

German Foreign Investment in Emerging Latin American Markets

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ABSTRACT

The determinants of German FDI to four main Latin American economies reflect the stringent limitations German MNCs had to export their products when the import substitution industrialization strategy was implemented throughout the region. To circumvent its pervasive effects, they invested heavily to open up subsidiaries to locally produce what those highly protected markets could not. Nowadays, German FDI as primarily been directed to expand the market presence of German MNCs by modifying their operations in Latin America in order to sell their products worldwide.

Keywords: foreign direct investment, multinational companies, Germany, Latin America.

I. INTRODUCTION

Capital flows from industrialized countries to developing ones have increased significantly during the last decades (Chakrabarti, 2002). After a period of financial isolation from world private capital markets following the external debt crisis of the early 1980s, Latin America witnessed a sharp reversal of capital flows. Since the beginning of the 1990s, most Latin American countries were flooded with massive amounts of foreign capital. Neither the Mexican tequila crisis in 1995 nor other external shocks that hit the region in the late 1990s discouraged investors to continue supplying funds to Latin America. The composition of capital flows entering the region greatly differed from what it had previously experienced (Tuman and Emmert, 2005). Back then, the majority of capital inflows were in the form of syndicated bank loans to primarily finance budget deficits. Later, portfolio investors followed suit by adding considerable amounts of capital into Latin American assets. Capital inflows were encouraged and welcomed by recipient countries because they served as a substitute for local savings and allowed them to finance current account deficits (Larraín, 2003).

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However, these capital inflows posed serious macroeconomic challenges on Latin American economies (Ffrench-Davis, 2002). International trade emphasized maintaining stable exchange rates among trading partners. Speculative portfolio flows such as short-term investments caused high volatility that countervailed sound monetary policies. Central Banks had to intervene in the foreign exchange market in an attempt to keep exchange rates stable. According to Vial and Cornelius (2002), Latin America explains nearly one-third of the stock of foreign direct investment (FDI) allocated to emerging economies. With an estimated inbound FDI of almost US\$ 20b, Brazil is the world's second most important host country after China. Such a resurgence of capital flows to Latin America fuelled many debates. Internal factors that influence capital flows include intrinsic characteristics of the recipient country such as market-oriented policies, privatization efforts, and liberalization of their capital accounts (Diamandis and Drakos, 2005). Conversely, external ones include worldwide trends that indirectly affect recipient countries such as globalization, macroeconomic performance, and interest rates in the largest industrialized economies (ECLAC, 2003).

Research carried out on FDI in Latin America has quite naturally focused on the two largest capital providers: the United States and Spain. However, German multinational companies (MNCs) have heavily invested in the region and contributed significantly to its growth and development (Nunnenkamp, 2004). Germany ranks third, behind the United States and Spain, in terms of FDI stock by taking into consideration reinvestments and investments via related companies in a third country (Rösler, 2002). The composition of German capital that enters Latin America consists of FDI flows, new investments, and loans. Since total FDI also comprises reinvested local earnings and inter-company loans, the overall picture can be deceiving when trying to look primarily at new investments originating from Germany. Thus, the underlying motives for German MNCs to select Latin American countries as a major destination are not altogether clear (Nunnenkamp, 2000).

This article underscores the macroeconomic and political elements that drive German MNCs to supply funds in the form of FDI, new investments, and portfolio investment to Latin America from 1985 to 2003. The analysis is important for several reasons. First, Germany is not only the third largest foreign direct investor

in Latin America via subsidiaries in third countries but also the largest foreign direct contributor that is not, in any form, related to the region. In effect, Germany is neither closely located to Latin America as the United States is nor culturally related as Spain. Second, German FDI shows a completely different pattern than that of other countries as German MNCs did not participate in the privatization wave that swept throughout the region in the 1990s. Third, German investment concentrated in only a few yet highly capital intensive industries. Finally, it is the fact that some of German FDI undertaken by MNCs goes back to the beginning of the 20th century, long time before United States and Spain began investing in Latin America.

The scope of this paper covers the region's four more distinctive economies and major FDI recipients. In 1999, Argentina, Brazil, Chile, and Mexico accounted for about 70 percent of total FDI stock in Latin America. It is organized as follows. The next section summarizes the main political and economic events that have occurred in these countries in the last two decades. The third section introduces the German industry and the factors that promote and deter different types and trends of capital flows. Empirical results are shown in section four. Lastly, the final section presents the conclusions.

II. THE POLITICAL ECONOMY OF LATIN AMERICA

Following World War II, most Latin American countries adopted a development strategy known as import substitution industrialization (ISI) to promote economic growth by protecting themselves from the rest of the world. Several steps were vital to effectively implement an ISI strategy. Tariffs, especially on non-essential goods, were increased to levels high enough to scare off importers. Licensing and the creation of multiple exchange rates were used to shrink the import bundle. Finally, government investment in key industries implied high entry costs which allured private domestic investors. Initially, ISI seemed to work well. Most countries witnessed rapid economic growth and considerable diversification of their production structure. Politicians and academics alike favored ISI as it allowed their countries to deal with unreliable trade partners and shortage of intermediate goods. However, ISI turned out to be less successful than previously thought. According to Frieden and Stein (2001), a major problem was the missing

transfer of knowledge needed to improve quality and ensure efficiencies. Furthermore, planning necessary to prevent bottlenecks and resource misallocations became difficult as domestic products were uncompetitive. Governments realized too late that ISI was the wrong approach to development after their countries entered into deep recessions.

1. Argentina

The era of ISI in Argentina ended in 1976 when a *Junta Militar* came to power following a coup. The military regime tried to make the Argentinean economy competitive by reducing import tariffs to a 50 percent average, supporting the Argentinean *peso*, and lifting restrictions on foreign borrowing. Despite all efforts, the military government was unable to accomplish a non-inflationary growth (Frieden and Stein, 2001). Late in 1978, a new economic program was introduced. It comprised a scheduled exchange rate devaluation known as the *tablita*, price controls of public goods and services, and establishing minimum wages. The program was unsuccessful as inflationary pressures led to a currency overvaluation. Foreign products kept flowing into the country and negatively affected Argentina's trade balance. The incoming government failed to stabilize a highly inflationary economy. In 1985, the government introduced the *Plan Austral* which established a fixed exchange rate along with wage and price freezes to lower inflation. A year after inflation had declined to less than 90 percent. Regrettably, success was short-lived. Interest groups forced the government to refrain from the *Plan Austral*. In the late 1980s, economic conditions deteriorated and Argentina was in crisis again. By mid-1989, a new government took office to implement wide-ranging economic reforms to fight inflation and cut the accumulated foreign debt. Its first actions included the privatization of large state-owned enterprises, reduction of trade barriers, and financial deregulation (ECLAC, 2003).

Another weapon to combat hyperinflation was introduced in 1991 with the approval of a Convertibility Plan that pegged the Argentinean *peso* one-to-one to the US dollar. The Central Bank served as a currency board responsible for maintaining the peg and ensuring full convertibility among currencies. These changes showed an immediate impact. Between 1991 and 1994, Argentinean GDP grew, on average, about 8 percent annually compared to a -2 percent between 1986

and 1990. Inflation went down from four digits to an average of about 30 percent reaching 3.9 percent in 1994 and budget deficit decreased noticeably. Unemployment became a serious problem reaching a two digit levels in 1994 where it has since then remained (Ffrench-Davis, 2002).

In January 1995, MERCOSUR entered into force and Argentina suffered the Tequila Crisis effects. Policy-makers found themselves scrambling to defend the currency board after bank deposits dropped by 17 percent and US\$ 5.5b flew out of the country. That year, the Argentinean economy recorded another GDP drop which bounced back the following year. In 1997 and 1998, Argentina's authorities were challenged by the Asian crises and the Russia's devaluation and later default. These events did not affect Argentina significantly as its GDP continued to grow and inflation remained low (ECLAC, 2003). However, the devaluation of the Brazilian *real* in early 1999 hit the Argentinean economy hardly and doubts were raised questioning the sustainability of its convertibility plan. By 1999, Argentina became the biggest borrower among the emerging economies. Increased risk premiums pushed debt-servicing costs to critical levels and a debt default on bonds worth US\$ 95b became inevitable. In 2001, the country announced the largest default in world's history despite the support of the IMF to obtain access to new funds (Wise and Roett, 2000).

2. Brazil

The oil shock of 1973 caused a dramatic decline in Brazil's terms of trade to strike a negative trade balance since 80 percent of its oil consumption was imported (Baumann, 2002). Instead of accepting an economic slowdown by reducing oil consumption, the Brazilian government continued importing oil at higher prices. Foreign debt increased as it was used to finance the current account deficit. In 1979, Brazil walked into a democracy with serious economic problems. A second oil shock that year brought about another deterioration of the country's terms of trade. In addition, rising world interest rates increased the debt burden since most of the country's external debt was on flexible interest rates (Stevens, 2000). In early 1986, the government introduced the *Plan Cruzado* to freeze prices, wages, and the nominal exchange rate in an attempt to bring down inflation (ECLAC, 2003).

However, the situation worsened and the government soon shifted to a crawling peg exchange rate with daily devaluations. It did not take long until next stabilization plans were imposed. The initially successful Bresser Plan of 1987 failed at curving down inflation. The so-called Rice and Beans Plan was passed in 1988 but inflation remained high (James and Veltmeyer, 2003). The Summer Plan, introduced in 1989, called for yet another freeze of prices and wages but also proved a failure. By late 1989, inflation had reached unprecedented levels. In turn, 70 percent of private monetary and financial assets were frozen and the exchange rate was floated. In 1991, the government froze again prices and wages, devalued the currency, and increased interest rates. Inflation continued growing and accusations of corruption erupted right after a short drop in 1991 (Font, 2003).

In 1993, an austerity plan called Immediate Action Plan was presented. Government spending was cut by US\$ 6b and tax collection was tightened. Later that year, a new stabilization program known as the *Plan Real* was in place. It comprised further fiscal adjustment measures (Amann and Baer, 2003). Moreover, an indexing system was introduced according to which prices, wages, and exchange rates were linked to a reference value called *Unidade Real de Valor*. In 1994, the *real* replaced the *cruzeiro* as the official currency. A new government in 1995 re-established economic stability and fostered growth. State controls were reduced and many government-owned enterprises were privatized. Restrictions on foreign ownership were eliminated to attract foreign investment at the time that several reforms aimed at cutting public expenditures. Inflation was brought under control averaging less than 10 percent and the budget deficit was drastically reduced (James and Veltmeyer, 2003).

Late in 1997, the Asian Crisis affected Brazil. The country's current account deficit along with an overvalued currency made it an attractive target for currency speculation (Baumann, 2002). In order to defend the *real*, the Central Bank spent an estimated US\$ 7b. By 1998, budget and current account deficits were both a major concern. When the Russian economy collapsed in the summer 1998, investors panicked fearing the crisis could spread over and rapidly pulled their money out of Brazil. A month later, Brazil received a US\$ 41.5b rescue package supported by the IMF. In January 1999, the Central Bank realized it could no longer maintain the exchange rate peg. The *real* was floated which led to an

immediate devaluation. Tighter fiscal and monetary policies combined with external financial support enabled the Brazilian economy to recover quickly and resume growing (Font, 2003).

3. Chile

Until late 1973, Chile pursued an inward-looking development strategy based on ISI. Average tariffs of around 100 percent and an assortment of differential exchange rates discouraged imports and prevented sophisticated goods and technologies from entering the country (Benavente *et al.*, 2003). The military regime lowered fiscal deficit from 24.6 to 2.6 percent of the GDP through an aggressive cut in government expenditures. The number of exchange rates was initially reduced from six to three and later to two as devaluation took place. The government privatized previously nationalized enterprises leaving 34 out of 500 under public control. Furthermore, trade barriers were gradually lifted to regain competitiveness. All those measures led to an economic recovery in 1975. Prices of copper, the country's main export commodity, soared and offset an increased spending on oil imports. In 1976, Chile withdrew from the Andean Pact to pursue far-reaching expansionary efforts. It gained greater access to foreign capital and private businesses made use of newly available funds due to its open market approach. The external debt grew from US\$ 4.7b to US\$ 16.8b between 1976 and 1982. Policy-makers fixed the currency at 39 Chilean *pesos* per US dollar to reduce inflation. Trade protection was further lifted and average import tariffs went from 27 percent to a uniform 10 percent rate for all products except for automobiles and certain agricultural products (ECLAC, 2003).

The economic crisis that erupted in 1982 was more severe in Chile than in any other Latin American country. The entire private sector went bankrupt and external capital came to a sudden halt due to large private borrowing. Inflation averaging about 30 percent since 1977 caused an acute overvaluation of the Chilean *peso*. Terms of trade worsened as world interest rates rose. All these factors led to a 14 percent plunge in GDP. Despite major protests, the military regime remained in power owing support to the largely diversified conglomerates known as *grupos económicos*. In 1977, a crawling-peg was abolished, reinstated, and then replaced with a band that allowed the Chilean *peso* to move within a 4 percent range which

was later widened. Rising discontent about the political and economic situation often ended in mass protests. Producers demanded greater protection from foreign competitors and subsidies to settle their debt. In early 1983, tariffs were raised to 20 percent and “productive debtors” were granted public debt relief. Moreover, a preferential exchange rate was obtainable for those with external liabilities. The crisis eased in 1985 and a sustained recovery set in a year after. The following years witnessed an increase in aggregate demand due to a combined expansion in money supply, tax reductions, import liberalization, and exchange rate appreciation, which made imported products cheaper (Biglaiser and DeRouen. (2006).

An improvement of the terms of trade caused by a rise in copper prices further fueled economic recovery. In 1988, the country returned to democracy and continued its free-market approach avoiding a radical departure from existing policies. A sound macroeconomic framework was already in place and minor adjustments were occasionally undertaken (Benavente *et al*, 2003). During the 1990s, the Chilean economy experienced a remarkable economic prosperity growing at an annual rate of 7 percent with inflation continuing its descending trend. Lately, Chile has focused on further integration into the world economy and transforming itself to a regional trade-hub (ECLAC, 2003). An agreement with the European Union was signed in 2003 while other free trade agreements with the United States and South Korea followed suit in 2004.

4. Mexico

ISI was widely encouraged in Mexico. In 1970s, the Mexican government increased the number of state enterprises to offset a slowdown in economic growth (Larraín, 2003). Over time, public spending led to a rising fiscal deficit that was financed with external borrowing. In 1976, the government repealed the Mexican *peso*-dollar peg when capital flights started to occur. A recession did not last as new oil reserves were discovered which gave Mexico access to cheap foreign borrowing. Oil prices continued to rise and so did public expenditures that led to further economic growth at the cost of exacerbating the budget deficit. By mid-1981, authorities realized they had made a mistake. The situation worsened in 1982 when almost half of Mexico’s outstanding external debt had to be repaid or, alternatively, refinanced.

Nevertheless, Mexico could no longer meet its interest payments on foreign debt. Capital was leaving the country at an alarming rate. In response, the government froze funds, nationalized the banking system, and introduced a dual exchange rate. In 1982, when foreign debt reached US\$ 91b, Mexico signed a stand-by agreement with the IMF that provided the country with a US\$ 4b loan. The conditionality package outlined a cut in public spending, a devaluation of the Mexican *peso* combined with a stable money supply, and the privatization of state-owned enterprises. Bank nationalizations could not be reversed as they were part of the constitution but all non-financial assets were sold back to the private sector. The government followed austerity measures and undertook privatization on a large scale to meet foreign debt obligations. Between 1982 and 1990, over 800 previously state-owned enterprises had been sold to the private sector (Frieden and Stein, 2001).

Mexico's entry into the GATT in 1986 was seen as an important step towards integration into world economy. The administration attempted to stabilize the economy by coordinating prices and wages with business leaders and labor union representatives. The government guaranteed to further cut its budget deficit and tighten money supply (Stevens, 2000). By 1988, the economy was recovering and foreigners were allowed to hold a 100 percent stake of companies within the tourism sector and in *maquiladoras*. In early 1990, Mexico signed the Brady Plan to decrease its foreign debt burden by swapping 30-year zero coupon bonds with a lower face value. A privatized banking system further strengthened foreign confidence. Late in 1992, Mexico signed NAFTA. However, it ignored a widening trade gap as a result of an overvalued Mexican *peso* and overall conditions deteriorated by 1994. The Central Bank intervened heavily in the foreign exchange market to maintain the peg with the US dollar (ECLAC, 2003).

An even further pressure on the Mexican *peso* was exercised when investors withdrew their money right after interest rates in the United States climbed up. Foreign exchange reserves went down from US\$ 25b to US\$ 6b. In 1994, the Central Bank floated the *peso* causing an immediate and drastic devaluation. This event marked the country's worst economic crisis and became known as the Tequila Crisis due to its wide-spreading consequences all over Latin America. In early 1995, Mexican authorities negotiated with the United States a financial package under strict conditions to bring down inflation, reduce the external deficit,

and keep the exchange rate stable. A new government signaled the end of 71 years of the most traditional political party and increased confidence in Mexico's democratic system. Since then, free-market policies, job creation, and balanced budgets have been on top of its political agenda.

III. GERMAN MULTINATIONAL COMPANIES

Manufacturing is the most important economic sector in Germany being the automobile industry its single most important one. Chemicals are another relevant industry that mainly provides for basic and intermediate goods to other industries. Engineering which can be further broken down into mechanical, electrical, and precision engineering ranks third. Consequently, German FDI participation in Latin America is a reflection of its own industrial landscape. Its industries account for as much as 91 percent of sales and 83 percent of employment in German manufacturing affiliates in Latin America (Vodusek, 2001). In 1998, six German MNCs were among the fifty largest worldwide corporations in the region. They made their first investments in Latin America about a century ago running car production facilities, chemicals, health care and nutrition products, telephone lines, and power distribution. Chiefly among them are Volkswagen, DaimlerChrysler, Siemens, BASF, Hoechst, and Bayer. These MNCs have lost ground in the last years as other global companies pushed their operations in Latin America but still find themselves among the top 50 in terms of sales (Robles *et al*, 2002).

Privatization played an important role in recent FDI trends (Watson *et al*, 2005). A large number of previously nationalized enterprises in Latin America were privatized since the debt crisis, especially in telecommunication, utilities, and financial services. However, German involvement pales when compared to Spanish and American MNCs which are more active players in the battle for privatized enterprises. Based on Nunnenkamp (2001), the negligible participation of German investors in utility services is because many of them were provided by the governments. Thus, German MNCs lacked the experience to successfully manage those enterprises.

Recently, the majority of FDI undertaken by German MNCs in Latin America went onto the expansion of their own facilities, followed by green-field investments, and the acquisition of existing private enterprises. Drivers of capital

flows, particularly FDI and portfolio investments are categorized in different ways. Looking at the industries in which the majority of German MNCs operate leads to the assumption that exploiting a natural resource endowment base is irrelevant. In contrast, investors from other European nations as well as the United States put a much higher emphasis on natural resources (Wezel, 2003). Market seeking motives are more obvious. Mexico and Brazil both offer a high domestic demand in addition to a net of well-established trade links owing to trade agreements.

With a GDP of over US\$ 800b, MERCOSUR accounts for around 45 percent of Latin America's GDP, which makes it an important destination for FDI. According to Vodusek (2001) some German FDI would be efficiency seeking in order to conquer other markets. Especially in manufacturing where potential for cost reduction exist by either taking advantage of abundant production factors or by achieving economies of scale. Argentina, Brazil, Chile, and Mexico offer cheaper labor when compared to industrialized countries and higher productivity levels than other developing countries (Nunnenkamp, 2001). Conversely, strategic asset seeking FDI does not seem to be relevant in the case of German investment in Latin America either as many economies have undergone major changes in an attempt to attract foreign capital (Wezel, 2003). Therefore, MNCs do not have to fear the risk of expropriation anymore with the arrival of democracy in Latin American countries to achieve long-term corporate objectives.

IV. TRENDS OF GERMAN CAPITAL ENTERING LATIN AMERICA

Capital flows are categorized as FDI, portfolio investment, and other flows that consist primarily of bank loans. FDI typically has a long-term connotation and investors require an effective voice in management decisions (Diamandis and Drakos, 2005). Therefore, they need to hold a share of ownership larger than a 10 percent threshold. Otherwise, it is considered a portfolio investment. An investment can be made either by acquiring existing assets through cross-border mergers and acquisitions or by investing in new assets also known as green-field investments. Additionally, FDI covers all subsequent investments being made to maintain or expand existing facilities using equity capital, inter-company loans, and reinvested

earnings. Portfolio investment is split into equity securities and debt securities (Mortimer, 2000).

Equity securities such as common stock can also be used for an acquisition which would be considered FDI. Other investments are a residual category that includes financial transactions not covered in direct investment, portfolio investment, or reserve assets. Items falling into that category include loans, short-term trade credits, currency deposits, and other assets and liabilities. Often times, loans by themselves count as the third major group and all remaining flows are gathered into a fourth category.

1. Argentina

Argentina experienced a constant decrease of German FDI and portfolio investments since the late 1990s. Both reached their peaks in 1996 and 1997, they then followed a sharp downturn from which they seem to recover. New investments and liquidations climbed and became more volatile since the early 1990s. After 1995, total FDI resumed growing but changed a few years later when it went down and so did new investments. During the late 1990s, new investments followed the same pattern as liquidations, just of a higher magnitude. The underlying assumption is that existing facilities were sold and immediately replaced by new ones. Despite an overall slump in FDI, new investments reached an all-time high of €353m in 2002. Portfolio flows declined dramatically when the Asian Crisis erupted in 1997. They hit another negative mark in 2001 when the government defaulted on its debt service. This leads to the assumption that portfolio investment which, compared to FDI, is usually of short-term, speculative nature, is more reactive to economic crisis. Purchases and sales of Argentinean securities reached extremely high levels between 1995 and 2002. Presumably, investors became more wary after the Tequila Crises and portfolios were managed more actively afterwards.

2. Brazil

There were some similarities regarding the trend and composition of capital flows between Brazil and Argentina. FDI and portfolio flows increased strongly

during the 1990s. The quantity of FDI was by far larger than in Argentina though. German new investments and liquidations in Brazil went mostly hand in hand. Between 1996 and 2000, liquidations remained low and far behind new investments which led to a high of overall FDI in 2000. Portfolio flows showed a tremendous increase in trading volume in 1997 and 1998. Undoubtedly, this also was a result of the Asian currency crisis. Another drop followed in 1999 and 2001 when overall portfolio investments showed a negative value. Trading activity decreased in 2002 when the Brazilian *real* became extremely unpredictable. Obviously, investors rather allocated their funds to safer investments.

3. Chile

Chile attracted by far less FDI and portfolio investments than Argentina and Brazil. Large quantities of loans entering the country signaled a much greater confidence from the international financial community. This can be ascribed to the country's economic stability. The lack in portfolio investment is somehow surprising. The pattern of German FDI in Chile is hard to retrace as it has been both low and volatile. Surprisingly, recent FDI flows have remained negative despite various trade agreement negotiations which should enhance Chile's export opportunities. Portfolio flows also followed a different trend than in Argentina and Brazil. They skyrocketed in 1999 to approximately €150m after averaging around zero between 1985 and 1998. The following year, portfolio investment plummeted and the balance was negative. A recovery set in quickly which led to an extremely high trading volume in 2002, the actual inflow remained lower than in 2000, though. It seems that investors relocated their capital from elsewhere, including other Latin American countries to Chile in search of a safer economic environment.

4. Mexico

An extremely large quantity of German portfolio investments had already entered Mexico in 1990. Another peak of about the same height followed in 1996 in the aftermath of the Tequila Crisis. There was no decline in loans during the following years unlike in Argentina or Brazil. Paralleling Chile, this can be attributed to Mexico's sound financial system. After 1990, FDI was on the decrease

until it hit the negative mark in 1994. Thereafter, substantial quantities of FDI poured into Mexico. In 1995, when the Mexican *peso* experienced a severe devaluation, new investments and overall FDI reached new heights. Investments resumed growing after a drop in 1996. FDI soared to an all-time high of over €1b in 1997. Since then, it averaged around €300m annually. In the late 1990s, portfolio flows followed a series of ups and downs that can hardly be attributed to economic or political events.

V. EMPIRICAL EVIDENCE

Macroeconomic and political factors undoubtedly affect foreign investment decisions. Currency crises, even if from another country, spill over Latin American economies. However, fluctuations of foreign investment can not be exclusively explained by them. Usually, only those investments which are of short-term and speculative nature can be traced back to unexpected events. A quantitative approach using a pooled time-series cross-sectional multivariate regression model allows further analyzing the drivers of long-term investment decisions. It examines the determinants of German capital flows between 1985 and 2003. Following scholarly works by Oliva and Rivera-Batiz (2002) as well as Biglaiser and DeRouen (2006) the econometric model presented below helps to measure by how much key macroeconomic and political variables influence individual capital flows. Its theoretical underpinnings are based on the most selective set of relevant explanatory approaches discussed by Tuman and Emmert (2005) and Asiedu (2006). Consequently, the empirical model used which incorporate both set of variables is stated as:

$$Y_{ij} = \beta_0 + \beta_{1ij} \Delta GDP_{-1} + \beta_{2ij} \Delta EXR + \beta_{3ij} \Delta IR + \beta_{4ij} INF_{-1} + \beta_{5j} DIR + \beta_{6ij} CI + \beta_{7ij} Y_{-1} + \varepsilon_{ij}$$

Where Y_{ij} represents total FDI, new investments, or total portfolio investments normalized by each country's GDP to control for differences in economic size and, ultimately, mitigate potential heteroscedasticity problems. The independent variables represent yearly changes in GDP, ΔGDP ; changes in the domestic real exchange rate with respect to the Euro, ΔEXR ; interest rate differential between the local real interest rate and the LIBOR rate, ΔIR ; inflation

rate lagged one year, INF_{-1} ; a direct investment risk index, DIR ; a corruption perception index, CI ; the own dependent variable lagged one year, Y_{ij} , to address the presence of error autocorrelation over time, and an error term is denoted by ε . Subscripts i are years while subscripts j are countries.

The rationale for using the same set of independent variables to predict changes in new investments as well as total portfolio investments was based on their lack of verifiably convincing explanations across Latin American countries. Other potentially relevant variables listed in the most standard literature on FDI such as labor market conditions and tax rate structures were also tested but rendered inconclusive results and were, therefore, left out of the analysis. Statistics were electronically obtained from the German *Bundesbank* database and complemented with country specific information data taken from each country's Central Bank. Loans were excluded from the analysis as they are often used by governments to finance their budget deficits. In fact, they correspond to a demand-driven type of capital flow. Hence, these flows fail to explain the intrinsic motives of corporate, institutional, or individual investors.

GDP growth is used as an indicator of future demand or economic prosperity. A growing GDP would mean that households have more income available to increase their consumption. MNCs would respond by expanding their existing facilities or establishing new ones to satisfy a potentially growing demand. This would indicate a positive relationship between GDP growth and FDI as well as portfolio investments. Inflation is the most prevalent enemy of almost every Latin American economy and its rate is used as a measure of macroeconomic instability. Rising inflation causes uncertainty about future prices for consumers and corporations alike. It is then reasonable to assume that FDI activities would decrease during times of higher inflation. Accordingly, the same negative association is expected for portfolio flows.

Interest rates have a strong impact on total portfolio flows and FDI. However, predicting their impact is troublesome since a higher risk needs to be compensated with a higher rate of return. If Latin American interest rates reached levels as low as those in industrialized countries, investors would invest in the latter due to lower risks associated with similar returns. In terms of FDI, the relationship would be negative as higher local real interest rates raise borrowing costs. Nevertheless, MNCs could circumvent high domestic interest rates by financing investment

projects out of cash flows or with money borrowed in their home country. Thus, interest rates would have an ambiguous effect. Exchange rates affect the behavior of foreign investors. In the case of portfolio investments, the purchase of foreign assets such as stocks or bonds would take place when investors' currency is rather overvalued compared to the foreign currency. Conversely, a sale would occur when these values reverse each other. FDI flows would follow the same pattern for similar reasons. Capital flows would enter a country at different times as investors can neither foresee the length of a currency appreciation nor when an exchange rate would hit rock bottom. Overall, it is reasonable to expect a negative relationship between both variables.

The direct investment risk index comparatively measures the risks facing foreign investment in wholly owned subsidiaries, joint ventures, and other forms of direct ownership of assets or equities in a host country. It is published under the *International Country Risk Guide* by the *Political Risk Services Group*. The index considers the following equally weighted factors such as turmoil, equity restrictions, local operations restrictions, taxation discrimination, repatriation restrictions, exchange controls, and labor costs to determine business and investments risks around the world. The corruption perception index was obtained from *Transparency International* and measures the different forms of corruption among bureaucrats and politicians. It extracts information out of 16 surveys from eight independent institutions to captures the inherent subjectivity of different forms of national corruption across countries. This index was inversely rescaled in order to facilitate the results interpretation. Both indexes are expected to be inversely related to each one of the independent variables.

Table 1 shows the econometric estimates for total FDI. The explanatory variables account on average for about 40 percent of variation in the total FDI flow and have all the expected signs. In addition, the *F*-statistics are significant at least the 10 percent level. Economic literature is ambiguous in terms of the role currency appreciation in propelling capital inflows. Results obtained show that total German FDI targeting Latin America moves in opposite directions with variations in the real exchange rates. Their influence on total FDI is statistically significant in all cases. On the other hand, lagged inflation confirms its negative relationship with total FDI flows. Its influence on total FDI for the aggregate as well individual

countries is always statistically significant. Economic expansion reflected by GDP growth indicates the existence of a positive and statistically significant relationship across countries. These results are consistent with the greater weight these countries carry in terms of the long-term connotation of FDI. Adjusted variation in local real interest rates manifest their negative connotation at explaining total FDI and their estimated coefficients proved to be statistically significant as well. This finding is not surprising as high interest rates usually increase investment-financing costs to a point of making it unfeasible. The direct investment risk and the corruption perception indexes have all the predictive negative signs and are highly significant.

Table 2 depicts the estimated parameters on new investments. Broadly speaking, they serve as a relatively good indicator of how German MNCs perceive the foreign investment climate. The independent variables explain an average goodness-of-fit of 38 percent in the flow of new investments with *F*-statistics still falling within acceptable statistical levels. Interestingly, variations in the domestic real exchange rates yield non-significant results for Argentina and Brazil suggesting that higher exchange rate volatility actually does not necessarily influence either the magnitude or the timing of new investments. Presumably, trade agreements or the like play a larger role or MNCs use methods to hedge unwanted currency development at the time they need to undertake an investment. The coefficients for lagged inflation turn out to be significant with the expected negative signs. The change in GDP turns out to be negative and statistically significant for the pooled regression as investors increasingly searched for opportunities in other countries of the region when economic situation deteriorates. Adjusted real interest rates return similar results as in the case of total FDI with mildly significant and negatively correlated results with new investments. Apparently, new investments are quite responsive to price changes of investment assets. Consistent with previous works the direct investment risk and the corruption perception indexes show their negative impact on new investments. However, the latter shows a much stronger statistical significance for all countries analyzed than the former.

Table 3 portrays the regression results for the portfolio investments. The explanatory variables account, on average, for a 39 percent fit in the portfolio investment flow. Furthermore, the *F*-statistics are significant at least at the 10 percent level. Once again, results maintain a consistent relationship with variations

in domestic exchange rates as portfolio investments would increase in proportion to a currency depreciation. Lagged inflation shows its negative and significant results in the net flow of portfolio investments as expected. The model yields a statistically high and significant coefficient for GDP changes in the case of portfolio investments into Latin America. These usually temporary disturbances of economic crises unambiguously explain portfolio investments with statistically significant results in all four cases. Interestingly, the relationship with changes in adjusted real interest rates is positive but not always statistically significant. This finding is somehow counterintuitive as German investors would be attracted by high nominal exchange rates without considering possible devaluations with respect to the German mark or the Euro. After all, currency devaluation was, most of the time, higher than nominal interest rates on Latin American assets yielding negative returns. The results for the direct investment risk and the corruption perception indexes are qualitatively similar to the other specifications in terms of both their sign and statistical significance.

VI. CONCLUSIONS

Latin America is an important strategic location for German FDI. Its presence goes back to the first half of the 20th century mainly in the automobile and chemicals industries as well as various engineering fields. Brazil stands out as the main destination with an accumulated stock equivalent to 43 percent of the total German FDI. Around 1,200 German MNCs have been established in Brazil, followed by Mexico and Argentina, leaving Chile far behind. The nineties witnessed fundamental variations in the investment motives among German FDI. Firstly, investment risk reduced significantly as overall conditions in most Latin American countries improved. Secondly, far-reaching regional integration agreements created new opportunities that evolved into an efficiency-seeking export platform for larger and more sophisticated markets. Lastly, corruption becomes another decisive factor as least corrupted countries are more prone to experience far more German FDI than more corrupted ones. Decision criteria for portfolio investment seemed similar insofar reduced direct investment risk combined with high nominal interest rates attracted investors. Whenever an economic crisis erupted, German portfolio investors seemed concerned given their

large trading volume. However, they did not refrain from investing in the region. Instead, they began selling old assets and purchasing new ones more often causing trading volume to increase significantly.

Latin American economies are still perceived as having weak legal institutions, poor enforcement mechanisms, intricate laws and regulations, and excessive discretionary power at various levels of government. These increase the cost of doing business. Argentina, Brazil, and Mexico, in particular, need a major overhaul. Solving it would entice foreign investors put more emphasis on Latin America. Whether or not German FDI in Latin America will reach similar or greater levels as in the mid-to-late nineties depends on several country specific factors. For instance, Argentina needs to recover in such a way that debt restructuring gets special attention to regain trust from the financial community. Brazil will always play a major role since it is the world's second largest emerging economy and the main recipient of German FDI. Whether or not Chile will be able to attract further German capital would depend on the impact of the trade agreements it has signed with its trade partners. Finally, Mexico will likely continue to be the focus of attention for most foreign investment in the region, primarily due to its proximity to the United States.

The extent of the political and economic integration agreements may potentially have a positive impact on Argentina, Brazil, and Chile. Despite its geographic advantage over neighboring nations, Mexico's future would be uncertain as most of the benefits it currently enjoys from NAFTA may fade out along with the need to forfeit portions of its inward investment. Ultimately, however, it will depend on the alternatives available both inside and outside such a regional trade integration area. Other countries may become increasingly attractive to German FDI because of their low-wages and large market opportunities or their geographical proximity to target markets and well-qualified labor like in China and Eastern Europe, respectively. Therefore, Latin American policy-makers urgently need to work out the social, legal, economic, political, and technological aspects that discourage foreign investment and better compete for attracting German FDI.

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APPENDIX

Table 1. OLS Estimates Dependent Variable: Total FDI

	All	Argentina	Brazil	Chile	Mexico
Intercept	1.31 (1.28)	-1.23 (-1.66)	-0.75** (-1.94)	1.78 (1.52)	-1.67* (-1.70)
Δ GDP	2.95** (2.10)	2.31* (1.82)	1.22** (1.96)	2.47** (1.99)	2.34* (1.83)
Δ Domestic Exchange Rate	-2.34* (-1.85)	-3.33** (-1.90)	-1.20*** (-2.52)	-3.11* (-1.95)	-2.48*** (-2.38)
Δ Interest Rate	0.77** (2.11)	0.20* (1.79)	0.47** (2.14)	0.64 (1.29)	0.70 (1.07)
Inflation Rate $_{-1}$	-1.29* (-1.76)	-1.73** (-1.85)	-2.00*** (-2.02)	-1.66* (-1.93)	-1.98** (-1.93)
Direct Investment Risk Index	-2.12* (-1.76)	-2.19** (-2.05)	-2.22** (-1.89)	-2.01* (-1.72)	-1.70* (-1.77)
Corruption Perception Index	-1.21** (-1.99)	-2.23*** (-2.45)	-2.70*** (-2.62)	-1.02 (-1.20)	-2.08*** (-2.53)
Total FDI $_{-1}$	1.22*** (2.76)	1.33*** (2.35)	1.70*** (2.42)	1.10*** (2.33)	1.66*** (2.53)
Adjusted R ²	0.40	0.42	0.34	0.39	0.41
F-statistics	2.21*	2.38**	1.71	2.53**	1.85

Note: p -values are in parentheses based on Cook-Weisberg test for heteroscedasticity while ***, **, and * indicate significance at 0.01, 0.05, and 0.10 levels respectively.

Table 2. OLS Estimates Dependent Variable: New Investments

	All	Argentina	Brazil	Chile	Mexico
Intercept	0.83* (1.77)	0.97 (1.67)	0.44* (1.80)	1.50* (1.88)	0.32** (1.93)

Δ GDP	1.84* (1.72)	2.64** (2.19)	1.42* (1.86)	3.00** (1.90)	2.01** (1.80)
Δ Domestic Exchange Rate	-2.60* (-1.72)	-2.31 (-1.22)	-1.03 (-1.40)	-2.38* (-1.62)	-2.41** (-2.29)
Δ Interest Rate	0.74* (1.79)	0.76** (2.05)	0.22** (2.15)	-0.27 (-1.90)	-0.36 (-0.82)
Inflation Rate $_{-1}$	-1.71** (-1.91)	-1.88** (-2.12)	-1.64** (-2.03)	-1.75* (-1.83)	-1.04* (-1.78)
Direct Investment Risk Index	-2.86* (-1.91)	-2.22* (-1.75)	-2.29* (-1.82)	-2.67** (-2.13)	-2.70* (-1.73)
Corruption Perception Index	-2.21* (-1.76)	-1.23** (-1.87)	-2.02*** (-2.56)	-1.89* (-1.90)	-2.44*** (-2.53)
New Investments $_{-1}$	1.48*** (2.49)	1.13*** (2.64)	1.37*** (2.78)	1.17*** (2.58)	1.51*** (2.61)
Adjusted R ²	0.38	0.36	0.42	0.46	0.36
F-statistics	1.92**	1.35	1.83*	1.40	2.37**

Note: p -values are in parentheses based on Cook-Weisberg test for heteroscedasticity while ***, **, and * indicate significance at 0.01, 0.05, and 0.10 levels respectively.

Table 3. OLS Estimates Dependent Variable: Portfolio Investments

	All	Argentina	Brazil	Chile	Mexico
Intercept	0.24* (1.75)	0.27 (1.21)	0.94* (1.84)	0.14 (1.11)	0.36** (2.49)
Δ GDP	1.33* (1.77)	1.21 (0.94)	1.46* (1.82)	1.43*** (2.66)	1.34*** (2.46)
Δ Domestic Exchange Rate	-2.48 (-1.53)	-2.42*** (-2.62)	-2.30*** (-2.39)	-2.27* (-1.86)	-2.56 (-1.45)
Δ Interest Rate	0.15* (1.80)	0.27 (1.39)	0.18* (1.81)	0.12 (1.57)	0.16* (1.92)
Inflation Rate $_{-1}$	1.89** (2.22)	1.39*** (2.07)	1.69** (2.05)	1.43* (1.87)	1.93** (2.36)
Direct Investment Risk Index	-1.41* (-1.86)	-2.23* (-1.88)	-2.32* (-1.90)	-2.02** (-1.93)	-2.77*** (-2.53)
Corruption Perception Index	-2.00* (-1.88)	-2.11** (-2.05)	-2.44*** (-2.29)	-2.02 (-1.33)	-2.53* (-1.83)
Portfolio Investments $_{-1}$	1.55*** (2.56)	1.66*** (2.22)	1.41** (1.94)	1.21*** (2.73)	1.04** (2.01)
Adjusted R ²	0.39	0.38	0.37	0.45	0.41
F-statistics	2.02*	1.61	2.41**	2.24*	1.93

Note: p -values are in parentheses based on Cook-Weisberg test for heteroscedasticity while ***, **, and * indicate significance at 0.01, 0.05, and 0.10 levels respectively.

德國在新興拉丁美洲市場的海外投資

JAIME ORTIZ, KASSIE FREEMAN, TOBIAS WOLLENHAUPT ***摘要**

德國在四個拉丁美洲經濟體海外投資中，反應了當區域進口替代產業策略普遍實施時，德國多國企業面臨嚴格出口限制的情境因素。爲了克服這個效應，他們大量投資設立子公司，並生產在嚴格保護市場中所無法進口的產品。以現階段而言，德國在拉丁美洲投資的海外投資子公司，已經主要導向爲以拉丁美洲生產進而將產品行銷全世界。

關鍵詞彙：海外直接投資，多國公司，德國，拉丁美洲

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上海深圳特別處理公司財務風險 與危機時程之研究

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摘要

本文以中國上海和深圳上市公司 A 股為研究對象，首先分別比較不同財務危機預警模型之區別正確率，選定以羅吉斯迴歸及馬可夫吸收鏈來建構財務危機預警模型並推估危機時程，預測特別處理公司由發生危機到退市或恢復正常交易所需的時程。經樣本期間選擇後發現，以 2003 年之解釋能力優於其他年度，本文應用逐步羅吉斯建構財務危機預警模型，實證結果發現羅吉斯迴歸模型有五項解釋變數皆顯著，且整體正確區別率達 96.28%。再以 2004 及 2005 年特別處理公司進行驗證，其正確區別率各為 84.38% 與 96.29%，顯示本文模型具有相當地穩定性；第二部份本文使用馬可夫吸收鏈，投入上述模型計算得到之危機機率，藉以探討特別處理公司在退市或撤銷特別處理之前的預期停留時程。本文發現驗證樣本的實際停留時間與馬可夫吸收鏈估算出的結果大致吻合，顯示應用馬可夫吸收鏈可以有效估算出特別處理公司撤銷特別處理與終止上市前之預期停留時程。

關鍵詞彙：財務危機，特別處理公司，財務危機，馬可夫吸收鏈

壹· 前言

近年來中國經濟的快速成長，中國股市吸引著世界越來越多的目光，投資者的熱錢不斷流入，中國證券市場將成為全球重要的市場之一，但如果無法充分瞭解中國股市的風險特性及做好風險的掌控，對投資者是具有相當程度的風險。由於公司在經營的過程中存在著許多的風險，為了使公司或投資人降低經營或投資上的風險，風險的預警與防範在近年是個重要的課題，隨著中國市

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場對外開放，世界各國企業競相到中國投資，繼而帶動中國市場的活絡，至 2005 年 11 月底上海、深圳市場 A 股¹上市企業家數已達一千三百多家。

而中國證監會爲了使得市場機制能充分運作，並保障市場投資人的權益，實施特別處理類股制度 (Special Treatment, ST)，也就是當上市公司有(1)最近兩個會計年度的審計結果顯示的淨利潤均爲負值；(2)最近一個會計年度的審計結果顯示其股東權益低於註冊資本，即每股淨資產低於股票面值；(3)註冊會計師對最近一個會計年度的財務報告，出具無法表示意見或否定意見的審計報告；(4)最近一個會計年度經審計的股東權益扣除註冊會計師、有關部門不予確認的部分，低於註冊資本；(5)最近一份經審計的財務報告對上年度利潤進行調整，導致連續兩個會計年度虧損；(6)經上海、深圳交易所或中國證監會認定爲財務狀況異常的。以上情形之一者，將被列爲財務狀況異常者。自從實施 ST 制度以來，市場中被列爲 ST 的公司，從 1998 年的 24 家開始逐年增加，在 2003 年達到高峰，有 52 家被列爲 ST 公司。被列爲 ST 的上市公司幾可與財務狀況異常公司劃上等號，ST 是一個客觀發生的事件，大部分 ST 的撤銷皆透過大規模重組得以實現 (陳曉、陳治鴻，2000)，上市公司財務風險評估之重要性日漸提升。

上市公司獲利能力除了是發行上市的重要條件，也是再融資的基本前提，更是證券市場考評上市公司質量的重要標準，諸如每股盈餘、每股現金流量及淨值週轉率無一不與獲利能力相關，公司虧損也預示著持續經營風險，據統計資料顯示，1999 年全部上市公司非標準審計意見的比例爲 19.64%，2000 年爲 14.48%，2001 年爲 13.38%，2002 年爲 12.1%，而同期首次虧損的公司當中非標準審計意見比重分別爲 63.04%、52.17%、48.28%和 27.38%，遠遠高於平均水準。也就是因爲虧損造成巨大負面影響，危機公司總會設法轉虧爲盈，諸如盈餘管理、資產轉讓、或債務重組等，當獲利情況無法改善時，反應在市場上即股價下滑。主管機關及投資大眾必須針對中國上市公司之風險評估與股價異常的形成進行更深入的探討。然而中國證券市場與其他國家證券市場的差

¹ 中國股市分爲上海盤 (滬股) 及深圳盤 (深股) 兩種；發行的股票主要可分爲人民幣普通股票 (A 股)、人民幣特種股票 (B 股) 及在香港上市的 H 股，(1)A 股：是由中國境內公司發行，提供中國境內機構、組織或個人 (不包含台灣、香港及澳門) 以人民幣認購和交易之普通股股票，(2)B 股：是由中國境內公司發行，於中國上市之股票，專供境外投資者以外匯進行買賣的股票，故投資人限定爲 a.外國的自然人、法人及其他組織；b.香港、澳門、台灣地區的自然人、法人及其他組織；c.定居在國外的中國公民；d.中國證監會規定的其他投資人。主要是爲了使中國吸引外資投入並保護中國的金融市場，避免外資大量進入股市，影響市場機制而特別設立。但自 2001 年 3 月起，中國 B 股市場亦同時開放予中國境內人士，但必須以合法外匯存款進行買賣。

異性，除了 ST 制度的實施外，在實際的統計數值顯示，上市公司從被列入 ST 之前的三個月到 ST 之後的二年中，股票市值的增長高於市場平均水平超過百分之三十，同時，超過百分之五十之上市公司在被列為 ST 公司後，陸續更換最大股東，並轉換主要的業務範圍，這與其他開發國家資本市場有極大的差別，甚至被認為是中國 ST 之謎，因此探索中國資本市場實有其特殊性及重要性。

隨著中國市場經濟政策的日趨開放，中國證券市場未來將可成為全球一個重要的集資場所，和投資者資產配置的重要市場。但進軍中國前，必須做好準備並掌控風險。在熱錢不斷的流入下，有經濟學者認為中國經濟的快速成長，國家的內需及生活水準卻遠遠跟不上，若中國此時沒有做好把關的動作，將可能造成另一波泡沫化。所以，投資中國股市具有一定的風險程度，投資者如果參與中國股市，必須充分瞭解大陸股市的風險特性。綜上所述，本研究之目的有二：(1)以選擇合適之迴歸模式建構一個財務危機預警模型，確保該模型可以在公司發生財務危機或異常狀況前，提早發現公司的狀況，提供公司高層提早解決異常財務狀況，免於被列為 ST 股，或提供投資人提早發現公司異常狀況。(2)以財務危機預警模型所估計出來的危機機率，利用馬可夫吸收鏈推論 ST 公司發生下市或撤銷前平均停留之時間。

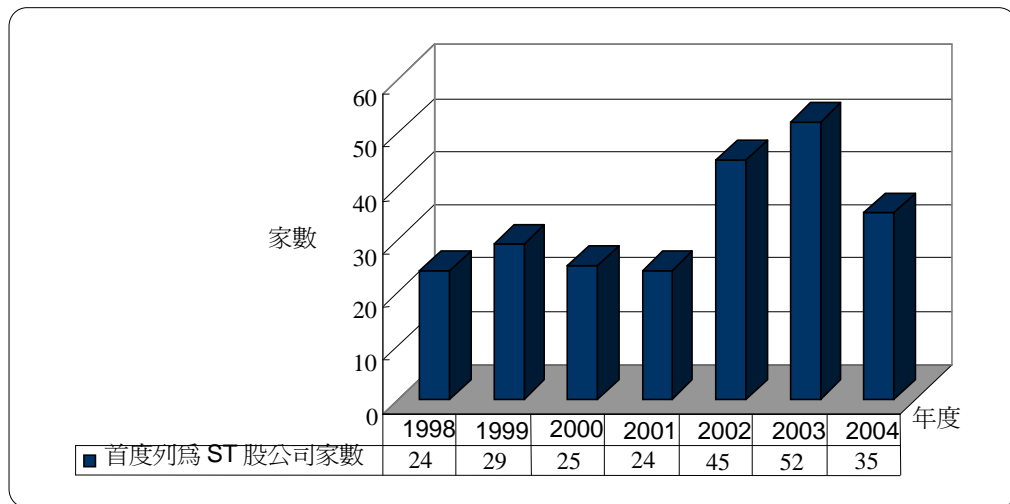
本文之研究結果顯示，樣本期間選擇方面，以 2003 年具有最高的正確率及最低的型 I 錯誤，優於其他各類樣本期間。應用逐步羅吉斯迴歸建立財務危機預警模型，實證結果發現五項顯著解釋變數，且整體正確區別率達 96.28%，對 ST 公司的正確區別率為 87.23%。再以 2004 年及 2005 年的特別處理公司為後驗資料，其正確區別率分別為 84.38%與 96.29%，亦顯示模型具相當程度的穩定性。此外本文應用馬可夫吸收鏈探討特別處理公司在下市或撤銷特別處理之前的預期停留時程，發現驗證樣本的實際停留時間與馬可夫吸收鏈估算出的結果大致吻合，顯示應用馬可夫吸收鏈可以有效估算出特別處理公司撤銷特別處理與終止上市前之預期停留時程。

本文接下來將於第二節介紹相關文獻探討，主要為針對中國上市公司風險評估、財務危機預警系統與馬可夫吸收鏈之相關文獻；第三節為研究設計與方法，對研究所使用的樣本、變數和研究方法詳細說明之；第四節為實證分析，分別就危機預警與馬可夫吸收鏈之實證結果詳加說明；第五節將實證結果進行結論以作為公司高層及投資人可以提早發現公司財務異常狀況之依據。

貳· 文獻回顧

中國在 1950 年以前，曾短暫的建立天津、北京證交所，但因共產體制的確立而關閉，直到 1981 年國庫券的發行，為經濟開放的一個開端。1990 年 11 月 26 日上海證券交易所成立更是一個重要的指標，從開始的 29 家上市公司，至 2005 年 11 月底共計達到 837 家公司，總發行 491,802 百萬股，總市值達 21,855 億元人民幣。而 1991 年 4 月 11 日成立深圳證券交易所，上市公司家數為 21 家公司，2005 年 11 月底亦增加至 547 家公司。

自從實施特別處理制度以來，被列為 ST 的公司從 1998 年的 24 家開始逐年增加，到 2003 年到達高峰，有 52 家被列為 ST 公司，而圖一與表一為 1998 年至 2005 年歷年 ST 公司家數。



資料來源：本研究整理

圖一 歷年首度列為 ST 股公司家數

表一 大盤指數與首度被列為 ST 的公司

年度	上海 A 股指數年度平均	深圳 A 股指數年度平均	首度列為 ST 股公司家數
1998	1337.29	412.42	24
1999	1463.83	438.08	29
2000	1998.04	623.69	25
2001	2046.31	612.96	24

2002	1635.76	480.28	45
2003	1536.19	423.90	52
2004	1555.55	395.31	35
2005	1212.04	292.63	28

資料來源：整理自台灣經濟新報資料庫

由於制度性原因，中國上市公司之持續經營危機實證研究多採用 ST 制度，將因財務狀況異常而被特殊處理的上市公司界定為持續經營危機公司，李皎予與方軍雄 (2003) 利用 ST 公司資料建立企業持續經營危機預測模型並探討決定持續經營危機演變趨勢的關鍵因素，結果發現持續經營危機來源於財務密度、經營品質和治理效能三個關鍵因素，任何企業的持續經營與否皆是這三因素共同作用的結果，而經營品質和治理效能決定持續經營危機的演化趨勢，且這三層因素對危機惡化與否的影響程度是不同的，因此財務失調是危機產生的導火線，但只要經營品質好、公司治理完善，財務失調產生的危機較易轉危為安；而經營品質和治理效能則是影響危機惡化與否的深層原因。劉力、王震與陳超 (2002) 發現當上市公司被宣告為 ST 公司時市場將做出負面反應，且資產負債比率越高的公司反應程度越大，而資產規模與上市期間長短則不顯著，潘玉強 (2004) 從股權結構的角度出發，結果發現 ST 公司在二年內回復正常的可能性與資產負債率顯著反相關，同時如持股比例、Tobin Q、公司市場價值、資本回報率等也表現出一定的相關性。朱武祥 (2002) 則透過內部治理觀點，認為建立信評制度與監理環境，透過法令增強對上市公司行為約束並增加違規成本將有助於防止危機公司的產生，然上述研究皆僅就財務風險評估、股價異常變化或事件後公司治理而論，無法加以連結進而呈現出較為完整之論述，結合多項主題進行較為完整之研究付之闕如，實有進一步探討之必要。

唯上述有關中國特別處理公司之文獻，多集中在制度比較或簡易數值分析，缺乏應用危機預警的統計模式之相關研究。然而危機預測的研究一直是學者熱衷的主題，國內外許多學者紛紛採用不同的研究方法、解釋變數、樣本設計，希望能找出最佳的預警模型。在財務預警模型的發展過程中，早期是由 Beaver (1966) 首先以單變量統計方法來進行實證分析，以一家失敗公司配對同產業且規模相近的正常公司，企圖找出影響企業失敗的單一財務比率。但由於企業的財務狀況複雜，由單一的財務比率判斷企業是否失敗略嫌主觀，因此便有學者利用多個層面的財務比率，將其組成綜合性財務指標，來預測企業失敗之原因，此種方法稱為多變量統計分析方法。Altman (1968) 是首先採用多

元區別分析 (Multiple Discriminate Analysis, MDA) 來進行分析的學者，以 1946-1965 年為樣本時間，選取 33 家失敗公司與 33 家正常公司以 1:1 配對，並採用獲利能力 (profitability)、流動性 (liquidity)、財務槓桿程度 (leverage)、清償能力 (solvency) 與營運能力 (activity) 五個層面共 22 個財務比率，利用區別分析選出最具有預測能力之五個變數，建構區別函數模型 (Z-SCORE 模型)。

然而在利用多元區別分析模型時，必須符合某些假設限制，如自變數須符合多元常態分配、兩群體變異數—共變數矩陣應相同，且若自變數存在共線性對模型也會產生不良影響，因此，在做多變量區別分析前必須先對資料作檢定，確認資料是否符合假設，但大多數資料並不容易符合相關的假設，故有學者提出 logit 模型，logit 模型可以解決線性機率模型，其應變數估計值落出(0,1) 區間和模型不容易合理被解釋的問題，且 logit 模型中自變數不須符合多元常態分配，也可以估計出企業破產的機率，解決多變量區別分析的缺點。

Martin (1977) 首先使用 logit 模型建構銀行財務預警模型，以全美聯邦準備系統會員銀行作為樣本，採用 25 個財務比率建構模型，預測正確率達 91.3%。Ohlson (1980) 採用 logit 模型建構財務預警模型，以 1970 年至 1976 年間資料，隨機抽取 105 家失敗公司與 2048 家正常公司為樣本，並以九個自變數建構三個預測模型，其區別正確率分別為 96.12%、95.55%、92.84%。Gentry et al. (1987) 以淨現金流量指標作為模型中的解釋變數，來探究財務危機預警模型，他們運用了多變量區別分析、Probit 和 logit 來比較不同模型所建構的預測分析結果，而實證結果顯示 logit 擁有最佳的預測能力，且正確率介於 77%—83%之間。Qui (1991) 採用 1890 年至 1985 年間 21 家不同地區之正常公司與失敗公司作為研究之觀察樣本，以財務指標及淨現金流量指標作為模型中的解釋變數，而 logit 模型之解釋能力介於 81%—90%。Wu and He (2000) 採用 1998 年至 1999 年間 41 家不同地區之正常公司與失敗公司作為研究之觀察樣本，運用 logit 模型驗證出短期之負債比率、EPS 及現金流量指標擁有比較佳的預測能力。Foreman (2003) 以美國本地電信產業為研究對象，以 1999 年選取 77 家美國本地電信公司，其中有 14 家破產 63 家正常，以 logit 模型來建構模型並分析美國本地新進區域電信公司破產的原因。

此外，在企業財務預警方面，除了上述模型外，也有學者利用 Cox 存活模型 (survival model)、CUSUM (Cumulative Sum) 模型、類神經網路 (Artificial Neuro Network) 模型進行預測分析。為切合本文之研究主題，建構

具有預測及驗證能力的良好模型，因此本文以 **logit regression** 為模型建構的方法。

由於過去文獻中討論馬可夫吸收鏈多見於數學或統計學上，集中於樣本空間認定、變動時間長短、或是開放假設條件等。而馬可夫隨機過程應用於時間序列之實證文獻頗豐，研究主題集中於國民生產毛額、市場利率變動、景氣循環之穩定性等方面。Corcoran (1973) 運用馬可夫吸收鏈作為人力資源評價模型，將定義機構中不同位階為數個狀態，以最高階及最低階兩狀態為吸收狀態，利用各位階平均薪資估計從業人員之經濟價值，並計算到達兩吸收狀態之所需時間。陳錦村 (1980) 嘗試利用馬可夫吸收鏈分析應收帳款的變動情形，求算最佳收帳政策，除可以建立的模式著重在於轉換期間及平衡狀態下現金流量的時間及習性，亦可依照帳齡機率，解釋各種收帳成本與努力和一個信用期間內移轉後所得的收入。黃萬傳 (1996) 藉由馬可夫吸收鏈的模式預估及分析台灣雞蛋運銷合作社之市場占有率，其利用者為正常型馬可夫吸收鏈，合作社市場占有率規模間的變動於持續時間下，最終應呈現均衡的狀態，以運銷合作社之最理想供蛋狀態預估未來市場占有率之變化。

Kijima (1998) 利用 Markov absorbing chain 模型說明債券信用評等 A 至 E 級的變動情形，估算受評單位之失敗可能。Mariano and Abiad (2000) 利用 Markov-switching model 來研究國民生產毛額、市場利率變動、景氣循環之穩定性等方面，然而由於資料之分解方式不同而造成馬可夫模型結果迥異，因此必須注意其時機上之配合再進行驗證比較。Pfeifer and Carraway (2000) 運用馬可夫吸收鏈來衡量顧客關係之模式，其方式可以處理顧客間複雜關係之變動，使得在管理顧客關係上具有彈性，並且計算 LTV (Lifetime Value)。由於馬可夫吸收鏈為一機率模型 (probabilistic model)，因此可以解決線性代數 (algebraic solution) 無法解決的問題。Clark and McCracken (2001) 對於經濟預測之行為，例如通貨膨脹，利用線性模型的一階領先指數來做預測，其模式中以馬可夫過程作線性過程。Mitchell (2001) 探討在不同的時間點上，考量利潤來做決策，並在馬可夫決策過程期間算出動態回饋模型，和最適政策。鄭文英等 (2005) 以財務穩定階段、未支付或較前一年減少股利達 40% 以上階段、無法償付貸款階段、受破產法保護下階段及破產階段之財務危機五階段歷程，以馬可夫吸收鏈估算出上市上櫃企業各經營階段的移轉情形及平均存活時間。

參· 研究設計與方法

一、財務危機預警模型

(一)財務危機之定義

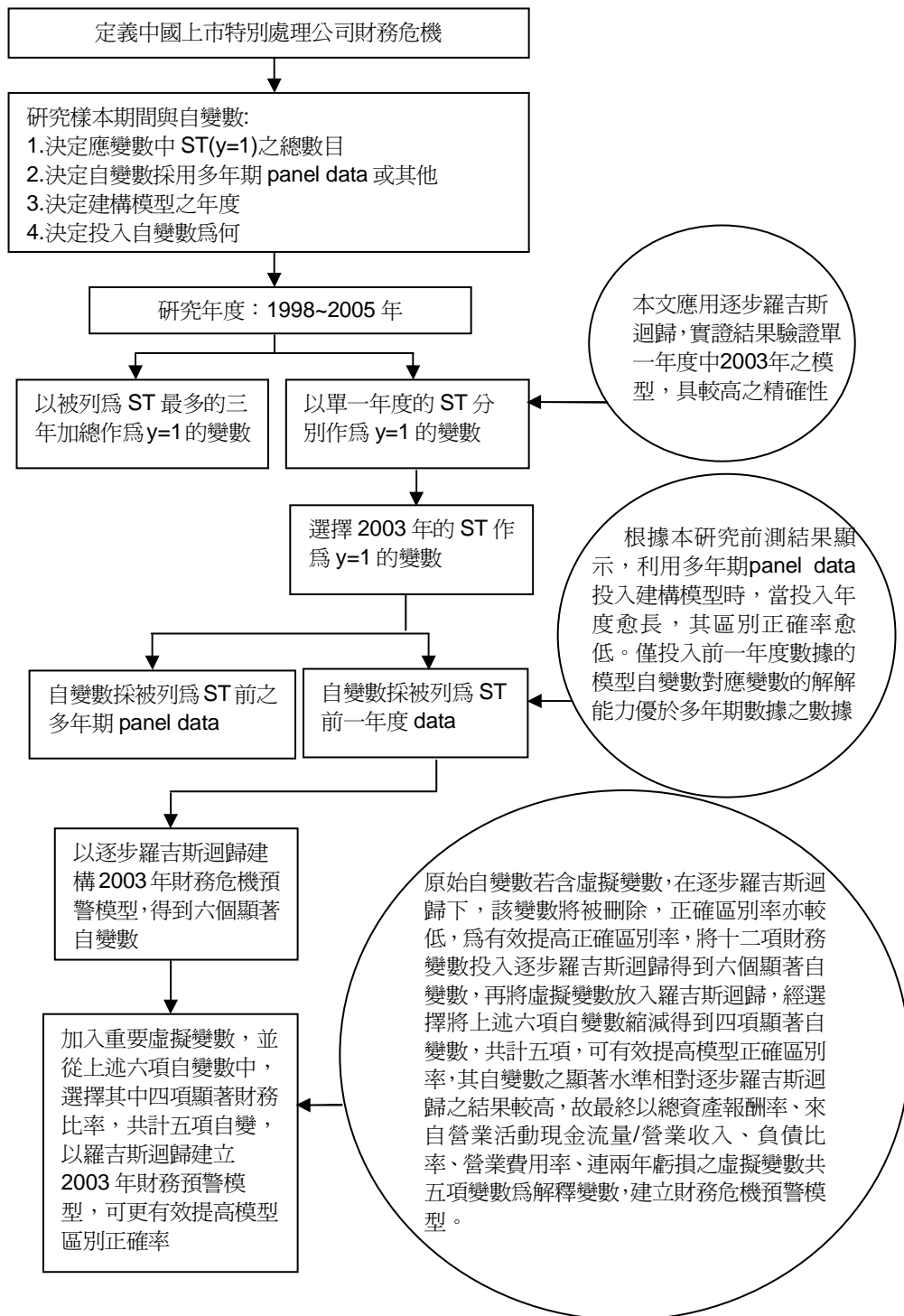
本文之研究對象為中國股市中的特別處理 (Special Treatment) 股，簡稱 ST 股，在上海和深圳證交所所訂定之股票上市規則中，公司如有其第九章第二節之 9.2.1 與 9.3.1 規定之事項者²，管理當局將會對公司處以特別處理，並且列為 ST 股。故本文財務危機公司的定義為，有發生上述規則中任一情形而被列為 ST 的公司，為本文之財務危機公司。

(二)研究樣本之期間

多數的財務危機預警模型研究中，在蒐集研究樣本時，由於單一年度中失敗樣本數不足，故大多都蒐集多個年度的失敗樣本進行研究，但每一個年度間其總體經濟狀況不同，多少會影響公司經營與獲利，或者可能發生某個偶發事件，如 911 事件、南亞海嘯、國際石油高漲等，這些事件對當年度公司營運都會產生影響。為有效選擇樣本期間，本文採取之步驟如下，首先，先決定應變數中 ST(y=1)之總數目，以被列為 ST 最多的三年加總作為 y=1 的變數或以單一年度的 ST 分別作為 y=1 的變數，分別利用各類樣本期間的前一年資料，以逐步羅吉斯迴歸 (stepwise logistic regression) 進行比較，結果發現，2003 年被列為 ST 公司之模型較高之判定係數及區別正確率，優於其他樣本期間；其次，決定自變數採用多年期縱橫資料 (panel data) 或較短期間，以自變數採被列為 ST 前之多年期資料逐年遞減，結果前測發現當投入年度愈長，其區別正確率愈低，僅投入前一年度數據時，自變數對應變數的解解能力優於多年期數據；第三，決定投入自變數，因原始自變數若含虛擬變數，在逐步羅吉斯迴歸下，該變數將被刪除，正確區別率亦較低，為有效提高正確區別率，將十二項財務變數投入逐步羅吉斯迴歸得到六個顯著自變數，再將虛擬變數放入羅吉斯迴歸，經選擇將上述六項自變數縮減得到四項顯著自變數，共計五項，可有效提高模型正確區別率。

有關樣本期間選擇流程如圖二，相關實證數值詳述於下一節實證分析。

² 請參考巨潮資訊網(中國證監會指定訊息揭露網站)：<http://www.cninfo.com.cn/flfg/flfg.html>



資料來源：本研究整理

圖二 研究樣本期間選擇流程圖

(三)資料投入方式與樣本配對

企業在發生危機前一年的財務資料，通常是最能夠反映出企業發生財務危機前的狀況，前兩年、前三年甚至前四年，會因為距離財務危機發生越久而能從財務報表中獲取的危機資訊越少。本文也曾嘗試使用危機發生前多年的財報資料，以 panel data 的方式建立危機預警模型，但結果發現模型之正確區別率並不理想，故本文採用公司財務危機發生前一年的資料建立模型，即以 2003 年正常公司與 ST 公司為樣本，使用其 2002 年之財務資料建立模型。在樣本配對方面，Beaver (1966)、Altman (1968) 首先以一家失敗公司配對同產業且規模相近的正常公司，舉凡採用 Binary dependent variable 為實證方法之研究，多數採用非隨機方式配對，以一比一配對為最多，如 Martin (1977)、Ohlson (1980)、West (1985)、Gentry et al. (1987)、Lee & Urrutia (1996) 等，然而此種抽樣方式容易造成過度抽樣 (over sampling) 的結果，產生選取的偏誤 (choice-based sample biases)，因而產生整體正確區別率的高估。Lane et al. (1986) 為有效提高模型之預測正確性及降低型一錯誤，採取一比三之配對方式，刪除重覆及不合適之配對公司，共得到 130 家失敗之美國商業銀行和 334 家正常銀行進行配對。經本文多次前測結果顯示，採取一比三配對方式相對其他配對方式或採取所有資料為樣本，表現較為平穩。

(四)研究變數選取

1.應變數：

本文之應變數採二分類法，1 代表財務危機公司—ST 公司，0 代表正常公司。

(1)自變數：

在變數選取方面，參考 Martin (1977)、Ohlson (1980)、Foreman (2003)、陳曉與陳治鴻 (2000)、張後奇等 (2002)、劉力等 (2002)、李皎予與方軍雄 (2003) 及潘玉強 (2004) 等，國內外研究財務危機預警系統之相關文獻，為本文財務指標選取的方式，整理出對模型較具貢獻的解釋變數，作為本文之初始研究變數。本文之解釋變數分為獲利能力、流量、營運能力、財務槓桿、流動性五大構面，其中包括總資產報酬率、每股稅前淨利、每股盈餘、來自營業活動現金流量/營業收入、每股現金流量、總資產總轉率、淨值週轉率、負債比率、負債/淨值、流動負債/流動資產、速動比率、營業費用率、外加連續兩年虧損之虛擬變數，共 13 個解釋變數，並以此建立中國企業財務危機預警模型。

自變數 (independent variables) 整理如下表二。

表二 本研究解釋變數整理表

財務構面	財務指標	計算公式	公式說明
獲利能力	總資產報酬率 (X ₁)	$\frac{[\text{稅後淨利} + \text{利息支出} * (1 - \text{稅率})]}{\text{資產總額}}$	指公司每投資一單位資產可以獲得多少利潤，如果比率越高，代表著每投資一單位資產，可為公司帶來的利潤越高，屬於公司整體的獲利能力指標。
	每股稅前淨利 (X ₂)	$\frac{(\text{稅前淨利} - \text{特別股股息})}{\text{加權平均股本}}$	指在稅前每股所能賺進的利潤，由於每家公司可能稅率不同，因此，可能會影響到其稅後淨利，而此項指標可以反應出稅前每股的獲利狀況。
	每股盈餘 (X ₃)	$\frac{\text{稅後淨利}}{\text{流通在外的股數}}$	指每股稅後所能獲得的利潤，屬於公司最後的獲利指標。
現金流量	來自營業活動現金流量/營業收入 (X ₄)	$\frac{\text{來自營業活動現金流量}}{\text{營業收入}}$	此項比率是在測量企業營業收入中有多少比例是由當年度營業活動所產生的現金流入量，此項比率高表示營業收入中由營業活動所帶來的現金流入比例高。
	每股現金流量 (X ₅)	$\frac{\text{來自營業活動現金流量}}{\text{加權平均股數}}$	指每股中來自當年度營業活動所產生的現金流入量有多少，比率越高代表公司每股中有著較高比例的現金來自於營業活動。
營運能力	總資產總轉率 (X ₆)	$\frac{\text{營業收入淨額}}{\text{平均資產總額}}$	指每一塊錢的資產，可以為公司創造出多少的營業收入，此項財務比率屬於經營能力指標。
	營業費用率 (X ₇)	$\frac{\text{營業費用}}{\text{營業收入淨額}}$	指營業費用占營業收入的比率，比率過高表示大部分的營業收入被營業費用侵蝕掉，導致獲利能力降低。
財務槓桿	淨值週轉率 (X ₈)	$\frac{\text{營業收入淨額}}{\text{平均淨值}}$	指每一單位的淨值，可以為公司創造多少的營業收入，比率越高表示自有資本從營業收入的回收速度越快。
	負債比率 (X ₉)	$\frac{\text{總負債}}{\text{總資產}}$	指總負債占總資產的比例，亦指債權人所提供的資金占全體資產的百分比，比率越高表示公司舉債程度越大。
	負債/淨值 (X ₁₀)	$\frac{\text{總負債}}{\text{總淨值}}$	指總負債占股東權益的比例，比率大於 1 則舉債資金大於自有資金，而舉債程度越大，破產的機會也越大。
流動性	流動負債/流動資產 (X ₁₁)	$\frac{\text{流動負債}}{\text{流動資產}}$	指每一單位流動資產中有多少比例的流動負債，流動負債為近期內需要償還的負債，必須由變現能力較佳的流動資產來償還，若此項指標大於一，代表須償還的負債已經大於能變現的資產，此時公司有著高度的財務風險，發生財務危機的機會也大大提升。
	速動比率 (X ₁₂)	$\frac{\text{速動資產}}{\text{流動負債}}$	指變現能力比流動資產更高的速動資產佔流動負債的比率，若指標較大，即有充裕的資金來償還流動負債。
虛擬變數	連續兩年稅後淨利虧損之虛擬變數 (X ₁₃)		由於被列為 ST 公司的情形，有一項為連續兩年稅後淨利皆為負值，故將連續兩年稅後淨利皆為負的公司設為 1，其他設為 0。

資料來源：本研究整理

二、ST公司下市或撤銷ST前平均停留時程之估計

本文以被列為 ST 公司加上在當年下市的公司與被撤銷 ST 的公司為研究樣本，採用先前模型所估算的危機機率將其分為 A、B、C、D、E 五群，其中 A 群為在 2003 年被撤銷 ST 的公司，此類公司雖然先前表現不佳被監理單位列為 ST 股，但公司近來經營績效表現良好，故管理當局撤銷其 ST，本文將其列為 A 群；而 E 群為先前經營績效不佳被列為 ST 的公司且在 2003 年發生危機終止上市的公司，此二群所處的狀態為吸收狀態；而 B、C、D 三群為非吸收狀態，本文將 ST 公司定義為非吸收狀態。

由於 ST 制度是監理當局為了警示投資人而特別設立的一種制度，當公司有某些異常狀態時，監理當局會在公司名稱前冠上 ST，讓投資人投資時更容易掌控風險，但如果公司爾後表現良好，監理當局會撤銷其 ST，使其恢復為正常公司，反之，若公司被列為 ST 之後，表現仍然不好，每況愈下，即可能會被監理當局終止上市，故公司被列為 ST 的狀態，為非吸收狀態，其有可能轉移至 A 或 E 群而達到吸收狀態，而本文以危機預警模型所估計出來之機率，依危機機率由低至高，分別將 ST 公司分為 B、C、D 三群，而各群彼此存在互動關係，例如 C 群可向上進步至 B 群、甚至 A 群，亦可能向下退步至第 D 群、甚至是第 E 群。

有關馬可夫吸收鏈使用上多將吸收狀態置於左上方，而將非吸收狀態置於右下方，構成吸收系統的標準狀態，若以機率矩陣 P (亦稱為轉移機率矩陣，transition matrix) 如下(1)式：

$$P = \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} \quad (1)$$

其中 I 為 $r \times r$ 的單位矩陣，由吸收狀態到吸收狀態，代表一進入便永遠停留的狀態。 ψ 為 $r \times s$ 的零矩陣，表示由吸收狀態轉移至非吸收狀態絕不可能發生。 R 為 $s \times r$ 之吸收矩陣，代表由非吸收狀態轉移至吸收狀態之機率。 Q 為 $s \times s$ 之非吸收矩陣，代表由非吸收矩陣轉移至非吸收矩陣之機率。若將馬可夫吸收鏈進行 n 次轉移可得結果如下：

$$P^2 = \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} = \begin{bmatrix} I & \phi \\ (I+Q)R & Q^2 \end{bmatrix} \quad (2)$$

...

$$P^n = \begin{bmatrix} I & \phi \\ (I+Q+Q^2+\dots+Q^{n-1})R & Q^n \end{bmatrix} \quad (3)$$

其中 Q^n 表示經 n 次轉移後，非吸收狀態到非吸收狀態的機率矩陣，因為 Q 為機率矩陣，所以在 Q 矩陣中的每一個元素皆小於 1，因此當 n 很大時，矩陣會趨近於零矩陣。又

$$I+Q+Q^2+\dots+Q^{n-1} = \frac{1}{I-Q} = (I-Q)^{-1} \quad (4)$$

$$P^n = \begin{bmatrix} I & \phi \\ (I-Q)^{-1}R & \phi \end{bmatrix} \quad (5)$$

令 $F = (I-Q)^{-1}$ 為基本矩陣 (fundamental matrix)，此基本矩陣可解決多項問題，其一由非吸收狀態開始仍停留於非吸收狀態之平均轉移期間，可由基本矩陣 F 中之各元素代表之。其二由非吸收狀態開始到達吸收狀態平均所需之時間或轉移次數，即 F 矩陣橫向之每一列加總。其三由非吸收狀態開始被某一吸收狀態吸收之機率為何，可以利用 B 矩陣，即以 $B=FR$ 表示之。

計算基本矩陣時，基本矩陣內之各元素值代表在離開 ST 狀態前各分群轉移至其他分群所須之轉移 (停留) 次數，並可得到轉移期間。亦可透過基本矩陣乘以吸收矩陣 ($B=FR$) 計算 ST 公司發生下市或撤銷 ST 之可能機率值。本文所擬建立之吸收鏈鎖機率矩陣概念如下：

$$P = \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ P_{ij} & P_{ij} & P_{ij} & P_{ij} & P_{ij} \\ P_{ij} & P_{ij} & P_{ij} & P_{ij} & P_{ij} \\ P_{ij} & P_{ij} & P_{ij} & P_{ij} & P_{ij} \end{bmatrix} \quad (6)$$

I 為 2×2 矩陣，表示撤銷 ST 狀態與下市狀態，由 0、1 之單位矩陣表之，分別以 A 、 E 表示之。 ψ 為 2×3 的零矩陣，表示由下市狀態之吸收狀態轉移至不穩定之非吸收狀態絕不可能發生。 R 為 3×2 之吸收矩陣，矩陣之各列分別表示 B 、 C 及 D 三群 ST 公司發生撤銷 ST 與下市狀態之機率值。 Q 為 3×3 之非吸收矩陣，表示各不穩定狀態之間轉移之機率值 P_{ij} ，此機率值皆不大於 1，且 R 矩陣與 Q 矩陣之橫向加總之機率值和必為 1。

此外，為了解單一吸收狀態的條件機率矩陣，假設在一給定吸收狀態下 s_1 ，計算由非吸收狀態開始而結束於此給定的吸收狀態 s_1 ，可以得到一個新的吸收鏈鎖。但除了得到新的轉移矩陣外，非吸收狀態依然與過去相同。令原始過程中被 s_1 狀態吸收的機率為 p ，並假設是 s_i 一非吸收狀態， s_j 為吸收狀態， f_1 為一階段出象函數 (outcome function)，新過程的轉移機率可寫成：

$$\Pr_j \langle f_1 = s_j | p \rangle = \frac{\Pr_j \langle f_1 = s_j \cap p \rangle}{\Pr_j \langle p \rangle} = \frac{\Pr_j \langle p | f_1 = s_j \rangle \Pr_j \langle f_1 = s_j \rangle}{\Pr_j \langle p \rangle} \quad (7)$$

簡化為 $\hat{P}_{ij} = \frac{b_{j1} P_{ij}}{b_{ij}}$ ，且 b_{i1} 代表從非吸收狀態轉移到吸收狀態的機率 s_1 ， P_{ij} 代表轉移矩陣之所有元素，公式之應用時，當 $j=1$ 時，可解釋 $b_{11}=1$ ，可求得一條條件矩陣 $\hat{Q} = H^{-1}QH$ ，同理 n 次方可得 $\hat{Q}^n = H^{-1}Q^n H$ ，可推得條件基本矩陣如下，

$$\hat{F} = H^{-1}(I + Q + Q^2 + \dots)H = H^{-1}FH \quad (8)$$

H 為方正矩陣，其主對角線之元素係 B 矩陣各狀態之行向量。或由此新條件矩陣建立吸收鏈鎖條件機率矩陣 \hat{p} ，求得條件基本矩陣 \hat{F} ， $\hat{F} = (I - \hat{Q})^{-1}$ ，由此條件基本矩陣，若已知整個系統曾進入狀態 i 而吸收狀態又屬已知，則此矩陣 \hat{F} 中每個元素 f_{ij} 可代表在狀態 j 中平均移轉期數，上述條件基本矩陣之各元素，即單一方向各分群移轉至其他各群所須之轉移 (停留) 次數，亦可透過此條件基本矩陣橫列加總，計算各分群在整個轉移狀態中之所須時程。

肆· 實證分析

一、樣本期間選擇 - 單一年度及多年期混合樣本

為檢測單一年度及多年期樣本何者具有較高的正確區別度及解釋能力，故選擇 1998 年至 2005 年間首度被列為 ST 公司超過 30 家以上之年度，分別為 2002、2003 及 2004 年，並將上述三年 ST 公司混合加總，各取其前一年財務報表資料彙整成混合樣本。因投入自變數³過多，選用逐步羅吉斯迴歸以挑選顯著變數並進行實證分析。結果顯示，單一年度樣本期間中，2003 年整體區別正確率為 88.5%，優於 2004 年的 87.9% 及 2002 年的 85.4%，且具有最高的判定係數 0.685，亦優於三年加總混合樣本的區別正確率 86.1% 及判定係數 0.555。此外財務預警模型最注重 ST 公司是否被誤判為正常公司的型 I 錯誤方面，2003 年型 I 錯誤為 28.8%，遠低於 2004 年的 34.3% 及 2002 年的 39.0%，亦低於三年加總混合樣本的 37.5%。⁴ 因此本文嘗試採用 2003 年之資料進行財務危機預警模型之建構。(詳如表三)

表三 財務危機預警模型各類樣本期間選擇彙總表

樣本期間	區別結果				臨界值
	危機公司正確率	正常公司正確率	整體區別正確率	R ²	
單一年度 2002 年	61.0% (16/41)*	93.5% (8/123)**	85.4%	0.515	0.5
單一年度 2003 年	71.2% (13/47)*	94.2% (5/141)**	88.5%	0.685	0.5
單一年度 2004 年	65.7% (12/35)*	95.2% (5/105)**	87.9%	0.659	0.5
三年加總 2002~2004 年	62.5% (47/123)*	94.0% (23/369)**	86.1%	0.555	0.5

註：*括號內表示型 I 錯誤，即 ST 公司被誤判為正常公司佔全部 ST 公司之比例；**括號內表示型 II 錯誤，即正常公司被誤判為 ST 公司佔全部正常公司之比例。

資料來源：本研究

³ 因 2002 年 ST 公司之每股盈餘資料無法取得，為求一致的比較基準，在樣本期間選擇時，各年度實證分析皆捨棄該自變數。

⁴ 型 I 錯誤計算方式為 100% 減去危機公司正確率。

二、樣本基本統計量

(一)模型解釋變數之敘述統計量分析與平均數檢定

表四及表五分別為全體樣本、正常公司樣本與 ST 公司樣本之敘述性統計量與平均數檢定。由於變數 X_{13} 為虛擬變數，故暫不加入基本統計量之檢定中。在檢定兩獨立母體平均數是否相同時，若無法滿足兩母體皆為常態分配且變異數相等，使用無母數之 Mann-Whitney U 統計量檢定；若滿足兩母體皆為常態分配且變異數相等，則使用 t 檢定。由表三可知除負債比率外，其餘變數皆不符合常態分配，因此將不符合常態分配之變數，採用無母數之 Mann-Whitney U 統計量檢定。

表四 全體樣本之敘述性統計量

解釋變數	全體公司樣本數	最小值	最大值	平均數	標準差
總資產報酬率 (X_1)	188	-0.6925	0.2033	-0.0122	0.1311
稅前每股淨利 (X_2)	188	-2.0600	1.5800	0.0269	0.5186
每股盈餘 (X_3)	188	-2.0600	1.0500	-0.0180	0.4830
營業活動現金流量/營業收入 (X_4)	188	-21.2225	17.8233	-0.0278	3.0992
每股現金流量 (X_5)	188	-1.0700	1.9500	0.2238	0.4046
總資產週轉率 (X_6)	188	0.0084	2.1600	0.4479	0.3940
營業費用率 (X_7)	188	0.0043	75.3970	1.2490	5.9652
淨值週轉率 (X_8)	188	0.0093	4.3200	0.8434	0.7943
負債比率 (X_9)	188	0.0528	1.0735	0.4252	0.2050
負債淨值比 (X_{10})	188	-14.6021	79.7706	1.3733	5.9671
流動負債/流動資產 (X_{11})	188	0.1061	5.3619	1.0513	0.8730
速動比率 (X_{12})	188	0.0865	9.4224	1.3023	1.3365

從表四正常公司與 ST 公司的基本統計量及平均數檢定中可以發現，正常公司與 ST 公司，無論在獲利能力方面、現金流量方面、營運能力方面、財務槓桿方面、流動性方面都呈現顯著差異，表示其平均水準是不相同的。在獲利能力方面的總資產報酬率、稅前每股淨利與每股盈餘⁵，從平均值的觀察中發現正常公司都明顯優於 ST 公司，表示被列為 ST 的公司在獲利能力方面，表現都不如正常公司；而在現金流量方面，正常公司所呈現的每股現金流量依然

⁵ 2003 年之每股盈餘資料已齊備。

優於 ST 公司，代表著正常公司比 ST 公司有較足夠的現金來償債；在營運能力方面，不管是總資產週轉率還是淨值週轉率，ST 公司表現的都比較差；而在償債能力方面，ST 公司的舉債程度都大於正常公司，這會使得 ST 公司曝露在高度的財務風險下，有較高的償債壓力；而在流動性方面，正常公司相較於 ST 公司有較高的流動性，流動性較高即有較高的能力償還短期到期的負債，故 ST 公司對於即將到期的負債償還能力較低，有較高的償債風險；最後，在營業費用率方面，ST 公司有著較高的比率，表示 ST 公司花費較高營業費用，此項比率若太高，可能會削減營業所獲得之收入，對公司獲利產生影響。

表五 正常樣本與 ST 公司之敘述統計量與平均數檢定

代號	解釋變數	公司類別	樣本數	最小值	最大值	平均數	標準差	Z 值
X ₁	總資產報酬率	正常公司	141	-0.3874	0.2033	0.0401	0.0658	-8.937***
		ST 公司	47	-0.6925	0.0791	-0.1690	0.1521	
X ₂	稅前每股淨利	正常公司	141	-1.2800	1.5800	0.2346	0.2994	-8.766***
		ST 公司	47	-2.0600	0.5200	-0.5966	0.5396	
X ₃	每股盈餘	正常公司	141	-1.2800	1.0500	0.1845	0.2552	-9.425***
		ST 公司	47	-2.0600	0.3400	-0.6257	0.4969	
X ₄	營業活動現金流量/營業收入	正常公司	141	-21.2225	2.6824	-0.1801	2.3242	-1.824*
		ST 公司	47	-11.0516	17.8233	0.4292	4.7245	
X ₅	每股現金流量	正常公司	141	-1.0700	1.9500	0.2822	0.4033	-4.966***
		ST 公司	47	-0.9900	1.2700	0.0485	0.3588	
X ₆	總資產週轉率	正常公司	141	0.0100	2.1600	0.5215	0.4072	-5.313***
		ST 公司	47	0.0084	1.2100	0.2272	0.2448	
X ₇	營業費用率	正常公司	141	0.0043	6.9546	0.2484	0.6508	-6.453***
		ST 公司	47	0.0174	75.3970	4.2510	11.4495	
X ₈	淨值週轉率	正常公司	141	0.0100	4.3200	0.9301	0.8265	-3.201***
		ST 公司	47	0.0093	2.4600	0.5832	0.6271	
X ₉	負債比率	正常公司	141	0.0528	0.7166	0.3634	0.1682	-8.389***
		ST 公司	47	0.0767	1.0735	0.6107	0.1945	
X ₁₀	負債淨值比	正常公司	141	0.0558	2.5286	0.7029	0.5298	-6.331***
		ST 公司	47	-14.6020	79.7706	3.3847	11.7637	
X ₁₁	流動負債/流動資產	正常公司	141	0.1061	5.0917	0.8706	0.6898	-5.173***
		ST 公司	47	0.1127	5.3619	1.5935	1.1177	
X ₁₂	速動比率	正常公司	141	0.1430	9.4224	1.4439	1.3340	-4.047***
		ST 公司	47	0.0865	8.8429	0.8774	1.2644	

說明：*在 $\alpha=0.1$ 下顯著、**在 $\alpha=0.05$ 下顯著、***在 $\alpha=0.01$ 下顯著

資料來源：本研究

三、模型配對標準之驗證

本文在樣本配對上，所採用的標準為公司資產規模，以資產規模相近的 ST 公司與正常公司配對，故需驗證以此種標準配對，對財務危機預警模型不會產生影響，即驗證公司被列為 ST 股與公司資產規模大小沒有關係。因此，本文使用 logit regression 進行驗證，以公司是否被列為 ST 公司為應變數（被列為 ST 公司設為 1，正常公司設為 0），公司資產規模大小為自變數。假設檢定為：

H_0 ：公司資產規模大小對於公司是否被列為 ST 無影響

H_1 ：公司資產規模大小對於公司是否被列為 ST 有影響

檢定結果如表六，公司資產規模大小變數並不顯著，表示公司資產規模大小對於公司是否被列為 ST 無影響，故以公司資產規模為配對標準，對財務危機預警模型並不會產生影響。

表六 公司資產規模變數

	係數	標準差	Wald	自由度	P-value
資產規模 ln	-0.14143	0.439367	0.103621	1	0.747527
常數	-0.25896	2.611521	0.009833	1	0.921012

說明：*在 $\alpha = 0.05$ 下顯著

資料來源：本研究結果

四、財務風險預警模型分析

接著採用 logistic regression model 建構 2003 年中國股票市場上市公司之財務危機預警模型，建構模型的變數選擇方式，除先前採取逐步迴歸篩選變數，以及參考 Martin (1977) 選出 25 個財務比率做為變數，最後採用了六個最具有預測能力的財務比率，和 Ohlson (1980) 加入損益虛擬變數值（連續二年虧損則設定為 1，反之則為 0），為建構危機預警模式的方式，將變數進行各種排列組合與試驗，選取對模型較有貢獻度，且使整體正確區別率達到最佳的變數建立模型。因此，本文最後採用了四個財務比率並加入損益虛擬變數，建立中國上市公司之財務預警模型，以公司是否被列為 ST 公司為應變數（被列為 ST 公司設為 1，正常公司設為 0），而總資產報酬率、來自營業活動現金流量/

營業收入、負債比率、營業費用率、連兩年虧損之虛擬變數共五項變數為解釋變數，建立財務危機預警模型。

假設檢定為：

H_0 ：解釋變數對模型無顯著關係

H_1 ：解釋變數對模型有顯著關係

檢定結果如表七所示，表中可以從 p-value 發現各項解釋變數皆拒絕虛無假設，表示解釋變數對模型有著顯著關係，而以連兩年虧損之虛擬變數、總資產報酬率、負債比率三項解釋變數顯著性較強烈，其係數也較其他解釋變數大，整體來說，解釋變數與應變數的正負向關係，也與預期的方向一致。

表七 模型解釋變數係數表

解釋變數	係數	標準差	Wald	自由度	P-value
總資產報酬率 (X_1)	-12.8490	5.6762	5.1242	1	0.0236**
營業活動現金流量/營業收入 (X_4)	0.5280	0.2833	3.4743	1	0.0623*
負債比率 (X_9)	6.4748	2.8944	5.0040	1	0.0253**
營業費用率 (X_7)	0.5774	0.3337	2.9942	1	0.0836*
連兩年虧損虛擬變數 (X_{13})	6.8559	2.3197	8.7347	1	0.0031***
常數	-6.0998	1.6444	13.7605	1	0.0002***

說明：*在 $\alpha = 0.1$ 下顯著、**在 $\alpha = 0.05$ 下顯著、***在 $\alpha = 0.01$ 下顯著

資料來源：本研究

表八 財務預警模型區別率表

Y = -6.0998 - 12.8490 X_1 + 0.5281 X_4 + 6.4748 X_8 + 0.5774 X_{12} + 6.8558 X_{13}				
		預測值		
		正常 0	ST 1	
觀察值	正常 0	140	1	99.29%
	ST 1	6	41	87.23%
整體正確區別率				96.28%
財務預警模型 $R^2 = 87.33\%$				臨界值 = 0.5
Hosmer-Lemeshow p-value = 0.8389				Chi-Square = 4.1973

說明：Hosmer-Lemeshow 適合度檢定：p-value=0.8389>0.05，不拒絕 H_0 ，表示模型有良好

的配適度，適合羅吉斯函數。
資料來源：本研究

由表八可以發現各解釋變數對模型的解釋能力達 87.33%，而模型整體正確區別率高達 96.28%，對 ST 公司的正確區別率為 87.23%，由上述結果可發現模型整體的區別能力相當不錯。結果發現，自選變數在預測能力及正確區別率上，都較上述逐步羅吉斯迴歸方式建構之模型為高 (96.28% > 90.40%)。因此本文最後採取最具有預測能力的四個財務比率並加入損益虛擬變數，建立中國上市公司之財務預警模型。

五、財務危機預警模型驗證

為了測試模型預測能力的穩定度，以 2004、2005 年的 ST 公司為驗證樣本進行驗證。2004 年總共有 35 家公司被列為 ST 公司，但有 3 家因財務資料不齊全，故以 32 家 ST 公司為驗證樣本，而 2005 年總共有 28 家公司被列為 ST 公司，但有 1 家因財務資料不齊全，故以 27 家 ST 公司為驗證樣本，以 2004、2005 年 ST 公司為驗證樣本，進行模型預測能力的驗證，並以依 Altman et al. (1977)⁶ 之估算方式，選取理論臨界值 0.5 為基準 (大於 0.5 為 ST 公司，小於 0.5 為正常公司)，進而估計出每家公司被列為 ST 的機率值。

表九為財務預警模型區別率整理表，彙整模型在建模模型及驗證模型之 ST 公司正確區別率。可以發現，不論是在建模樣本還是驗證樣本，在正確區別率方面，顯示模型有一定穩定性。因此，本文採用建構之財務預警系統，應用在後續之實證研究。

表九 財務預警模型區別率整理表

	建模模型	驗證模型	
	2003 年	2004 年	2005 年
ST 公司正確區別率 (%)	87.23	84.38	96.29

資料來源：本研究結果

⁶ Altman et al. (1977) 文中選擇 0.5、0.05 和 0.0263 三個數值作為臨界值，而其中 0.5 又稱為理論臨界值，本文為求周延與穩定，採取 0.5 作為切割點。

六、馬可夫吸收鏈 - ST公司預期停留時程之估算

(一)ST公司預期停留時程之估算

ST公司預期停留時程⁷估算是根據先前模型所估計出ST公司之預期發生危機機率值分類，將其分為A、B、C、D、E五群，其中A群為在2003年被撤銷ST的公司，此類公司雖然先前表現不佳被監理單位列為ST股，但公司近來經營績效表現良好，故管理當局撤銷其ST，本文將其列為A群；而E群為先前經營績效不佳被列為ST的公司且在2003年發生危機終止上市的公司，此二群所處的狀態為吸收狀態；而B、C、D三群為非吸收狀態，本文將ST公司定義為非吸收狀態，由於ST制度是監理當局為了警示投資人而特別設立的一種制度，當公司有某些異常狀態時，監理當局會在公司名稱前冠上ST，讓投資人投資時更容易掌控風險，但如果公司爾後表現良好，監理當局會撤銷其ST，使其恢復為正常公司；反之，若公司被列為ST之後，表現仍然不好，每況愈下，即可能會被監理當局終止上市，故公司被列為ST的狀態，為非吸收狀態，其有可能轉移至A或E群而達到吸收狀態。

而本文以危機預警模型所估計出來之機率，依危機機率由低至高，分別將ST公司分為B、C、D三群。為避免單一的分群標準造成研究結果的迥異，研究中採取二種分類，分類一中，A、E兩群分別為撤銷ST公司與終止上市之公司，B、C、D三群是依照羅吉斯迴歸模型之方程式所算出的Z值⁸來分類，而B、C、D三群分類標準為Z值0以下、0~20、20以上。分類二中，A、E兩群同樣分別代表撤銷ST公司與終止上市之公司，而B、C、D三群分類標準為危機模型所估計出的危機機率，B、C、D三群機率分別是為 $P < 0.8$ 、 $0.8 < P < 0.9999$ 、 $P > 0.9999$ ，由於所估計的公司為ST公司，模型所估計之危機機率大多大於0.9，故本文將機率做較詳盡的分類。

首先計算2003年ST公司在2003、2004年之危機機率值，先以分類一為分群標準，了解ST公司在兩年間群組的分佈情形，並探討兩年間的移轉機率，而2003年各分群家數分別為7、6、36、5、3家；而以分類二為標準，則2003

⁷ ST公司預期停留時程亦指列為ST股之公司被監理單位撤銷ST或終止上市前，停留於ST狀態之時間。

⁸
$$Z_i = \alpha + \sum_{j=1}^n \beta_j X_{ij} + \varepsilon_i$$

年各分群家數分別為 7、7、26、14、3 家，各群中的 ST 公司在 2003 年至 2004 年前後兩期間的變動情況及移轉率如表十。

表十 分類一及分類二前後期機率變動表

分類												
	分類一						分類二					
前/後	A	B	C	D	E	前小計	A	B	C	D	E	前小計
A	7	0	0	0	0	7	7	0	0	0	0	7
B	2	0	3	1	0	6	3	0	1	3	0	7
C	9	12	9	4	2	36	8	7	3	7	1	26
D	1	1	1	1	1	5	1	6	1	4	2	14
E	0	0	0	0	3	3	0	0	0	0	3	3
後小計	19	13	13	6	6	57	19	13	5	14	6	57
前/後	A	B	C	D	E	機率和	A	B	C	D	E	機率和
A	1	0	0	0	0	1	1	0	0	0	0	1
B	0.3333	0	0.5	0.1667	0	1	0.4286	0	0.1429	0.4286	0	1
C	0.25	0.3333	0.25	0.1111	0.0556	1	0.3077	0.2692	0.1154	0.2692	0.0385	1
D	0.2	0.2	0.2	0.2	0.2	1	0.0714	0.4286	0.0714	0.2857	0.1429	1
E	0	0	0	0	1	1	1	0	0	0	0	1

資料來源：本研究結果

將所計算之各分群變化機率值寫為矩陣式，重新排列成吸收鏈鎖機率矩陣之標準形式如下式(9) (10)：

【分類一】

$$p = \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} = \begin{bmatrix} 1 & 0 & | & 0 & 0 & 0 \\ 0 & 1 & | & 0 & 0 & 0 \\ \hline 0.3333 & 0 & | & 0 & 0.5 & 0.1667 \\ 0.25 & 0.0556 & | & 0.3333 & 0.25 & 0.1111 \\ 0.2 & 0.2 & | & 0.2 & 0.2 & 0.2 \end{bmatrix}$$

(9)

【分類二】

$$p = \begin{bmatrix} I & \phi \\ R & Q \end{bmatrix} = \begin{bmatrix} 1 & 0 & | & 0 & 0 & 0 \\ 0 & 1 & | & 0 & 0 & 0 \\ \hline 0.4286 & 0 & | & 0 & 0.1429 & 0.4286 \\ 0.3077 & 0.0385 & | & 0.2692 & 0.1154 & 0.2692 \\ 0.0714 & 0.1429 & | & 0.4286 & 0.0714 & 0.2857 \end{bmatrix}$$

(10)

上式中，I 表示撤銷 ST 與終止上市兩狀態之單位矩陣，分別代表 A 及 E 兩類。 ϕ 為零矩陣，表示終止上市之吸收狀態不會轉移至不穩定的非吸收狀態。R 為吸收矩陣，矩陣之各列分別表示 B、C 及 D 三群 ST 公司發生撤銷 ST 與下市狀態之機率值。Q 為非吸收矩陣，表示各不穩定狀態之間轉移之機率值，此機率值皆小於 1，且 R 矩陣與 Q 矩陣之橫向加總之機率值和必為 1。

將 ST 公司吸收鏈鎖機率矩陣之標準形式進行高階推移，即經過一單位時間，進行馬可夫吸收鏈之試行一次（吸收鏈鎖機率矩陣之標準形式自乘一次），可以計算未來 ST 公司落入撤銷 ST 與下市前之平均停留時程。以馬可夫吸收鏈之特性，馬可夫吸收鏈進行 n 次轉移可得一收斂解， n 階推移之吸收鏈鎖機率矩陣標準形式右下方，可以形成一無窮等比級數和 (FR)，其中 F 為基本矩陣，此基本矩陣中之各元素表示，由非吸收狀態開始仍停留於非吸收狀態之平均停留時程。透過三乘三單位矩陣減去 Q 矩陣，計算其逆矩陣，得 $F(11)$ (12)式。

【分類一】

$$F_1 = \begin{vmatrix} 1.4545 & 1.0909 & 0.4545 \\ 0.7273 & 1.9301 & 0.4196 \\ 0.5455 & 0.7552 & 1.4685 \end{vmatrix} \quad (11)$$

【分類二】

$$F_2 = \begin{vmatrix} 1.5394 & 0.3333 & 1.0493 \\ 0.7732 & 1.3333 & 0.9665 \\ 1.0010 & 0.3333 & 2.1262 \end{vmatrix} \quad (12)$$

上式 F 矩陣橫向之每一列加總，即表示非吸收狀態開始到達吸收狀態平均所需之時間或轉移次數，以 B 群為例，每一列加總代表在未來進入撤銷 ST 或下市前停留的總時程，同理 C 、 D 群亦可利用同樣道理計算之。上述計算為向上及向下雙向轉移出體系之時程，而研究關注主要為單向之時程，故後續將以條件機率計算向上或向下單向轉移出體系所需要之時程。

求解由非吸收狀態開始被某一吸收狀態吸收之機率，利用 $B=FR$ 矩陣得知，以分類一(13)式可知，分類為 B 群者其轉移到 E 群的機率最低，為 15.15%， C 群移到 E 群的機率為 19.11%，最高為 D 群轉移到 E 群的機率，是 33.57%。相對轉移至 A 群之機率高低依序為 B 、 C 及 D 群；分類二(14)式中可發現， B 群者其轉移到 E 群的機率為 16.27%， C 群移到 E 群的機率為 18.93%，最高為 D 群轉移到 E 群的機率為 31.66%。而其相對轉移至 A 群之機率高低依序為 B 、 C 及 D 群，而與當初各群中 ST 公司之預期機率值高低完全呼應。

【分類一】

$$B_1 = \begin{vmatrix} 0.8485 & 0.1515 \\ 0.8088 & 0.1911 \\ 0.6643 & 0.3357 \end{vmatrix} \quad (13)$$

【分類二】

$$B_2 = \begin{vmatrix} 0.8373 & 0.1627 \\ 0.8107 & 0.1893 \\ 0.6834 & 0.3166 \end{vmatrix} \quad (14)$$

此外為求解撤銷 ST 及下市狀態的條件機率矩陣，計算由非吸收狀態開始而結束於此給定的吸收狀態，可以得到一個新的吸收鏈鎖，但除了得到一新的轉移矩陣外，非吸收狀態依然與過去相同。分別利用上述 B 矩陣之左欄（撤銷 ST 之機率）右欄（下市之機率）之元素，各寫成三乘三矩陣對角線之元素，成

一新的 \mathbf{H} 矩陣及 \mathbf{G} 矩陣，利用此矩陣及其逆矩陣乘以原本之 \mathbf{Q} 矩陣，可得條件矩陣 $\hat{\mathbf{Q}}$ ，利用計算基本矩陣 \mathbf{F} 矩陣之做法，可得到條件基本矩陣 $\hat{\mathbf{F}}$ 和 $\hat{\mathbf{K}}$ 。

【分類一】

$$H_1 = \begin{vmatrix} 0.8485 & 0 & 0 \\ 0 & 0.8088 & 0 \\ 0 & 0 & 0.6643 \end{vmatrix} \quad (15)$$

$$\hat{F}_1 = \begin{vmatrix} 1.4545 & 1.0399 & 0.3559 \\ 0.7630 & 1.9301 & 0.3446 \\ 0.6967 & 0.9195 & 1.4685 \end{vmatrix} \quad (16)$$

$$G_1 = \begin{vmatrix} 0.1515 & 0 & 0 \\ 0 & 0.1911 & 0 \\ 0 & 0 & 0.3357 \end{vmatrix} \quad (17)$$

$$\hat{K}_1 = \begin{vmatrix} 1.4545 & 1.3761 & 1.0072 \\ 0.5766 & 1.9301 & 0.7371 \\ 0.2462 & 0.4299 & 1.4685 \end{vmatrix} \quad (18)$$

【分類二】

$$H_2 = \begin{vmatrix} 0.8373 & 0 & 0 \\ 0 & 0.8107 & 0 \\ 0 & 0 & 0.6834 \end{vmatrix} \quad (19)$$

$$\hat{F}_2 = \begin{vmatrix} 1.5394 & 0.3227 & 0.8564 \\ 0.7985 & 1.3333 & 0.8147 \\ 1.2264 & 0.3954 & 2.1262 \end{vmatrix} \quad (20)$$

$$G_2 = \begin{vmatrix} 0.1267 & 0 & 0 \\ 0 & 0.1893 & 0 \\ 0 & 0 & 0.3166 \end{vmatrix} \quad (21)$$

$$\hat{K}_2 = \begin{vmatrix} 1.5394 & 0.3878 & 2.0419 \\ 0.6645 & 1.3333 & 1.6164 \\ 0.5144 & 0.1993 & 2.1262 \end{vmatrix} \quad (22)$$

以分類一之分類基準下，上式(16) \hat{F}_1 條件基本矩陣可以觀察到，探究其往撤銷 ST 的方向轉移時之活動。以 B 群為例，該群中的 ST 公司若是最後為撤銷 ST 的情況，則在其被撤銷前，會停留在 B 群本身達 1.4545 年，同理以 C 群為例，該群中的 ST 公司若是最後為撤銷 ST 的情況，則在其被撤銷前，會停留在 C 群本身長達 1.9301 年、再轉移至 B 群後停留 0.7630 年，合計 2.6931 年。最後，被歸類為 D 群之 ST 公司，則在其被撤銷前，停留在 D 群本身長達 1.4685 年、轉移至 C 群後再停留 0.9195 年、最後轉移到 B 群停留 0.6967 年，共計 3.0847；而從上式(18) \hat{K}_1 條件基本矩陣，探究其往下市的方向轉移時之活動。以 B 群為例，該群中的 ST 公司若是最後發生下市的情況，則在其發生下市前，會停留在 B 群本身長達 1.4545 年、轉移至 C 群後再停留 1.3761 年、最後轉移到 D 群停留 1.0072 年，共計 3.8378 年。同理以 C 群為例，該群中的 ST 公司若是最後發生下市的情況，則在其發生下市前，會停留在 C 群本身長達 1.9301 年、再轉移至 D 群後停留 0.7371 年，合計 2.6672 年。最後，被歸類為 D 群之 ST 公司，則在其發生下市前，會停留在 D 群本身之時間為 1.4685 年。

以分類二之分類基準下，上式(20) \hat{F}_2 條件基本矩陣可以觀察到，探究其往撤銷 ST 的方向轉移時之活動。以 B 群為例，該群中的 ST 公司若是最後為撤銷 ST 的情況，則在其被撤銷前，會停留在 B 群本身達 1.5394 年，同理以 C

群為例，該群中的 ST 公司若是最後為撤銷 ST 的情況，則在其被撤銷前，會停留在 C 群本身長達 1.3333 年、再轉移至 B 群後停留 0.7985 年，合計 2.1318 年。最後，被歸類為 D 群之 ST 公司，則在其被撤銷前，停留在 D 群本身長達 2.1262 年、轉移至 C 群後再停留 0.3954 年、最後轉移到 B 群停留 1.2264 年，共計 3.748；而從上式(22) \hat{K}_2 條件基本矩陣，探究其往下市的方向轉移時之活動。以 B 群為例，該群中的 ST 公司若是最後發生下市的情況，則在其發生下市前，會停留在 B 群本身長達 1.5394 年、轉移至 C 群後再停留 0.3878 年、最後轉移到 D 群停留 2.0419 年，共計 3.9691 年。同理以 C 群為例，該群中的 ST 公司若是最後發生下市的情況，則在其發生下市前，會停留在 C 群本身長達 1.3333 年、再轉移至 D 群後停留 1.6164 年，合計 2.9497 年。最後，被歸類為 D 群之 ST 公司，則在其發生下市前，會停留在 D 群本身之時間為 2.1262 年。整理如表十一。

表十一 ST 公司預期停留時間彙整

	各分群至「撤銷 ST」之停留時間 (年)		各分群至「下市」之停留時間 (年)	
	分類一	分類二	分類一	分類二
B	1.4545	1.5394	3.8378	3.9691
C	2.6931	2.1318	2.6672	2.9497
D	3.0847	3.7480	1.4685	2.1262

資料來源：本研究

(二)ST公司預期停留時程估算值與實際值之比較分析

為了解馬可夫吸收鏈估計之停留時間，採用樣本中 2003 年為 B 群之 ST 公司，在 2004 年移轉為 A 群之公司為驗證樣本，探討其停留在 B 群之時程與馬可夫吸收鏈估算出之時程是否吻合；此外，也採用樣本中 2003 年為 D 群之 ST 公司，在 2004 年移轉為 E 群之公司為驗證樣本，探討其停留在 D 群之時程。符合上述條件的驗證樣本共三家 ST 公司 (表十二)，其中 B 群轉移至 A 群兩家，D 群轉移至 E 群一家。前述分類一馬可夫吸收鏈估計出 B 群轉移至 A 群之停留時間為 1.45 年，而錦州港 (600190) 與本鋼板材 (000761) 兩家符合條件的驗證樣本，其實際停留在 B 群的時間分別為 1.22 年與 1.36 年，與馬可夫吸收鏈估計出的停留時間大致吻合。

表十二 撤銷 ST 之實際與預期停留時間整理表

公司代號	公司名稱	撤銷 ST 時點	實際停留時間	預測停留時間	
				分類一	分類二
600190	錦州港	2004/3/19	1.22 年	1.4545 年	1.5394 年
000761	本鋼板材	2004/5/10	1.36 年		

資料來源：本研究

而符合 D 群轉移至 E 群的 ST 公司為北科 (600878) 如表十三，其實際停留在 D 群的時間為 1.32 年，與分類一估計出的機率 1.47 年相差不大，顯示應用馬可夫吸收鏈估計出達吸收狀態前之預期停留時程，有一定之準確性。

表十三 下市公司之實際與預期停留時間整理表

公司代號	公司名稱	下市時點	實際停留時間	預測停留時間	
				分類一	分類二
600878	北科	2004/9/27 (2004/4/27 已暫停上市)	1.74 年 (1.32 年)	1.4685 年	2.1262 年

資料來源：本研究結果

伍· 結論

企業在經營的過程中存在著許多的風險，為了使企業或投資人降低經營或投資上的風險，風險的預警與防範在近年是個重要的課題。由於中國市場相當廣大，投資人非常眾多，一旦有任何一家公司發生經營上或財務上的危機，不僅對整體經濟環境影響甚大，還將會有廣大無辜的投資者受害，對投資者造成的鉅額損失將是無法估計的。所以，藉由本文探討中國上市公司被列為 ST 股的主要財務因素與 ST 公司的預期停留時程，讓投資人了解中國市場之風險，並使投資人更能掌控風險。

本文分為兩部份，第一部分是以上海與深圳股票市場 A 股公司中，首度被列為 ST 股的公司為樣本，以資產相近作為配對準則，研究總樣本數為 188 家公司，建立 logit 迴歸模型，探討中國上市公司被列為 ST 股的因素，並估計出被列為 ST 公司之機率，企業在發生危機前一年的財務資料，通常是最能夠反映出企業發生財務危機前的狀況，前兩年、前三年甚至前四年，會因為距

離財務危機發生越久而能從財務報表中獲取的危機資訊越少。經繁複的樣本期間選擇後，本文採用公司財務危機發生前一年的資料建立模型，即以 2003 年正常公司與 ST 公司為樣本，使用其 2002 年之財務資料建立模型。第二部分以 2003 年被列為 ST 公司加入在當年下市的公司與被撤銷 ST 的公司為樣本，採用先前模型所估算的危機機率將其分為 A、B、C、D、E 五群，應用馬可夫吸收鏈估算 ST 公司發生下市或撤銷 ST 前，停留在 ST 股的時間，讓投資人更能夠掌控風險。本文結論如下：

1. 本文首先以 logit 迴歸模型建立中國股票市場之財務危機預警模型，實證結果發現模型有五項解釋變數顯著，分別為「總資產報酬率」、「來自營業活動現金流量/營業收入」、「負債比率」、「營業費用率」、「連兩年虧損之虛擬變數」五項變數，且整體正確區別率為 96.28%，顯示模型有著不錯的區別率。為了瞭解模型的穩定度與模型機率的準確性，本文以 2004、2005 年被列為 ST 公司為驗證樣本，對模型預測能力進行驗證，結果發現 2004 年、2005 年的整體正確區別率分別有 84.38% 與 96.29%，顯示模型有一定的穩定性。
2. 利用上述之財務危機預警模型所估計出的機率，將公司分為 A、B、C、D、E 五群，應用馬可夫吸收鏈估算 ST 公司發生下市或撤銷 ST 前停留在 ST 股的時間，結果發現以分類一為分類準則，馬可夫吸收鏈估算 B 群在撤銷 ST 前與 D 群在發生下市前之平均停留在 ST 股時間分別為 1.45 年與 1.47 年；而以分類二為分類準則時，馬可夫吸收鏈估算撤銷 ST 前與發生下市前之平均停留在 ST 股時間為 1.54 年與 2.13 年。此外為驗證馬可夫吸收鏈估計出之時程之精確性，採用符合 B 群移轉至 A 群與 D 群移轉至 E 群的 ST 公司為驗證樣本，則驗證樣本的實際停留時間與馬可夫吸收鏈估算出的時間大致吻合，顯示應用馬可夫吸收鏈可以有效估算出 ST 公司撤銷 ST 與終止上市前之預期停留時程。

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A Study on Financial Distress and Risk Duration of Shanghai and Shenzhen Special Treatment Companies in China

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ABSTRACT

The research constructs prediction model with logistic regression and estimates enterprises distress duration with Markov absorbing chain, using the companies of the A-share in the stock market of Shanghai and Shenzhen as a sample. The empirical result finding that there are five explanatory variables significantly, and uses special treatment companies of 2004 and 2005 to test predictable ability of model. The first, the discriminate rates of 2004 and 2005 are 84.38% and 96.29% respectively by logistic regression. Secondly, the enterprises distress duration estimated by Markov absorbing chain could provide exactly approximations before to rescind special treatment or to drop out from the stock market.

Keywords: financial distress, special treatment company, financial distress, markov absorbing chain

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