经济学硕士 学术论文

The Relationship Between Export and GDP Growth in China

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經濟學碩士 學位論文

중국의 수출과 GDP 간의 관계에 관한 연구

本 論文을 劉翔의 經濟學碩士 學位論文으로 認准함.

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Chapter 1 Introdiuction

1.1 The study background

China's total foreign trade volume surpassed $1 trillion in November 2004, making China the world's third-largest trading nation behind the US and Japan.

With a relatively low-cost labour, a government eager to facilitate foreign investment and an ever-improving infrastructure, China is poised to consolidate its dominance in manufacturing and exporting. The WTO commitments, with their promise of lower tariffs and increased foreign access to Chinese markets, have also fuelled the interest of foreign businesses, and hence, foreign direct investment.

According to international prices, GDP levels show China's percentage of global economic resources rising swiftly, with the gap with the United States narrowing significantly. China is the most rapidly expanding economy in the world and is on track to become the largest economic entity in absolute terms by 2020.

China also has more economic growth potential than most other countries. China's GDP growth potential from 1965 to 1999, according to World Bank estimates, was more than double the world's growth potential. If it lives up to its potential, China could become the biggest economic entity in the world by 2020, with its GDP making up 22.2 percent of the world's total, higher than the 20 percent of the United States China's GDP could exceed that of the United States by 2015.

The export-oriented trade policy has been widely accepted by developing countries. However, the empirical analysis on relations between export and economic growth has reached different, sometimes even conflict conclusions, because different countries and regions have selected and different models and analytical methods have been used. Based on annul data and with the help of bi-variable framework model (VAR) and Granger causality test, Jung and Marshall (1985)(1) analyzed the relations between real GDP (GNP) growth rates and export growth rates of 37 developing countries between 1950 and 1981, and got the conclusion that among all 37 cases, 5 were for the hypothesis that export boosted economic growth, 11 revealed the export's economic boosting facts, and only in Israel did bi-directional causality relation exist. In the rest 20 countries no causal relationships have been found between export growth and economic growth. Similar conclusion has been reached by Chow (1987), who, using annul data and VAR model, studies the relations between export and output in the manufacturing industry of 8 NICs between 1960 and 1984. With the implementation of Rank Correlation Approach (RC) and VAR model, and consideration of trade terms as variables, Dhawan and Biswal (1999)(2) studied the relations between real GDP and export of India between 1961－1993. Study has found that export's economic boosting effects were only short-run phenomena.

The relationship between exports and economic growth has always been a hot issue among economists. The debate on "Export-led Economic Growth" is just one reflection offshoot of this discussion. Generally speaking, there are two approaches to addressing the issue:

The first approach is to study export's the contribution of exports to economic growth through analysis of the supply side of the economy. This approach originates from the neo-classical economic growth theory. According to the approach, the major source of economic growth lies in

two areas: 1) factor input increases and 2) efficiency-improvements. Correspondingly, analysis in from this approach often regards exports as a factor that can affect technological progress or other factors that are related to economic efficiency. In practice, the contribution of exports is thought to be included in the residuals of the growth accounting. The "new growth theory" endogenizes the mechanism that through which exports affects the economic growth. For instance, Grossman and Helpman(3) (1990) proposed a two-country growth model with endogenous technological progress. In their model, exports help to promote technology and knowledge diffusion and thus accelerate economic growth.

How to introduce exports into the production function is the main problem involved in econometric analysis that follows the neoclassical approach. Some analysts directly include exports in the production function as the third variables besides labor and capital. Others use more sophisticated methods. For example, Feder(4) (1983) divided the economy into two sectors: the export sector and the domestic sector. Because the export sector has to cope with foreign producers and consumers more often than the domestic sector does, it is more efficient than domestic one sector. In order to reflect capture the diffusion process of technology and knowledge, Feder introduced the output of the export sector (total exports) into the production function of the domestic sector as an element that could affect its economic efficiency.

The second approach is to study export's the contributions of exports through analysis on the demand side of the economy. Since this is just the approach taken flowed in this paper, we will make a more detailed thorough review in the following paragraphs.

This demand-side approach is also called demand oriented analysis or Post-Keynesian analysis. According to the traditional Keynesian theory, an export increase in exports is one of the factors that can stimulate demand increases in demand and thus will surely lead to output increases in outputs. However, this approach has not been used widely. According to McCombie and Thirlwall (5) (1994), this is because of the remnant of Say's Law in people's mind. Most people believe that the major constraints of modern economic growth lie on the supply side instead of on the demand side. In other words, only increases in factor inputs and improvements in economic efficiency can stimulate economic growth.

1.2 The study method & organization

The relations between export and economic growth are one of the main debating problems in the economic field. Following the previous literature research about "Export and GDP" written by Chinese and foreign scholars, according to granger causality test theory, I established proper model. And, based on China's data of EXP, and GDP between 1978 and 2003, this paper use unit root test, cointergration testand granger causality test proposes the dynamic relations between China's Export trade and economic growth.

Chapter 2 gives the supplementary literature of this paper, and the utilizing of economic application in real world, to introduce these theories. Chapter 3 introduces China's economy actuality; give us direct viewing understanding for Chinese economy situation. Chapter 4 utilize

unit root test, cointegration test and granger causality test, based on the data of china' Export and GDP (1978-2003) analysis the relations between Export and GDP. Chapter 5 is summary.

Chapter 2 literature review

For a long time, an economic educational circles is being disputed has been the focus that whether foreign trade promoted the economic growth. About 3 kinds of point of view exists in the domestic and abroad document: ***Promotion; Obstacle; Combing.*** Many economists took out the theory which promotes economic growth of foreign trade, from different angle. In study territory of foreign trade and related proof of economic growth, It includes 3 kinds of following way mainly: First, To cross country or local section data, using OLS(least squares); second, using single national or the local time series data cooperates the entire examination, the causal relation analysis and so on; Carries on according to the cross country or the local section and the time series data kneading board data studies. Because uses the research technique and the sample is different, the conclusion obtains from that The foreign trade and the economical growth relations real empirical studies are not also consistent

2.1 The studies using cross country or local section data

In the early research, The economical scholars use (OLS) carry on to the cross country or the local section data test The empirical result generally all supports the viewpoint which the exportation promotion grows. Balassa(6)（1978）Using 11 preliminary industrialization countries 1960-1966 and 1966-1973 year two times data, establishing under the opens economical condition the function of exportation expansion total quantity production, put in function of the Labor force average growth , Domestic investment, and foreign investment accounts for the average proportion which delivers. Using OLS to analysis the relationship between average increase of GDP and export. Obtains conclusion support exportation promotion growth. ***Feder*** (7) (1983) the research centralism analyzed the export department couplets on non- exportation department's external economy benefit, from this promoted the famous ***Feder*** model, the viewpoint which the conclusion similar support exportation promotion grew.

The early time about the cross country or the local section data experience analyzes although the conclusion is similar, but its reliability is worth suspecting, this is because when selection various countries section data, has not considered diversities between different national or the local. Elected country in the economic structure, the production technical level as well as the essential factor reports bestows on and so on aspect is very similar. Cause the analysis conclusion to be similar. In addition, using section data carrying on OLS test, obtains the conclusion only can indicate the foreign trade and the economy grows have relationship, certainly cannot explain two whether has the causal relation.

2.2 The studies using single national or local time series

This kind of research use single country or the local time series data, use cointegration test and granger causality test, both the analysis foreign trade and the economy grows the between correlational dependence, and continue analyzes two causal relations, obtains rich conclusion. Karunaratne (8) (1994) analysis data of Australia in 1959 the 3rd quarter to 1992 the 2nd quarter

data, utilized the double variable   Granger test obtained that   export promotes to grow. But utilizes separately (IRFS) and (FEVDS) analyzes, obtains the conclusion is not actually same. Dhawan and Biswal (9) (1999) using (VAR) and JJ cointegartion analysis   technology using   the regression model, analyzed Indian   1961-1993 year GDP and the exportation relations, discovered exports   growth impetus economy in short-term grows, in the long-term inside   this kind of relations was not certainly obvious.

2.3 The studies using cross country or local kneading board data

Jung and Marshall (10) (1985) analyzed 37 developing nations and the local   1950-1981 year export and the GDP relations, discovered has 20   national exportation growths and economy grows between does not exist   causal relation, only Israel has Bidirectional causality relation. Ghartey (1993) using American, Japanese and Taiwan's economical data   carries on the analysis discovers American GDP is the reason which its exportation grows, Taiwan just is opposite, in Japan, this two factor are effect relationships relations.

The latter two methods because can overcome between different national and the local neterogeny question very well, at present has become the foreign trade and the economical growth relations real diagnosis research mainstream method.

China also had many scholars inspects the relations between China's foreign trade and the economy grows, also made some achievements. 杨全发、舒元 (11)（1998）after elaborated the mechanism and the condition which   export promotion economy grew, carried on the real empirical analysis using   Balassa and the Feder establishment model, finally indicated that promote action from China' export to economy is not obvious; 沈程翔 (12)（1999）according to 1977-1998 years Exports and the GDP statistical data   China, examined " the exportation guide the Chinese economy grew " theore, finally discovered in china between the exportation and the industry had the bidirectional causal relation, but did not have the long-term   balanced relations; 宋少华、宋泓明 (13) (2001) analyzed the Chinese 1978-1999 year export and the GDP   relations, thought in short-term exports promotes economical growth,   but in long-term was not certainly obvious.

2.4 Literature summary

The multitudinous scholar above utilizes the different method carries on the real empirical analysis, drew the different conclusion.   But I think there have several questions, which from those researchers should be discussed:

First, The former research establishes the model only considers the influence of export factor to economy grows, but not considers the import factor or   only is simple treats the import GDP as one decrement computation net   import, or simply established model did not considered the import factor. It is worth being discussed. The export and the import is two big differences variables. The export is more receiveved influence from the economical exterior factor, may regard as one exogenous variable, but the change of imports is more received influence from the

economical interior factor, mainly is one endogenous variable. Obviously one should Comprehensive consider the influence both of export and imports two variables to economy grow.

Second, in formally empirical analysis of relation between foreign trade and economy grow, Specially when establishment Revision error model, Besides considers the export, not simultaneously considers the influence of import and invests to the economy grow. Purely considering the export, is obviously cannot make one believe.

Third, The tradition surveys method existence certain flaw to the foreign trade and the economical growth relations.

Figure1,2 show us the present empirical study about relationship between trade and economic growths in using economics.

Figure 1. The overseas empirical analysis about the hypotheses that china's export accelerate economy growth

Researchers	Data	GDP	Export	Mathematics' method	Other variable	Conclusions
zuo (1994)	1980-1993 time series data	Real GDP Growth	Real export Growth	Rank correlation and ad.hoc model	Empty	Support hypotheses
kwan&cotso -mitis(1991)	1952-1985 time series data	（personal average） Income growth	Export volume in gdp	Granger causality test. F test	Empty	Support hypotheses
lee (1994)	1984-1990 time series data	（personal average） Income growth	Export Growth	Ols and ad.hoc model	Time trend、 fdi and lag time	Support hypotheses And fetch regional difference
xue (1995)	1980-1994 time series data	Gnp growth	Export Growth	Rank correlation. ad.hoc model	Empty	Support hypotheses

kwan&kwork (1995)	1982-1985 time series data	Income growth	Export Growth	Engle Hendry Richard test and ols	Labor, investment productivity	Support hypotheses
shan&sun (1998)	1978(5)-1996(5) time series data	Real industry output	Export Growth	var.granger no causality test. Lag term.	Labor, Capital Energy puts Export Import	Double action Causality relations
shen (1998)	1977-1998 time series data	GDP of Reduced export	Export Growth	Granger causality test.	Import Government spending Net capital	Support hypotheses and Double action Causality relations

China' domestic scholars also carried on empirical analysis on relationship between china's economy growth and foreign trade. In the following figure, I also gather it.

Figure 2.   The domestic empirical analysis about the hypotheses that china's export accelerate economy growth

Researchers	Economics method	主要结论
Yixiangshuo （1997）	gnp＝export industrial sector＋import industrial sector	The impetus function of export to the non-exportation department and the entire economy is not strong
laimingyong （1998）	Simple linear regression	The impetus function of export grows to the economy is weaker
yangquanfa（1998）	Product function linear regression	The impetus function of export grows to the economy is weaker
Jiamingsi（1998）	Sna identical equation and	The net export has the effects to economy

	model of trade led GDP	growth
Chajiaqin（1999）	Degree of trade dependence, elasticity analysis, causality test	The impetus function of export grows to the economy is weaker
Shenchengxiang（1999）	granger（f statistic）causality test, DF unit root test, EG－DF co integration test	twoway causality relationship between export and input, but non long-term stationary relation
Yaomingfang（2001）	Pure export analysis, pure import analysis, import decompounded analysis	The impetus function of export grows to the economy is different based on 3 method.
Chenling songshaohua（2001）	In 3 variable system vecm, granger causality test, ADF and PP unit root test, jj co-integration test and aic、scstandard	The impetus function of export and import grows to the economy is short-term.
Linyifu（2001）	equation group	The impetus function of export grows to the economy is strong
Liuxiaopeng（2001）	Co-integration test , ECM	The impetus function of import grows to the economy is strong
Zhoushen（2001）	ar（1）ma（1）regression analysis	There is a stationary relationship between trade and GDP growth ratio.
Wangke（2003）	Unit root test, co-integration test, ECM	The impetus function of export grows to the economy is strong in short-term but negative in long-term.
baoqun（2003）	correction, regression, autoregression（var）	The impetus function of export and import grows to the economy is not obviously.

So, this paper base on data of 1978-2003 of china. Using the mainstream research technique, joins import into the model. Utilizing, unit root test and granger causality test to analysis the relation between Export and GDP of china. Makes every effort to break through old method, and

make the real empirical analysis conclusion to be more persuasive. This article will mainly analyze: if export and import is the cause of GDP; if GDP is the cause of export and import.

Chapter 3 The development of chinese economy

In the fifty years since the founding of the People's Republic of China, especially in the two decades since the initiation of reform and opening to the outside world, China's socialist construction has scored great achievements that have attracted world attention. The national economy showed a rapid and sustained growth, the overall strength of the country expanded noticeably, the standard of living of the people improved with the passage of time and unprecedented results have been achieved in such undertakings as science and technology, education, culture, health and physical culture.

Since the foundation of the People's Republic in 1949, China has made great achievements in the fields of economic and social development. The poor, backward old China has been marching into the initial stage of a prosperous and modern new China. China has witnessed tremendous changes especially after the reform and opening policy commencing in early 1979, thanks to the further emancipation and development of social production force. From 1979 to 2005, China's Gross Domestic Products had been growing at the annual rate of over 9%. In the past three years, China's GDP maintained growth around 8%, making China one of the fastest growing economies in the world. China's GDP grew up to 13.65 trillion RMB Yuan (equal to 1.65 trillion US dollars) in 2004, up 9.5% over 2003. Among countries in the world, China now ranks the third in GDP, only after the United States and the European Union.

The reform and opening policy has also enhanced the economic exchange and cooperation between China and the rest of the world.

In 1978, China's exports were valued at around $20 billion, and its rank among world exporters was 32nd. Since then, its exports have grown at an average annual rate of 30 per cent, such that in 2004 China overtook Japan to become the world's third largest exporter, with exports of nearly $600 billion.

In 2005, export growth has continued unabated, with even more breathtaking increases recorded in the first quarter of this year. Exports grew by more than 35 per cent compared to the same period last year, while the import growth slowed to 15 per cent. As a result, the Chinese economy posted a trade surplus of $16.6 billion compared to an overall trade deficit of $8.4 billion in the first quarter of 2004.

This extraordinary growth has already given rise to backlash, especially in the United States, where protectionist pressures and anti-Chinese sentiments are on the rise. There have been calls for China to revalue upwards its currency, the yuan (or RenMinBi; RMB), which is currently pegged at 8.28 per US dollar, not only from the US administration, but also from the OECD, the G-7, and the IMF.

Many observers have attributed this to the benefits of international economic integration, which is why the Chinese economy is typically cited as the great success story of globalisation.

There is no doubt that such an integration has played an important role, but the point to remember when analysing the Chinese experience is that this integration has not been purely market-led, but has been closely monitored, regulated and, indeed, controlled by the state.

This is clearly evident from a look at the external trade policy regimes in China, which have gone through several major phases.

For two decades after the Government Administration Council adopted the Interim Regulations on Foreign Trade Management in 1950, China's trade was based on complete state monopoly and dominated by trade with the former Soviet Union and other Eastern European countries.

From 1979, along with various internal reforms especially related to the peasant contract system in agriculture, there was some opening up of trade.

From 1979 to 1987, there was a process of delegating authority with respect to foreign trade to lower levels and decentralising the highly concentrated planning management system.

National purchase and allocation plans were replaced with instructive plans with market regulation and implementing import and export licenses and a quota system.

The pattern of trade was also diversified to include compensation trade, processing with supplied materials, trade on commission basis, border trade, local trade, small-deal trade, processing and assembling with imported materials, processing for export, chartering and leasing trade.

Between 1988 and 1990, foreign trade subsidies were frozen and a contract responsibility system in foreign trade was implemented. From 1991 to 1993, the foreign exchange mechanism was readjusted and a double-track exchange rate adopted. Foreign trade enterprises (still dominantly State Owned Enterprises) were allowed to retain part of their foreign exchange earnings, but all financial subsidies to them were stopped and they were made to take on the responsibility for their own profits and losses.

In 1994, the unification of the dual rates in foreign exchange and adopting a unified floating exchange rate for RMB on the basis of market need and supply effectively meant a substantial devaluation of the RMB.

At the same time, the practice of allowing foreign trade enterprises to retain part of their foreign exchange earnings was abolished. The tax refund system for exports was implemented, and the range of import and export quotas and licenses was substantially cut.

On July 1, 1994, the "Foreign Trade Law" was officially put into effect, which stated that China practices a unified foreign trade system and, while giving appropriate protection to domestic enterprises, adopts such internationally conventional anti-dumping, anti-subsidy and

guarantee practices. Controls were lifted over more than 90 per cent of export commodities, where market prices were to be dominant, and a bidding system was introduced for some important export commodities.

The WTO Accession Agreement of 2002 marked a new phase of intensified liberalisation of trade, with China making sweeping commitments to reducing quota controls, tariffs and so on especially on agricultural products.

Nevertheless, despite the apparent drastic trade reforms, the Chinese Government retains substantial control over trade through two important levers.

First, nearly half of all exports are still accounted for by State Owned Enterprises, although the share of foreign owned enterprises has been increasing recently.

Second, control over the banking system and the ability to direct and regulate the allocation of credit has been the most important instrument both of macroeconomic control and of direction of investment and production, which has had direct effects on both exports and imports. The recent deceleration in import growth, for example, is a clear result of the controls on credit implemented by the Chinese authorities on fears of overheating in the economy.

These various phases have also been associated with different degrees of integration into the world economy, based on such indicators as trade dependence in GDP.

The share of total trade (imports and exports) in GDP rose in a stable fashion from 9 per cent in 1978 to 25 per cent in 1989.

In the 1990s, influenced by the dual impact of the RMB's devaluation and the accelerated growth of GDP value counted in terms of RMB, China's foreign trade dependence ratio experienced great fluctuations. From 2000, the rise in trade shares of GDP has been very rapid, going up from 43.8 per cent in 2000 to 60 per cent in 2003 to 70 per cent in 2004.

Despite the past experience of major exporters of the 20th century such as Japan and South Korea, this experience is historically unique in its rapidity and extent, since no other country has been through such a massive increase in trade shares in such a short time.

This can be attributed to a number of special features of China's current trade that is particularly based on the globally integrated production which is a relatively new feature of the world economy.

The proportion of processing trade is rather high in the makeup of China's foreign trade, which accounts for high imports being associated with high exports. Further, the Chinese expansion is still dominantly driven by manufacturing, and the tertiary sector still accounts for only one-third of GDP.

It is also true that China's GDP has probably to some extent been devalued because of statistics reasons.

The overall GDP value of the country is lower than the summation of the production values of all regions, which suggests that the aggregate GDP data could be underestimates.

The sums of the regional GDP values were 8.7, 9.7, 11.7 and 15.6 per cent higher respectively than the overall GDP values in the years from 2000 to 2003. This would make the trade share of GDP appear to be higher than it actually is.

Chart 1

China's external trade
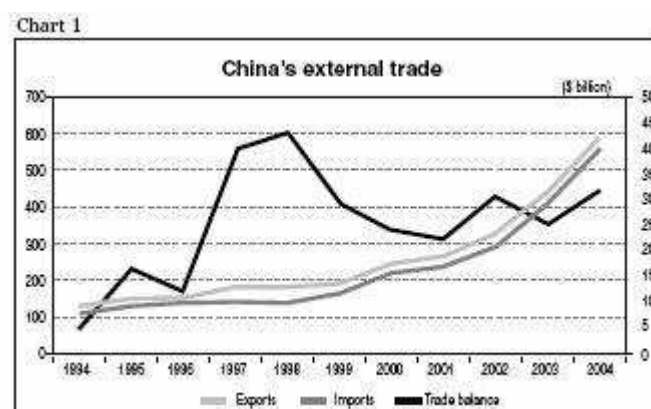
This is the context in which the recent trends in China's trade have to be viewed. Chart 1 shows the pattern of overall trade since 1994. It is evident that both exports and imports have been rising rapidly, but the trade surplus (on the right axis) has been relatively moderate and indeed has declined from its peak of 1997.

The perception of overvaluation of the RMB is not justified from the point of the of the overall trade balance, which is currently showing a surplus of only around $32 billion, or only 2.3 per cent of GDP, which is hardly large by international standards.

What is of greater interest is the pattern of recent trade. The conventional view is that it has been driven by export of textiles and clothing, after the withdrawal of Multi-Fibre Agreement quotas and the entry of China in the World Trade Organisation.

Table 1

Top ten exports in China			
Commodity Description	2003 ($ mn)	2004 ($ mn)	(%) change
Electrical machinery & equipment	88,977.6	129,663.7	45.8
Power generation equipment	83,468.9	118,149.3	41.7
Apparel	45,759.2	54,783.6	19.7
Iron & steel	12,864.8	25,216.4	96.0
Furniture & bedding	12,895.5	17,318.6	29.1
Optics & medical equipment	10,564.3	16,221.0	53.6
Footwear & parts thereof	12,955.0	15,203.2	17.4
Toys & games	13,279.9	15,089.2	13.6
Mineral fuel & oil	11,110.2	14,475.7	30.2
Inorganic & organic chemicals	10,734.8	13,937.6	29.8

But Table 1, which indicates the top ten categories of export, suggests that apparel or garments has been only one of the factors behind the big export push.

Toys, which formed the other great export success of the 1990s, are also relatively less important in recent exports, which have been dominantly driven by capital goods.

This indicates some shifts in trade pattern. Toys, clothing, furniture and television sets have dominated Chinese exports for years, but now newer products such as portable electric lamps and even radio navigation equipment are being shipped in growing quantities to countries ranging from Britain and Spain to Brazil and Indonesia.

At the same time, China is becoming a large exporter of industrial commodities such as steel and chemicals, importing fewer cars and less heavy machinery as Chinese companies and multinationals manufacture more of these in China.

These changes are reflected in imports, which are again dominated by capital goods rather than raw materials.

Table 2

Top ten imports in China

Commodity Description	2003 ($ mn)	2004 ($ mn)	(%) change
Electrical machinery & equipment	103,925.9	142,073.6	36.7
Power generation equipment	71,500.2	91,631.6	28.2
Mineral fuel & oil	29,272.5	48,036.6	64.2
Optical & medical equipment	25,137.5	40,154.9	59.8
Iron & steel	25,596.9	28,387.1	10.9
Plastics & articles thereof	21,032.6	28,060.1	33.4
Inorganic & organic chemicals	18,736.9	27,809.0	48.4
Ore, slag, & ash	7,171.9	17,292.7	141.0
Vehicle & parts other than rail	11,814.8	13,102.7	11.2
Copper & articles thereof	7,165.4	10,484.3	46.3

Even though China became the most significant marginal consumer in the world oil market in 2004, oil imports are only the third largest element in the total import bill, as Table 2 indicates.

The changes in the steel industry are perhaps the most illustrative of what is going on. China has become the world's largest steel consumer, because of its massive construction boom and investment in road infrastructure.

But Chinese steel production has risen even faster, as practically every province has erected steel mills.

So many of these mills produce steel reinforcing bars, known in the industry as rebars and used in concrete construction, that China has gone from a shortage of rebars to a glut, and Chinese rebars are now being exported all over the world.

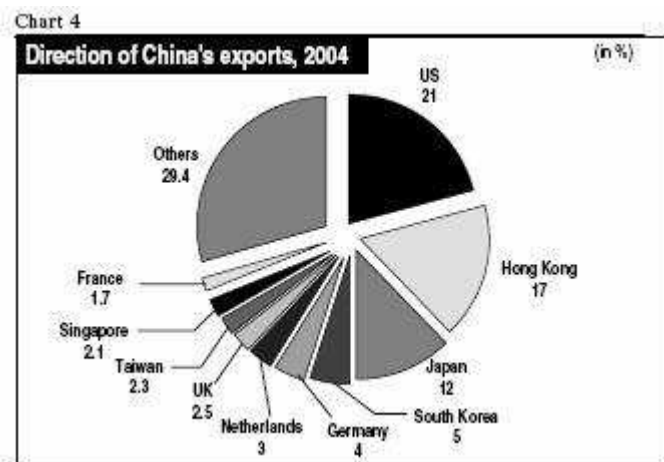China became the largest foreign supplier last year of steel tubing and casing for oil wells in the United States, another technologically simple steel product that Chinese mills have mastered.

Over all, China remains a net importer of steel, but by a shrinking margin. In 2004, steel imports fell 11.3 per cent to $3.82 billion, while exports rose 389 per cent to $2.62 billion.

Chart 3

Source of China's imports, 2004 (in %)

- Japan 16.8
- Taiwan 11.5
- South Korea 11.1
- US 8
- Germany 5.4
- Malaysia 3.2
- Singapore 2.5
- Russia 2.2
- Hong Kong 2.1
- Australia 2.1
- Others 35.1
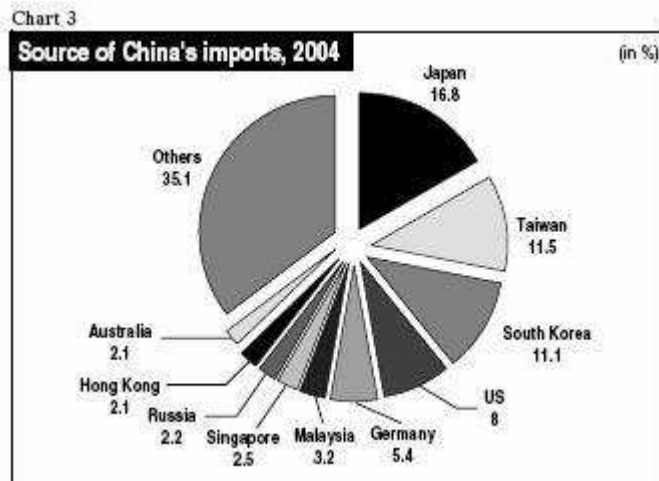
These changes are also mirrored in the direction of trade, which has shown less dependence upon the United States in very recent times, and more concentration of Asia.

Chart 4

Direction of China's exports, 2004 (in %)

- US 21
- Hong Kong 17
- Japan 12
- South Korea 5
- Germany 4
- Netherlands 3
- UK 2.5
- Taiwan 2.3
- Singapore 2.1
- France 1.7
- Others 29.4

This shows the destination of exports and the source of imports respectively in 2004.

This is part of a conscious policy of the Chinese government, to diversify trade patterns and increase interaction not only within Asia (as exemplified by the China-Association of South-East Asian Nations deal of late last year) but also attempts to reach out to Latin American and African countries.

Chapter 4 The empirical analysis

This paper utilizes the method is that the unit root test, and the Granger causal test

4.1 Test methodology

4.1.1 Unit root test

Empirical work based on time series data assumes that the underlying time series is stationay. It is important if time series are stationary. Because if a time series is nonstationary, we can study its behavior only for the time period under consideration. Each set of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize it to other time periods. Therefore, for purpose of forecasting, such nonstationary time series may be of little practical value. Causality tests of granger and sims also assume that the time series involved in analysis are stationary. Therefore, tests of stationarity should precede tests of causality.

And, how do we know that a particular time series is stationary? Now a test of stationarity that has become widely popular over the past several years, it is called Unit root test.

First let's start from unit root stochastic process.

We assume this euqation:

$$x_t = p \, x_{t-1} + \varepsilon_t$$

this model resembles the markov first-order autoregressive model.

If p = 1，we face what is known as the unit root problem, that is, a situation of nonstationarity; We know that in this case the variance of x is not stationary. The name unit root is due to the fact that p = 1. If ｜p｜ $\leqslant$1, that is if the absolute value of p is less that one, then it can be shown that the time series x is stationary.

For theoretical reasons, we manipulate equation(?)as follow: substract x_{t-1} from both sides of equation () obtain:

$$\Delta x_t = \phi x_{t-1} + \varepsilon_t$$

If ϕ = 0, we know the variance of x is not stationary, if ｜ϕ｜ $\leqslant$1, it is stationary.

Dickey and Fuller have shown that under the null hypothesis that ϕ = 0, the estimated t value of the coefficient of x_{t-1} follows the t (tau) statistic. And developed Dickey-Fuller (DF) test. It based on there null hypotheses model:

1） $x_t = \phi x_{t-1} + \varepsilon_t$.   random walk

2） $x_t = \alpha + \phi x_{t-1} + \varepsilon_t$ random walk with drift

3） $x_t = \alpha + \beta t + \phi x_{t-1} + \varepsilon_t$ random walk with drift around a stochastic trend

in conducting the DF test, it was assumed that the error term ε_t was uncorrelated. But in case the ε_t are correlated, Dickey and fuller have developed a test, known as the augmented Dickey-Fuller (ADF) test. This test is conducted by "augmenting" the preceding three equations

by adding the lagged values of the dependent variable Δx_t. The ADF test is based on the following regressions:

1）$\quad x_t = \phi x_{t-1} + \sum_{i=1}^{k} \delta_i \Delta x_{t-i} + \varepsilon_t$ $\qquad$ random walk

2）$\quad x_t = \alpha + \phi x_{t-1} + \sum_{i=1}^{k} \delta_i \Delta x_{t-i} + \varepsilon_t$ $\qquad$ random walk with drift

3）$\quad x_t = \alpha + \beta t + \phi x_{t-1} + \sum_{i=1}^{k} \delta_i \Delta x_{t-i} + \varepsilon_t$ $\qquad$ random walk with drift around a stochastic trend

Phillips and Peron use nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. It's called PP test. the asymptotic distribution of the PP test is the same as the ADF test statistic.

4.1.2 Cointegration

The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

An (n x 1) vector time series y_t is said to be cointegrated if each of the series taken individually is ... nonstationary with a unit root, while some linear combination of the series a'y is stationary... for some nonzero (n x 1) vector a."

Hamilton uses the phrasing that y_t is cointegrated with a', and offers a couple of examples. One was that although consumption and income time series have unit roots, consumption tends to be a roughly constant proportion of income over the long term, so (ln income) minus (ln consumption) looks stationary.

The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not. there have five deterministic trend cases considered by Johansen:
1. no deterministic trends and the cointegrating equations do not have intercepts
2. no deterministic trends and the cointegrating equations have intercepts
3. linear trends but the cointegrating equations have only intercepts
4. the cointegrating equations have linear trends
5. quadratic trends and the cointegrating equations have linear trends

4.1.3 Granger Test of Causality

Granger point: If it's the whole to join the hands during a variable, the Granger cause on at least 1 direction exists. A basic principle related to a check of cause and effect of granger test is so: When regress to other variables of Y is done. When it's possible to include the price at which lagged x and improve a prediction to Y remarkably. So X is the granger cause of Y for us.Similar, Y is the granger cause of X.

In this paper estimate the following pair of regressions model:

$$g_t = \sum_{i=1}^{k} \zeta_i^g \, g_{t-i} + \sum_{i=1}^{k} \zeta_i^m m_{t-i} + \psi_t$$

$$m_t = \sum_{i=1}^{k} \pi_i^g \, g_{t-i} + \sum_{i=1}^{k} \pi_i^m m_{t-i} + \varepsilon_t$$

g_t, m_t point at gross national products and value of export in t time respectively.

The null hypothesis is H0: $\sum \int = 0$, that is, lagged M terms do not belong in the regression. To test this hypothesis, we apply the F test namely:

$$F = \frac{(ESS_0 - ESS_1)/m}{ESS_1/(n-k-m-1)} \sim F(m, n-k-m-1)$$

If the computed F value exceeds the critical F value at the chosen level of significance, we reject the null hypothesis, in which case the lagged M terms belong in the regression. This is another way of saying that M cases GDP.

4.2 Empirical analyses

4.2.1 The data

From National Bureau of Statistic of China, I get the data of Normal GDP and Export from 1978 to 2003. And based on price level of 1978 we get the Real Export and GDP data.

Figure 3 china's Normal Export and GDP, Real Export and GDP

obs	Real EXPORT	Real GDP	IPD	Normal EXPORT	Normal GDP
1978	167.6	3624.1	100	167.6	3624.1
1979	204.71	3899.53	103.51	212	4038.2
1980	252.35	4203.96	107.47	271.2	4517.8
1981	334.55	4425.03	109.88	367.6	4860.3
1982	402.06	4823.68	109.76	441.3	5301.8
1983	395.08	5349.17	110.94	438.3	5957.4
1984	498.84	6160.97	116.39	580.6	7206.7
1985	630.82	6990.89	128.23	808.9	8989.1
1986	807.24	7619.61	134.05	1082.1	10201.4
1987	1043.44	8491.27	140.88	1470	11954.5
1988	1118.16	9448.03	158	1766.7	14922.3
1989	1137.34	9832.18	171.98	1956	16917.8
1990	1643.44	10209.09	181.68	2985.8	18598.4
1991	1973.55	11147.73	193.92	3827.1	21662.5
1992	2235.65	12735.09	209.17	4676.3	26651.9
1993	2295.38	14452.91	239.64	5284.8	34560.5

1994	3629.14	16283.08	287.17	10421.8	46670
1995	3831.44	17993.66	324.99	12451.8	57494.9
1996	3653.17	19718.73	344.26	12576.4	66850.5
1997	4368.2	21454.67	347.07	15160.7	73142.7
1998	4437.24	23129.01	343.27	15231.7	78017.8
1999	4774.51	23807.66	338.46	16159.8	80579.4
2000	6072.33	25971.28	339.81	20634.4	88254
2001	6436.31	27974.87	342.19	22024.4	95727.9
2002	7938.46	30618.29	339.46	26947.9	103935.3
2003	10562.98	33942.65	343.53	36287.9	116603.2

Primitive data from <<The statistics almanac of China>>
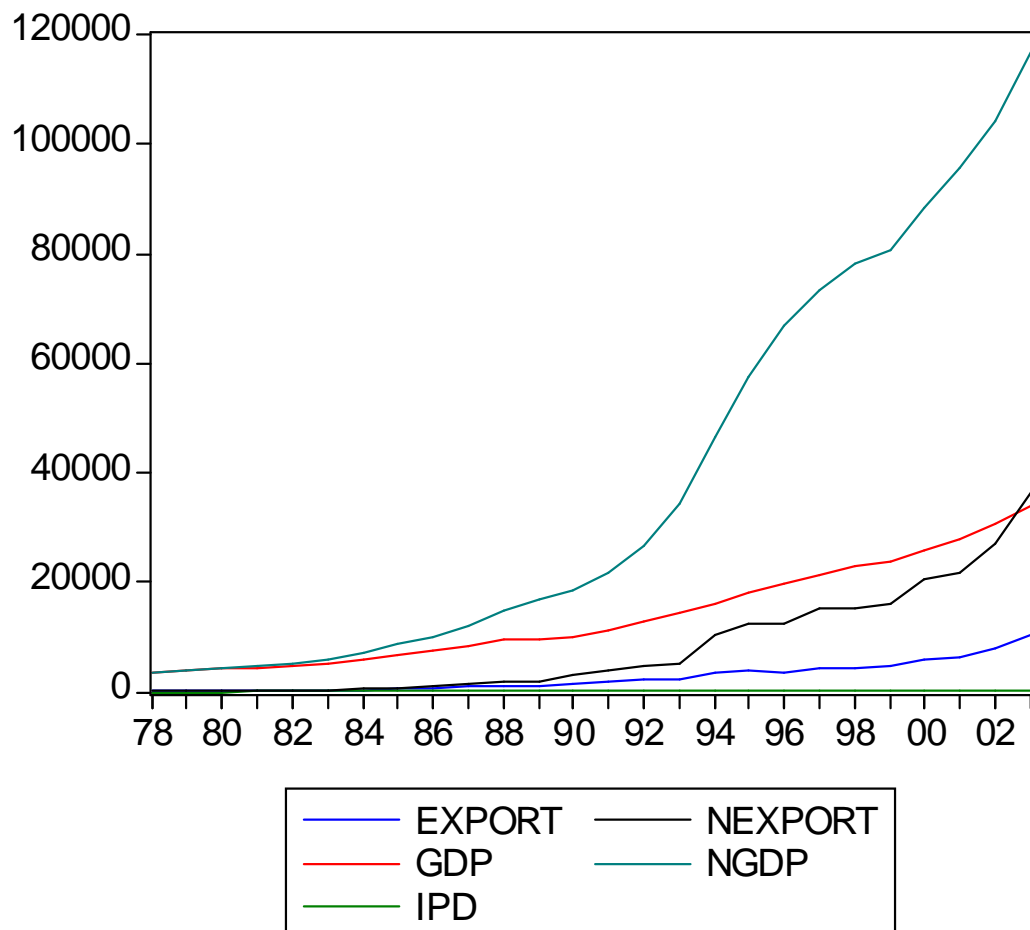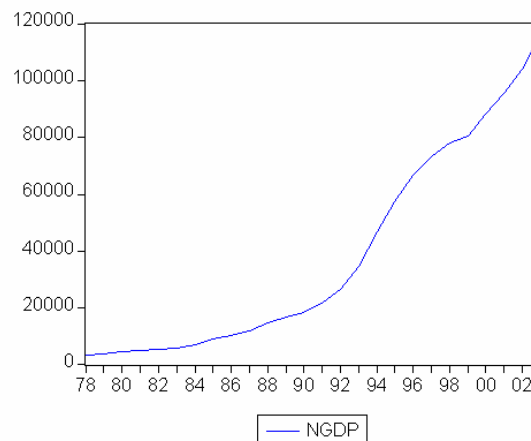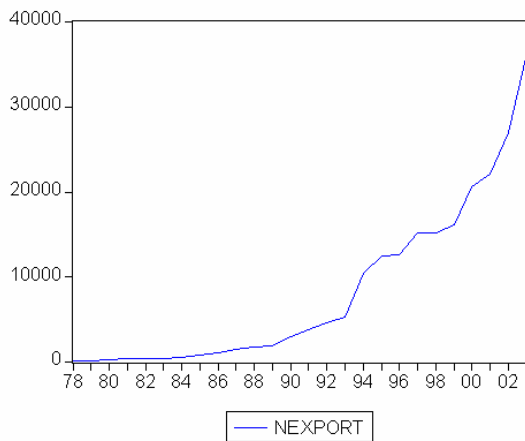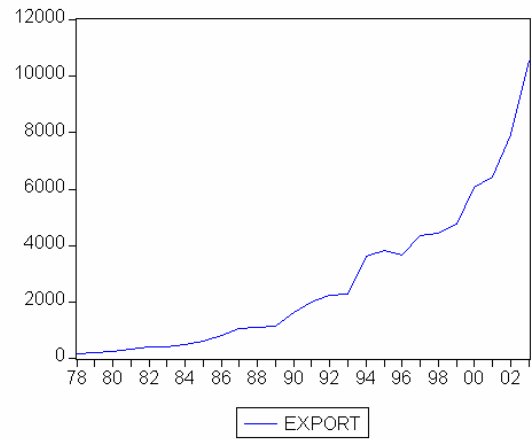Based on china's domestic price level of 1978

Chart 5

Chart 6
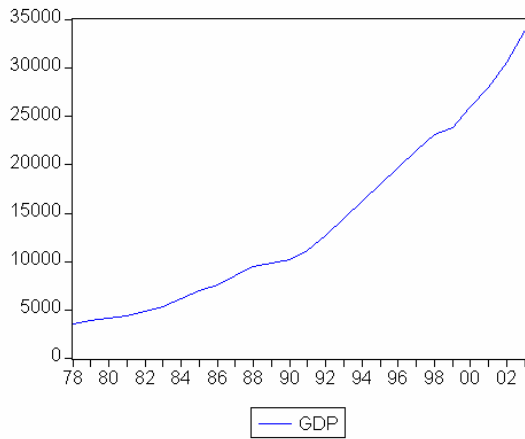
4.2.2 Unit root test results

To guarantee the validity of the model, first using unit root test including (ADF,DF,PP Test) to examine the stationary of Real Export and GDP. See the examination result in Table 3

Table 3

variable		Real export	Real GDP
maximum		10562.98	33942.65
minimum		167.6	3624.1
mean		2724.769	14011.81
median		1808.495	10678.41
DF TEST(level)	intercept	4.86467***	11.63854***
	intercept,trend	3.544535**	6.442519***
ADF TEST(level)	non	6.486988***	16.5331***
	intercept	4.594331***	8.098779***

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| | | 2.256451*** | 1.208335 |
| | intercept,trend | | |

PP TEST same with ADF

variable		Logexport	Loggdp
maximum		4.02	4.53
minimum		2.22	3.56
mean		3.176846	4.049231
median		3.25555	4.03
DF TEST(level)	intercept	3.62538**	13.94706***
	intercept,trend	2.32179	4.443***
ADF TEST(level)	non	6.09466***	3.10608***
	intercept	1.04839	3.33123**
	intercept, trend	2.40628	4.25863***

PP TEST same with ADF

Logexport, LogGDP stand for logarithms of Real Export and GDP respectively.

There are 26 observations for the two variables over the period 1978 - 2003

*, **, ***, significant at the 1% 5% 10% level respectively.

From table3, we can see that according to DF, ADF, PP test t value are almost in high significant. we can reject 0 hypotheses, in other word, Real export and GDP, Log export and GDP are stationary time series.

4.2.3 Johansen cointegration test results

Here we used Johansen cointegration test to analysis the data of Real export and Real GDP. Result seen in following.

For Real export and Real GDP

No deterministic trends and the cointegrating equations do not have intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.593198	35.22901	12.32090	0.0000
At most 1 *	0.433596	13.64274	4.129906	0.0003

No deterministic trends and the cointegrating equations have intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.613043	36.70786	20.26184	0.0001
At most 1 *	0.440130	13.92123	9.164546	0.0059

Linear trends but the cointegrating equations have only intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.595190	32.86586	15.49471	0.0001
At most 1 *	0.371911	11.16177	3.841466	0.0008

The cointegrating equations have linear trends

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.656750	37.39300	25.87211	0.0012
At most 1	0.386605	11.72989	12.51798	0.0674

Quadratic trends and the cointegrating equations have linear trend

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.616589	28.34911	18.39771	0.0015
At most 1 *	0.199536	5.341532	3.841466	0.0208

For Log export and Log GDP
No deterministic trends and the cointegrating equations do not have intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.593198	35.22901	12.32090	0.0000
At most 1 *	0.433596	13.64274	4.129906	0.0003

No deterministic trends and the cointegrating equations have intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.613043	36.70786	20.26184	0.0001
At most 1 *	0.440130	13.92123	9.164546	0.0059

Linear trends but the cointegrating equations have only intercepts

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.595190	32.86586	15.49471	0.0001
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Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
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Quadratic trends and the cointegrating equations have linear trend

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.616589	28.34911	18.39771	0.0015
At most 1 *	0.199536	5.341532	3.841466	0.0208

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

 **MacKinnon-Haug-Michelis (1999) p-values

From above, in each case, value of test is bigger than Critical value at the 0.05 level. So that we can reject hypothesis, accept that Real export and Real GDP are cointegration. The same to Log export and GDP.

4.2.4 Granger Causality test results

Real export and Real GDP

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
GDP does not Granger Cause EXPORT	25	0.16544	0.68813
EXPORT does not Granger Cause GDP		5.41854	0.02952

0.005%   9.48
0.01%   7.77
0.025%   5.69
0.05%   4.24
0.1%   2.92

Log export and Log GDP

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
Log GDP does not Granger Cause Log export	25	3.84044	0.62823
Log export does not Granger Cause Log GDP		7.02045	0.01464

0.005%   9.48
0.01%   7.77
0.025%   5.69
0.05%   4.24
0.1%   2.92

Granger Causality test results see in **Table 4**
Table 4

Variable direct		Causality
Real Export → Real GDP	1	YES***
Real GDP → Real Export	1	NO
Log Export → Log GDP	1	YES***
Log GDP → Log Export	1	YES*

*, **, ***, ****, ***** significant at the 0.005% 0.01% 0.025% 0.05% 0.1% level

From Table4, except real GDP to Real Export, the none hypotheses can be reject in each direction. In other words, Real export have the granger causality to Real GDP; Real GDP have not the granger causality to Real export; Log export have the granger causality to Log GDP; Log GDP have the granger causality to Log Export.

Chapter 5 Summary & conclusion

The purpose of this study was to test the applicability of the export led growth hypothesis for the case of china during 1978 to 2003.

The paper tested if whether exports and GDP are stationary time series use DF,ADF,PP test ; whether export Granger cause GDP growth; whether export Granger cause domestic investment. Our results support the exports, and GDP are stationary time series. From table 3, we get these conclusion: Real Export is high significant stationary time series data in period 1978-2003. Without trend Real GDP is also high significant stationary time series data. Logexport is stationary time series data without intercept and trend. LogGDP is high significant stationary time series data. Although time series of Real export and Real GDP is stationary, and in other words cointegration test is base on nonstationary time series. But in our paper, for making it more believable to other readers, we continue doing Jashon cointegration test. From the cointegration analysis between Real export and Real GDP, Log export and Log GDP above, it support the rejecting null hypothesis of no cointegration between them in any cases. In other words, the results confirm that there have relationship between Real export and Real GDP, also in Log export and Log GDP. Because of the time series data of Export and GDP is stationary and these two variables are cointegration in period 1978-2003, so we can continue to utilize Granger causality test to analysis the relationship between Real export and GDP. From the results of Granger Causality test, we find that: Real Export is the Granger causality of Real GDP in short lags term. Real GDP is not the Granger causality of Real Export except in Long lags term. Logexport is the Granger causality of LogGDP. LogGDP is not the Granger causality of Real Export. The result indicates, GDP is not the strong exogenous variable of Export, but Export is the strong exogenous variable of GDP.

Footnote

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