, and the direction of growth

has been centrifugal. "The central government could not regain control it had just a decade ago without severe economic consequences; indeed, some worry that the central government is in danger of losing its general regulative capacity, and that the centrifugal effects of diversification might lead to national disorder. Such concerns are heightened by the Soviet Union's downfall" (Womack, 1994). As a result of these tendencies officials have attempted to take regulatory action at the central government in order to slow the dizzying pace of growth and inflation. Most of these regulatory actions have come in the form of slowing the removal of restrictions on investment and trade. The expedient nature with which the Soviet Union jumped on to the capitalist train and its subsequent downfall has allowed Chinese officials to keep the volume of trade and investment concessions fairly controlled. During the 1990's, however, China has made giant leaps into the international scene.

Compared to other neighboring countries, China sustained a low initial GDP per capita and GDP per worker up until its opening to international markets in 1979 with a real GDP just under 700 billion yuan (see Appendix I Table 1). Some economists argue that China's low economic growth in the 1980's was partially due to China's low degree of openness to international markets. While other variables such as investment and schooling are the dominant determinants in most of its neighboring countries, some economists believe that the "unexplained component" resulting in China's large positive growth can be explained by China's initial low GDP (the natural state of "catch-up") (Frankel, Romer and Cyrus, 1996). This observation, however, does not explain the causal factors that continue to lead China's rapid "catch-up" rate.

Over the first decade after the passing and initial implementation of the so-called "Open-door" legislation, China enjoyed tremendous economic growth. Figure 1 depicts China's growth rates of real GNP and GDP over 1979-1997. Gross Domestic Product (GDP) grew from 699.7 billion yuan to 3,849.9 billion yuan and Gross National Product (GNP) grew five times its 1979 amount starting at 685.2 billion yuan and climbing to 3717.2 billion yuan in 1990 (see Figures 1 and 2, and Appendix I Table 1). The economic growth rates regarding these two indicators over the 1979-1990 time period were large and also relatively constant, as were the growth rates of other economic indicators. For example, as it is shown in figure 6, real exports grew by a factor of 21 from 363.7 billion yuan to 7668.4 billion yuan and China's real imports grew by a factor of 14.3 over the same time period, from 417.4 billion yuan to 5974.6 billion yuan (see Figures 6 and Appendix I Table 1). China's massive export and import growth rates post 1979 relative to its neighbors are not too shocking considering the huge increase in China's degree of relative openness to pre-1979 legislation and neighboring countries.

Recognizing the significant economic impact of its 1979-1981 trade legislation and regulations the Chinese government began passing new legislation between 1990 and 1993 pushing in both directions. This occurred in conjunction with China's application to GATT (General Agreement to Tariffs and Trade, now known as the World Trade Organization (WTO)). On one hand the government recognized its own lack of control over its country's growth as well as the necessity of a legal

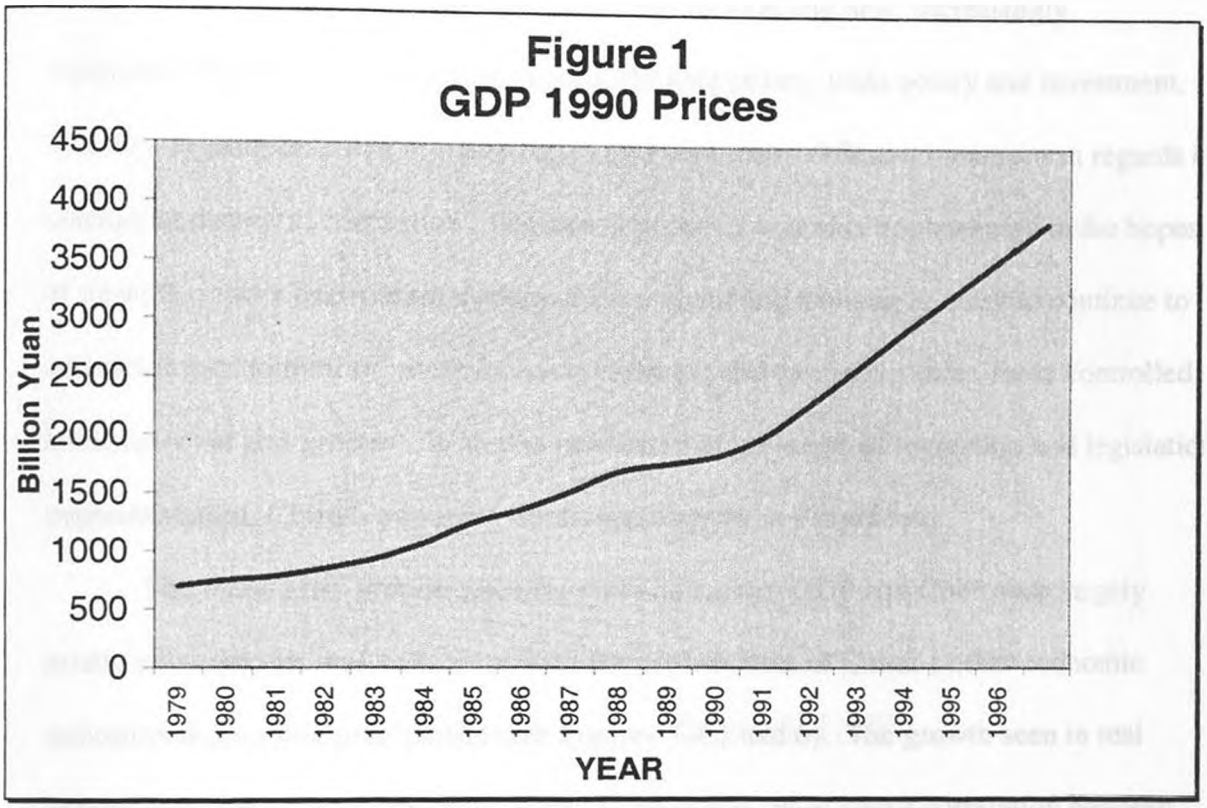


Figure 1
GDP 1990 Prices
Billion Yuan
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
YEAR

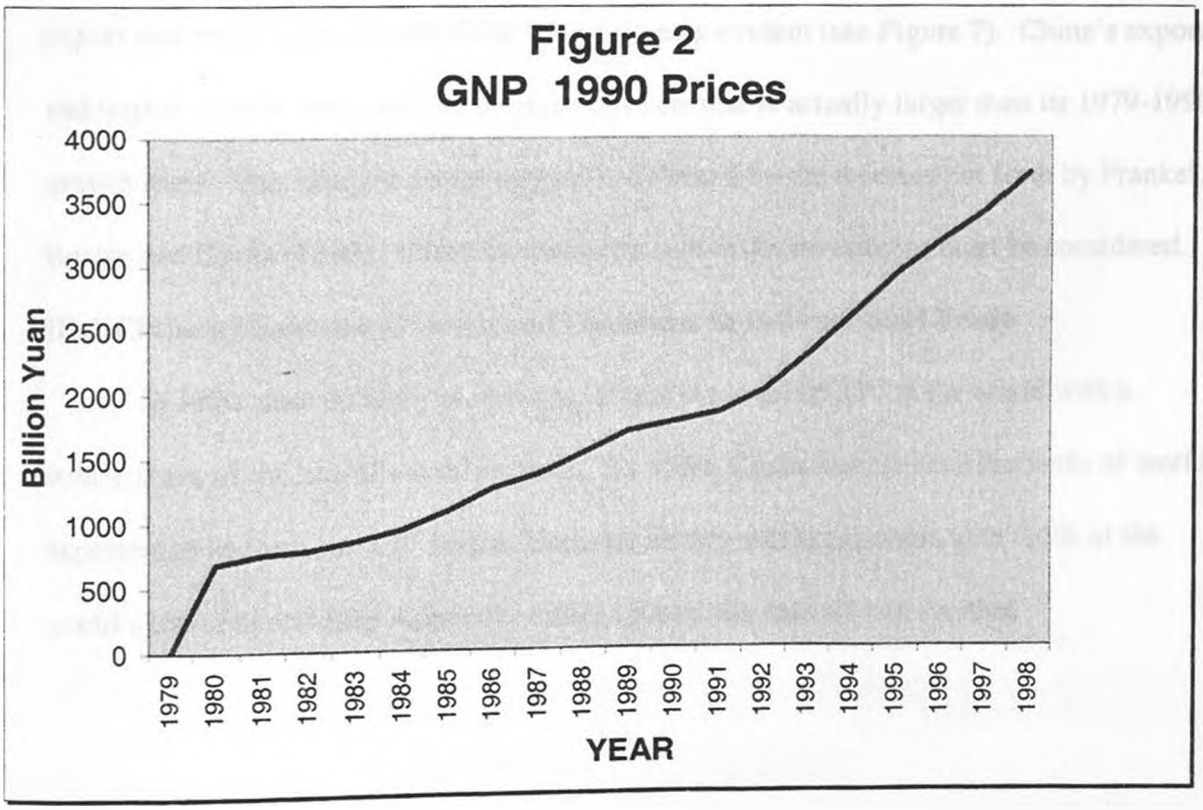


Figure 2
GNP 1990 Prices
Billion Yuan
4000
3500
3000
2500
2000
1500
1000
500
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
YEAR

construct for international investment and trade by enacting new, increasingly transparent legislative measures regarding banking policy, trade policy and investment. This new legislation came in many forms and with many different intentions in regards to combating domestic corruption. The new legislation was also implemented in the hopes of creating a more transparent system of investment and banking in order to continue to attract a larger amount of international investment and to create a safer, more controlled arena for trade and growth. With this new batch of government regulation and legislation implementation, China's economy continued to grow at a rapid rate.

The 1990-1997 growth rates for real and current GDP and GNP were largely erratic although this was consistent with the growth rates of China's other economic indicators during this time period (see Figures 3,4,5 and 6). The growth seen in real exports and imports was similarly large. Even in this crude data a correlation between export and import growth and GDP growth seems evident (see Figure 7). China's export and import growth rates post 1990 grow at a rate that is actually larger than its 1979-1990 growth rates. This observation is not well explained by the theories put forth by Frankel, Romer and Cyrus (1996). Other factors such as foreign investment must be considered.

III.2 China's Economic Growth and Openness to International Trade

In 1980, shortly after its opening, China was ranked 28th in the world with a 0.92% share of the world's total exports. By 1994, China had climbed the ranks of world exporters to become the 11th largest exporter among world exporters with 2.6% of the world's total exports (see Appendix table). From this data we can see that

Figure 4
GDP Growth

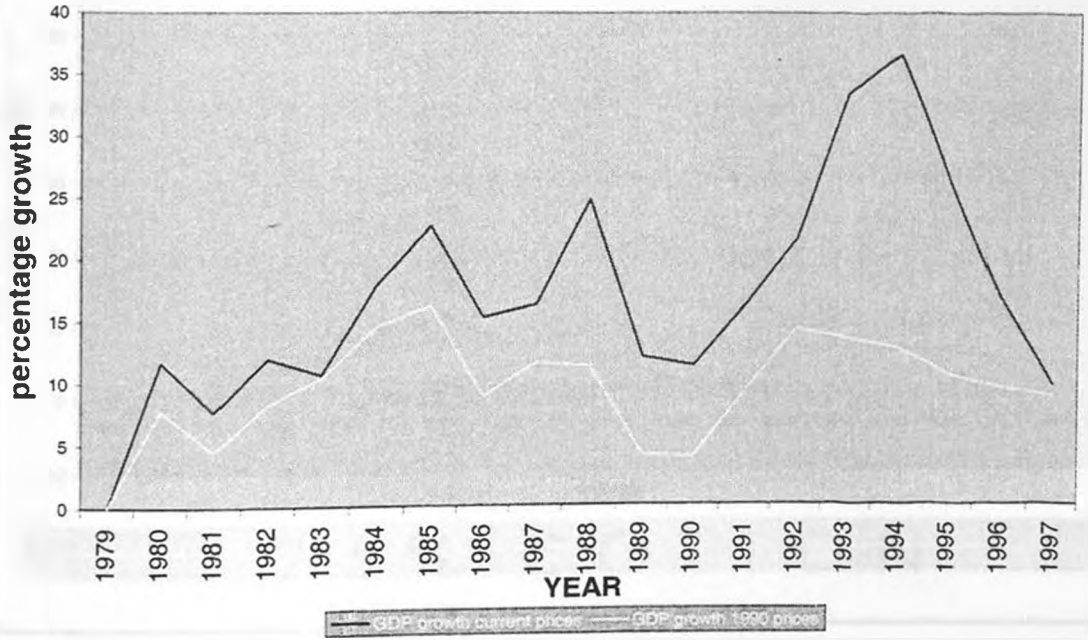


Figure 3
GNP vs. GDP Growth

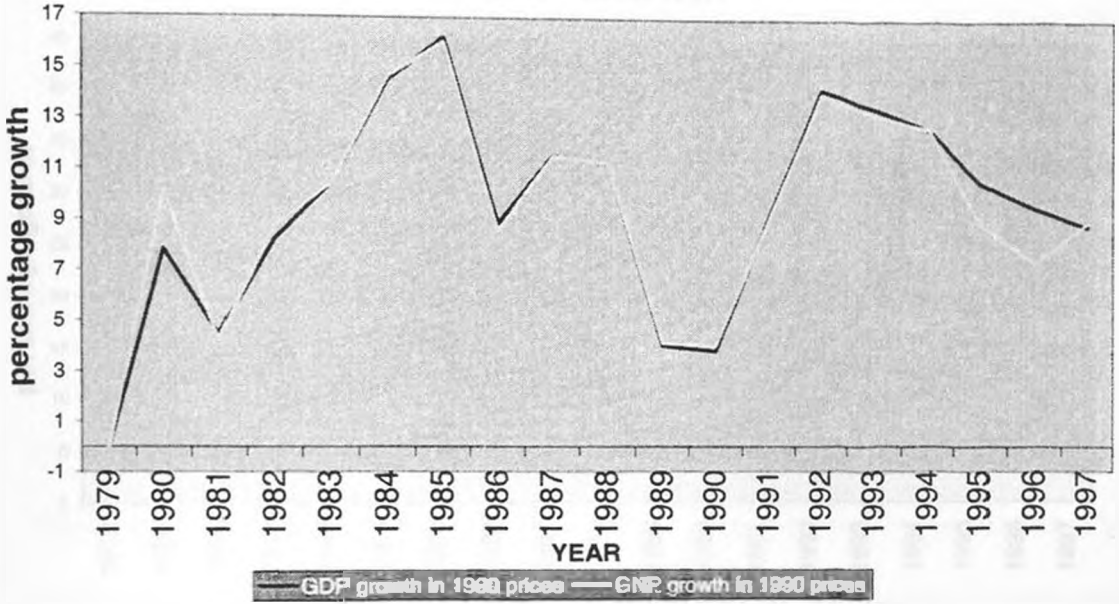


Figure 5
GNP Growth

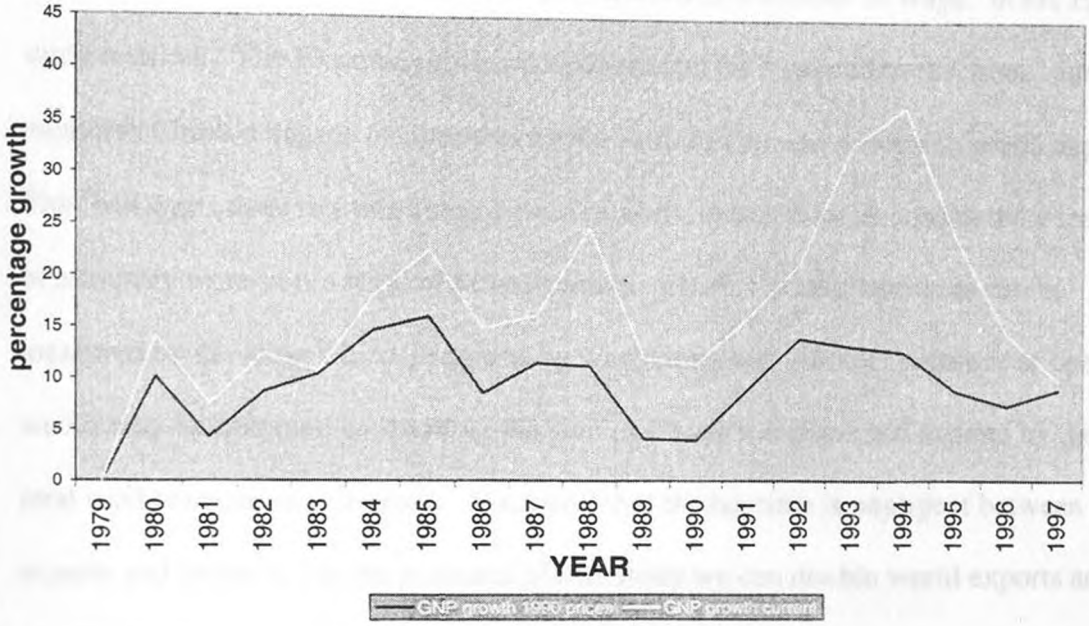
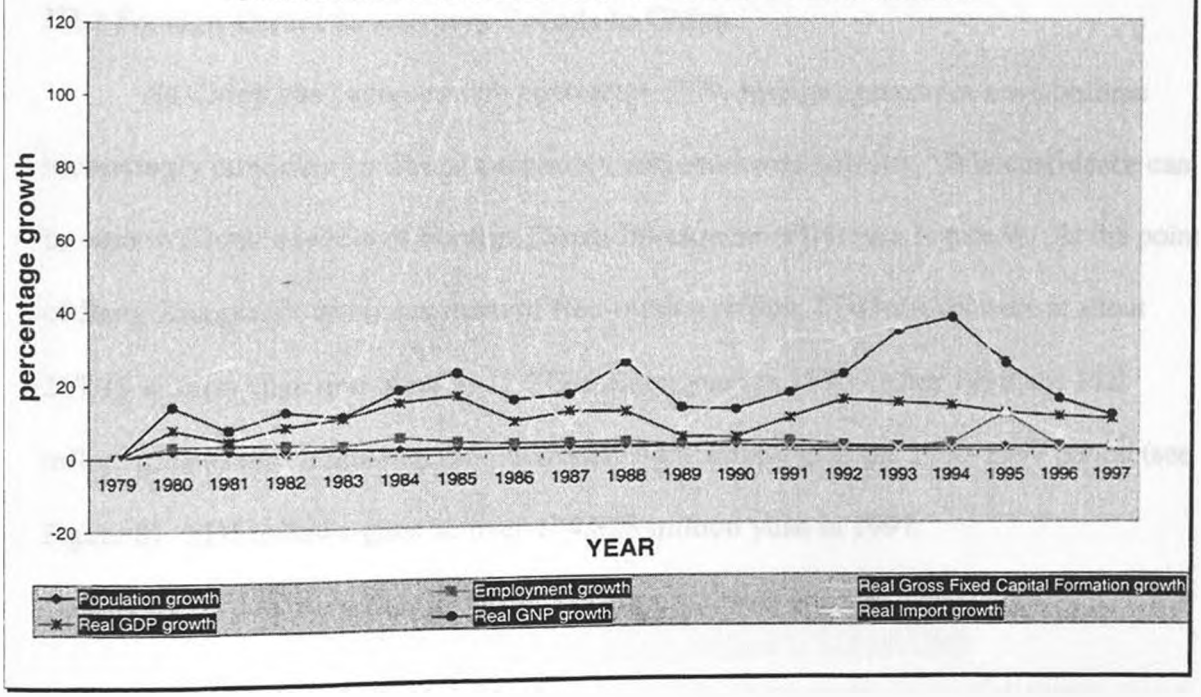


Figure 6
Chinese Economic Growth Indicators



China's relative degree of openness has risen from being "moderately open" in 1981 to strongly "outward-oriented" by the mid 1990's (Jinjun, 1995).

This increase in openness can be measured in a number of ways. In his 1995 study entitled, "The Export-Led Growth Model and Its Application to China," Junjun measures China's degree of openness by the ratio of Chinese exports to world exports. This, however, does not take into account imports, which may be considered a measure of a country or region's level of protectionism. China's border openness can be measured by dividing China's imports by world imports. Another measure of openness would may be obtained by dividing the sum of China's imports and exports by the sum of total world exports and imports. Assuming that the lag time is negligent between yearly exports and imports, for the purposes of this study we can double world exports and use this sum as a measure of total world exports and imports. In doing so, three alternate measures of China's degree of openness are presented in Figure 8.

III.3 Foreign Direct Investment Trends in China

As China has become more open after 1979, foreign companies have become increasingly confident in China's economy and economic stability. This confidence can be seen in China's levels of Foreign Direct Investment (FDI) (see Figure 9). At the point of Deng Xiaoping's announcement of free-market reform, FDI inflows were at about 267.18 million yuan and grew to 12,719 million yuan in 1990. After 1990, the FDI inflow growth rate fluctuated, but increased significantly over the 1990-1997 period (see Figure 8). FDI inflows grew to over 174,828 million yuan in 1997.

Figure 8
China's Openness

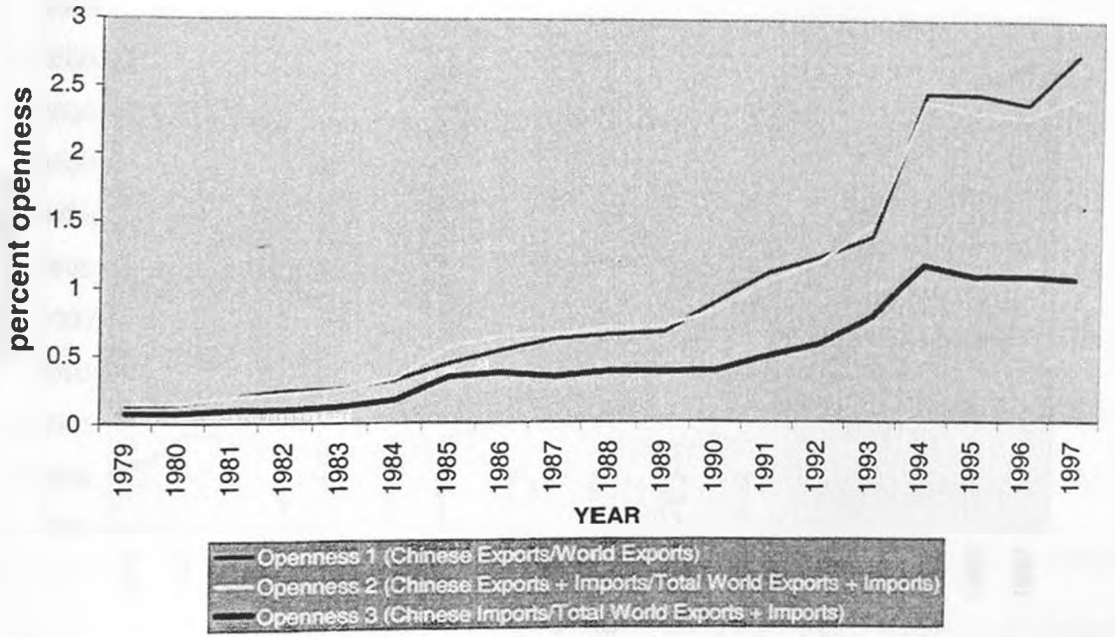


Figure 7
Chinese Imports and Exports in 1990 Prices

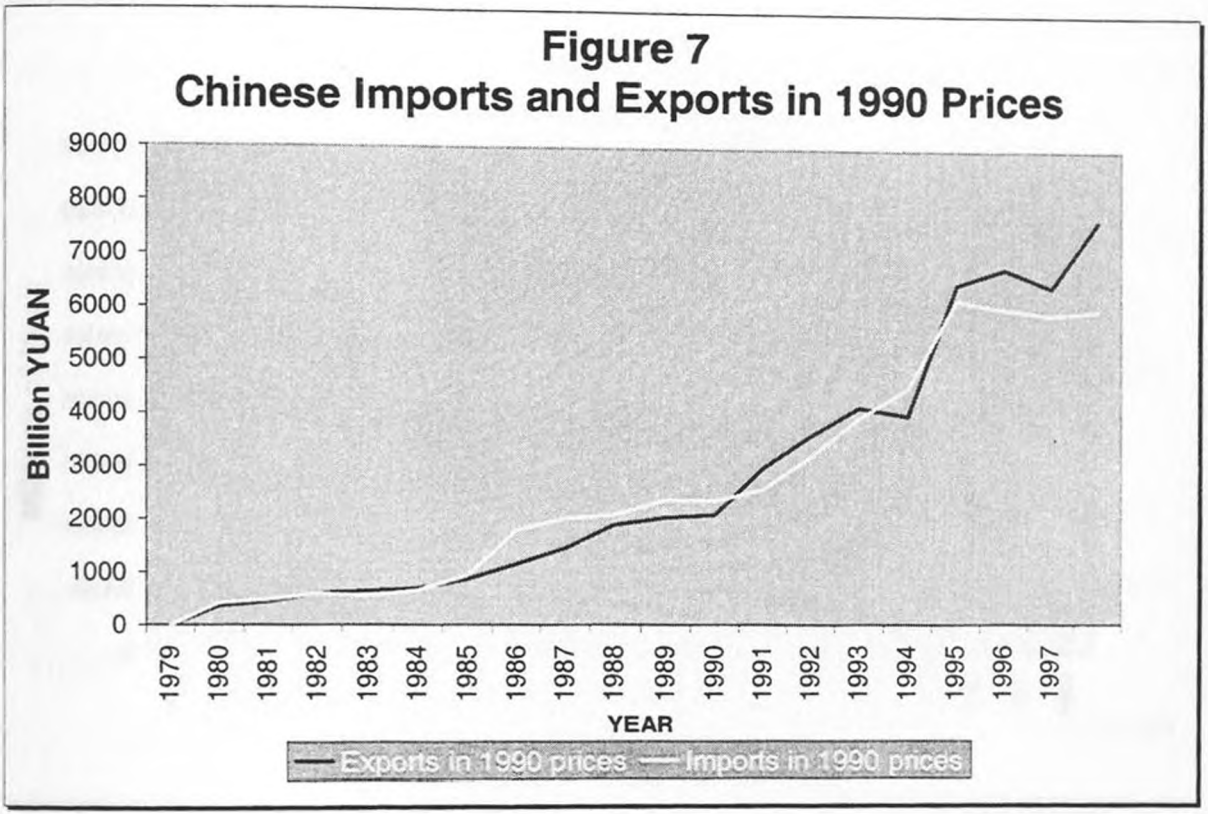


Figure 9
FDI Flows in China

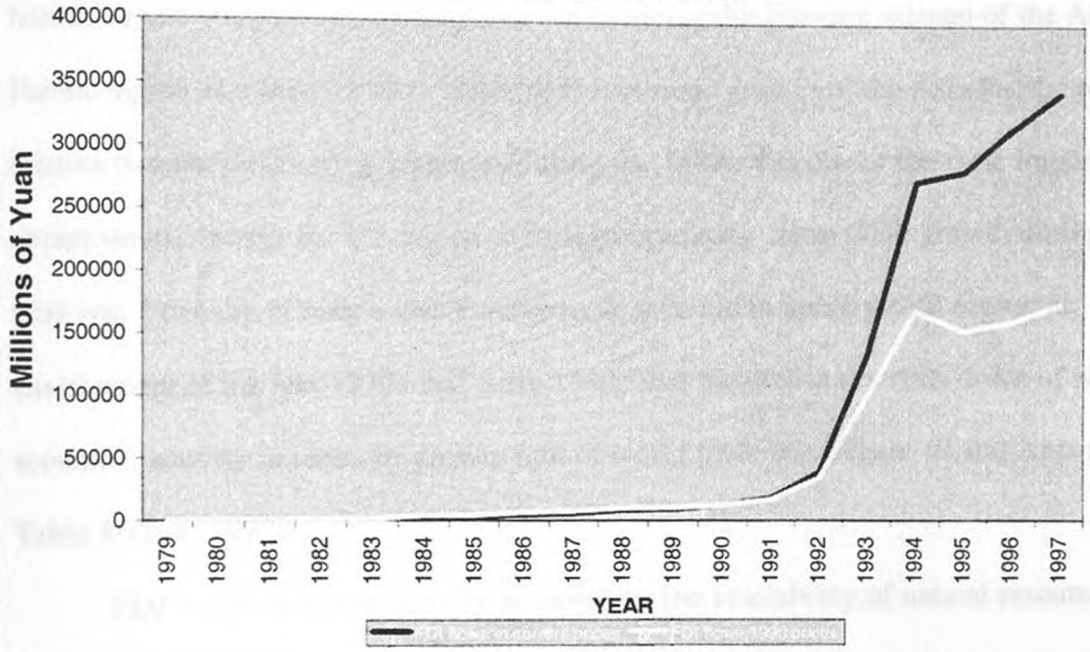
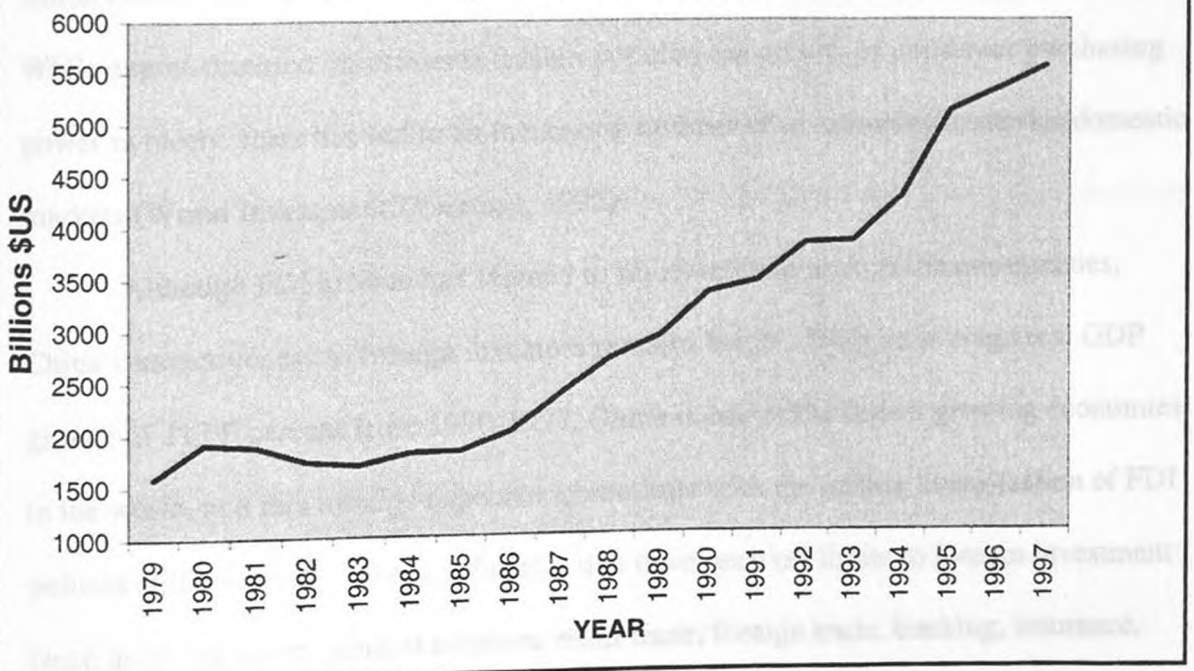


Figure 10
World Exports in Current Prices



Economic growth, the size of domestic markets and the availability of natural resources, the growth of trade, the existence of adequate infrastructure and the quality of human capital were all important factors influencing the growing interest of the Asia-Pacific region as a host for FDI. The rapid economic growth of the Asia-Pacific region relative to other developing countries during the 1980s was one of the most important attractiveness factors for the region to foreign investors. Most GDP growth during that time was 7 percent (China's was 9 percent) despite unfavorable global economic environment of the late 1970s and early 1980s that resulted in the slow down of world economic activity in terms of growth rate of world trade (see Figure 10 and Appendix I Table 3) (IFS, 1992).

FDI in China was originally attracted by the availability of natural resources but more importantly by low wages in manufacturing. Low wages in manufacturing encouraged labor-intensive FDI initially in low technology and assembly activities, which turned into progressively more sophisticated advanced-technology industries. While export-oriented investments remain popular, the growth of consumer purchasing power in recent years has led to an increasing number of investments to service domestic markets (World Investment Directory, 1992).

Although FDI growth has seemed to hit its relative peak in the mid-nineties, China's attractiveness to foreign investors remains bright. With an average real GDP growth of 11.05 percent from 1990-1997, China is one of the fastest growing economies in the world, and this trend is expected to continue with the further liberalization of FDI policies still underway. Some industries that have been off limits to foreign investment (such as air transport, general aviation, retail trade, foreign trade, banking, insurance,

accounting, auditing, legal service, the mining and smelting of precious metals, and the prospecting, extraction and processing of diamonds and other precious non-metal minerals) are being opened gradually. There is also a significant potential for FDI participation in infrastructure and some foreign investors have been allowed to purchase state-owned firms. With these increases in openness, China's currency's increasing convertibility will allow for easier profit repatriation, making China a more attractive investment (World Investment Report, 1996).

Table 1
Inbound FDI in China by Country of Origin 1994
millions of yuan

Hong Kong	7798.5
Japan	1915.1
United States	878.3
European Union	545.6
Singapore	103.5

Countries and regions with the highest cumulative contracted FDI in China are, in descending order: Hong Kong, Japan, the United States, European Union and Singapore (see Table 1). Most of China's inward Foreign Direct Investment has been in petroleum, agriculture, mechanical equipment, distributive trade, transport and storage as well as construction. The majority of China's outward foreign direct investment has been in the form of agriculture, mining and quarrying, textiles, leather and clothing, coal and petroleum products, metals, electrical equipment, construction, distributive trade and transport and storage (see Appendix I Table 1) (World Investment Directory, 1992).

III.4 Fixed Capital Formation and Employment

Gross fixed capital formation (current) in China grew at a constant rate from 1979 to 1990, tripling from 115.1 billion yuan to 473.2 billion yuan. Over the 1990 to 1997

period gross fixed capital formation grew to a much higher rate to nearly four times China's 1990 gross fixed capital formation (See Figure 11 and Appendix I Table 1). Employment growth rates in China remained fairly constant between 1979 and 1990 at around 3 percent with overall Chinese employment beginning at 405.81 million workers in 1979 and 567.4 million employed workers in 1990. After 1990 the employment growth rate dipped below 2 percent, increase more than 10 percent in 1994, then fell back to less than 2 percent in 1996 with over 696 million workers employed (See Figure 12 and 13 and Appendix I Table 1).

Perhaps one of China's most proud accomplishments has been its success in controlling its population growth rate with the famous one child policy. Over the last two decades China's population growth rate has been cut in half from over 2 percent to less than 1 percent growth. There has been a relatively steady incline in overall population from 975 million in 1979 to 1.243 billion in 1997 (see Figure 14). In other words, the employment growth rate has been almost three times as large as the population growth rate since 1979.

Figure 11
Gross Fixed Capital Formation Current Prices

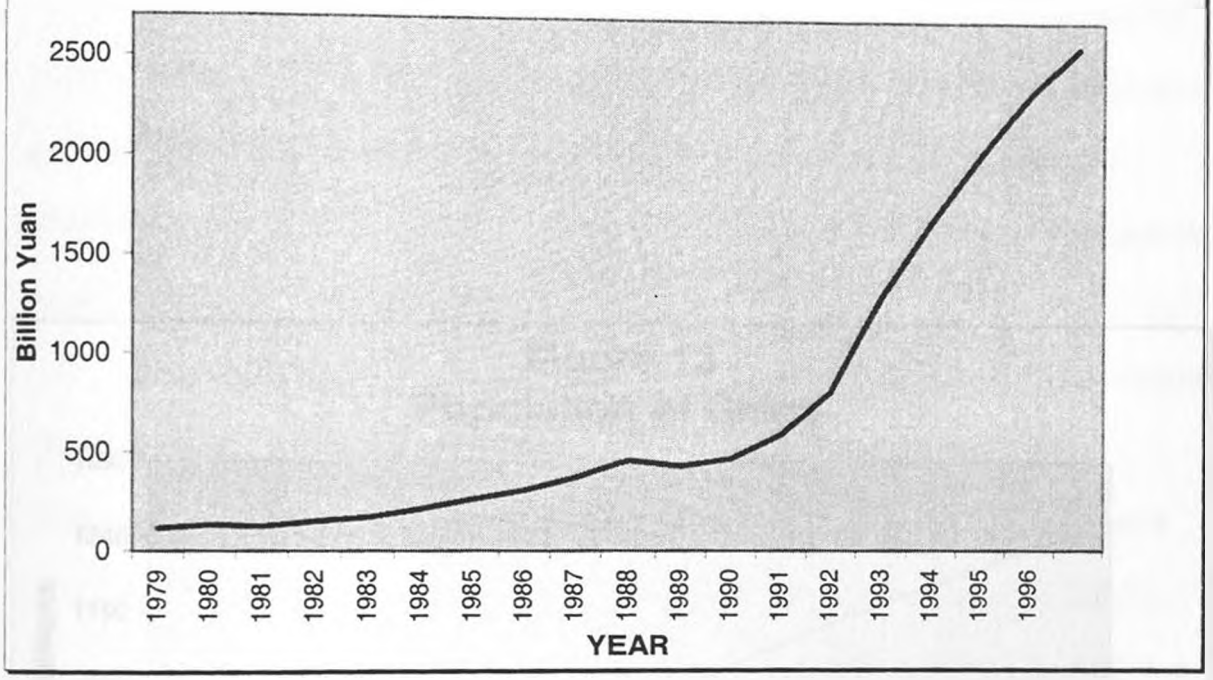


Figure 12
Employment in China

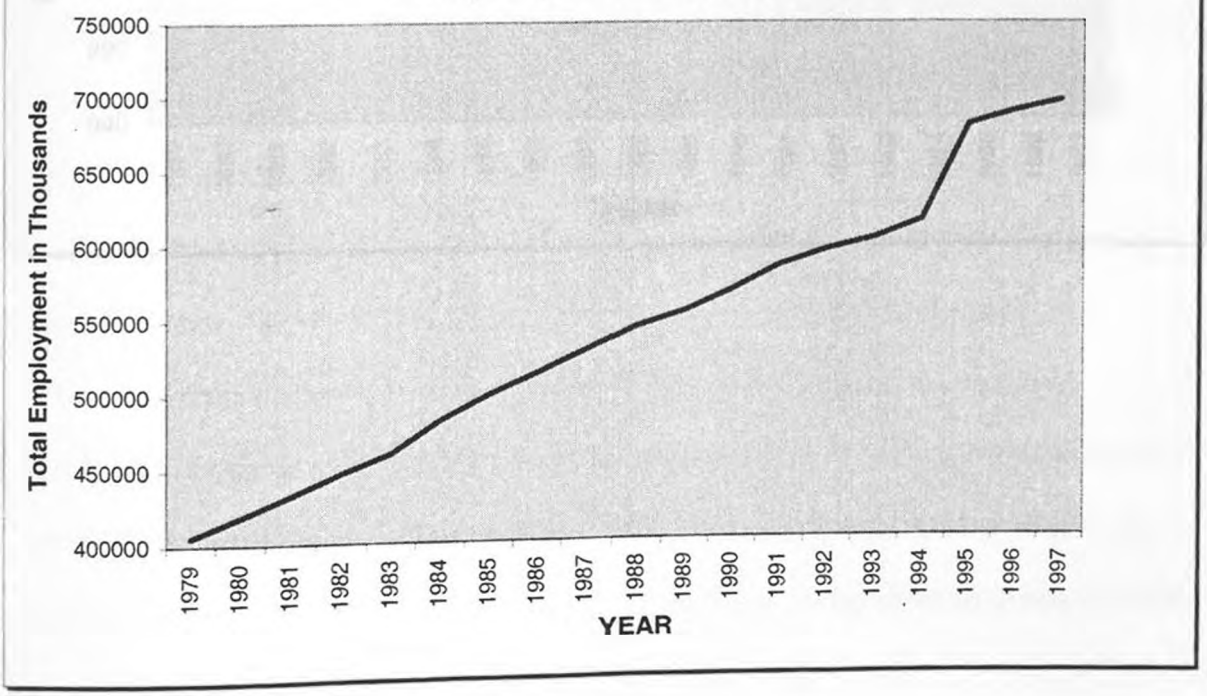
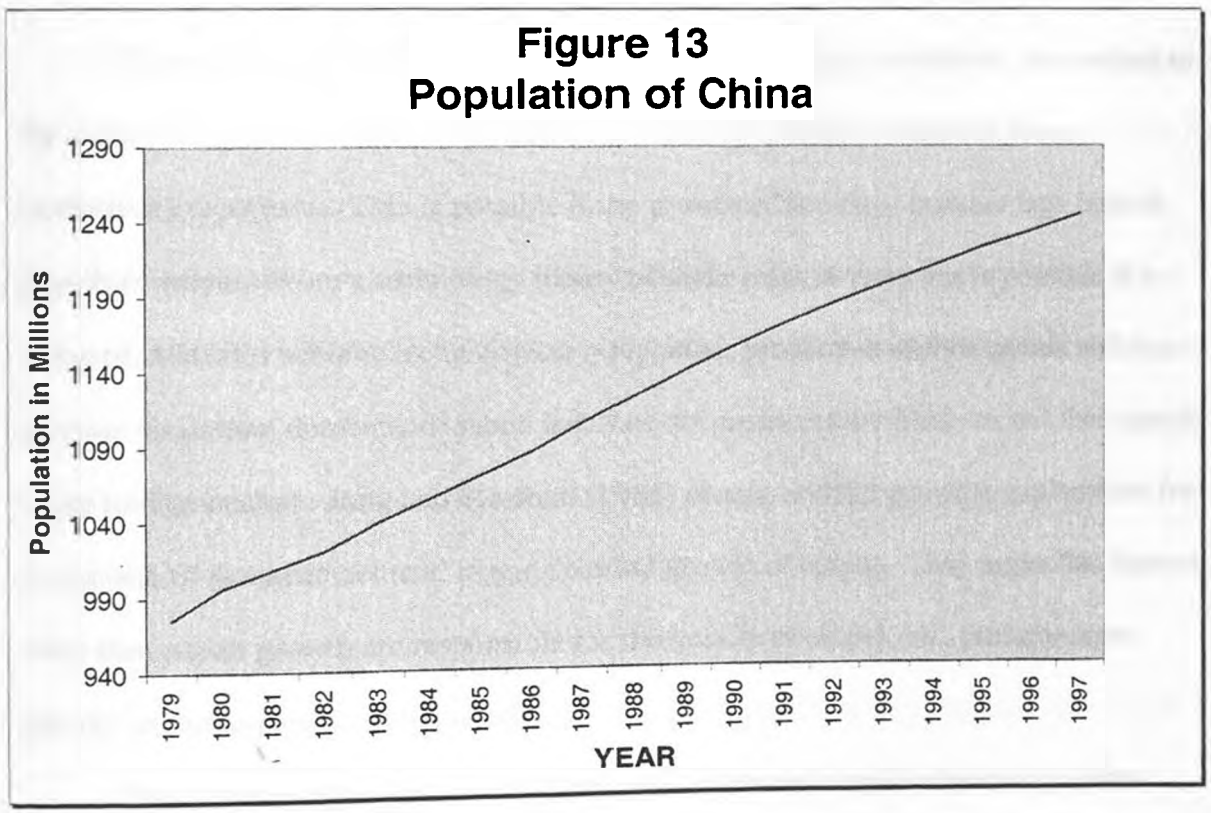


Figure 13
Population of China



Chapter IV

Conceptual Models and Empirical Results

As it was demonstrated in chapter two, in the last two decades, development and international trade economists have done many theoretical analyses and empirical studies on the relationship between exports and economic growth. Their framework can be simplified as $Y = f(K,L,X)$. Thus, it is hypothesized that the sources of economic growth come from capital, labor and exports.

Emami et. al., (2000) classifies the potential hypotheses as follows: In contrast to the export-led growth model, it can also be argued that causality could run from productivity to exports. This is possible if the growth of domestic demand lags behind growth of output. From a technology theory of trade point of view this is possible if a group of industries achieve technological innovation; production of their goods will then increase faster than domestic demand, and thus the producers are likely to sell their goods in the foreign market. Jung and Marshall (1985) discuss another possible explanation for the growth of domestic demand lagging behind growth of output. They argue that factors other than export growth are responsible for the growth of output, i.e., primary-input growth, or factor-productivity growth.

The third possible hypothesis is that a bi-directional causal relationship exists between output growth and export growth. Kunst and Marin (1989) justify this bi-directional causality from the point of view of intra-industry trade theory, which incorporates imperfect competition and economies of scale. According to these theories, productivity increases made possible by the realization of economies of scale give rise to exports (Helpman and Krugman, 1989). If the resulting market structure is one in which

there are few industries, the existence of economies of scale will enable further cost reduction. Hence, a potential feedback effect between exports and productivity growth is possible.

In the output model, labor and capital are included as the most likely variables to explain growth apart from exports. According to neoclassical growth theory, growth of these factors would be expected to cause output growth. In the export model, the exchange rate and world output is included in addition to domestic output. Exports in developing countries depend on the world demand for exported goods, and world demand depends on the price of goods and the income of buyers. Thus, it is hypothesized that world income and the exchange rate as well as domestic output growth cause export growth in developing countries. Note that change in world income is expected to cause export growth because higher level of world income generates more demand for exported goods. Furthermore, it is also hypothesized that world income and the exchange rate indirectly cause the output growth of developing countries through demand for their exported goods. During recessionary times in industrial countries the demand for imported goods decreases, which leads to a decrease in exports from developing countries which in turn decreases the total output of exporting countries, and vice versa.

Imports have seldom been utilized in economic growth analyses. According to Chenery and Strouts (1966) savings-gap, trade-gap model, imports may also make positive contributions to economic growth. For example, imports can bring in advanced technologies and increase productivity. Imports can also relieve the supply shortage of some intermediate input and cause output growth (Esfahani 1991). The new growth theory has provided a new way to analyze the impact of international trade on output

growth. Grossman and Helpman (1991) modeled endogenous technological progress that results from the profit-maximizing behavior of far-sighted entrepreneurs. These entrepreneurs invest in research and development in order to capture monopoly rents from innovative products. The productivity of their employees in the research lab depends on the general state of scientific, engineering, and industrial know-how in the country. This level of know-how which they refer to as the 'stock of knowledge capital' is related to the number of contacts that local agents have with their counterparts in the international research and business communities. The number of contacts most probably increases with the extent of commercial exchange. Thus, the cumulative value of trade (exports plus imports) will increase the accumulation of knowledge capital and make a positive impact on the economy growth.

On the other hand, growth in output may increase the demand for imports and cause the imports growth. It is also possible that there might exist a mutual feedback relationship between output growth and imports growth.

IV.1 Conceptual Models

Based on models reviewed in Chapter two, modified growth models are constructed for identifying determinants of China's economic growth with special emphasis on the impacts of foreign direct investment, and imports in addition to traditional factors such as labor, domestic capital and exports.

Regression Models described in table 1, Chapter two, support the hypothesis that rate of economic growth is affected by production inputs including exports and contributions from foreign capital. Accordingly, this study attempts to adopt the following regression equations in Table 1 to estimate relationship between China's economic growth and corresponding factors.

Table 1 Regression Equations for Conceptual Model*

Equation#	Regression Equation
1	$GNP = \alpha + \beta FK + \chi L$
2	$GNP = \alpha + \beta FK + \chi L + \delta FDI$
3	$GNP = \alpha + \beta FK + \chi L + \delta FDI + \varepsilon X$
4	$GNP = \alpha + \delta FDI$
5	$r_{GDP} = \alpha + \beta rFK + \chi rL$
6	$r_{GDP} = \alpha + \beta rFK + \chi rL + \delta r FDI$
7	$r_{GDP} = \alpha + \delta r FDI$

*Note: GNP, FK, L, FDI and X are the level values of GNP, domestic capital, , labor services, foreign capital in the form of foreign direct, and exports. The growth rates of GDP, domestic capital, , labor services, foreign capital in the form of foreign direct investment are represented by r_{GDP}, r_{FK}, r_{L}, r_{FDI}, respectively. The regression coefficients are denoted by α, β, χ , ε.

IV.2 Data Sources[3]

- **Foreign Direct Investment (FDI)** refers to the investments inside China by foreign enterprises and economic organizations or individuals (including overseas Chinese, compatriots from Hong Kong and Macao, and Chinese enterprises registered abroad), following the relevant policies and laws of China. These funds are used for the establishment of ventures exclusively with foreign own investment, Sino-foreign joint ventures and cooperative enterprises or for co-operative exploration of resources with enterprises or economic organizations in China. It includes the re-investment of the foreign entrepreneurs with the profits gained from the investment and the funds that enterprises borrow from abroad in the total investment of projects, which are approved by the relevant department of the government. FDI flows for this study were accumulated from a number of different sources.

  All of the data used for FDI that was reported in yuan and subsequently used in the data analysis came from the Balance of Payments Statistics Yearbook from years 1989 to 1998.[4] This source describes the exact FDI reported by the Central Bank of China. Other FDI Inflow information was gathered in SDRs or Millions of United States Dollars. These numbers were used only as references (World Investment Report (WIR) 1996 p. 230, 1992 p. 315, 1998 p. 365; Handbook of International Trade and Development Statistics 1989, 1990, 1994, 1995). FDI was reported in

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3 Source Definitions were taken from the Statistical Yearbook of China, (1996). State Statistical Bureau, PRC. Wing Fat Printing co. Ltd. Hong Kong.

4 FDI numbers are located in YUAN in the world investment directory but were found to be the US SDR prices converted into Yuan as well as US Dollar prices converted into Yuan using the SDR conversion rate in the 1989 Balance of payments and the Yuan per US Dollar conversion rate in 1991 and 1998.

current prices and was converted into constant or real 1990 prices by dividing by the 1990 GDP deflator.

- **Total Imports and Exports** refers to the value of commodities imported into and exported from the boundary of China, not including Macao or Hong Kong. These commodities are made up of the actual imports an exports through foreign trade, imported and exported goods under the processing an assembling trades and materials, supplies and gifts as aid given free of charge between governments and by the United Nations and other international organizations, and contributions donated by overseas Chinese, compatriots in Hong Kong and Macao and Chinese with foreign citizenship, leasing commodities owned by the tenant at the expiration of the leasing period, the imported and exported commodities processed with imported materials, commodities trading in border areas (excluding mutual exchange goods, the imported and exported commodities and articles for public use of the Sino-foreign joint ventures, cooperative enterprises and ventures exclusively with foreign own investment.

  Also included are import or export samples and advertising goods for whose CIF (Cost, Insurance and Freight) or FOB (Free On Board) value are beyond the permitted ceiling (excluding goods of no trading or use value and free commodities for export), imported goods sold in China from bonded warehouses and other imported or exported goods. The indicator of the total imports and exports at customs can be used to observe the total size of external trade in a country. In accordance with the stipulation of the Chinese government, imports are calculated at CIF while exports

are calculated at FOB. Import and Export values used in the data analysis were reported in yuan from the China Statistical Yearbook from years 1983 to 1998 in current prices. These numbers were then put into constant or real prices through their division by the GDP deflator or the Chinese CPI. Other sources for Imports and Exports in SDRs and Millions of United States dollars (1980 and 1990) are from The Statistical Yearbook 1987, 1994 and 1999, International Financial Statistics (IFS) 1998-99.

- **Population** (millions) data for China represents midyear estimates that are located in the IFS yearbook and provided by the United Nations and are also published in the UN Monthly Bulletin.

- **Employment** (millions of workers) refers to the total number of persons engaged in social labor which generates income, including: (1) Total staff and workers, (2) Employees in urban private enterprises, (3) Urban individual laborers, (4)Rural laborers, (5) Other social laborers. The indicator refers to the total laborers actually engaged in production or other operations in various units.

- **Gross Domestic Product (GDP)** refers to the gross domestic product calculated at market price, which is all the final product of all residents units (enterprises and self-employed individuals) of a country (or region) during a certain period of time. GDP comes in three different forms, i.e. value added, income, and products respectively. The form of value added refers to the total value of all products and services

produced by all resident units during and distributed primarily to all residents and non-resident unites; the form of product refers to all final goods and services minus imports of goods and services. In the practice of national accounting, GDP is calculated by three approaches; the product approach, income approach, and expenditure approach to reflect the different aspects of GDP.

- **Gross National Product (GNP)** Gross National Product refers to gross national product calculated at market price, which is the primarily distributed final products of all resident units of a country during a certain period of time. The value added by resident units of a country engaging in production activities is distributed mainly to the resident units of that country with part of it in the form labors' compensation and property income distributed to non-resident units of the country. Simultaneously part of the value added created abroad is distributed to resident units of the country in the form of labors' compensation and property income. Thus the concept of GNP is form, which equals the GDP plus overseas income as labors' compensation and property income. Unlike GDP which is a concept of production, GNP is a concept of income. GNP and GDP data used in this study were collected from the International Financial Statistics (IFS) 1998-99 in 1990 prices and current prices in millions of yuan. Alternate sources also contain GDP and GNP data including the China Statistical Yearbook from years 1983 to 1998 in current prices.

- **GDP Deflator** shown in the IFS Yearbook is not a direct measurement of prices but is derived implicitly by dividing GDP at current prices by GDP at constant prices. The deflator is expressed in index for with the base 1990=100.

- **Fixed Capital Asset Formation** refers to fixed assets purchased, transferred-in and produced-for-own-use products by resident units during the reference period, excluding the value of sale and transferred-out fixed assets. Fixed assets formation and newly increased animals used for draught, stud, dairy production, fur-bearing animals, cash forest, etc. during a certain period of time.

IV.3 Empirical Results

Prior to estimating the regression in Table 1, the correlation coefficient matrix for variables are estimated as follows:

Table 2

	r GNP	*r FK*	*r L*	*r X*	*r FDI*	*r M*
r GNP	1					
r FK	0.956528	1				
r L	0.008722	-0.03551	1			
r X	0.888697	0.809487	-0.01781	1		
r FDI	0.728184	0.783551	-0.12742	0.664103	1	
r M	0.863781	0.822371	4.69E-05	0.845026	0.663347	1

Table 3

	GDP CUR	*FK*	*L*	*X*	*FDI*	*M*
GDP CUR	1					
FK	0.997158	1				
L	0.919133	0.905777	1			
X	0.992937	0.990854	0.902281	1		
FDI	0.972037	0.981429	0.827254	0.978784	1	
M	0.98855	0.991101	0.916273	0.991963	0.978266	1

Table 4

	GDP R	*FK R*	*L*	*X R*	*FDI R*	*M R*
GDP R	1					
FK R	0.970079	1				
L	0.978392	0.915317	1			
X R	0.979273	0.96871	0.942833	1		
FDI R	0.922338	0.957028	0.838701	0.942143	1	
M R	0.976487	0.972125	0.949506	0.982551	0.935172	1

According to Table 2 the level of real GDP is highly correlated with each variable, from .92 to .97. The level of real domestic capital (FK) is also highly correlated with other variables, from .91 to .97. Employment (L) is correlated with other variables from .83 to .94. The level of real exports (X) is correlated with other variables from .94 to .97. The real FDI is correlated with the other variables from .83 to .95. Similarly, real imports are correlated with other variables from .93 to .98.

With respect to correlation, among growth rates of variables, real GNP is highly correlated with all variables except for employment. Foreign capital (FK) is highly correlated with all variables except employment. Employment is not significantly correlated with any of the variables. Foreign direct investment (FDI) is significantly correlated with all variables except employment. Imports (M) and exports are highly correlated with all variables except labor (see Table 4).

According to Table 4, the rate of growth of GDP is significantly correlated with any each variable. The significant correlation between level data for independent variables (FK, L, X, FDI, M) alarms probable multicollinearity problems for regression analysis which may result in the elimination of some candidate independent variables from regression analysis to correct for multicollinearity problems.

IV.4 Regression Results

Table 5 summarizes selected regression estimates for different theoretically supported relationships between economic growth and variables determining such growth. As mentioned earlier, the multicollinearity problem due to the relationships between independent variables created inefficient and biased coefficients for most regression equations estimated (see Appendix II Table 1 for all regression results).

Table 5: Summary of Regression Analysis

	Independent Variables		FK	L	FDI	X	M	Adj. R^2
Eq.	Data	Coefficients	α	β	χ	δ	ε	φ	
		Dependant Variables							
1	Level	GDP	-794.277096	2.4339**	2.141892*	-1.25588	0.203092**	-0.16098	0.997
		Current	-1.08152488	6.400647	1.216001	-0.46177	3.999643	-1.87358	
2			-885.963205	2.619511**	2.263296				0.995
			-1.92736932	23.80385	2.303307				
3			454.2653254**				0.468752		0.986
			5.370520812				34.50749		
4			975.859799**			17.84295**			0.941
			6.477678743			17.06709			
10		X	1113.230388**			38.05827**			0.955
			3.998097711			19.69601			
11	Level	GDP	-2311.23102	0.755012**	6.716122**	2.661794**	0.071347	-0.09881	0.994
		Real	-7.28357064	2.67685	8.494591	2.317333	1.486129	-1.65575	
12			-2259.83324	1.311504**	6.096622**				0.99
			-8.92875015	8.033505	9.749359				
13			657.2799159**				0.406879		0.956
			8.674637866				19.93445		
14			1216.800916**			13.54644**			0.842
			11.06819159			9.84226			
15			-2264.95655**	0.661352**	6.586982**	2.866192**			0.993
			-10.6545661	2.434021	11.88532	2.771592			
20		X	1374.692156**			33.30354**			0.881
			5.988614354			11.58841			
21	log	GDP	-12.2749057	0.101536**	2.639268**	0.039484	-0.07631	0.053367	0.991
		Real	-6.48983899	1.032338	7.604519	1.016916	-0.80037	0.634901	
22			1.820762	0.145087**	2.810477**				0.98
			22.17897	2.802919	16.15229				
23			1.286600311**				0.579775**		0.93
			10.40083328				15.61334		
24			2.09678926			0.274022**			0.954
			35.76602052			19.29243			
28			-12.9539324		2.761595			0.101923	0.99
			-10.3903575		11.33118			2.134805	
30		X	1.467752102**			0.455246**			0.946
			13.90966992			17.80721			
31	rate of growth	GDP	0.097326082**	0.05061	134.7996	-4.14951	-0.10836	0.088244*	0.188
		Real	6.080961558	0.916142	0.354026	-0.25737	-2.63046	2.105039	
40		X	0.043658705			321.1621**			0.998
			0.498627781			3.553058			
42	Level	GNP	-1238.51544	2.430813**	3.128435**				0.996
		Current	-3.10296998	25.43931	3.666608				
43			493.53597**				0.45219**		0.985
			5.947486126				33.93115		
44			1000.05267**			17.16891**			0.936
			6.574842466			16.26545			
51	Level	GNP	-461.306589	2.027159**	2.109967**				0.974
		Real	-1.23770801	8.432132	2.291272				
52			847.5243988**				0.364845**		0.947
			11.2972074				18.05368		
53			1351.037378**			12.10801**			0.828
			13.08665668			9.368			
59	log	GNP	1.765752857	0.628857**	-0.19044	-0.09376	0.353584**	0.018403	0.986
		Real	0.878429156	6.016097	-0.5163	-2.27228	3.4894	0.206011	
70	rate of growth	GNP	1.533280235				0.672765**		0.776
							7.753181		
		Real	-0.75415839						
71			1223.345			.266587**			0.845
			11.30446116			4.249806			

Notes:

1. Bold numbers are estimated coefficients
2. Numbers under coefficients represent T statistics
3. Coefficients significant at 95% are indicated by ** and those significant at 90% are indicated by *

The following selected regressions are reports on the relationship between different measures of economic growth and domestic capital, employment, foreign direct investment and exports.

IV.5 Factors Impacting Real GDP in China

The summary table of relationships between GDP and GNP and domestic capital (FK), exports (X), and imports (M) are reported in Appendix 2 Table 6. As indicated in equation 22, domestic capital (FK) and employment (L) significantly impacted China's real GDP. The adjusted $R^2$for this equation indicates that 99 percent of the variations in real GDP are due to domestic capital and employment. The estimated coefficients in that equation imply a real GDP-domestic capital elasticity of 0.145 and real a GDP-employment elasticity of 2.81. These elasticity's imply that when domestic capital changes by 1 percent, China's real GDP changes in the same direction by 0.14 percent and as employment changes by 1 percent, real GDP changes in the same direction by 2.8 percent. Note that these elasticities are different from the concept of factor marginal productivities. Because employment is measured by the total number of people working rather than being measured monetarily or by wage hours, employment elasticity is not comparable to the domestic capital elasticity. Labor hours nor monetary values were available for the complete time period covered in this study.

Equation 24 estimates the impact of foreign direct investment on real GDP without contributions from other variables. This relationship indicates a GDP-foreign direct investment elasticity of 0.27. Equation 30 measures the relationship between exports and foreign direct investment in China. This equation implies an export-foreign

direct investment elasticity of 0.45, that is, a 1 percent increase in foreign direct investment enhances China's exports by 0.45 percent.

IV.6 Factors Impacting Real Rate of Growth of GDP and GNP in China

Equation 71 estimates the relationship between foreign direct investment and the rate of growth of real GNP. This equation indicates the existence of a significant relationship between foreign direct investment and the rate of growth of real GNP. Equation 70 estimated the very significant relationship between exports and the rate of growth in real GNP. Tested relationships between output and domestic capital (FK), exports (X), foreign direct investment (FDI), labor (L) and imports (M) are reported in Appendix 2 Table 1.

Chapter V

Conclusion

This study attempted to measure the relationship between openness and China's economic development in terms of GNP and GDP and production factors such as fixed domestic capital (FK), employment (L), exports (X), imports (M) and foreign direct investment (FDI). The empirical results indicate a strong relationship between China's GNP and GDP and China's domestic capital and employment. It further supports the relationship between the inflow of FDI in China and increase its overall economic activity in terms of GNP and GDP. Results also indicate that exports significantly effect economic activities in that country.

Empirical results obtained in this study are consistent with Kwan, and Kwok (1994), and Emami et. al., (2000) study, indicating more significant contribution from labor input to China's output than capital and other variables. Kwan and Kwok (1994) study on China for the period 1952-1985, found that while the weak, strong and super exogeneity assumptions appear valid, the current export growth variable has a significant and positive coefficient. Because Kwan and Kwok's interest in testing the export-led growth hypothesis, they provide no information on how much the exports and other factors contribute to China's economic growth.

Using data on China for the period of 1952-1992, Emami, A., J. Cornelius, and J. Zhang (2000) found that:

> "The causal investigation has shown that (a) the growth rate of output was caused by the growth rates of capital, labor and exports, but imports; (b) the growth rate of

exports was caused by the growth rate of world GDP, but the growth rates of output GDP and imports; (c) the growth rate of imports was caused by the growth rate of exports, but the growth rate of output GDP. There are no feedback relationship between export growth and output growth.

In addition to the causal investigation, we have used the growth rate model to empirically analyze China's economic growth and identified the growth engines. We included export variable, capital variable and labor variable in a conventional aggregate production function and found that they all have statistically significant positive impact on China's economic growth rate " (Emami et al., 2000, p.1)

Table 3. The Estimated Coefficients for Growth Rate Model

	RK	RL	RE	R^2	DW	SSE
OLS	0.5038 (2.658**)	2.0467 (3.055**)	0.2529 (3.071**)	0.5219	1.4824	0.2226
AR(1)	0.6258 (2.99**)	1.7422 (2.741**)	0.2107 (2.33*)	0.5561	1.6553	0.2067
AR(2)	0.3650 (2.389*)	1.9654 (3.891**)	0.2754 (4.117**)	0.6725	2.0206	0.1525

Note: The numbers in parentheses are t-values. ** and * show that these statistics are significant at the 1% and 5% level of significance respectively. AR(1): first order autocorrelation; AR(2): second order autocorrelation. .The Dependent variable is the rate of growth of real GDP. RK, RL, and RE denote rate of growth of domestic fixed capital, labor, and exports respectively." (Emami, et. al., (2000), p. 11)

Although results reported in table 5 of the previous chapter and table three above, may seem to run against the conventional theory that scarce capital input used with abundant labor should show higher productivity, it should not be surprising to get the opposite results. First available data on capital is fixed capital rather than variable capital Second, the lower contribution from capital might be due to the fact that China's production is highly labor intensive and fixed capital employed is old and based on inefficient technology which do not produce theoretically expected higher contribution than labor.

Although, due to multicollinearity, the impacts of all these factors (FK, L, FDI, X, M) on real GNP and GDP could not be simultaneously measured, individual equations, however, support significant relationships.

Major shortcomings of this study are: (1) the absence of any test on causal relationship, (2) the existence of multicollinearity, and (3) the existence of autocorrelation. Thus, the estimated coefficients have to be interpreted with caution. The challenge for future research is to correct the estimation procedure for econometric problems inherent in the regression models.

In summary, the significant relationship between China's output and domestic capital formation, employment, trade, foreign direct investment supports the neoclassical theory of economic growth. These relationships imply that China's probable membership in the World Trade Organization (WTO) along with her recent permanent classification under most favored nation (MFN) status with the United States enhances China's openness to external trade and increases inflows of foreign direct investment in China, thus fostering higher economic growth for this country.

Appendix I

Table 1

Statistical Data on China in 1990 prices

Year	Imports Billion YUAN (1990 prices)	Exports Billion YUAN (1990 prices)	GNP Billion YUAN (1990 prices)	GDP Billion YUAN (1990 prices)	FDI Flows Billion YUAN (1990 prices)	Gross Fixed Capital Formation Billion YUAN (1990 prices)	Employment (millions)	Population (millions)
1979	417.4	363.7	685.2	699.7	0.267	66.9882	405.81	975.4
1980	961.7	899.0	754.7	754.4	0.497	39.9354	418.96	996.1
1981	1141.9	1141.6	786.8	788.2	1.199	40.3466	432.80	1008.4
1982	556.3	644.3	855.6	853.2	1.265	95.9999	447.06	1020.6
1983	654.0	679.5	944.9	942.3	1.663	110.2305	460.04	1039.6
1984	934.5	874.3	1083.7	1079.5	3.928	141.1664	481.97	1054.9
1985	1794.3	1154.4	1257.7	1254.5	4.317	185.1341	498.73	1070.2
1986	2019.3	1458.3	1365.4	1365.7	6.633	229.8716	512.82	1085.7
1987	2088.2	1901.6	1523.4	1523.7	8.038	289.2566	527.83	1104.2
1988	2370.4	2037.7	1695.2	1695.4	10.063	400.9008	543.34	1121.9
1989	2357.9	2096.4	1765.8	1764.3	10.545	404.8287	553.29	1139.2
1990	2574.3	2985.8	1837.0	1832.0	12.719	473.2000	567.40	1155.3
1991	3194.3	3596.8	2004.2	2000.4	17.276	632.0160	583.64	1170.1
1992	3925.2	4131.0	2285.9	2285.2	34.861	921.1084	594.32	1183.6
1993	4500.9	3973.5	2588.4	2593.5	100.140	1726.3400	602.20	1196.4
1994	6178.7	6465.1	2916.9	2921.9	169.950	2717.1872	614.69	1208.8
1995	6007.7	6770.9	3176.8	3230.1	153.720	3733.3539	679.47	1221.5
1996	5896.6	6416.5	3410.7	3538.4	161.470	4573.8560	688.50	1232.1
1997	5974.6	7668.4	3717.2	3849.9	174.830	5077.9248	696.00	1243.7

Table 2

Growth Rates for Statistical Data on China

Year	Import growth (Percent)	Export growth (Percent)	Real GNP Growth (Percent)	Real GDP Growth (Percent)	Real FDI Growth (Percent)	Real Gross Fixed Capital Growth (Percent)	Employment Growth (Percent)	Population Growth (Percent)
1979	-37.54	-33.01	-41.75	7.82	0.34	-40.38	3.24	2.12
1980	34.10	43.41	14.33	4.48	164.56	1.03	3.30	1.23
1981	94.26	125.06	117.83	8.25	117.70	137.94	3.29	1.21
1982	18.29	6.12	12.72	10.44	32.31	14.82	2.90	1.86
1983	51.44	36.37	24.53	14.56	150.30	28.06	4.77	1.47
1984	114.00	36.37	31.68	16.21	22.49	31.15	3.48	1.45
1985	26.09	47.16	20.12	8.86	72.13	24.16	2.83	1.45
1986	12.24	41.53	22.08	11.57	31.52	25.83	2.93	1.70
1987	42.80	41.52	40.01	11.27	57.49	38.60	2.94	1.60
1988	15.19	34.80	22.00	4.06	21.35	0.98	1.83	1.54
1989	25.42	19.14	17.83	3.84	38.56	16.89	2.55	1.41
1990	40.47	63.61	23.93	9.19	53.78	33.56	2.86	1.28
1991	39.09	36.38	30.90	14.24	128.40	45.74	1.83	1.15
1992	58.29	30.00	52.36	13.49	296.54	87.42	1.33	1.08
1993	101.66	32.78	63.67	12.66	149.31	57.40	2.07	1.04
1994	26.54	139.02	40.54	10.55	17.71	37.40	10.54	1.05
1995	11.49	36.30	23.92	9.54	19.32	22.51	1.33	0.87
1996	2.98	7.65	10.77	8.80	10.05	11.02	1.09	0.94

Table 3

World Export and China Openness Statistics

Year	World Exports in billions SUS	Total World Exports and Imports in billions SUS	World Export growth	Total World Exports and Imports growth	Openness (Chinese Exports/World Exports)	Openness 2 (Chinese Exports + Imports/Total World Exports + Imports)	Openness 3 (Chinese Imports/Total World Exports + Imports)
1979	1584.800	3169.600			0.134	0.143	0.153
1980	1910.900	3821.800	0.206	0.206	0.143	0.148	0.152
1981	1881.200	3762.400	-0.016	-0.016	0.195	0.195	0.195
1982	1731.400	3462.800	-0.080	-0.080	0.239	0.223	0.207
1983	1697.500	3395.000	-0.020	-0.020	0.258	0.253	0.248
1984	1810.800	3621.600	0.067	0.067	0.321	0.332	0.343
1985	1822.000	3644.000	0.006	0.006	0.444	0.567	0.690
1986	2005.400	4010.800	0.101	0.101	0.540	0.643	0.747
1987	2360.700	4721.400	0.177	0.177	0.623	0.653	0.684
1988	2697.300	5394.600	0.143	0.143	0.655	0.708	0.762
1989	2908.600	5817.200	0.078	0.078	0.672	0.714	0.756
1990	3330.900	6661.800	0.145	0.145	0.896	0.835	0.773
1991	3441.700	6883.400	0.033	0.033	1.112	1.050	0.988
1992	3807.600	7615.200	0.106	0.106	1.228	1.198	1.167
1993	3824.600	7649.200	0.004	0.004	1.382	1.473	1.565
1994	4260.000	8520.000	0.114	0.114	2.446	2.392	2.338
1995	5099.300	10198.600	0.197	0.197	2.442	2.304	2.167
1996	5310.400	10620.800	0.041	0.041	2.368	2.272	2.176
1997	5535.700	11071.400	0.042	0.042	2.737	2.435	2.133

Appendix II

Table 1

Regression Analysis

Eq.	Data	Independent Variables / Coefficients / Dependant Variables	α	FK β	L χ	FDI δ	X ε	M ϕ	Adj. R^2
1	Level	GDP Current	-794.277096	2.4339**	2.141892*	-1.25588	0.203092**	-0.16098	0.997
			-1.08152488	6.400647	1.216001	-0.46177	3.999643	-1.87358	
2			-885.963205	2.619511**	2.263296				0.995
			-1.92736932	23.80385	2.303307				
3			454.2653254**				0.468752		0.986
			5.370520812				34.50749		
4			975.859799**			17.84295**			0.941
			6.477678743			17.06709			
5			-644.004114	2.887085	0.001628	-0.00133			0.995
			-0.99326199	5.701262	1.05464	-0.54195			
10		X	1113.230388**			38.05827**			0.955
			3.998097711			19.69601			
11	Level	GDP Real	-2311.23102	0.755012**	6.716122**	2.661794**	0.071347	-0.09881	0.994
			-7.28357064	2.67685	8.494591	2.317333	1.486129	-1.65575	
12			-2259.83324	1.311504**	6.096622**				0.990
			-8.92875015	8.033505	9.749359				
13			657.2799159**				0.406879		0.956
			8.674637866				19.93445		
14			1216.800916**			13.54644**			0.842
			11.06819159			9.84226			
15			-2264.95655**	0.661352**	6.586982**	2.866192**			0.993
			-10.6545661	2.434021	11.88532	2.771592			
20		X	1374.692156**			33.30354**			0.881
			5.988614354			11.58841			
21	log	GDP Real	-12.2749057	0.101536**	2.639268**	0.039484	-0.07631	0.053367	0.991
			-6.48983899	1.032338	7.604519	1.016916	-0.80037	0.634901	
22			1.820762	0.145087**	2.810477**				0.98
			22.17897	2.802919	16.15229				
23			1.286600311**				0.579775**		0.93
			10.40083328				15.61334		
24			2.09678926			0.274022**			0.954
			35.76602052			19.29243			
25			-11.80855585	0.081833	2.5538098	0.0398434			0.993
			-7.374187178	1.0601739	8.7887179	1.0989559			
30		X	1.467752102**			0.455246**			0.946
			13.90966992			17.80721			
31	rate of growth	GDP Real	0.097326082**	0.05061	134.7996	-4.14951	-0.10836	0.088244*	0.188
			6.080961558	0.916142	0.354026	-0.25737	-2.63046	2.105039	
32			0.090864304	0.0251448	0.1769315				0.057
			5.529732642	0.8788281	0.4111304				
33			0.101107896				-0.0051375		0.003
			9.903795166				-0.2207927		
34			0.096990023			0.0049593			0.012
			8.938876996			0.4427411			
35			0.093360854	0.0368691	0.154386	-0.0059396			0.064
			4.982530504	0.7724326	0.3432817	-0.3125376			
40		X	0.043658705			321.1621**			0.998
			0.498627781			3.553058			

Eq.	Data	Independent Variables / Coefficients / Dependant Variables		FK β	L χ	FDI δ	X ε	M φ	Adj. R^2
			α						
41	Level	GNP	**-696.5688428**	**2.322419**	**0.0019032**	**-0.0028122**	**0.1773077**	**-0.0779511**	0.998
		Current	-1.09890409	7.0760852	1.2518652	-1.1979991	4.0456475	-1.0511445	
42			**-1238.51544**	**2.430813****	**3.128435****				0.996
			-3.10296998	25.43931	3.666608				
43			**493.53597****				**0.45219****		0.985
			5.947486126				33.93115		
44			**1000.05267****			**17.16891****			0.936
			6.574842466			16.26545			
45			**-1006.037369**	**-0.0012777**	**2.6879024**	**0.0025182**			0.996
			-1.790904899	-0.601009	6.1264388	1.8826708			
50	Level	GNP	**321.7508672**	**2.5882531**	**-0.0003074**	**-0.0056844**	**0.207352**	**-0.0538826**	0.991
		Real	0.772676669	6.992848	-0.296266	-3.7711443	3.2912905	-0.6880182	
51			**-461.306589**	**2.027159****	**2.109967****				0.974
			-1.23770801	8.432132	2.291272				
52			**847.5243988****				**0.364845****		0.947
			11.2972074				18.05368		
53			**1351.037378****			**12.10801****			0.828
			13.08665668			9.368			
54			**-455.2864878**	**2.7911157**	**0.0015338**	**-0.0033679**			0.982
			-1.335436277	6.405192	1.725632	-2.0306964			
59	log	GNP	**1.765752857**	**0.628857****	**-0.19044**	**-0.09376**	**0.353584****	**0.018403**	0.986
		Real	0.878429156	6.016097	-0.5163	-2.27228	3.4894	0.206011	
60			**-0.045160923**	**0.7904419**	**0.1977502**				0.973
			-0.031341181	9.2244855	0.6865332				
61			**1.533280235**				**0.5142792**		0.952
			16.45802969				18.389398		
62			**2.293283115**			**0.2328456**			0.894
			28.54955251			11.964521			
63			**-2.421529473**	**0.8919324**	**0.6095697**	**-0.0639283**			0.975
			-0.911257011	6.9632893	1.2641369	-1.0625532			
68	rate of growth	GNP	**-0.028651315**	**0.6602965**	**0.4165053**	**-0.0271677**	**0.2259666**	**0.0557584**	0.746
		Real	-0.811286286	5.4168753	0.4957393	-0.7636575	2.4858658	0.6027998	
69			**-0.018440314**	**0.8875815**	**0.5956268**				0.917
			-0.4649814	12.853452	0.5734627				
70			**1.533280235**				**0.672765****		0.776
			-0.75415839				7.753181		
71			**1223.345**			**.266587****			0.845
			11.30446116			4.249806			
72			**-2.421529473**	**0.8919324**	**0.6095697**	**-0.0639283**			0.918
			-0.25384027	7.9986417	0.491304	-0.3622009			

Notes:

1. Bold numbers are estimated coefficients
2. Numbers under coefficients represent T statistics
3. Coefficients significant at 95% are indicated by ** and those significant at 90% are indicated by *

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