Essays on International Financial Market and Asset Pricing

HE, Qing

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摘 要

本文对金融市场的几个重要的问题进行了探讨。第一章着重于如何有效地防范国际货币危机。已有的危机管理办法主要依靠于几个静态的宏观经济指标进行预警，而事实证明，这一预警机制并不能有效地防止货币危机的发生。有鉴于此，本文试图将货币危机与这些指标的动态变化联系起来，并检验是否这一新的动态方法能更有效地预测了币危机的发生。研究结果表明，外汇储备的动态变化对货币危机的预警有很强的指示作用。当反应外汇充足率指标的下降速度超过一定界限时，发生货币危机的可能性就会急剧地增大。我们的动态预警方法提供了一个简单有效地操作标准，便于政策制定者及时地采取措施防止货币危机的全面发生。第二章主要利用了竞争风险模型 (Competing Risks Models) 对两种不同的退出盯住汇率制度的方式（主动型退出模式和被动型退出模式）进行了衡量。我们的研究结果表明，盯住汇率的持续期自身是决定不同退出模式的重要因素。对于被动型退出模式而言，退出盯住汇率制度的可能性随着盯住时间的延长而增加，即被动型退出模式存在正的持续期依赖性；而对于主动型的退出模式而言，盯住汇率制度的国家通常在较短的盯住期内退出了这一制度，即主动型退出模式存在负的持续期依赖性。即使在控制了时变的解释变量的情况下，这一特性也没有发生变化。此外，在考虑其他控制变量的情况，我们的结果表明。越开放的国家越有可能退出盯住汇率制度，而贸易集中度越高的国家主动退出盯住汇率制度的可能性越低。金融市场的开放则增加了主动退出盯住汇率的可能性。外汇储备的流失以及本国银行危机的发生都增加了被动刑退出盯住汇率制度的可能性。第三章检验了是否公司治理水平提高所带来的收益(gains from incentive realignment) 是决定上市公司退市（going private）的主要因素。我们的研究结果表明，证券市场上分散化收益 (diversification gains) 的减少是决定公司是否退市的主要原因。对于一些管理层持股较多，负债水平较高的公司而言，其潜在的委托代理成本是比较小的，因此，公司治理水平提高所带来的收益将不是退市的决定因素。这一类公司退市是基于节约上市成本的考虑，负债的增加以及利润的减少都会增加公司保持上市资格的压力。因此，他们退市通常发生在经济低谷的时期。而对于，一些管理层持股较少，负债水

平较低的公司而言，公司治理水平提高所带来的收益将是决定上市公司退市的主要因素。当公司利润增长的时候，由于欠缺较好的激励机制，反而增加了公司的委托代理成本。这个时候退市，将会提高管理机制；有效地保证股东的利益最大化。因此，这一类公司退市经常发生在经济上升时期。第四章将经济周期核算的分析方法（Chari, Kehoe and McGrattan, 2007）扩展到开放型宏观经济模型中，并对经济效率、劳动、投资和外债市场扭曲等四种楔变 （wedge）在解释中国经济波动中的相对重要性进行了分析。经济周期核算的结果表明，在1978-2006 年间，生产率是解释中国总体经济变化的最主要因素，劳动市场的刚性则在解释劳动力投入中起主要作用，外债和投资市场的扭曲对产出的变动没有显著的影响，而主要影响产出的构成，即消费，投资以及外贸结余在产出中的比重。我们的研究认为，政府需要重点关注如何增加要素的使用效率以及劳动力市场刚性所带来的相关问题。

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ABSTRACT

This dissertation consists of four chapters. The first chapter developed a new warning system for international currency crises. The existing crisis indicators in the literature are essentially static. We examine the relationship between the foreign reserves dynamics and currency crises. It is shown that rapid reserve depletion is a prominent feature before the collapse of the exchange rate system. Our model provides clear warning signals for policy makers to take actions before the reserves has reached a critical value that heralds the arrival of a full-blown crisis. The second chapter employed a competing risk model to investigate the crisis-driven exit and orderly exit from fixed exchange rate regime for the period 1972-2001. It is found that the time spent within a regime is itself a significant determinant of the probability of an exit. Different types of exits exhibit different patterns of duration dependence. Crisis-driven exits have a positive duration dependence pattern while orderly exits show a negative duration dependence pattern, even after controlling for country specific characteristics and unobserved heterogeneity. The Competing Risk model yields several interesting results. It is found that the more open the economy, the lower the likelihood of leaving an exchange rate peg, and that the higher the trade concentration, the lower the probability of an orderly exit. Further, financial openness increases the probability of having an orderly exit. There is also strong evidence that a lower reserve growth rate and the incidence of bank crisis are associated with a higher likelihood of crisis driven exits. The third chapter examines whether the gains from incentive realignment have driven corporations out of the public security market. It is shown that going private transactions are due to the reduction in the diversification gains from the public market. For firms whose managers own most equity and are highly leveraged, they have low incentive gains prior to the public-to-private transaction.

Such firms go private because of financial distress and dwindling profitability. These kinds of going-private activities are counter-cyclical. On the other hand, a financially healthy firm with a low managerial ownership has high anticipated incentive gains. The gain from incentive realignment is the dominant factor for these going-private transactions. Such firms go private because of an increase in profitability or an improvement in financial distress. We show that these going-private activities are pro-cyclical. The fourth chapter investigates the sources of economy fluctuations in China since its economic reform in 1978. Under the framework of a standard neoclassical open economy model with time-varying frictions (wedge), we study the relative importance of efficiency, labor, investment and foreign debt wedges on recent business cycles phenomena in China. The business accounting procedure suggests that productivity best explains the behavior of aggregate economic variables in China throughout the 1978-2006 periods. Labor wedge plays a major role in explaining the movement of labor enforcement. Foreign debt wedge and investment wedge primarily affect the composition of output between consumption, investment and trade balance, and have a modest role in explaining the fluctuation of output. Our results imply that the reform on inefficiency factor utilization and labor market rigidity should be a focus of future government policies.

Chapter One

The Nonlinear Dynamics of Foreign Reserves and Currency Crises

1.1 Introduction

The accurate prediction of currency crises is an important issue yet to be adequately studied. Various methods have been proposed to give warning signals in advance of a financial crisis. Krugman (1979) develops the first-generation crisis model, which suggests that crises may occur when the fiscal deficit is too high. The second-generation model (Obstfeld, 1986) argues that there is a surge in the domestic interest rate before a crisis, and that the sheer pessimism of investors can cause a capital outflow which leads to the collapse of the exchange rate system. Eichengreen *et al.* (1996), Sachs *et al.* (1996), Frankel and Rose (1996) and Kaminsky and Reinhart (1999) also suggest that the occurrence of currency crises can be predicted by the levels of interest rate and foreign reserves. Krugman (1999) observes that neither the first nor the second generations' stories can explain the 1997 Asian crisis. He develops the third generation crisis model, which suggests that international illiquidity in a country's financial system precipitates the collapse of the exchange rate. A financial system is internationally illiquid if its short-term obligations exceed the amount of foreign currency to which it can have access at short notice. When authorities do not have adequate foreign reserves, the financial system is highly

vulnerable to speculative attacks. Thus, external illiquidity is a crucial indicator of currency crises (McKinnon and Pill, 1997)[1].

The aforementioned indicators of crisis are essentially static. Bird and Rajan (2003) argue that a country with a low level of reserves is less vulnerable to crises than a country with a fast depletion of reserves. A rapid depletion of reserves lower investors' confidence, which in turn accelerates the dissipation of reserves and triggers a currency crisis. Thus, a measure reflecting the dynamics of reserves is also important for central banks to take precautions in advance of crises (Miller, 2000). In light of this, this chapter examines the relationship between the depletion rate of foreign reserves and currency crises in eight Asian emerging economies. A threshold autoregressive model is estimated. The predictive ability of three indicators related to the depletion rate of the foreign reserves, namely, the Reserves-to-Imports ratio, the Reserves-to-Short-Term External Debt (R/STED) ratio and the Reserves-to-Broad-Money-Supply (R/M2) ratio are examined in turn. The remainder of this chapter is organized as follows. We briefly review the indicators used in measuring reserve adequacy in section 1.2. Section 1.3 describes the model and the data. Section 1.4 estimates the threshold model using three different threshold variables. The predictive ability of our model is discussed in Section 1.5. The last section concludes the chapter.

[1] The third generation model suggests that reserve inadequacy is a major cause of currency crises. In the aftermath of the Asian Financial Crisis, countries in the region have quickly built up large stockpiles of foreign reserves. According to the International Monetary Fund (IMF), Asian countries have nearly doubled their reserves during the period 1998-2005, holding more than the total reserves of all industrialized countries. Although a healthy level of foreign reserves helps to prevent currency crises (Heller, 1966), an excessive accumulation of reserves has a huge opportunity cost (Bird and Rajan, 2003). Recent empirical analyses show that Asian countries have replenished more than adequate reserves in the post-crisis period (De Beaufort Wijnholds and Kapteyn, 2001; Bird and Rajan, 2003; Hong and Tornell, 2005). For more recent discussions on international reserves, one is referred to Aizenman and Lee (2007).

1.2 A Brief Review on Indicators of Reserve Adequacy

Why should countries need foreign exchange reserves? Sufficient reserves can mitigate the external shocks on a nation's domestic economy and ease consumption and production costs. Reserves can also be used as collateral against external vulnerability, especially for debt payment[2].

In general, the adequacy of the foreign exchange reserve is affected by factors in the current account and the capital account.

Current Account Factors:

Lively debate of foreign exchange reserves and their role against current account vulnerability dates back to the 1950's. In the post World War II period, international capital flows were highly limited, and capital account was used only to complement the current account balance: "Foreign trade is the largest item in the balance of payments. It is therefore natural that in the first place reserves should be compared with a country's trade figures (IMF, 1958)." Thus, the reserve adequacy is proxied by the value of imports. For reasons of operational simplicity, a rule-of-thumb emerged that reserves were inadequate if they covered less than about three to four months' worth of imports (Fischer, 2001). However, after the breakdown of the Bretten-Woods system, industrial countries made the move to a flexible exchange rate arrangement, and the level

[2] For more discussions on international reserves, one is referred to Aizenman and Lee (2006), Aizenman and Pinto (2005) and Dooley, Folkerts-Landau and Garber (2005).

of reserve demand became largely determined by easy access to the expansive international capital market[3]. Current account factors become biased and limited in the measure of reserve adequacy.

Capital Account Factors:

As the international capital market continues its vast expansion, it is necessary to take into account the importance of capital flows on emerging market countries. One lesson learned from the Asian Financial Crisis is that the extreme reversibility of short-term debt exposes Asian countries to the lack of liquidity and induces systemic crises. The capital nature of crises has led most governments and the IMF to derive new rules of thumb concerning different types of international liabilities.

Two commonly used indicators are the Reserves-to-Short-Term External Debt (R/STED) ratio and the Reserves-to-Broad-Money-Supply (R/M) ratio. After the Asian Financial Crisis, the extent of short-term indebtedness has been regarded as a key indicator of illiquidity and a predictor of currency crises (Rodrik and Velasco, 1999; World Bank 2000). In this regard, Pablo Guidotti, the former Deputy Minister of Finance of Argentina, proposed that countries should be capable of living without foreign borrowing for up to one year. Alan Greenspan, former Chairman of the Federal Reserve Board of the United States, complements the "Guidotti rule"[4]. This rule implies that a country's usable foreign exchange reserves should exceed scheduled

[3] Reserve demand is influenced by the exchange rate regime. Frenkel (1983) found evidence that countries will need a lower level of reserve when moving to floating exchange rate regime.

[4] The first of these would be the average maturity of a country's external liabilities should exceed a threshold; the second is a country's external liquidity position would be calculated over a wide range of possible outcomes, taking into account the full set of external assets and liabilities (De Beaufort Wijnholds and Kapteyn, 2001).

external amortization for one year (De Beaufort Wijnholds and Kapteyn, 2001; Bird and Rajan 2003). The second ratio R/M emerges to supplement R/STED ratio. The R/STED gives an indication of the vulnerability to an "external drain", but fails to consider the internal drain associated with capital flight. The latter is best captured by the R/M ratio, which indicates the extent to which liabilities of domestic credit are supported by foreign assets. A low and declining R/M ratio is a leading indicator of a currency crisis (Kaminsky and Reinhart, 1999).

1.3 The Model and Data

A threshold autoregressive (TAR) model will be estimated to forecast currency crises. The TAR model was introduced by Tong (1983), and has become increasingly popular in empirical studies[5]. Recent works of the TAR model includes Dueker *et al.* (2007), who develop a contemporaneous TAR model and apply it to the pricing of bonds. Using a balanced panel data set, we estimate the following TAR model with individual-specific fixed effect[6] :

$$y_{i,t} = \mu_i + \varphi' x_{i,t}(\lambda) + e_{i,t}, \tag{1.1}$$

where

[5] Some extensions of the TAR model include the functional-coefficient autoregressive (FAR) model of Chen and Tsay (1993) and the nested threshold autoregressive (NeTAR) model of Astatkie *et al.* (1997). A wide variety of applications of threshold models have been found in recent years. For example, Hansen (1999) studies how financial constraints affect investment decisions. Henry *et al.* (2001) provide evidence of threshold effect in the Australian real exchange rate.

[6] As pointed out by Pesaran and Smith (1995), if slope coefficients differ across countries, the fixed effect model with lagged dependent variables may be biased. As the Asian emerging countries are quite similar in terms of the growth rates, the exchange rate regime, reserves ratios and the external debt composition, the problem of inconsistent estimation due to heterogeneity should not be severe. Further, Chong (2003) and Bai *et al.* (2008) point out that the estimate of threshold variable remains consistent even the model is misspecified. With a consistent estimate of threshold parameter, the bias problem of other parameters should be reduced.

$$x_{i,t}(\lambda) = \begin{pmatrix} x_{i,t} 1_{(z_{i,t-1} \le \lambda)} \\ x_{i,t} 1_{(z_{i,t-1} > \lambda)} \end{pmatrix},$$

$$x_{i,t} = (y_{i,t-1}, \cdots, y_{i,t-p})',$$

$$\varphi = (\alpha' \quad \beta')',$$

$$\alpha = (\alpha_1, \cdots, \alpha_p)$$

and

$$\beta = (\beta_1, \cdots, \beta_p).$$

$z_{i,t}$ is the threshold variable and $1_{(.)}$ is an indicator function[7]. λ is the threshold value and p is the autoregressive order. The individual effect μ_i is eliminated by removing individual-specific means.

Note that taking averages of (1.1) over time produces:

$$\bar{y}_i = \mu_i + \varphi \bar{x}_i(\lambda) + \bar{e}_i \tag{1.2}$$

Where $\bar{y}_i = T^{-1} \sum_{t=1}^{T} y_{i,t}$, $\bar{e}_i = T^{-1} \sum_{t=1}^{T} e_{i,t}$ and

$$\bar{x}_i(\lambda) = \frac{1}{T} \sum_{t=1}^{T} x_{i,t}(\lambda)$$

[7] The threshold model is similar to the structural-change model (Chong, 2001; Bai *et al.*, 2008) in nature. $1_{(A)}$ takes the value unit when event A occurs and is zero otherwise.

$$= \begin{pmatrix} \frac{1}{T}\sum_{t=1}^{T} x_{i,t} 1_{(z_{i,t-1} \le \lambda)} \\ \frac{1}{T}\sum_{t=1}^{T} x_{i,t} 1_{(z_{i,t-1} > \lambda)} \end{pmatrix}$$

Taking the difference between (1.1) and (1.2) yields

$$\tilde{y}_{i,t} = \varphi \tilde{x}_{i,t}(\lambda) + \tilde{e}_{i,t} \tag{1.3}$$

Where $\tilde{y}_{i,t} = y_{i,t} - \bar{y}_i$, $\tilde{x}_{i,t}(\lambda) = x_{i,t}(\lambda) - \bar{x}_i(\lambda)$, and $\tilde{e}_{i,t} = e_{i,t} - \bar{e}_i$

For any given λ, the coefficient φ and corresponding sum of squared errors $S(\lambda)$ can be estimated by ordinary least squares (OLS). Therefore, the least squares estimators of λ is achieved by minimizing the sum of squared errors.

$$\tilde{\lambda} = \arg\min_{\lambda} S(\lambda)$$

Once $\tilde{\lambda}$ is obtained, the slope estimation[8] is $\tilde{\varphi} = \varphi(\tilde{\lambda})$.

Our sample includes eight Asian emerging countries, namely, China, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. Quarterly observations of the Reserves-to-Imports ratio, Reserves-to-Short-Term External Debt ratio, Reserves-to-Broad-Money-Supply ratio from 1990 to 2003 are obtained and transformed into logarithms. We first estimate a fourth-

[8] Detailed explanations are introduced in Appendix 1.

order autoregressive model[9] as our baseline model. We assume that there are two states, namely, a state of relative calmness (tranquil period) and a state prone to the currency crisis (speculative attack period). As the movement of foreign reserves during the speculative period is different from that during the tranquil period, we define $z_{i,t} = y_{i,t} - y_{i,t-2}$[10] as a crisis indicator to classify the sample into the two states. Our main parameter of interest is the threshold value. The sampling distribution of an F test for the threshold effect is bootstrapped. The advantage of our model is that it provides an early warning signal for currency crises when the threshold variables drop rapidly.

1.4. Threshold Variables

1.4.1 Reserves-to-Imports (R/M) ratio

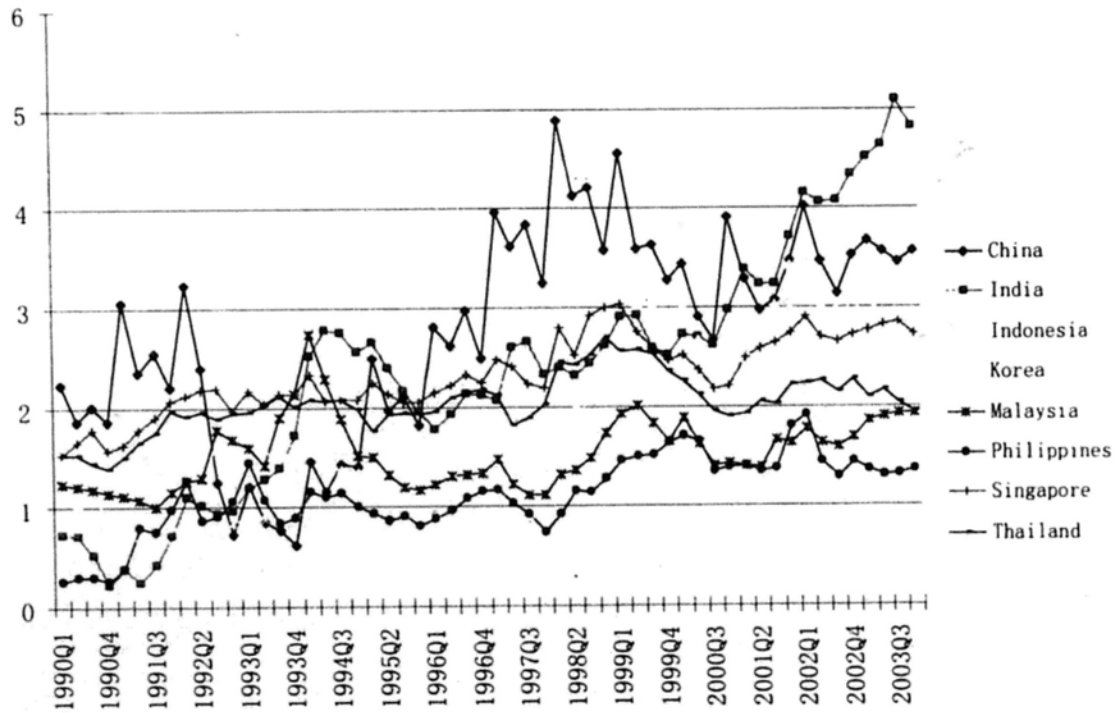
International foreign reserves serve as an essential insurance against the uncertain future course of the balance of payment. As a rule-of-thumb, reserves are said to be inadequate if they are less than three to four months' worth of imports (Fischer, 2001). With quarterly data, the threshold value of the Reserves-to-Imports ratio should be approximately equal to unity. However, a visual

[9] We calculate the AIC (Akaike's Information Criterion) for each reserve variable. For most countries, a model of order which is less than or equal to four generates the smallest value of AIC. As a result, we set equal to 4. From Chong (2003) and Bai *et al.* (2008), the initial order will not affect the consistency of the threshold estimate. We have also calculated the threshold estimates of the third-order and fifth-order models, they are very close to that of the fourth-order model.

[10] Before the year 2000, the data set for external debt is available on a semi-annual basis only, thus we choose the two-quarter change in the ratios as our threshold variable. The choice of the two-quarter change in reserves is appropriate, as a warning signal based on the one-quarter change will generate too many false alarms, and a signal based on the one-year change may not leave policy makers enough time for taking pre-emptive measures against the crisis.

examination of Figure 1 suggests that most of the countries have achieved this threshold value, even during the crisis periods.

Figure 1.1: Level of Reserves-to-Imports Ratio



Thus, the crude rule of thumb of the Reserves-to-Imports ratio has lost much of its relevance for these Asian countries. To test the threshold effect, Equation (1.3) is estimated and the value of the F statistic testing the null hypothesis of no threshold, and the associated bootstrapped p-value are reported in Table 1.1. The results from Table 1.1 show that the test for threshold effect F is insignificant with a bootstrapped p-value of 0.622. Thus, there is no threshold effect in the model, and our result is consistent with the observations in Figure 1.1.

Table 1.1: Testing Results for Threshold Effects of R/M and the TAR Estimates

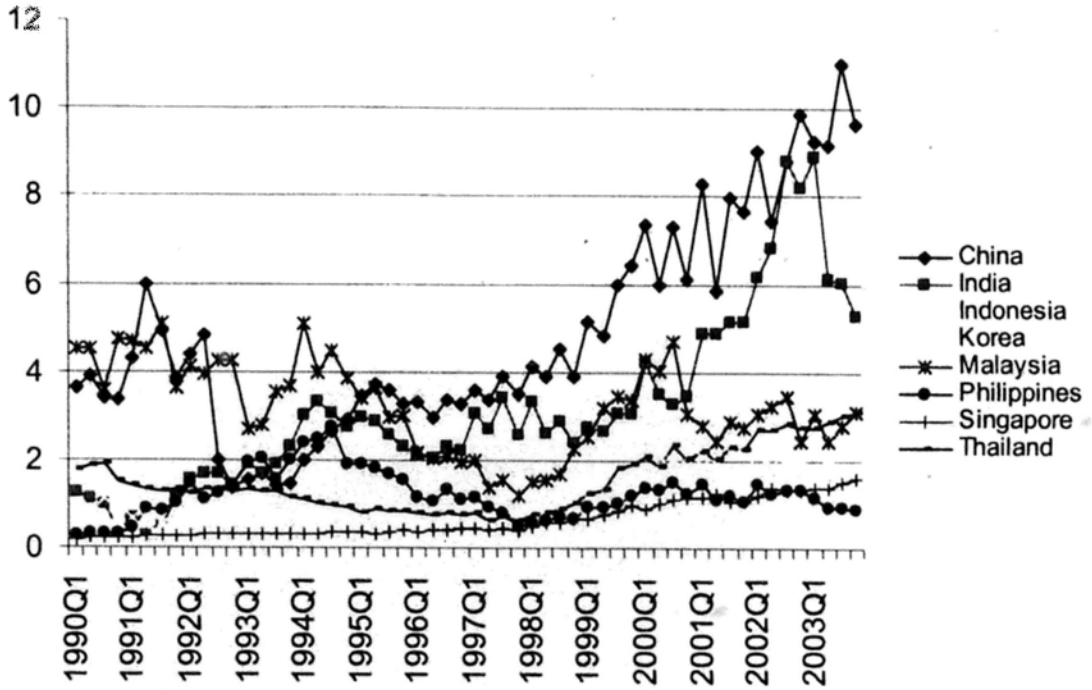
Test for threshold effect	
F	33.22
p-value	0.622
(10%, 5%, 1% critical values)	(93.23, 108.11, 119.06)

1.4.2 Reserves-to-STED ratio

The financial crises over the past decades have led to the development of several leading indicators of international illiquidity. Two such indicators are the Reserves-to-Short-Term External Debt (R/STED) ratio and the Reserves-to-Broad-Money-Supply (R/M2) ratio. The ratios of Reserves-to-Short-Term External Debt[11] (R/STED) for the eight Asian emerging countries are plotted in Figure 1.2.

[11] Following De Beaufort Wijnholds and Kapteyn (2001), all the data are extracted from IMF's *International Financial Statistics* (line 1.1.d. for non-gold reserves, line 71.d for imports c.i.f. and the sum of lines 34 and 35 for broad money), except for the short-term external debt data (residual maturity within one year) which is from the *Joint BIS/IMF/OECD/World Bank Statistics* on External Debt (line 15 to line 22). Before the first quarter of 2000, the consolidated statistics are available on a semi-annual basis only. When quarterly data are not available, the available data are regressed on the polynomials of time trend, and the estimated coefficients are used to construct the quarterly data.

Figure 1.2: Level of R-to-STED ratio



In the aftermath of the Asian crisis, the level of short-term indebtedness has been suggested to be a crucial indicator of illiquidity and a good predictor of financial crises (Rodrik and Velasco, 1999). According to the Guidotti-Greenspan rule, a country should hold reserves equal to their foreign liabilities coming due within a year. (De Beaufort Wijnholds and Kapteyn, 2001; Bird and Rajan, 2003). Figure 1.2 shows that the R/STED ratios for most countries fall below unity during the crisis period. Countries with a high R/STED ratio, such as China and India, successfully avoided the currency crisis in 1997. Thus the likelihood of an occurrence of a crisis is negatively related to the R/STED ratio. In contrast to the existing studies which focus on the level of this ratio, we establish a link between the dynamics of the R/STED ratio and currency crises.

Table 1.2: Testing result for threshold effects of R/STED and the TAR estimates

Test for threshold		
	F	37.477
	p-value	0.047
	(10%, 5%, 1% critical values)	(30.482, 36.671, 40.283)

	Threshold estimate	95% confidence interval
$\hat{\lambda}$	-0.291	[-0.306, -0.263]

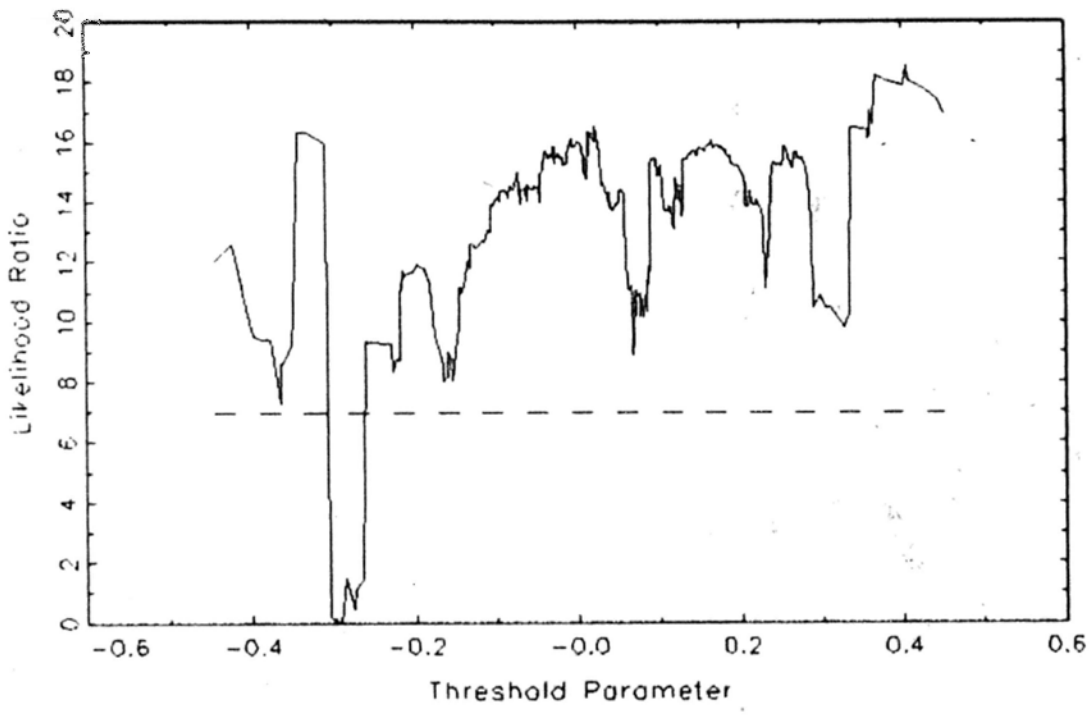
	TAR estimates					
	$Z_{t-1} < \hat{\lambda}$			$Z_{t-1} \geq \hat{\lambda}$		
Regressor	Estimate	OLS SE	White SE	Estimate	OLS SE	White SE
y_{t-1}	0.624	(0.108)	(0.194)	0.860	(0.056)	(0.063)
y_{t-2}	0.274	(0.127)	(0.284)	0.323	(0.069)	(0.091)
y_{t-3}	0.540	(0.200)	(0.318)	-0.236	(0.069)	(0.074)
y_{t-4}	-0.641	(0.199)	(0.340)	0.004	(0.049)	(0.054)

Table 1.2 reports the corresponding estimation and testing results. Figure 1.3 plots the concentrated likelihood ratio function. The likelihood ratio function helps us to identify the threshold effect and provides a confidence interval for the true threshold value if it exists. From Figure 1.3, the 95% confidence interval for the threshold value is (-0.306, -0.263), which contains the values of $\hat{\lambda}$ for which the likelihood ratio lies beneath the dashed line.

Since the test value F is significant, there is a threshold effect in the model. The point estimate of the threshold is found to be -0.291. Thus, the TAR model splits the observations into two regimes. Which regime an observation belongs to depends on whether $z_{i,t-1} = y_{i,t-1} - y_{i,t-3}$ lies above or below -0.291. We denote the case where $z_{i,t-1} \leq -0.291$ regime 1 or the speculative attack regime, and the case where $z_{i,t-1} > -0.291$ regime 2 or the tranquil regime. Thus, when the dissipation rate of R/STED is higher than 29.1% over two quarters, there is a high chance of having a crisis. Note from Table 2 that the standard errors of the model estimates for regime 1 are roughly triple those of regime 2, indicating that there is a considerable variation[12] in the estimates of regime 1.

[12] The differences in standard errors between the two regimes are more significant for R/M2 ratio. Thus, we discuss the implications in the next section.

Figure 1.3: Confidence interval construction for the R/STED ratio



1.4.3 Reserves-to-M2 ratio

The R/STED ratio indicates the vulnerability of a country to an external drain, but it fails to indicate the threat of an internal drain associated with capital outflows caused by nationals (De Beaufort Wijnholds and Kapateyn, 2001). As a result, the R/M2 ratio, which indicates the extent to which liabilities of domestic credit are supported by foreign assets, emerges as a supplement to the R/STED ratio. A low and declining R/M2 ratio is a leading indicator of the occurrence of a currency crisis (Kaminsky and Reinhart, 1999).

Figure 1.4: Level of R-to-M2 ratio

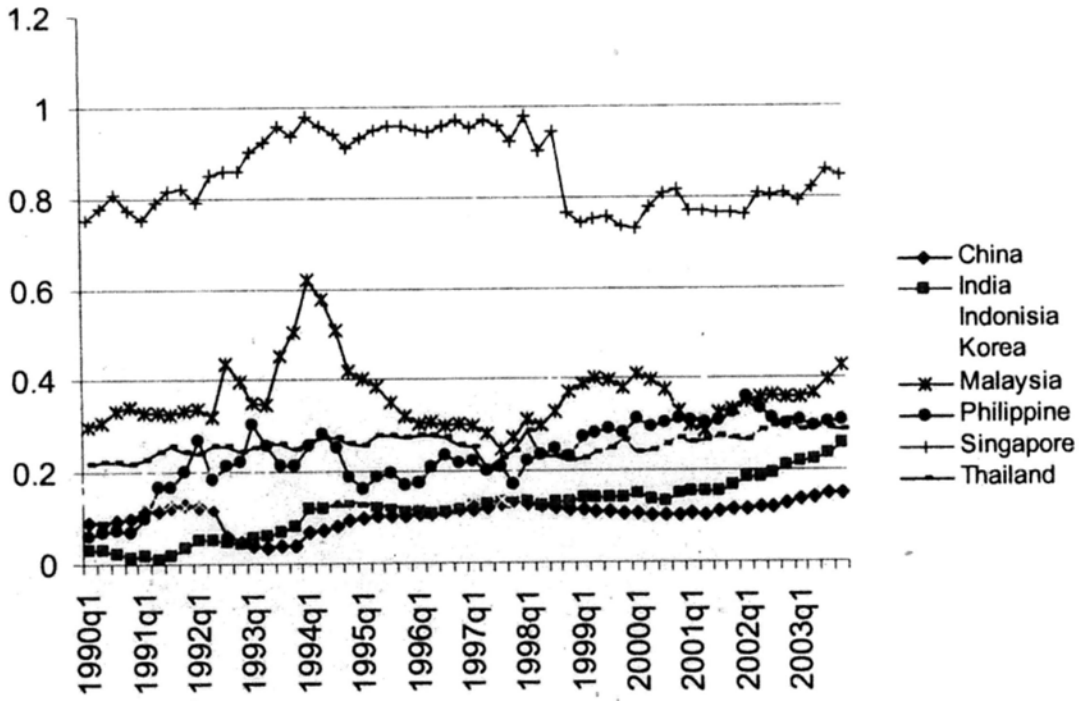


Figure 1.4 shows that the R/M2 ratio ranges from 0.01 to 0.98. Table 1.3 shows the corresponding estimation and testing results. The results suggest that there is a threshold in our model. The point estimate of this threshold is -0.243, and the 95% confidence interval is also reported. Figure 1.5 plots the concentrated likelihood ratio function and the 95% confidence interval for the threshold value. Similar to R/STED ratio, we label the period when the R/M2 ratio drops by more than 24.3% within two quarters regime 1 (the speculative attack regime), and the period with a drop of less than 24.3% regime 2 (the tranquil regime). Note also that the standard errors of the first regime estimates are much higher than those of the second regime. In particular, the slope estimates in regime 1 are insignificant if the White-corrected standard error is used. Thus, for regime 1, the movements of R/M2 ratio can be considered as a random walk while for regime 2, it is more likely to display mean reversion.

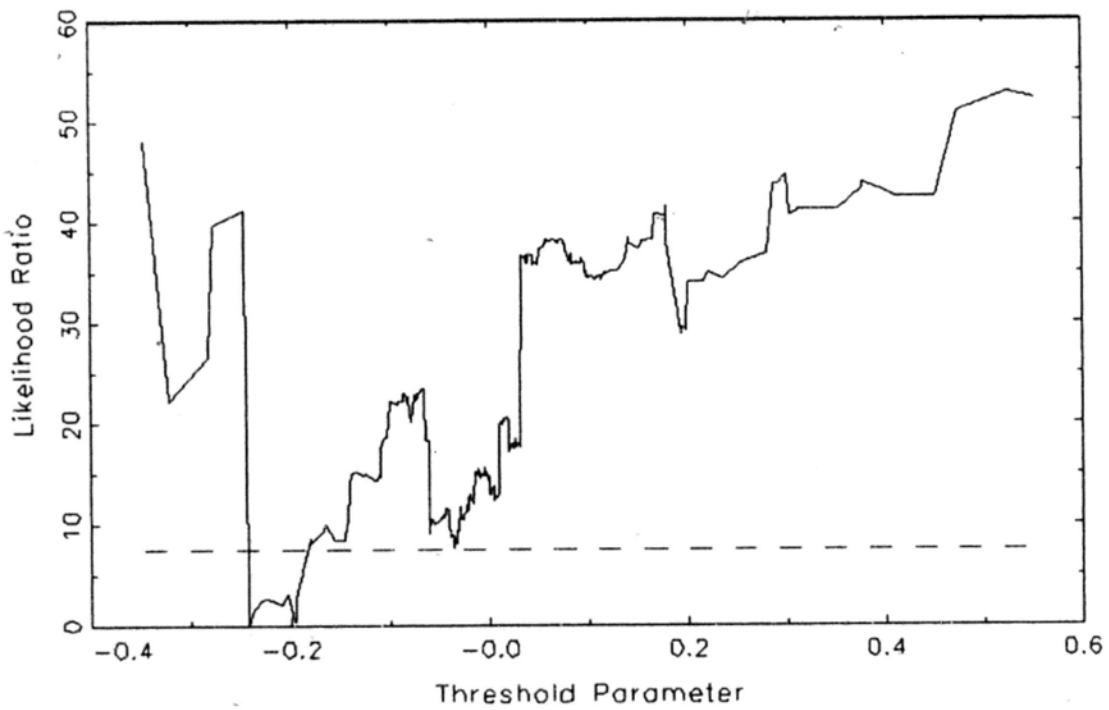
Table 1.3: Testing result for threshold effects of R/M2 and the TAR estimates

Test for threshold effect	
F	54.819
p-value	0.034
(10%, 5%, 1% critical values)	(36.56, 50.25, 72.53)

	Threshold estimate	95% confidence interval
$\hat{\lambda}$	-0.243	[-0.254, -0.196]

	TAR estimates					
	$Z_{t-1} < \hat{\lambda}$			$Z_{t-1} \geq \hat{\lambda}$		
Regressor	Estimate	OLS SE	White SE	Estimate	OLS SE	White SE
y_{t-1}	0.547	(0.132)	(0.313)	0.931	(0.052)	(0.067)
y_{t-2}	0.743	(0.177)	(0.388)	-0.057	(0.067)	(0.101)
y_{t-3}	-0.056	(0.238)	(0.225)	-0.121	(0.064)	(0.087)
y_{t-4}	-0.350	(0.163)	(0.349)	0.098	(0.045)	(0.060)

Figure 1.5: Confidence interval construction for the R/M2 ratio



1.5. Predictive Ability

In the previous section, we obtain a threshold estimate of -0.291 for the R/STED ratio and -0.243 for the R/M2 ratio. We now examine how well these threshold values can be used to distinguish the tranquil regime from the speculative attack regime. The exchange market pressure index (Eichengreen *et al.*, 1996; Frankel and Rose, 1996; Sachs *et al.*, 1996; Goldstein *et al.*, 2000) is

used to identify the crisis episodes of the eight Asian emerging countries[13]. The results are reported in Table 1.4. The periods of rapid depletion of reserve are also listed in Table 1.4.

Table 1.4: Crisis Episodes in Asian Countries

Countries	Crisis episodes identified by the exchange market pressure index	Rapid depletion of reserve identified by our model	
		R/STED	R/M2
China	1992Q3-1993Q2	1991Q4, 1992Q3-Q4, 1993Q1	1992Q3-Q4,1993Q1-Q2
India	1991Q1-Q2	1990Q4,1991Q1-Q3, 2003Q2-Q3	1990Q3-Q4,1991Q2
Indonesia	1997Q3-1998Q2	1997Q3	1999Q3
Korea	1997Q4	1991Q1,1997Q4	1991Q1,1997Q4
Malaysia	1997Q3-Q4, 1998Q2	1993Q1-Q2,1995Q1,1996Q1-Q2,1997Q2-Q3,2000Q4, 2001Q1,2002Q4	1993Q1,1994Q3-Q4, 1995Q1, 2001Q1
Philippines	1997Q3	1995Q1,1996Q1-Q2,1997Q3-Q4,1998Q1, 2003Q2	1992Q3,1993Q3,1994Q4, 1995Q1
Singapore	1997Q3-Q4, 1998Q2		1999Q1
Thailand	1997Q3-Q4	1991Q1	1997Q2,1998Q3

[13] Exchange Market Pressure (EMP) index was developed by Eichengreen, Rose and Wyplosz (1994). They use a weighted average of exchange rate changes, changes in reserves and interest to construct the index of exchange market pressures. A currency crisis is said to exist when this index two standard deviations above the sample mean.

The results in Table 1.4 indicate that the threshold variables perform well in forecasting the currency crises identified by the exchange market pressure index. If one of the threshold variables falls below the corresponding critical value, the likelihood of the occurrence of a crisis rises. In most cases, a crisis occurs when the threshold variable crosses the critical value. For instance, the depletion rate of the R/STED ratio for Malaysia crosses the critical threshold value in 1997Q2, one quarter before the crisis. Meanwhile, the R/M2 ratio also drops 18.3% before the crisis. For Thailand, the depletion rate of the R/M2 ratio for Thailand crosses the critical threshold value one quarter prior to the crisis. There is also a large drop of R/STED ratio of 18% during the pre-crisis period. In addition, the R/M2 ratio of Philippines also drops substantially (-16.7%) before the crisis. It should be mentioned that if we just use the R/M2 ratio alone, the predictive performance is bad for Indonesia, Malaysia, Philippines and Singapore. For Philippines, four signals have been generated between 1992 and 1995, but the crisis occurs only in 1997. For Malaysia, there are also four signals, all of which are at least 2 years apart from the 1997 crisis. For Indonesia and Singapore, the signals for the 1997 crisis are not generated until 1999. The results are not totally unexpected. If we compare the movement of R/STED in Figure 2 with that of R/M2 in Figure 4, the R/M2 ratio is relatively more stable than the R/STED ratio. As such, R/STED should generate a more timely warning signal as compared to R/M2. However, there are also cases where the R/M2 ratio performs better than or at least as good as the R/STED ratio. For the Thailand case, R/M2 generates a correct signal while R/STED does not. For the cases of China, India and Korea, both indicators have good performance. The results suggest that we should combine the two indicators to generate warning signals.

Table 1.5: Measure of Predictive Power

	Using the original threshold estimate	Using the 0.75 times the original threshold estimate
Percent of pre-crisis periods correctly called[14]	86	86
False alarms as percent of total alarms	36	51

Table 1.5 reports the predictive ability of the model. The threshold estimate correctly calls 86 percent of pre-crisis periods, with 36% of false alarms[15]. To see if the predictive power can be improved by using a more conservative threshold, we also use another threshold, which is the original threshold estimate multiplied by 0.75, to see if it gives a better warning with fewer false alarms. Note from Table 5 that if the 75% threshold estimate is used, there is no improvement in the percentage of correctly called pre-crisis periods, but the fraction of false alarms increases. Almost half of the signals are false alarms, which come mainly from the cases of Malaysia and Philippines in 1992Q3-1995Q1, a period when exchange rates are highly volatile in both countries[16] .

[14] A pre-crisis period is correctly called when either depletion of R/STED or R/M2 is below the cutoff value and the crisis ensues within 4 quarters.

[15] Similar to Abiad (2003), a pre-crisis period is correctly called when either the depletion of R/STED or R/M2 is below the cutoff value and the crisis ensues within 4 quarters. A false alarm is observed when the depletion of R/STED or R/M2 falls below the cutoff value but there is no crisis within 4 quarters.

[16] Zhang (2001) and Abiad (2003) have identified these periods as Speculative Pressure Episodes in Malaysia.

1.6. Conclusions

The existing crisis indicators in the literature are essentially static. This chapter explores the connection between the dynamics of reserves and currency crises. Using a panel data of eight Asian countries from 1990 to 2003, a threshold model is estimated to monitor the dynamics of foreign reserves. We show that there is no threshold effect for the depletion rate of the Reserves-to-Imports ratio. However significant threshold effects are found for the depletion rates of the Reserves-to-STED ratio and the Reserves-to-M2 ratio. It is observed that the depletion rates tend to cross the threshold values one to three quarters before the occurrence of a crisis. Our method implies that when the Reserves-to-STED ratio drops by more than 29.1%, or when the Reserves-to-M2 ratio drops by more than 24.3% within six months, there is a high likelihood of the occurrence of a crisis. The success in anticipating future currency crises in real time demonstrates that the two leading dynamic indicators can be informative tools that allow the authority to take preemptive measures to avoid a full-blown crisis or at least to mitigate its potential severity. Finally, it should be mentioned that for simplicity our TAR model assumes i.i.d. error terms. Future research along this line may allow the error terms to have long memory (Chong, 2000; Chong and Hinich, 2007).

Chapter Two

Exits from exchange rate pegs: A competing risks analysis

2.1. Introduction

The decision of a country to exit fixed exchange rate regime has long been a subject of debate in academia and the policy community. Throughout the post Bretton Woods period, more and more countries have switched to a floating exchange rate regime. The move from a fixed exchange rate regime to a free floating one may be voluntary or involuntary. In a voluntary exit, a country moves to a floating regime without triggering a currency crisis. This type of exit improves the performance of the economy (e.g., Japan in 1977, and Israel in 1986). An involuntary exit is often driven by severe crises and speculative attacks, so it is also referred to as crisis-driven exit (e.g., Mexico in 1994, Thailand in 1997, and Argentina in 2002).

The economic implications of the two exits are very different. An orderly exit is fully anticipated and well managed, hence the market has sufficient time to react to the regime shift, and the transition should be smooth. On the contrary, exits driven by speculative attacks often result in macroeconomic turbulence. Some economists argue that the exchange rate pegs may serve as a temporary arrangement to stabilize domestic inflation and support development strategies (e.g., export-led), thereby improving economic growth in developing countries. However, the pegs may also bind domestic monetary policy and make domestic financial system

vulnerable to speculative attacks. Therefore, countries in pegs may be more likely to have financial crises. Eichengreen (1999) suggests that exits from pegged exchange rates have seldom occurred under favorable circumstances. Countries are often prone to keep the status quo until reserves are exhausted, and they usually miss the appropriate time of adjusting the exchange rate regime.

Economic theory offers little guidance on the appropriate time to abandon a fixed exchange rate (Rebelo and Vegh, 2006)17. Few significant empirical studies on this front include Klein and Marion (1997), who use a Binary Logit model to examine the longevity and the collapse of the fixed exchange rate system. They find that the longer a peg lasts the more likely it is to break. Duttagupta and Otker-Robe (2003) extend the simple model of Klein and Marion to a Multinomial Logit model[18]. It is found that the peg duration plays an important role in determining the modes of exit from pegs. Sebastien (2005) shows a non-monotonic relationship between the peg duration and its ending probability. Klein and Shambaugh (2006) provide a revisionist view of peg duration, and conclude that it is an important determinant of exchange rate collapse.

What has been absent from the study of peg durability, though, is the role of peg duration on the different types of exits. Since the policy implications of orderly exits are very different from those of crisis-driven exits, misunderstanding the nature of exits may lead to severe policy consequences. Our paper complements this literature by uncovering the relationship between duration peg and different types of exits. By analyzing transitions out of exchange rate pegs in a competing risks framework, we can test whether the length of the time already spent on the peg

[17] The dominant models for this issue are proposed by Krugman (1979) and Flood and Garber (1984).
[18] Logit and probit model suffer the problem of survivorship bias, in the sense that many countries are still in their pegged regimes at the end of sample periods.

determines the probability of different types of exits. It also allows us to analyze simultaneously the impact of different time dependent variables on the probability of exit from a pegged regime to a floating one. Our goal is to identify some institutional, operational and time characteristics of successful transitions (orderly-exit) and to distinguish them from the failures (crisis-driven exits).

Recent studies have recognized that countries' actual exchange rate arrangements usually differ from their announcements. Calvo and Reinhart (2002) show that while many countries declaim to be floating, they peg in fact - an epidemic case of "fear of floating." In this paper, we follow the well-known classification method of Rinehart and Rogoff (2004), hereafter "RR". This exchange rate regime classification uses a new data set on dual and parallel exchange rate. It provides a "natural classification" by focusing on the actual exchange rate movements. We use this de facto classification[19] to construct the sample of peg duration.

Our work is also related to the literature of currency crisis. Defining the currency crisis is by no means an easy task. There is currently no single definition that is generally accepted in the literature[20]. We follow the simple method of Duttagupta and Otker-Robe (2003) to construct the sample of crisis-driven exits. They classify the movement to floating exchange rate as a crisis if the end of month exchange rate movement is larger than two times of the standard deviation of monthly depreciation rate in this peg period. The methodology is different from the well-known EMP index developed by Eichengreen, Rose and Wyplosz (1996). They use a weighted average of exchange rate changes, changes in reserves and interest to construct the index of exchange market pressures. A currency crisis is said to exist when this index is one and a half standard

[19] Other de facto classifications include Bubula and Otker-Robe (2002), and Levy-Yeyati and Sturzenegger (2003).
[20] There is an extensive literature on the definition of currency crisis, which is too broad to list here.

deviation above the sample mean. However, this method does not take the exchange rate regime into consideration. Using the classification of Duttagupta and Otker-Robe, we can compare different types of exits from exchange rate peg.

The remainder of this chapter is organized as follows: Section 2.2 briefly reviews the methodology of the competing risks model. Section 2.3 describes the data and variables used. The estimation results are presented in Section 2.4. Section 2.5 concludes this chapter. Data descriptions and the definitions of variables are collected in the Appendix.

2.2. Methodology

To analyze the behavior of exits from exchange rate pegs, a competing risks model (CRM) is estimated. We assume that the pegged duration is a realization of random variable T, and the indicator of type of exits is a realization of random variable R. The hazard function[21] for an exit of type r (the cause-specific hazard), is defined as

$$h^r = \lim_{dt \to 0} \frac{\Pr(t \le T < t + dt, R = r | T \ge t)}{dt} \tag{2.1}$$

The conditional probability that an exit of type r happens in the interval $(t, t + dt)$ is the event specific density function:

[21] The hazard function (also known as the failure rate, hazard rate, or force of mortality) is the ratio of the probability density function to the survival function.

$$f^r(t) = \lim_{dt \to 0} \frac{\Pr(t \le T < t + dt, R = r)}{dt} = h^r(t)S(t), \tag{2.2}$$

where $S(t) = \Pr(T \ge t)$.

For each country i, let t_i^1 be the duration of exchange rate peg before an orderly exit and t_i^2 the duration of pegs before a crisis-driven exit. The different types of exits are mutually exclusive. Define $t_i = Min(t_i^1, t_i^2)$. Let r_i be an indicator variable, which equals 0 under exchange rate pegs, equals 1 if there is an orderly exit from exchange rate pegs to floating; and equals 2 if there is a crisis-driven exit from exchange rate peg to floating. We observe an event or censoring time t_i and a categorical variable r_i indicating they are censored if $r_i = 0$, and if uncensored, the type of events they experienced $(r_i = 1,2)$.

Under the assumption of independent risks, a competing risks model can be considered as two independent models, one for each type of exits. In the model for exit type r, all exits other than r are treated as censored.

Consider Cox PH models of the form:

$$h^r(t; x) = h_0^r(t) \exp[x(t)'\beta^r], \qquad r = 1,2 \tag{2.3}$$

where both the baseline hazard ratio $h_0^r(t)$ and β^r are specific to type r hazard, and $t_1^r < \cdots < t_{k_r}^r$ denote the k_r ordered failures of type r. The likelihood function for the Cox competing risks model is then

$$L(\beta^1, \beta^2) = \prod_{r=1}^{2} \prod_{j=1}^{k_r} \frac{\exp[x_j(t_j^r)'\beta^r]}{\sum_{l \in R(t_j^r)} \exp[x_l(t_j^r)'\beta^r]} \tag{2.4}$$

State dependence may exist because of unobserved heterogeneity. To incorporate the unobserved heterogeneity in our model[22], a commonly used functional form is the exponential mean with a multiplicative error[23]. The Cox CRM can be extended to include a multiplicative term v. That is

$$h^r(t;x) = h_0^r(t)\exp[x(t)'\beta^r]v^r, \qquad r = 1,2, \tag{2.5}$$

where x_t is observed characteristics denoted by potential explanatory variables at time t. v^r is the destination specific and unobserved individual effect. We assume that the unobserved heterogeneity is independent of observed characteristics and follows a gamma distribution with unit mean and variance theta.

[22] When the unobserved heterogeneity is ignored, its impact is confounded with that of the baseline hazard, which may result in spurious regression.

[23] Manton (1986) states essentially that if the hazard function is well specified then the precise parametric specification of the heterogeneity distribution is relatively innocuous.

In the proportional hazards type formulation of CRM, the interpretation of the parameters is analogous to the Cox PH model. The marginal effect of a certain variable, say x_k, on the probability of entering state x_k, is equal to

$$\partial h^r(t|x,\beta)/\partial x_k = h_0^r(t)\exp[x(t)'\beta^r]\beta_k^r = \beta_k^r h^r(t|x,\beta) \tag{2.6}$$

Thus, if $\beta_k^r > 0$, an increase in x_k will increase the probability of exiting from exchange rate pegs for a certain destination state r relative to the probability of keeping pegs.

Furthermore, the proportional hazard competing risks models allow us to compare the probability of each type of exits. If $\beta_k^r > \beta_k^j$, $\forall j \neq r$, then the estimated coefficient in h^r is larger than the corresponding coefficients in all other hazard functions. An increase in x_k will increase the conditional probability of exiting via route r.

2.3. Data and Stylized Facts on Pegged Spells

The duration of an exchange rate peg is defined as the time spent on a peg. Using the RR's classification, we define an exit from a fixed exchange rate regime to a flexible exchange rate regime as a shift from any fixed categories to manage floating, freely floating and freely falling. Our sample period[24] is from 1972 to 2001. The monthly data set between January 1972 and

[24] The monthly RR database is only available upto 2001.

December 2001 yields 133 durations for 79 countries[25]. Following Duttagupta and Otker-Robe (2003), we define a crisis-driven exit as:

$$\varepsilon_t \geq \bar{\varepsilon} + 2\sigma,$$

where ε_t is the year average monthly depreciation rate of nominal exchange rate at the time of regime shift (units of the national currency per U.S. dollar), $\bar{\varepsilon}$ is the average of monthly depreciation rate during a given peg, σ is the standard deviation of monthly depreciation rate during the same time. We also use the index of currency crisis (Glick and Hutchison, 2004) as a reference when ambiguity arises. The remaining types of exits are regarded as orderly exits.

In our sample countries, Eighty-three pegged durations ended before or in December 2001, and the remaining 51 observations are right-censored. Table 2.1 provides the summary statistics of durations for the two types of exits.

Table 2.1: Summary Statistics on Pegged Duration

	Full Sample	Crisis-driven Exit	Orderly Exit
Failed	82	30	52
Censored	51		
Mean	131	128	71
Median	105	110	56
Stdev	111	93	65
Min	3	11	3
Max	360	311	323

[25] Developed countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Iceland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, US.
Developing countries: Argentina, Armenia, Bolivia, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Cyprus, Czech Rep, Dominica, Dominican Rep, Ecuador, Egypt, El Salvador, Estonia, Guatemala, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Latvia, Lao, Lebanon, Lithuania, Malaysia, Mexico, Moldova, Myanmar, Nicaragua, Paraguay, Peru, Philippines, Poland, Romania, Russia, Slovenia, Slovak Rep, South Africa, Thailand, Turkey, Ukraine, Uruguay, Venezuela.

The average duration of a peg is 131 months while the median duration is 105 months. The range of the peg duration is from three months to 360 months. By the exchange rate regime categories defined above and the information on regime transitions from 1972 to 2001, a total of 134 spells are identified, among which 30 are crisis-driven exits and 52 are orderly exits. Furthermore, exchange rate pegs in the crisis-driven exits on average last significantly longer than those of orderly exits. To examine the general distribution of exits, we begin with a preliminary analysis without explanatory variables, using the standard nonparametric Kaplan-Meier estimators.

Figure 2.1: Estimated hazard function, all types of exits

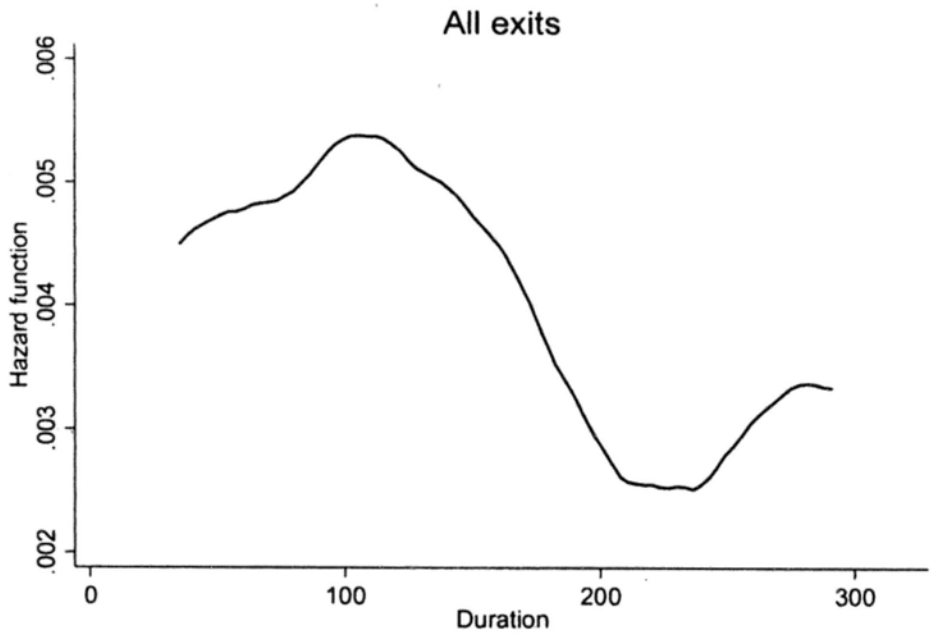


Figure 2.2: Estimated hazard functions for Crisis-driven exits

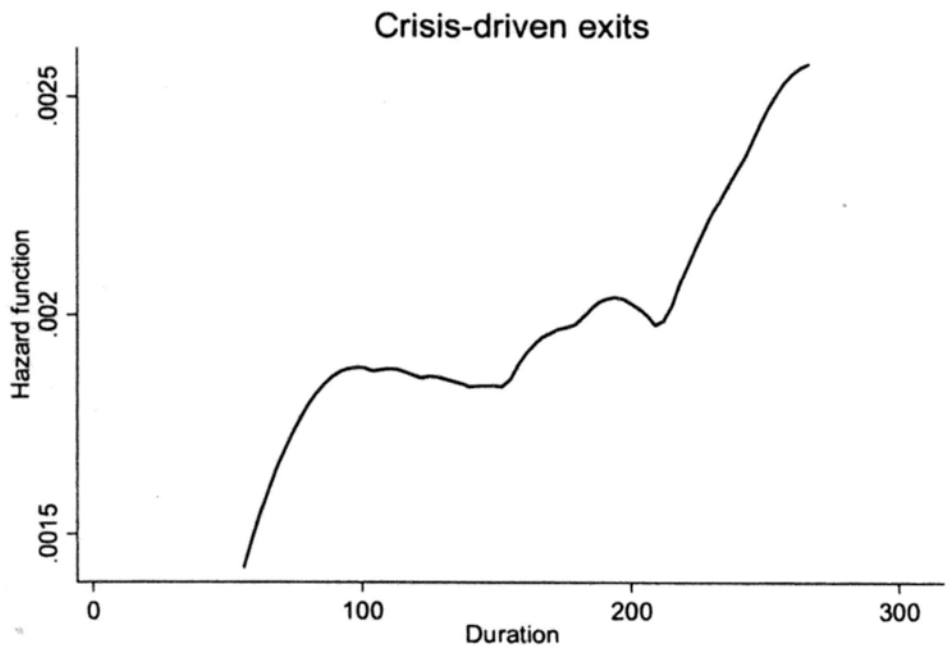


Figure 2.3: Estimated hazard function for Orderly exits

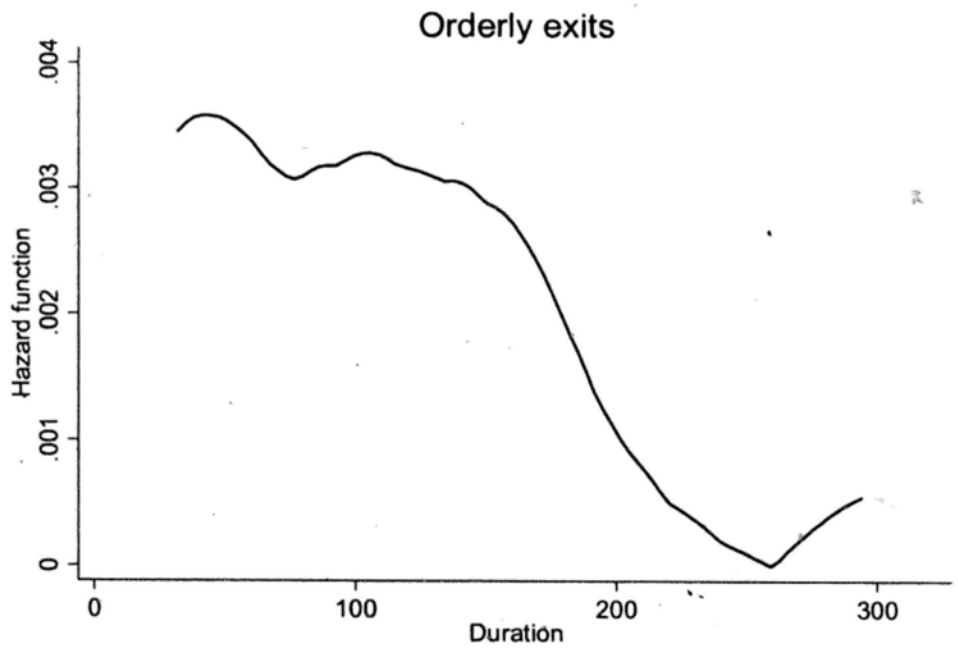


Figure 2.4: Estimated survivor functions

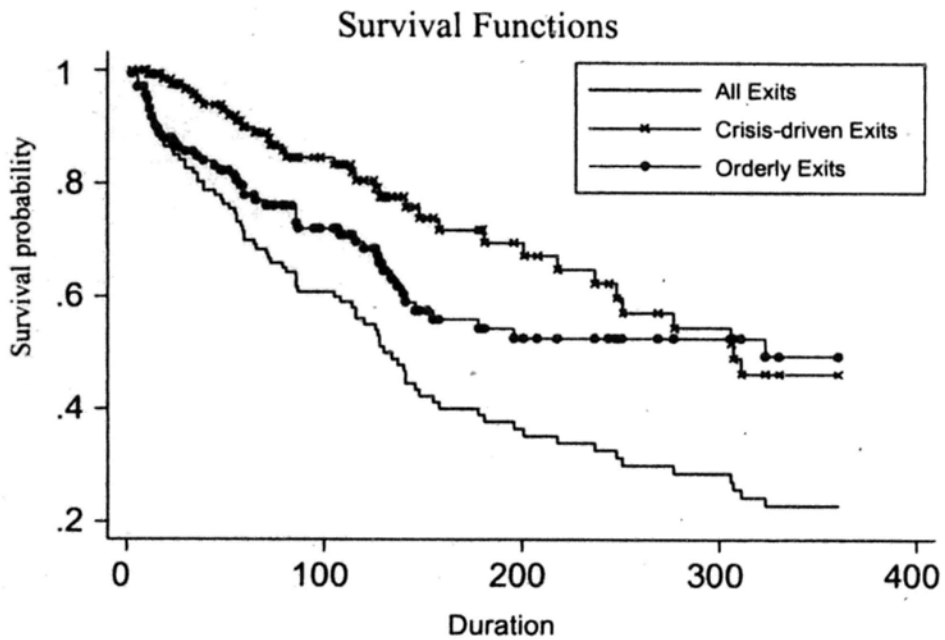


Figure 2.1 presents the estimated hazard function for both types of exits from exchange rate pegs. The results show a clear non-monotonic pattern of duration dependence, which corroborates the finding of Sebastien (2005). However, when we distinguish two destination states (orderly-exit and crisis-driven exit), crisis-driven exits, in general, show a positive duration dependence pattern while orderly exits show a negative duration dependence pattern.

We adopt the estimation method of Cox competing risks model (Cox CRM) to allow for time-varying explanatory variables. In addition, the baseline hazard ratio estimated by Cox CRM can capture the duration dependence. As for control variables, we use data available from IMF and other sources, covering most determinants suggested by currency crisis theory and the optimal regime choice theory.

The following explanatory variables are used in the analysis:

(A) Macroeconomic variables: Openness, Trade Concentration, Domestic Inflation Rate, Economic Growth, and Volatile of Output.

(B) Financial variables: Base-country interest rate[26], Foreign Debt position, Financial Openness[27], Bank Crisis, Central Bank Independence.

(C) Political and Institutional variables: Democratization, County Type, Hyperinflation

[26] In most developing countries, the time-series interest rate data is not available. We therefore use the interest rate of base county as a proxy.

[27] The traditional measures of financial openness are based on IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. These measures may not adequately reflect actual or *de facto* exposure of countries to international capital markets (Eichengreen, 2001).In this chapter, we use the measure of financial openness that focuses exclusively on portfolio equity and FDI holdings (see Lane and Milesi-Ferretti, 2003).

The partial likelihood estimation allows us to only use the data at failure times[28].

2.4. Results

The estimates for the competing risks model are reported in Table 2.2 for standard Cox CRM model and in Table 2.3 for Cox CRM model with unobserved heterogeneity. For both models, we control for country specific time-varying explanatory variables. In the baseline specification (1), selected macroeconomic and financial variables include openness, trade concentration, inflation, growth, volatility of output, interest and financial openness. We check the robustness of these results by adding other country-specific attributes to the initial specification (in specifications (2)-(5)), which enables us to identify the determinants of exiting from exchange rate pegs.

Concerning unobserved heterogeneity (compare Table 2.2 and Table 2.3), we remark that σ_v^2 is close to zero in all specifications, and we cannot reject the null hypothesis $\sigma_v^2 = 0$. It is found that the main estimates are almost identical to those of the standard model. Furthermore, all the thetas, except for the orderly exit in specification 3, are close to zero. Therefore, heterogeneity problem is less severe in our estimation[29].

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[28] Since our sample for exchange change rate pegs contains monthly data, the time-varying data used in duration analysis is also monthly data at the times of failures. However, most of data cannot be found at monthly frequency, therefore we use the yearly data before the year containing the failure times.

[29] Since simultaneous exits cannot occur, the possibility of dependent risks can only be induced through heterogeneity variables correlated across competing hazards. However, our specifications show little evidence of heterogeneity. The assumption of independent risks is relatively innocuous.

The coefficient in the degree of openness is always negative and significantly different from zero for orderly exit; but insignificant for crisis driven exit; an increase in openness significantly lowers the probability of orderly exits, implying a more open economy will experience a great impact on its price level and its government may suffer a larger political cost to unpeg. The coefficients in trade concentration are negative and only significant in specification (2) for orderly exit, but are positive and significant in most specifications in crisis driven exit. For orderly exit, a higher trade concentration increases the linkage between domestic and pegged countries. The pegged regimes serve well, so the concentration of trade favors fixed exchange rate. While, in crisis driven exits, a higher trade concentration exacerbates a given misalignment; this increases the probability of speculative attack. The coefficient on the rate of inflation is always positive and significant for orderly exit but is negative and insignificant for crisis driven exits. The higher rate of inflation enlarges the economic difference between domestic and foreign countries. It is better to leave exchange rate pegs for sustaining development. This results in an increasing probability of an orderly exit. The coefficients on the degree of financial openness are positive and significant for orderly exit but negative and non-significant for crisis driven exits. Under high capital mobility, floating exchange rate provides a better insulation of output against shocks to aggregate demand. This implies that the greater in the degree of financial openness corresponds to an increasing probability of an orderly exit.

The effect of economic growth is negative but insignificant in all specifications. The coefficients on the volatility of output and the interest rate of base countries are strongly positive for both exits in most specifications. The high volatility of output would lead policymakers to introduce a flexible exchange rate system to avoid economic shocks, thereby reducing the

survival probability of exchange rate pegs. The increase in the interest rate of base countries accelerates capital outflows from the domestic economy, which forces the country to exit from the exchange rate peg. The value of the coefficient is larger for crisis-driven exits, suggesting that an increase of the base interest rate is more likely to increase the chance of a crisis-driven exit. A possible explanation is that the peg forces a county to follow the base country's interest rate, even when it is not optimal for the domestic economy[30]. It increases the vulnerability to speculative attacks[31].

By adding other variables into our specifications, it is found that the main estimates are almost identical to those of the initial specification (Except for specification (2), controlling the degree of central bank independence makes the coefficient on volatility of output negative and insignificant). However, some interesting results are found. A high turnover of central bank (less central bank independence)[32] implies an increasing probability of both exits. This is significant for orderly exits but insignificant for crisis-driven exits. The conditional probability of an exit is not significantly affected by the degree of democracy, hyperinflation and whether the country is developed or not. From the signs of the coefficients of these variables, it is found that hyperinflation decreases the probability of leaving exchange rate pegs. Pegged exchange rate provides a potential nominal anchor helping central bank to achieve its inflation object. The fast growth in reserve increases the confidence to defend exchange rate pegs, which lower the probability of leaving pegs.

[30] Miniane and Rogers (2006) find that local interest rates are more likely to follow base interest rates for pegs.
[31] Di Giovanni and Shambaugh (2007) find evidence that a high base country's interest rate has a concretionary effect on domestic economy, especially for country with a fixed exchange rate.
[32] The argument for using this proxy is that a greater degree of turnover rate reflects low independence from the government.

Table 2.2: Cox Model

	Specification 1		Specification 2		Specification 3		Specification 4		Specification 5	
Risk Coefficient	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2
Transitions	40	29	34	26	36	28	36	29	37	29
OPENNESS	-2.767***	-0.411	-1.372*	-0.321	-1.792**	-0.251	-3.203***	-0.25	-3.343***	-0.459
TRADECONCENTRATION	-0.014	0.021*	-0.019*	0.018	-0.012	0.021*	-0.012	0.020*	-0.009	0.024*
INFLATION	0.431***	-1.131	0.481***	-4.821	0.454***	-3.093	0.565***	-1.182	0.475***	-1.922
RGDPG	-1.397	-1.323	-0.155	-1.792	-1.056	-1.162	0.711	-0.993	-0.109	-1.343
RGDPDVS3	11.293*	12.725**	-0.208	13.558**	9.58	13.448**	15.601**	12.950**	15.678**	9.724*
BASEINTEREST	15.643***	22.927***	14.254**	33.794***	18.273***	32.244***	13.375**	21.416***	14.399**	21.141***
FINOPENNESS	1.381***	-0.619	1.201**	-0.597	1.460**	-0.681	1.288**	-0.653	1.383**	-0.646
CBI			1.624***	0.755						
COUNTRYTYPE			0.235	-0.146						
DEMOCRACY					-0.133	-0.019				
DEBTPOSITION					-0.811*	-0.117				
RESERVEGROWTH							-0.850*	-1.009**		
HYPERINFLATION							-1.267	-0.392	-1.279	-0.629
BANKCRISIS									-0.056	0.989**
ln L	-240.817		-194.32		-213.711		-215.379		-217.969	

* significant at 10%; ** significant at 5%; *** significant at 1%, Risk 1 for orderly exits, Risk 2 for crisis-driven exits

Table 2.3: Cox Model With Gamma Heterogeneity

	Specification 1		Specification 2		Specification 3		Specification 4		Specification 5	
Risk Coefficient	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2	Risk 1	Risk 2
Transitions	40	29	34	26	36	28	36	29	37	29
OPENNESS	-2.780***	-0.411	-1.381*	-0.321	-1.586**	-0.251	-3.120***	-0.25	-3.265***	-0.459
TRADECONCENTRATION	-0.014	0.021*	-0.019*	0.018	-0.018	0.021*	-0.016	0.020*	-0.013	0.024*
INFLATION	0.430***	-1.131	0.478***	-4.821	0.421***	-3.093	0.553***	-1.182	0.460***	-1.922
RGDPG	-1.359	-1.323	-0.119	-1.792	-1.533	-1.162	0.597	-0.993	-0.347	-1.343
RGDPDVS3	11.374*	12.725**	-0.019	13.558**	9.251	13.448**	15.260**	12.950**	15.293**	9.724*
BASEINTEREST	15.860***	22.93***	14.270**	33.794***	18.856***	32.244***	13.477**	21.416***	14.595**	21.141***
FINOPENNESS	1.369***	-0.619	1.200**	-0.597	1.376**	-0.681	1.283**	-0.653	1.393**	-0.646
CBI			1.635***	0.755						
COUNTRYTYPE			0.236	-0.146						
DEMOCRACY					-0.189	-0.019				
DEBTPOSITION					-0.803*	-0.117				
RESERVEGROWTH							-0.863*	-1.009**		
HYPERINFLATION							-1.396	-0.392	-1.426	-0.629
BANKCRISIS									-0.062	0.989**
σ_v^2	1.36e-15	2.11e-16	1.27e-14	7.00e-19	0.152	2.11e-16	0.061	2.08e-18	0.071	1.27e-14
ln L	-240.565		-194.204		-213.206		-214.967		-217.577	

The coefficients in net debt position are negative in both exits but only significant for orderly exits. As Calvo and Reinhart (2002) note that foreign liabilities are the main consideration countries may fear exchange rate volatility and thus prefer pegs. More foreign liabilities reduce the tendency toward floating. The incidence of bank crisis significantly increases the probability of crisis-driven exits, while no effect on orderly exits.

After controlling country specific time varying variables and unobserved heterogeneity (based on specification (1)), we retrieve the baseline hazard functions for both types of exits by Cox CRM model. The hazard functions remain relatively unaffected. Consistent with our non-parametric estimation, crisis-driven exits show a positive duration dependence pattern while orderly exits are more likely to occur in early pegged stage.

Figure 2.5 Estimated Cox hazard function for Crisis-driven exits

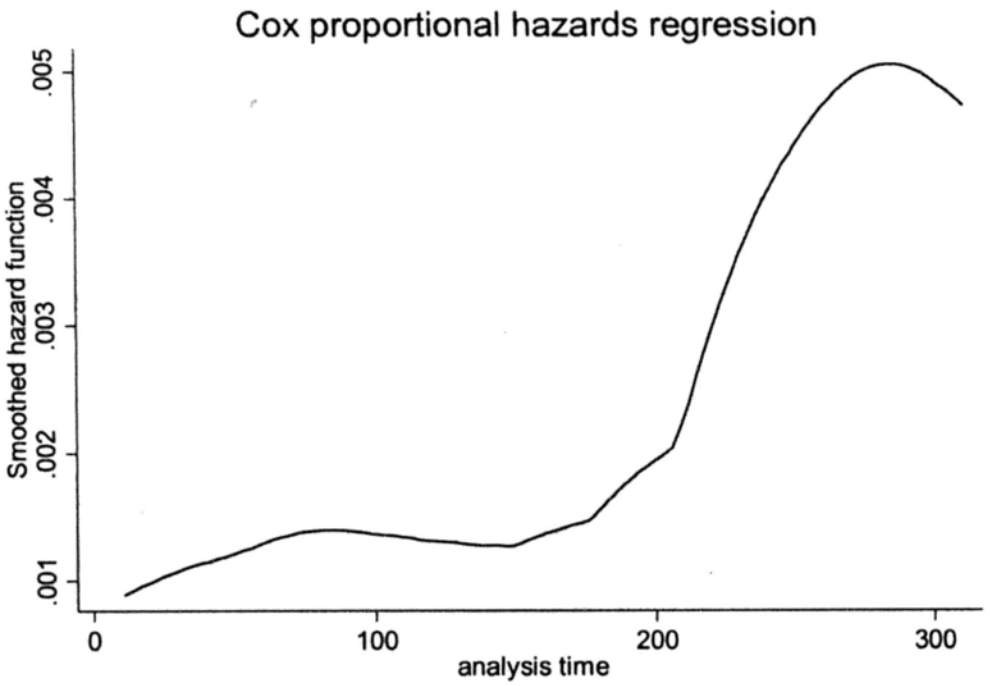
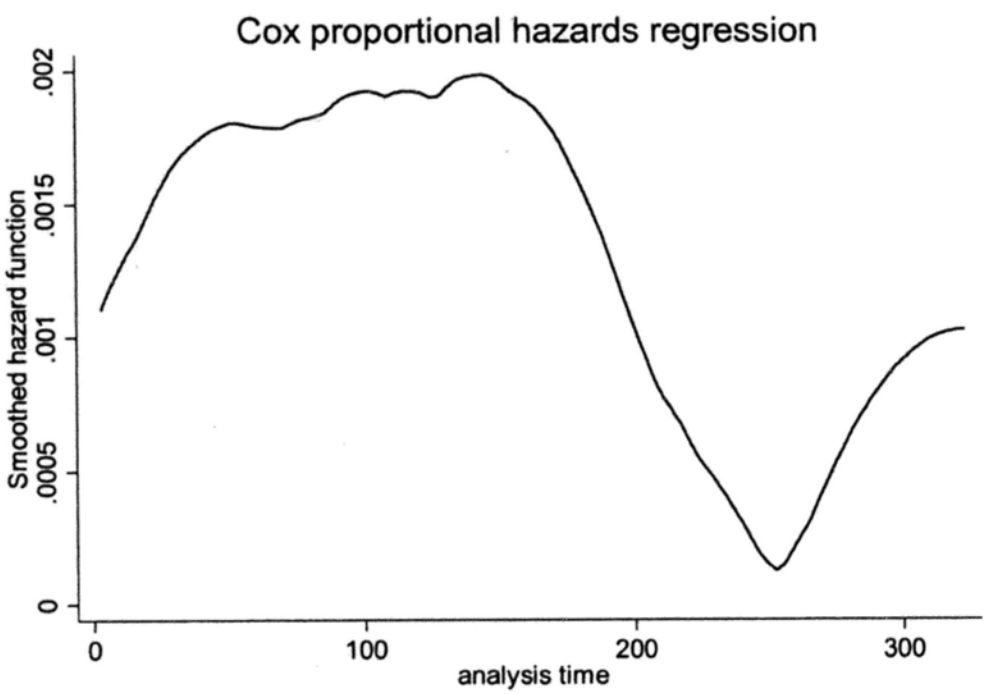


Figure 2.6 Estimated Cox hazard function for Orderly exits



2.5. Conclusion

This chapter studies the exits of exchange rate pegs via the duration model. We distinguish two types of exits. The first is the crisis-driven exit, and the second type of exit is voluntary exit. Our results indicate that the duration of exchange rate pegs is an important determinant of exiting from exchange rate pegs, but the effect is significantly different in each type of exits. Crisis-driven exits show a positive duration dependence pattern while orderly exits show a negative duration dependence pattern, even after controlling for country specific time varying variables and unobserved heterogeneity. Several general conclusions are obtained. The openness and trade concentration of an economy significantly influence exchange rate duration. For orderly exits, the great integration (high openness and trade concentration) increases the advantage of fixed exchange rate, responding to a lower probability of exits. However, the great integration also increases the cost of a given misalignment, prone to be speculatively attacked. Financial openness increases the probability of orderly exits while it has no effect on the likelihood of crisis driven exits. Other variables suggested by currency crisis theory also have a significant effect on crisis driven exits. Such as, the likelihood of crisis driven exits increases immediately after the incidence of bank crisis. Finally, a fast reserve growth reduces the probability of leaving a peg.

Chapter Three

Incentive Realignment or Cost Saving: the Decision to Go Private

3.1 Introduction

After a lull during the 1990s, going-private activities[33] resurge in recent years. According to a survey by FactSet Mergerstat Release (2006), these transactions accounted for approximately 31.7% of public takeovers in 2005, up from 26.3% in 2004 (Figure 3.1)[34]. A popular explanation for these transactions is the gain from incentive realignment after the private buyout. For example, Jensen (1986) argues that the high level of debt after taking a company private can force the management to direct the free cash flow[35] from value-dissipating investments to debt holders. The increase in managerial equities can mitigate conflicts of interest between insiders and outside investors, and enhance the productivity of the firm[36]. However, the extent to which the motivation of incentive realignment can account for the public-to-private transactions is still controversial. DeAngelo et al. (1984) argue that the costs of being

[33] In going-private transactions, shareholders of a publicly held corporation are bought out at a large premium by a bidder, who takes a concentrated position in the restructured private held firm.

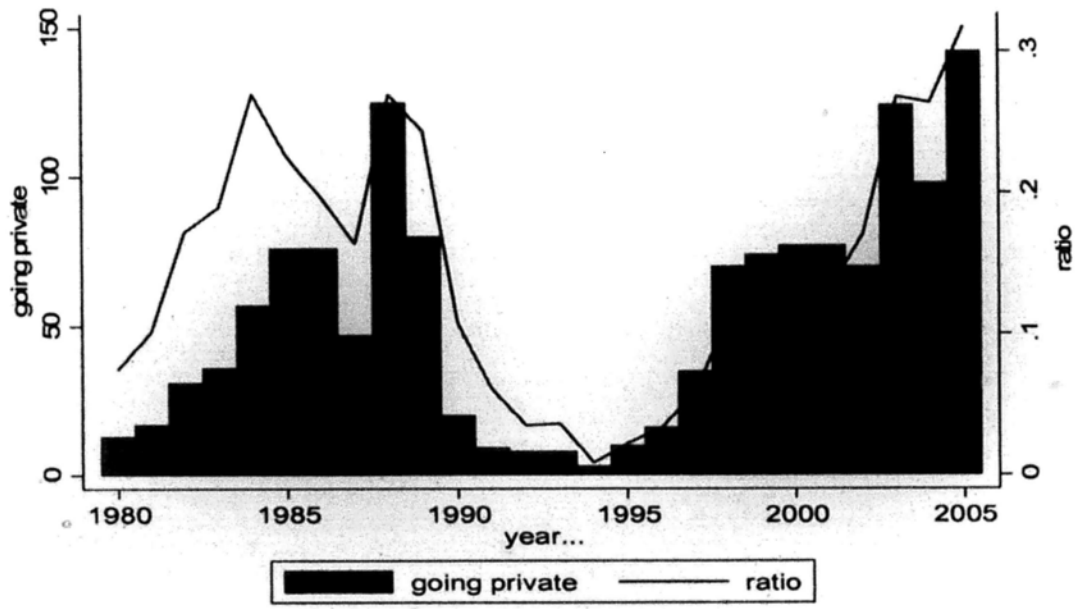
[34] The Wall Street Journal (2006) reported that private equity is booming. Fifteen years ago, a handful of private equity firms managed a few billion; today, more than 250 firms control some $800 billion in capital. Nearly $175 billion in new money flowed into U.S.-based private equity firms last year alone, including giants such as Blackstone, KKR, and the Carlyle Group." It is estimated that private equity has grown 3000% in the past 10 years (The Economist, 2003).

[35] Free cash flow is cash flow in excess of that required to fund all projects that have positive net present values when discounted at the relevant cost of capital. (Jensen, 1986).

[36] Empirical evidence is documented by Kaplan (1989) and Smith (1990). Kaplan reports an increase in operation income and cash flow for a sample of 48 MBO. Smith shows that operating cash flow per employee and per dollar operating assets increase in comparison with the industry.

a public firm are very high[37]. The gains from going-private transactions are mainly due to the elimination of the listing costs. Moreover, the recent compliance costs incurred by the Sarbanes-Oxley Act (SOX) of 2002 have generated extensive concerns about the regulatory burden that deters firms from seeking financing in the public equity market[38].

Figure 3.1: US public-to-private activity



Remark: This figure shows the number of going-private transactions (left hand scale) and the ratio of these transactions over total public takeovers (Right hand scale). Source: FactSet Mergerstat Release (2006).

To address this question, we evaluate the two hypotheses on the firms' going-private decision, and examine the extent to which the motivation of incentive realignment is associated this decision. Using a sample of nearly 7000 firms from 1978 to 2006, we

[37] Benninga, Helmantel and Sarig (2005) estimates that the average direct cost of being a publicly traded firm is above 10% of the first-day IPO gain.
[38] Academic studies of the effect of SOX on firms' decision to go private include Bushee and Lenz (2005), Engel et al. (2005) and Kamar et al. (2006).

compare the characteristics of firms that have gone private with those that have not. In particular, we examine the relationships between the propensity to go private and i) the gains from incentive realignment, ii) the listing cost and iii) the Sarbanes-Oxley Act.

As shown below, the trend towards privatization is largely due to the reduction of diversification gains[39] from staying in the public capital market. The decision to go private depends on how large the anticipated incentive gain a firm has before going private. Such gains are related to the quality of governance of the firm and its associated capital structure. For privatizations motivated by incentive realignment, the gains are coming from the reduction in agency costs. A financially healthy firm whose governance quality is weak suffers from a severe agency problem. It may go private because of the benefits from incentive realignment. Taking a firm private can align closely insiders' interest with that of outside investors. Given the necessity of raising new capital and the liquidity considerations in the public capital market, these transactions are worthwhile only if the gain exceeds a certain threshold. The improvement in profitability only increases the amount of free cash flow, resulting in more self-serving behaviors of management. The benefits of incentive realignment are substantial by taking this firm private.

[39] Leland and Pyle (1977) argue that entrepreneurs can gain by taking a firm public because diversified investors value firm shares more than the under-diversified entrepreneurs. In this chapter, the higher price outsider investors are willing to pay captures all the benefits of being public, such as increased liquidity and added value of monitoring.

If, instead, cost saving[40] is the main reason for privatization, then the increasing burden of staying public should play an important role in firms' decision to go private. A higher leveraged firm, being better governed, has a lower agency cost. However, the high administration and auditing costs increase the regular burden of being public. More importantly, public firms have a more rigid governance structure, which brings a higher cost of management autonomy[41]. These types of firms are more likely to go private when their profitability begins to fall, because the deterioration in performance makes them more financially distressed and exacerbates the regulatory burden for staying public.

In order to test our arguments, we first develop a simple model yielding the empirical implications mentioned above. In the model, the equilibrium timing of the going-private decision is determined by the firm's tradeoff among diversification gains, incentive gains and cost-saving consideration. It is worthwhile to take a firm private only if the gain from incentive realignment or the cost saved outweighs the diversification gains of staying public. It should be stressed that the incentive realignment and cost-saving hypotheses suggest different sets of factors for the going-private decision. Thus, whether the going-private transactions are motivated by incentive realignment or cost saving can be tested by our model.

Although we focus primarily on the effect of incentive gains on the firm's decision to go private, our story also has implications on the post-buyout behavior of

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[40] The direct cost for listed companies is the high audit and legal fees. The indirect costs include the costs of disclosure of inside information that may be valuable to their competitors (Healy and Palepu, 2001), and also refer to the cost of losing management autonomy, such as managers has to abide to a much more rigid governance structure, and managers must act according to short-term incentives from the viewpoint of outside shareholder rather than on the company's strategy and operations.

[41] Brau and Fawcett (2006) suggest that "CFOs identify the desire to maintain decision-making right as the primary reason for staying private."

firms going private. In particular, when the going-private decision is motivated by the gains from incentive realignment, the process of going-private functions serves as a shock therapy for accomplishing one time change (Kaplan, 1991, 1993). Hence, after resolving agency costs by going private, the firm will go public again because of high profitability. For privatizations motivated by cost saving, going-private transaction may serve as a natural or appropriate form of organization. This type of privatizations may go public again when its profitability return to a high level. Therefore, our model suggests that privatizations due to incentive gains are more likely to go public again compared to those due to cost savings.

We then test the predictions of the model using a comprehensive sample of U.S. IPOs taking place between 1978 and 2002, and the corresponding delisting behaviors until 2006 among these IPOs. The reason of focusing on the IPOs is to track the whole history of a corporation from its initial listing to its exit from the public capital market. Most of the earlier studies, such as Lehn and Paulsen (1989) and Opler and Titman (1993), rule out the possibility of liquidations. Our study differs from its predecessors in that it takes into account all potentially relevant alternatives of delisting. A firm may go private, be acquired by or merge with another operating company. Alternatively, the firm might go bankrupt or be liquidated (delisting for cause)[42].

Our study also differs from its predecessors in terms of econometric methodology. In this chapter, a competing risks model is employed. The model allows the delisting probability to depend on its listing duration. It also allows one to simultaneously

[42] This type of firms that disappear from CRSP are delisted because of poor performance (Fama and French, 2005)

analyze the impact of different variables on the probability of transition from a publicly traded company to a privately held company. The result of this chapter suggests that the going-private transaction is driven by deterioration in diversification gains in the public capital market. Prior to delisting, firms that go private are thinly traded and exhibit a deterioration of growth opportunities. Moreover, we examine the impacts of managerial equity holding and leverage ratio. Firms with a higher level of managerial ownership and debt ratio are more financially distressed and exhibit a deterioration of operating performance before going private. Most of them come from industries with financial difficulties and exhibit deteriorating performance. Financial distress and declines in profitability increase the burden of staying public, which drive them out of the public market. We also find that the greater the proportion of managerial ownership, the more likely a firm will go private. These findings are consistent with the cost-saving hypothesis.

However, for firms with diffused ownership and low level of debt ratio, privatizations are more likely due to large free cash flow and under borrowing. Prior to delisting, firms that go private are relatively less distressed and exhibit an increase in tax payment[43]. Most of them come from industries with high profitability. We also find that the lower the proportion of managerial ownership, the more likely the firm will go private. These findings are consistent with incentive realignment and the Jensen's hypothesis. Our empirical results suggest that the privatization waves for incentive realignment are disproportionately populated in high profitability industries.

[43] This evidence suggests that tax incentive is an important source of wealth gains in going-private transactions.

We also analyze the duration dependence pattern for firms engaging in privatizations. It is shown that the conditional probability of exiting the capital market due to cost saving rises first and then falls with the listing duration. On the contrary, the longer the listing history, the higher the probability of going private due to incentive realignment. Finally, we test the SOX effects on firms' decision to go private. It is found that the number of cost-saving privatizations has increased slightly after the passage of SOX.

The remainder of the chapter is organized as follows. Section 3.2 provides a brief review of the literature. Section 3.3 presents a simple framework within which the decision to go private is analyzed. Section 3.4 describes the data and reports relevant characteristics of variables. Section 3.5 introduces the econometric methodology and presents the empirical results. Section 3.6 concludes this chapter.

3.2. Literature Review

The problem of why a firm chooses to go private has been widely studied in the past two decades. For example, Jensen (1986) suggests that going private in a leveraged recapitalization improves the operation efficiency of a firm by committing management to pay free cash flow to debtors and increasing insider equity holding percentages. Lehn and Paulsen (1989) provide evidence supporting the Jensen's free cash flow hypothesis. Opler and Titman (1993) study the effects of free cash flow and financial distress costs on the decisions of LBOs. They find that LBOs tend to have relatively high cash flows and low expected costs of financial distress. In contrast, Kieschnick (1989, 1998) and Servaes (1994) find no evidence for the free cash flow

hypothesis. Halpern, Kieschnick and Rotenberg (1999) show that LBOs with different level of management shareholdings are different in their motivations and post-transaction actions. Goktan, Kieschnick and Moussawi (2005) investigate the relationship between corporate governance and corporate survival. It is shown that the more shares the management owns, the more likely the firm will go private. Benninga, Helmantel and Sarig (2005) argue that public firms re-privatize when their cash flows decline and go public again when their cash flows return to a higher level.[44] Recent studies by Boot, Gopalan, and Thakor (2006) also examine the choice of whether to go public or stay private by focusing on the stringency of public corporate governance. They suggest that both excessively stringent and excessively lax corporate governance structures with public ownership encourage firms to stay private.

In light of these mixed results, this paper studies the going-private problem by isolating the anticipated incentive gains from the benefits of cost saving and testing for the extent to which incentive realignment can account for firms' decision to go private. We find that there are two types of cyclical patterns for private transactions, suggesting that both the cost saving and incentive realignment hypothesis can explain the going-private phenomena. Our study is also germane to Engel, Hayes and Wang (2005) and Kamar, Karace-Manic and Talley (2006), who investigate the role of Sarbanes-Oxley (SOX) Act on firms' going-private decision. Although these studies compare the benefits and costs brought by the SOX act, the empirical evidence is broadly consistent with the notion that the high cost of SOX compliance drives small firms to leave the public capital market.

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[44] While their model is similar to ours, they focus on the timing dimension of the decision to go public and its impact on firm value and firm's risk over time.

3.3. The Model

To begin with, we assume that the fundamental value of a company depends on the cash flows received by stockholders in each time period. We assume that stockholders receive a cash flow CF_t in period t. Thus, the evolution of the firm value is:

$$V(CF_t) = \frac{E[V(CF_{t+1}) + CF_{t+1}]}{1+r},$$

where $r > 0$, is the risk-free rate in each period.

At the beginning of each period, the manager decides whether to stay public or to take the firm private. The decision is reversible in the next period, depending on the value of the firm in each state.

A. The evolution of cash flow

Following Benninga, Helmantel and Sarig (2005), we assume that the evolution of risky cash flow is based on a binomial framework. In each period, CF moves from its initial values to one of two new values, uCF and dCF, where $u > 1 > d$. The state values of u and d are called "up movement" and "down movement" respectively.

The risk-free rate of return r is available to all investors, so both insider and outside investors use the same risk-free rate to discount future cash flow. To capture the value of risky cash flow, the firm is valued on a pair of state prices framework. One price is

for up state and another price is for down state. If a firm is private (public), the private (public) state prices are given by $p_u(q_u)$ for up state and $p_d(q_d)$ for down state. Since all investors can invest in risk-free assets, the sum of the state prices should be equal to risk-free return[45]:

$$p_u + p_d = q_u + q_d = \frac{1}{1+r} = \frac{1}{R}.$$

The diversification effect exists under the assumptions that $p_u < q_u$ and $p_d > q_d$. An intuitive explanation is that undiversified firm owners are more risk averse to firm's specific risk than the diversified outside investors[46]. In the up state, the entrepreneur has too much consumption relative to diversified investors. This entails selling some of his excess consumption. Hence, the private price p_u is lower than public price q_u. However, in the down state, the consumption of entrepreneurs is not enough relative to diversified investors. They should buy some of the shortage consumption. Thus, the private price p_d is higher than the public price q_d. Thus, the private value of unit uncertainty cash flow is less than its public value[47].

$$CE^{Private} = p_u u + p_d d < q_u u + q_d d = CE^{Public},$$

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[45] Suppose there exists a security, which pays off \$ 1 in an up state tomorrow and nothing otherwise. The state price p_u is the price of the security and can be considered as an insurance premium that the agent will pay in order for her to enjoy \$ 1 in the up state tomorrow. The definition of p_d is analogous. Consider the agent buys both securities. She will enjoy \$ 1 in either up state or down state. In another words, she has paid $p_u + p_d$ and secured \$ 1 in the next period. Given the risk free return r, it implies that
$q_u + q_d = 1/(1+r)$.

[46] Benninga, Helmantel and Sarig (2005) provide a detailed description for this assumption.

[47] Since $p_u + p_d = q_u + q_d$, it follows that $p_d - q_d = q_u - p_u > 0$. Hence $u > d$, we have $d*(p_d - q_d) < u*(q_u - p_u)$, which can be rewritten as above.

where $CE^{Private}$ and CE^{Public} are the private and public certainty equivalent of unit uncertain cash flow over the next period.

B. Incentive effect on cash flow

Investments in private (public) firms generate a stream of uncertain private (public) cash flows to stock holders. We assume that CF is the cash flow of public firm and αCF is the cash flows when the firm is taken private. The index α captures the anticipated gains from incentive realignments prior to going private.

For a less distressed firm with weak governance, managers may misuse investors' funds for personal benefits. Because the gain from mitigation of agency costs is likely to be high, it implies a higher value of α. The easiest way to expropriate personal benefits for managers is via the consumption of perquisites, such as plush carpets and company airplanes (Burrough and Helyar, 1990). Taking a firm private can enhance the value of the firm. On the contrary, a relatively distressed firm, who is better governed, is subject to a lower agency cost. Thus, it is associated with a smaller value of α. The increase in firm's value is likely to be a result of cost saving by exiting the public capital market, since shareholders gain fewer from incentive realignment.

We assume that there exists a cutoff value of the index α, known as α^*, above which the anticipated incentive gain is high. Forgoing the private transactions force the manager to disgorge most of consumption on agency goods. Going private, therefore, means that the manager gives up the consumption of agency goods for the incentive benefits of being a privately owned firm. The loss of agency goods may

exceed the benefits from cost saving so that the net benefit is negative. For $\alpha < \alpha^*$, the anticipated gain from incentive realignment is small, and hence managers suffer a smaller loss of agency goods. The gain from cost saving is the main reason for privatization, and the net benefit of cost saving versus loss of agency goods is positive. At each pairs $\{t,s\}$ of time and state, the total stream of benefits of firm's cash flow in the private state is $\alpha CF_0 u^s d^{t-s} + UW$, where CF_0 is the initial cash flow and UW is the net benefit of cost saving versus loss of consumption of agency goods. $UW < 0$, if the anticipated incentive realignment is high ($\alpha > \alpha^*$), while $UW > 0$, if the anticipated incentive realignment is low ($\alpha < \alpha^*$).

C. The decision to go private

Consider a publicly-traded firm whose stockholders receive a cash flow CF in current period. In the next period, if its shares stop trading in the stock market, stockholders receive the private cash flow, plus UW (the net benefits of cost saving versus the loss of consumption on agency goods). Thus, the managers' payoff will be equal to $\alpha uCF + UW + V(uCF)$ in up state and $\alpha dCF + UW + V(dCF)$ in down state. Thus, the value of the firm in private state is:

$$V^{Private}(CF) = q_u(\alpha uCF + V(uCF)) + q_d(\alpha dCF + V(dCF)) + UW / R.$$

Analogously, the value of the firm in the case that shares of the firm are still trading in the public market is:

$$V^{Public}(CF) = p_u(uCF + V(uCF)) + p_d(dCF + V(dCF)).$$

The decision to stay public or go private in the next period depends on whether $V^{Private}(CF) \underset{<}{\overset{>}{-}} V^{Public}(CF)$. This gives the firm's recursive value function:

$$V(CF) = Max\left\{V^{Public}(CF), V^{Private}(CF)\right\}$$
$$= Max\left\{\begin{array}{c} CE^{Public}CF + p_u V(uCF) + p_d V(dCF) \\ \alpha CE^{Private}CF + q_u V(uCF)) + q_d V(dCF)) + UW / R \end{array}\right\}$$

The recursive value function explains the stockholder's decision of taking company private. Several important characteristics of these transactions are noteworthy:

Proposition 1: The asymptotic properties of $V(CF)$ are as follows[48]:

·The value of a firm that is always public is: $\frac{CE^{Public}}{1-CE^{Public}}CF$

·The value of a firm that is always private is: $\alpha\frac{CE^{Private}}{1-CE^{Private}}CF + UW / r$

·The slope of the value function depends on the anticipated incentive realignment α. If $\alpha > (<)\alpha^*$, the slope of the "always public" function is less (greater) than the slope of the "always private" function[49].

[48] This proposition is similar to that of Benninga, Helmantel and Sarig (2005).

[49] For ease of exposition, the cutoff value α^* is assumed to make the slope of always public firms to equal to that of always private firms. That is, $\frac{CE^{Public}}{1-CE^{Public}} = \frac{CE^{Private}}{1-CE^{Private}}\alpha$. In this case, the net benefits of cost saving versus the loss of consumption on agency goods are zero. Thus, the firm value in private state is always equal to its value in the public state for any level of cash flow.

As the value function $V(CF)$ is continuous, increasing, and convex in CF [50], Proposition 1 states that the value function looks like the one shown in Figure 3.2 and Figure 3.3

[50] Benninga, Helmantel and Sarig (2005) provided a detailed proof of the property.

Figure 3.2: Going Private for Cost Saving

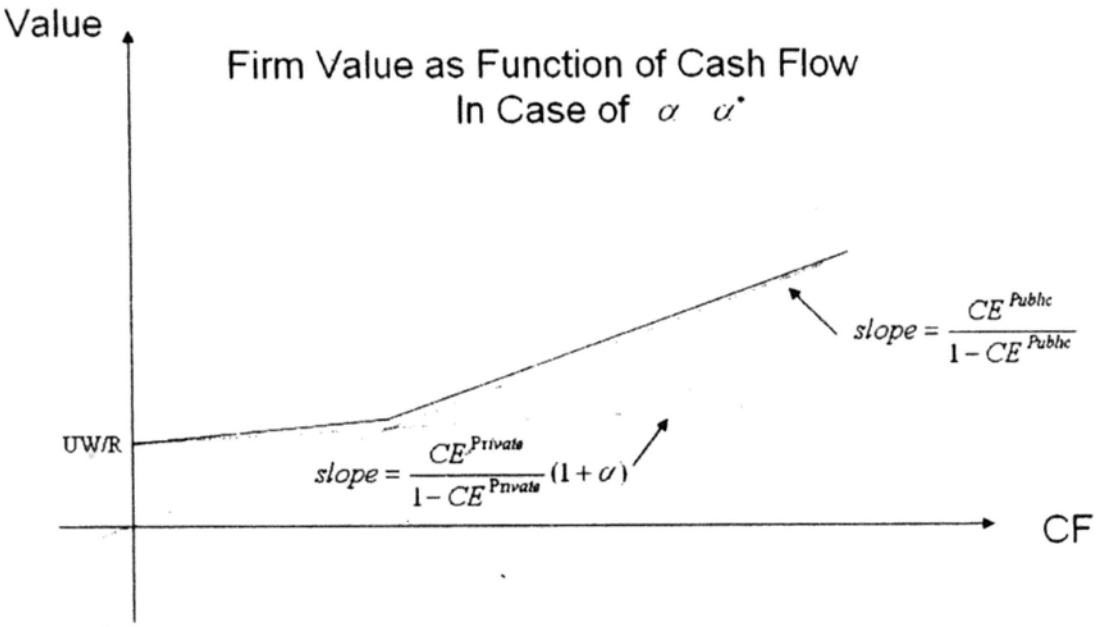
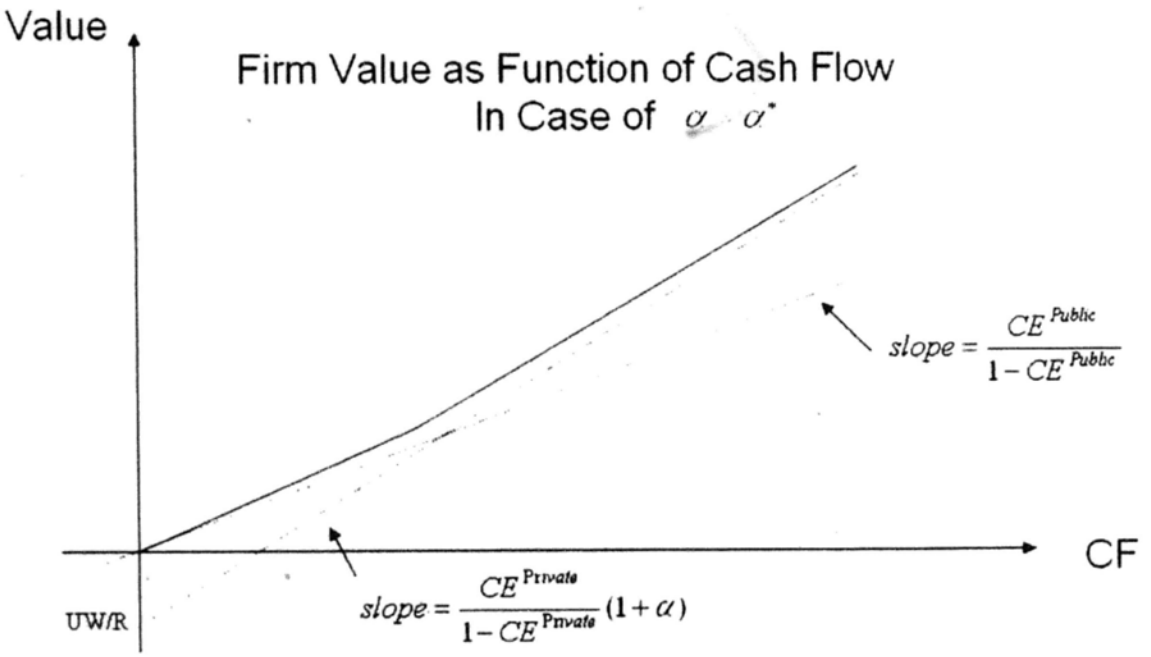


Figure 3.3: Going Privatize for Incentive Realignment



The shape of the value function suggests that privatizations for incentive realignment occur when the level of cash flow is high, while privatizations for cost savings occur when the level of cash flow is low.

Proposition 2: Suppose that, at current public state price $\{p_u, p_d\}$, it is optimal to take the firm private in the next period. Then, it is also optimal to go private for any public state price $\{p'_u, p'_d\}$, where $p'_u < p_u$.

Proof. The value of public firm in the case of $\{p'_u, p'_d\}$ is

$$V^{Public}(CF|p'_u) = p'_u(uCF + V(uCF)) + p'_d(dCF + V(dCF))$$

Define $D = V^{Public}(CF|p_u) - V^{Public}(CF|p'_u)$. We can rewrite D as

$$(p_u - p'_u)(uCF + V(uCF)) + (p_d - p'_d)(dCF + V(dCF)$$

Since $p_u + p_d = p'_u + p_d$, it follows that $p_u - p'_u = p_d - p'_d > 0$, rewriting the equation, we have

$$D = (p_u - p'_u)(uCF + V(uCF) - dCF - V(dCF))$$

Since $uCF > dCF$, and $V(CF)$ is increasing in CF, this implies $D > 0$ and $V^{Public}(CF|p'_u) < V^{Public}(CF|p_u) < V^{Private}(CF)$.

Proposition 3: Suppose that, at time t, a firm has cash flow CF and $\alpha < \alpha^*$. If it is optimal for the management to take a firm private, i.e., $V^{Private}(CF) > V^{Public}(CF)$, then it is also efficient to take the firm private for any cash flow $X < CF$; Similarly, if it is optimal to keep a firm public at current cash flow CF, i.e.,

$V^{Private}(CF) < V^{Public}(CF)$, then it is also optimal for the firm to stay public for any cash flow $X > CF$.

This result is similar to BHS's proposition and thus its proof is suppressed. Given $\alpha < \alpha^*$, the proposition implies that there is a critical cash flow level, CF^*, for any cash flow greater than or equal to CF^*, the firm will stay public, while for any cash flow less than the CF^* the firm will be privatized. Thus, the firm is taken private when its cash flow falls below CF^* and will go public again when its cash flow rises above CF^*.

Proposition 4: Suppose that, at time t with cash flow CF and $\alpha > \alpha^*$, if it is optimal for the management to take the company private, i.e., $V^{Private}(CF) > V^{Public}(CF)$, then it is also efficient to take a firm private for any cash flow $Y > CF$. However, after resolving the agency problem by going private, the index value of α falls below α^*, the firm may go public again in a short period, given current high level of cash flow.

Proof: The first part of this proposition is the direct result from the properties of the value function that $V(CF)$ is continuous, increasing, and convex in CF. To prove the second part of this proposition, we assume that CF_1 and α_1 are the cash flow and the anticipated incentive gain before going private respectively, with $\alpha_1 > \alpha^*$ and $V^{Private}(CF_1|\alpha_1) > V^{Public}(CF_1)$.

After internalizing the agency costs by going private, the cash flow and anticipated incentive gain change to CF_2 and α_2 with $\alpha_1 CF_1 = \alpha_2 CF_2$ and $\alpha_2 < \alpha^*$. It follows that $CF_2 < CF_1$ and $V^{Private}(CF_1|\alpha_1) = V^{private}(CF_2|\alpha_2)$.

We define $CF_* = \alpha_1 CF_1 / \alpha^*$, since $V^{Private}(CF_*|\alpha^*) = V^{Public}(CF_*)$. It implies that $V^{Public}(CF_*) = V^{Private}(CF_*|\alpha^*) = V^{Private}(CF_1|\alpha_1) = V^{private}(CF_2|\alpha_2)$.

$CF_2 > CF_*$ is true since $\alpha_2 < \alpha^*$. As $V(CF)$ is increasing in CF, it means that: $V^{Public}(CF_*) < V^{Public}(CF_2)$. We get that $V^{Private}(CF_2|\alpha_2) < V^{Public}(CF_2)$.

Given $\alpha > \alpha^*$, the proposition implies that there is some critical cash flow levels, CF^*, any cash flow greater than or equal to CF^* taking the company private is a better choice. However, after going private, the firm increases its debt ratio and resolves most of agency costs. Therefore, the anticipated incentive gains drop to a low level when the firm goes public again, which corresponds to the value of $\alpha \leq \alpha^*$. Given current high cash flow level, the firm will be taken public again in a short period.

The model allows us to make predictions on the relationships among incentive realignment, cost saving, diversification gains, as well as other variables. The main empirical implications are as follows.

Implication 1: The benefit from diversifications is crucial for the going-private decision. For many firms, the going-private decisions are driven by the deterioration in diversification gains in the public capital market. If $\alpha > \alpha^*$, the motive to take public firms private is that the gains from incentive realignment outweigh the benefits

of diversification, While if $\alpha < \alpha^*$, the cost saved exceeds the benefits of diversification.

Implication 2: If the anticipated incentive gain is low ($\alpha < \alpha^*$), it is optimal to take a firm private when the firm's cash flow falls below a certain level. When the cash flow returns to a high level, the firm will be taken public. However, if the anticipated incentive gain is high prior to going private ($\alpha > \alpha^*$), the firm will go private when the cash flow exceeds a certain value. After resolving the agency costs by going private, the anticipated incentive gains return low level ($\alpha < \alpha^*$). Given current high cash flow, the firm will go public again. Thus, our model predicts that the process of going private serves as a kind of shock therapy for firms whose anticipated incentive gains are high. Therefore, the going-private duration associated with incentive realignment will generally be shorter than that of cost-saving privatizations.

Finally, the model has implications for the clustering of going-private activities. It predicts that firms benefited from incentive gains will be taken private when their cash flows are high. If one firm finds it optimal to go private, so do other similar firms. Since cash flows are generally positively correlated to the economy, our model predicts privatizations for incentive realignment will come in waves when the economy is good. Analogously, privatizations for cost savings will also cluster during periods in which the economy is in recession. This kind of buyout waves will be concentrated in specific industries where the cash flows are low.

3.4. Data

3.4.1 Data source

To test the hypotheses for going-private transactions, we employ a comprehensive sample combining the NYSE, AMEX, and NASDAQ IPOs for 1978-2002. The IPO data are extracted from the Securities Data Company (SDC) U.S. New issues Database, combining with Ritter's IPO database which covers the period of 1975-1984. We eliminate the ADRs, Unit issues, REITs, Spin-offs, Rights issues, prior LBOs, and dual class stocks trading on the NYSE, AMEX, or NASDAQ[51]. This process yields 6975 IPOs. To account for all possible alternatives, we divide the failures of IPO sample into four subsamples: a subsample of firms going private; a subsample of firms acquired by or merged with other companies; a subsample of firms delisted from the market for poor performance; and a subsample of firms which remain publicly quoted.

The going-private subsample was created in the following manner. First, we use Thomson Research to identify companies that file a Schedule 13E-3 followed by a form 15, which are transactions initiated by affiliates of the company[52]; (2) The subsample was drawn form an original sample of transactions identified in the Securities Data Corp. ("SDC") mergers and acquisitions database as leveraged buyout (LBO), since going private usually involves borrowing. Next, we cross-reference the two samples with delisting information provided by CRSP (Center for Research on Securities Prices). We exclude cases where the going-private firm is bankrupt or liquidated. The final sample consists of 627 completed going-private transactions.

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[51] The logic for excluding spinoffs, pre-LBOs and dual class stocks is that these firms are more matured and so are different from the typical new lists.

[52] The SEC defines going private as "transactions initiated by affiliates of the company." DeAngelo at al. (1984), and Engel et al. (2004) and Leuz et al. (2006) are defined their sample based on Rule 13E-3.

Other types of firms are identified by using corporate delisting information from the CRSP events file. We first classify firms as delisted for cause[53] if their CRSP delisting codes are in the 400-range or 500-range, excluding firms with delisting codes of 501-503[54] and going-private transactions. The merger and acquisition type of firms are defined by their CRSP delisting codes in the 300 range, excluding going-private transactions. All other firms that are not delisted are considered to be firms that stay public.

The listing period of each firm is from the first year that the corporation is reported in CRSP until the firm delists or December 2006, whichever comes first. In our sample, 5531 listing durations ended before or in December 2006, and the remaining 1444 observations are right-censored.

[53] The delist for cause defined by Fama and French (2005) is based on CRSP-based information, similar to those adopted by Schultz (1993), and Weber and Willenborg (2003) and Elizabeth and Philip (2006).

[54] The delisting codes of 501-503 are the switching among NYSE, AMEX, and NASDAQ. Firms switching from the three market to other markets are called "going dark", and are included in our delists for cause sample.

Table 3.1. The Summary Statistics of Listing Duration

	Full sample	Going private	Merge & Acquisition	Delist for Cause
Failed	5531	627	2379	2525
Censored	1444			
Mean	6.53	7.74	6.84	5.94
Median	5	6	5	5
Stdev	4.24	4.81	4.48	3.72
Min	1	1	1	1
Max	26	26	26	25

Note: The duration of each firm listing on the stock market is from the first year that the corporation is reported in CRSP until the firm delists or December 2006, whichever comes first.

Table 3.1 provides the summary statistics of the listing durations. 5531 listing durations (79 percent of the public corporations) are observed to leave exchange market over the sample period. The average listing duration is 6.53 years while the median duration is 5 years. The range of the listing duration is from one year to twenty-six years. Of the delisted corporations, 627 corporations (11 percent) go private, 2379 corporations (43 percent) are merged with or absorbed by another operating company and 2525 corporations (46 percent) are delisted from the stock market simply because of poor performance. The going-private subsample has the highest mean listing duration. It implies that matured corporations are more likely to choose privatization as a way to delist from the public capital market.

Figure 3.4.Kaplan-Meier Estimates of Smoothed Hazard Functions

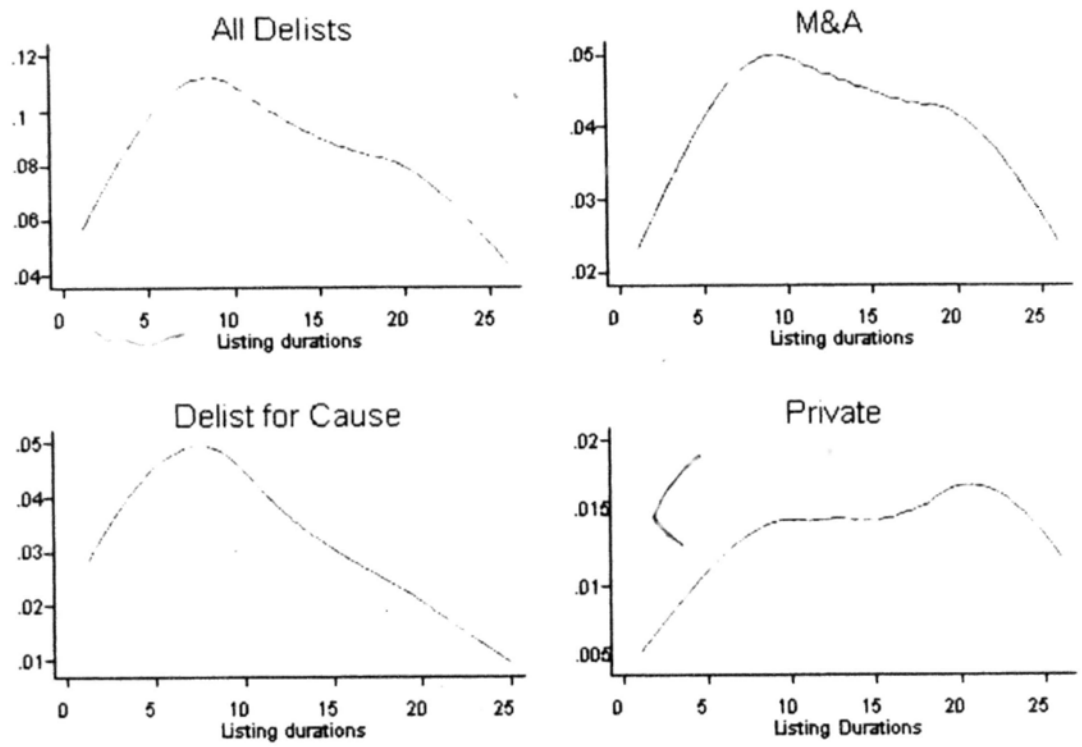

Figure 3.5. Kaplan-Meier Estimates of Survival Functions

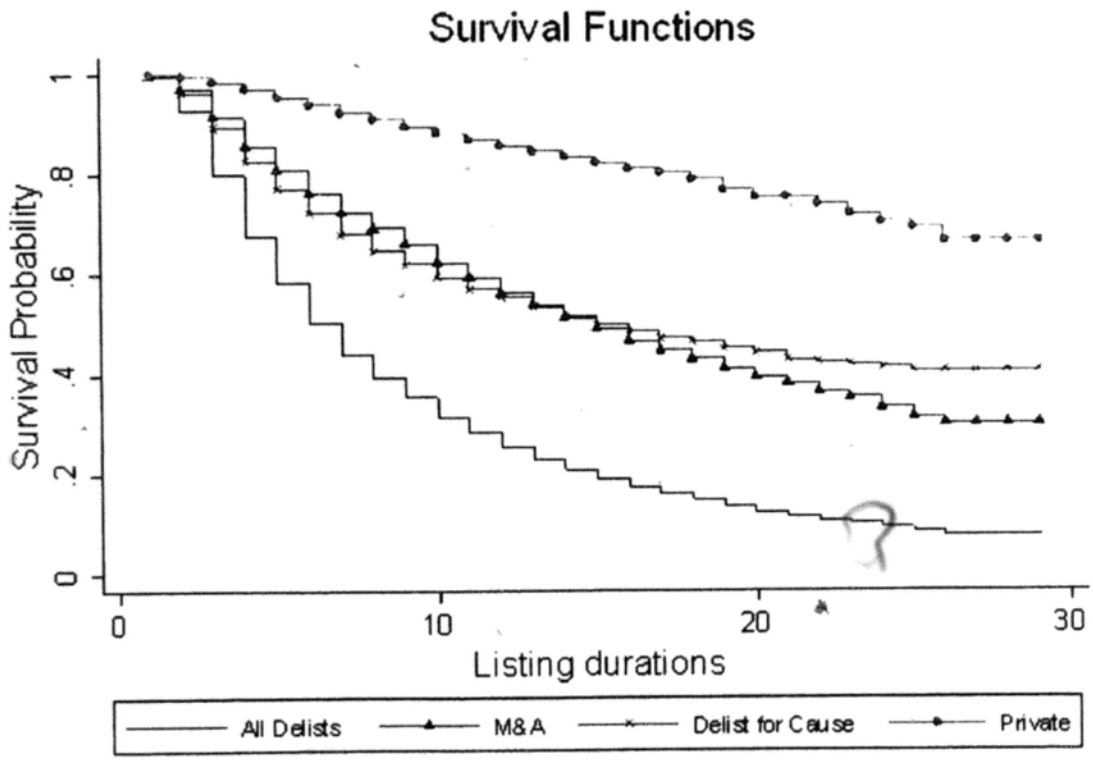

Figure 3.4 presents the nonparametric hazard functions for all types of exits from the stock market. The results show a clear monotonic piecewise pattern of duration dependence except for firms that go private. Positive duration dependence is observed until the eighth year, and negative dependence is observed after the eighth year of listing. We argue that the listing cost for IPO firms exceeds the benefits from trading in stock market in the first few years[55]. This causes the clustering of delists for new IPO firms. The listing benefit increases with its listing duration. Thus, the hazard rate shows negative duration dependence. For firms that go private, the hazard rate rises initially, and become relatively stable afterward. Privatization in the earlier stage is likely due to the cost-saving reason, since IPO firms are relatively better governed and have a higher leverage ratio. While, privatizations in a later stage are more likely to be driven by incentive consideration, since the management generally holds fewer shares when the firm becomes matured.

3.4.2 Relevant Characteristics of Variables

Following the existing literature, we associate a firm's current year status (private, acquired, delist for cause and public) with its previous calendar year characteristics. Testing the gains from incentive realignment requires one to investigate the quality of governance structure. In the corporate governance literature, a firm's governance environment is usually determined by the stockownership of its insiders, its board size and composition and other laws and charter provisions to which it is subject. We use the share of managerial ownership as a proxy of governance quality[56]. While there is

[55] Fama and French (2004) document the decline in IPO profitability in the years after listing for the full 1973-2001 period.

[56] Jensen and Meckling (1976) argue that agency costs increase with a reduction in managerial ownership. Ang, Cole, and Lin (2000) provide empirical evidence for this prediction.

no consensus on whether a higher ratio of managerial ownership leads to better governance quality[57], the empirical evidence is consistent with the notion that agency costs increase as the equity share of the manager declines. For instance, Ang, Cole and Lin (2000) find that agency costs fall with managerial ownership.

Debt financing is often an integral part of the going-private transactions. Grossman and Hart (1982) and Jensen (1986, 1989) argue that debt can align the interest of management with outside investors in a way that cannot be duplicated by any compensation contract[58]. However, firms in a business where financial distress is high will find it less attractive to take the debt to induce managers to act in the interest of outside investors. Such firms may be able to realize the gains from internalizing agency costs of management but may find it costly to borrow. Thus, the magnitudes of financial distress as well as the governance quality play important roles in determining the gains from incentive realignment after a private buyout.

As stated above, we consider a firm's governance quality to be primarily determined by its managerial ownership. Following the literature, we measure the managerial ownership as the ratio of the number of shares held by officers and directors to the total number of shares outstanding, and label this variable PSIO[59]. Table 3.2 reports that the average managerial ownership of the going-private subsample is higher than that of the M&A and Public subsamples, but less than that of the subsample of firms

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[57] Governance quality may not increase monotonically in manager's ownership shares. Mork, Shleifer and Vishny (1988) provide a U-shaped relation.

[58] Leverage also serves as an important mechanism for corporate governance, since higher leverage ratio limits future free cash flow.

[59] We obtain data of insider ownership from Compact Disclosure, a monthly CD-ROM product. Because the change in insider ownership between two consecutive months is substantially small, we do not include all the CD-ROMs and use the August CDs to compile our data. The August CDs available from 1990-2006.

delisted for poor performance. The cost of financial distress is high for a highly leveraged firm. Thus, we construct our primary indicator of financial distress as the ratio of a firm's total liabilities to total assets, and label it as DR. Jensen (1986) suggests that firms that are likely to go private tend to underutilize their debt capacity. The results of the univariate test in Table 3.2 do not support this notion as we do not find the debt leverage ratio of going-private subsample significantly less than firms staying public or being acquired. Titman (1984) suggests that the cost of financial distress is likely to be higher among firms with relatively unique products. Following Titman (1984), we also include product uniqueness as an indicator of financial distress. The proxy for uniqueness is the expense of research and development divided by asset (RDA). From Table 3.2, we find convincing evidence that, in general, firms in the going-private subsample are less financially distressed than other types of firms. In this chapter, we identify several relevant factors that have been significant determinants in the literature.

Firm size: Firm size is expected to be negatively correlated with the odds of being taken over or going bankrupt, since the take-over cost is high and larger firms can avoid financial distress through public financing. We measure firm size by the natural logarithm of a firm's total asset[60], and label this variable as LA. Table 3.2 suggests that the size of going-private subsamples are smaller than those of M&A and Public subsamples, while bigger than firms delisted for poor performance.

Profitability: Previous literature shows that less profitable companies are more likely to be taken over or go bankrupt. Following Fama and French (2004), we

[60] The total asset is adjusted by annual inflation at the price of 1995.

measure a firm's profitability by the ratio of earnings before interest but after taxes to total assets[61], and label this variable as EA. As shown in Table 3.2, the average profitability of going-private firms is the highest in our sample.

Free cash flow: Jensen (1986) argues that a firm with high level of free cash flow is more likely to be taken over. Following Lehn and Poulsen (1989), and Halpern, Kieschnick and Rotenberg (1999), we measure a firm's free cash flow by the ratio of raw free cash flow to total assets. The raw free cash flow is defined as its operating income before depreciation, minus its total income tax adjusted for the change in deferred taxes, minus its cash dividends to common and preferred stocks holders, minus net common stock repurchases. We label this variable as FCF. The results reported in Table 3.2 suggest that there is no significant difference across different categories of firms. It provides no evidence for the free cash flow hypothesis.

Tax expenditure: Firms that go private or are being acquired often use debt financing. Kaplan (1989) and Marais, Schipper and Smith (1989) argue that tax saving is a source of gains in these transactions. We measure the tax expenditure as the ratio of the tax expense, adjusted for deferred taxes, to the firm's asset, and label this variable as TAX. Table 3.2 suggests that going-private firms pay more tax than all other firms.

Growth prospects: In the literature, two ratios are used to measure the market's assessment of the firm's growth prospects. The first is the market to book value of

[61] Earning before interest is income before extraordinary items (Compustat data item 18) plus interest expense (data 15), plus income statement deferred taxes (data 50) if it is available.

assets, labeled by MB[62]. The market value of assets is measured by the book value of assets minus the book value of common equity plus the market value of common equity. The second ratio is measured by the growth rate of asset, labeled by AG. Under the free cash flow hypothesis, going-private firms should have a lower growth prospect than firms staying public or being acquired.

Fixed assets: Previous studies show that the probability of a firm being acquired or going bankrupt is decreasing with the ratio of tangible assets to total assets, since such firms have greater debt capacity. Following the existing literature, we measure a firm's fixed assets by the ratio of its net property, plant and equipments to its total assets, and label this variable as PPE.

Liquidity: Firms with a low liquidity are more likely to go bankrupt since they cannot pay off their liabilities on time. We use the ratio of current assets to current liabilities to measure this liquidity effect, and label this variable as CAL. Table 3.2 suggests that firms that go private have a lower liquidity than that of M&A and Public subsamples.

Stock price performance: We measure a firm's stock price performance as fiscal year stock return, and label this variable as SPP. Existing literature suggests that firms going private perform poorer than firms being acquired or staying public. The results from Table 3.2 also suggest that the stock performance of going-private firms is poorer than that of M&A and Public subsamples.

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[62] The MB ratio could also proxy for firm performance, for example Morck, Shleifer and Vishny (1988).

Trading volume: Diversification effects measure the gains of staying public, since the diversified outside investors value the share price more than the entrepreneurs. We proxy diversification effect as a firm's trading volume for a year. Following Smith (1990) and Campbell, Grossman and Wang (1993), we measure the trading volume as the ratio of the total number of shares traded to the total number of shares outstanding, and label this variable as TV. From Table 3.2, going-private firms' turnover rate is in general significantly less than all classes of firms, implying that the management may take a firm private when its benefit of listing in stock market falls substantially.

Table 3.2: Comparison among Subsamples

	Private	Public		M&A		Dcause	
Variable	Median	Median	p-value	Median	p-value	Median	p-value
FCF	0.072	0.072	0.916	0.070	0.449	-0.028	0
LA	4.414	5.078	0	4.369	0.167	2.906	0
AG	0.112	0.130	0	0.152	0	0.102	0.11
CAL	2.070	2.634	0	2.593	0	1.956	0.002
MB	1.214	1.610	0	1.467	0	1.34	0
DR	0.429	0.326	0	0.341	0	0.452	0.002
RDA	0.025	0.072	0	0.080	0	0.063	0
TAX	0.014	0.012	0	0.011	0	0.000	0
PPE	0.240	0.151	0	0.154	0	0.173	0
SPP	-0.050	0.075	0	0.023	0	-0.278	0
TV	0.057	0.097	0	0.080	0	0.067	0
EA	0.062	0.057	0.042	0.051	0	-0.072	0
PSIO	0.317	0.178	0	0.243	0	0.370	0

Note: The medians for all financial variables are calculated across all firm-year observations. FCF measures the free cash flow to total assets. LA represents the ln(total assets). AG indicates the growth rate of asset. CAL is the ratio of firm's current asset to current liabilities. MB represents the ratio of market value of asset to the book value of asset. DR is ratio of total liabilities to total assets. RDA is the research & development expenses over total assets. PPE represents the ratio of property, plant and equipment to total assets. SPP is the buy and hold return for prior fiscal year. TV represents the monthly average turn over rate for a year. PSIO represents manager and director ownership percentage. Public represents corporations that continues as public firms. Private represents corporations that went private. M&A represents firms that merge with or acquired by another firm. Dcause represents corporations that went dark, went bankrupt or were liquidated. The p-value reports the significance of the bivariate test for the difference in Private-Public, Private-M&A, and Private-Dcause. To mitigate the influence of outliers, we use the median rather then the mean of corporation values.

To conclude, the results in Table 3.2 suggest that firms that go private are those with a poorer growth prospect and stock performance, smaller size, higher leverage ratio,less stock turnover rate and a high concentration of management ownership. These firms also have less R&S expenses and higher profitability. However, there is no evidence that firms going private have higher free cash flow as compared to M&A and public firms.

3.4.3 Cluster Analysis of Going-private Subsamples

As stated above, we use managerial ownership and the associated leverage ratio to proxy the anticipated incentive gains prior to going private. We expect that the going-private sample to cluster into two subsamples according to the prior characteristics of the two variables. To test this conjecture, we perform a cluster analysis[63]on the going-private sample. The subsample is partitioned into two clusters. To highlight the difference between the two clusters, we report the bivariate test for the different characteristics in Table 3.3. The statistics of Chi2 show that managerial equity holding and the ratio of leverage are the most significant variables that distinguish the two groups of going-private subsamples. It is found that the average management stock holding in Cluster 1 firms is 51.6% while managerial ownership in Cluster 2 is 24%; the average leverage ratio in Cluster 1 is 61.9% while it is 33.9% in Cluster 2. The anticipated incentive gain for Cluster 1 is small because of high managerial equity holding and the high associated leverage ratio. We expect that cost saving is the dominant factor making a firm private. Firms in cluster 2 are characterized have

[63] The cluster analysis programs begin by creating the 2 clusters by some arbitrary procedure, and then calculate the medians of the each cluster. If one of the observations is closer to the median of another cluster, then the observation is made a member of that cluster. The procedure is repeated until there is no any observation will assign to another cluster.

low managerial ownership and leverage ratio. Thus, the mitigation of agency costs should be the primary cause for the going-private transactions.

Table 3.3: Comparison of Going-private Clusters

Variable	Cluster1	Cluster2	Chi2	p-value
FCF	0.053	0.083	85.596	0
LA	4.304	4.389	1.902	0.168
AG	0.090	0.114	3.568	0.059
CAL	1.546	2.457	212.575	0
MB	1.158	1.239	2.978	0.095
DR	0.619	0.339	347.987	0
RDA	0.004	0.044	59.012	0
TAX	0.005	0.020	86.565	0
PPE	0.282	0.199	45.419	0
SPP	-0.140	-0.022	18.366	0
TV	0.052	0.080	45.419	0
EA	0.048	0.063	12.272	0
PSIO	0.516	0.240	361.134	0

Note: The cluster analysis allocates the going-private samples to clusters based on its Euclidean distance from the median values of the two characteristics of a cluster. The bivariate test for the different characteristics between the two clusters is reported. Chi2 represents the Chi-Square statistic for likelihood ratio test of the difference, and p-value represents the level of significance.

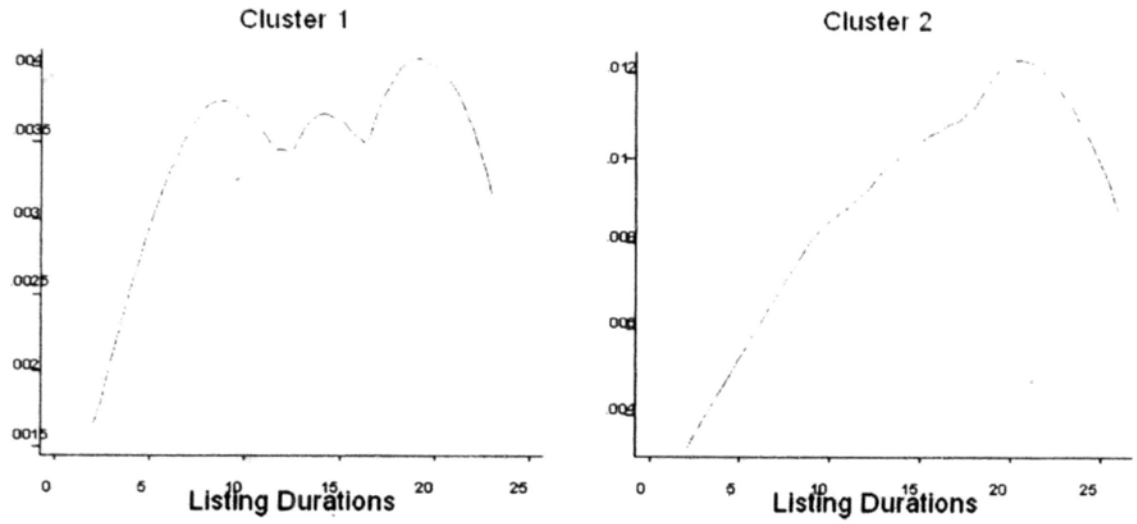
The results provide strong evidence for our conjecture. Except that both cluster firms share the similar firm size, the testing results in Table 3.4 report that privatized firms in Cluster 1 have a lower level of free cash flow, profitability, liquidity and turnover rate as compared to their counterparts in Cluster 2. Cluster 1 firms also have lower growth prospects and poorer stock performance than firms in Cluster 2. Therefore, Cluster 1 privatizations are likely to be driven by the cost-saving motivation, while incentive gains should play an important role in Cluster 2 privatizations

Table 3.4: Summary Statistics on listing durations for Cluster1 and Cluster 2

	Cluster1	Cluster2
Failed	107	225
Mean	7.86	8.77
Median	6	7
Stdev	4.66	5.15
Min	2	2
Max	23	26

Table 3.4 provides the summary statistics of the listing durations for the two types of privatizations. Cluster 2 firms have higher median and mean listing durations than Cluster 1 firms. Figure 3.6 also shows that the hazard rate for Cluster 1 firms reach its peak in early listing years, while the hazard rate for Cluster 2 firms increases with the listing duration until its later stage. Our results imply that privatizations for cost savings are more likely to happen in the early stage of listing.

Figure 3.6: Smoothed Hazard Functions for Cluster 1 and Cluster 2



Since our sample excludes firms that go public after going private, we cannot investigate the post-buyout behavior of firms going private. However, the empirical evidence in Halpern et al. (1999) suggests that the probability of going public again is negatively related to managerial equity holdings prior to the buyout. LBOs with low prior managerial shareholdings remain private only for a short period. After restructuring, the firm may go public again. LBOs with high prior managerial shareholdings may regard private status as an efficient form of organization and remain as such. Since firms with low prior managerial equity are more likely to have higher anticipated gains from incentive realignment, consistent with the predictions of our model, going-private transaction functions as a shock therapy for firms with high anticipated incentive gains, after controlling the agency problems subsequent to the buyout, these firms may return to public in a short period of time given current high profitability. Thus, the going-private duration associated with incentive realignment will generally be shorter than that of cost-saving privatization.

3.5. Empirical Analysis

3.5.1 Methodology and Model Specification

The dataset used in our analysis is collected on an annual basis. We assume a discrete time hazard model, which will be extended to incorporate competing risks in later analysis. However, the drawback of this model is the restrictive assumption of Independence of Irrelevant Alternatives (IIA). To relax this assumption, Steele et al. (1996) propose that the durations of events can be measured in discrete time intervals, indexed by $t, (t = 0,1,2.....)$. At each discrete time interval t for individual i, a response $y_i(t)$ is observed. Suppose there are R end events, $y_i(t) = r$ if an event of type r has occurred at time interval t, $(r = 1,2.....R)$, and $y_i(t) = 0$ if no event occurs. Thus, at each time interval t, the hazard rate of an event of type r can be defined as:

$$h_i^r(t) = \Pr(y_i(t) = r | y_i(t-1) = 0).$$

Using the logit model, we obtain the odds of exiting an event via type r relative to the null event at time t for the i th individual.

$$\log\left(\frac{h_i^r(t)}{h_i^0(t)}\right) = Z_i^r(t)'\alpha^r + X_i^r(t)'\beta^r + \mu_i^r,$$

where $Z_i^r(t)$ is a function of t[64] and α^r is a vector of the duration dependence parameters. $X_i^r(t)$ denotes the observed vector of covariates at time t. μ_i^r is the unobserved individual-specific factor which may differ for different events. The random effects are assumed to follow a multivariate normal distribution. The

[64] The function $Z_i^r(t)$ can be polynomials of t. For example, $Z_i^r(t) = (1, t, t^2)$. Alternatively the duration effect can be assumed piecewise constant, $Z_i^r(t)$ may be a vector of dummy variables for time intervals.

correlation between the random effects allows for shared or correlated unobserved risk factors across competing risks.

3.5.2 Empirical Results

A. The cause of going private

In this section, we investigate the determinants of going-private hazards as well as other delists hazard ratio under the competing risks framework. Following Goktan, Kitschnick and Moussawii (2006), we create two measures for each financial characteristic. The first measure is the firm's industrial financial characteristics measured by the median of that financial variable for the industry according to Fama and French's 38 industry classifications[65]. The second measure is the firm's specific values defined by the firm value less its industry median. The two measurements allow us to test whether it is the financial characteristics of the industry or firm's specific characteristics that govern the delisting behavior.

[65] The classification is available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Table 3.5: Estimation Results for Competing Risks Model

	Decause	M&A	Private
Duration (years)			
0-2	-31.736	-33.582	-32.512
3-8	-3.757***	-4.321***	-4.728***
9-14	-3.829***	-4.542***	-4.706***
15-20	-4.130***	-4.647***	-4.417***
21+	-3.581***	-4.672***	-4.613***
Financial Variables			
M_LA(t-1)	-0.505***	-0.001	0.002
D_LA(t-1)	-0.610***	0.849***	0.272*
M_AG(t-1)	-0.933	1.312**	-0.831
D_AG(t-1)	-0.501***	-0.833***	-0.857***
M_CAL(t-1)	-0.492***	-0.374***	-0.767***
D_CAL(t-1)	-0.108***	-0.027**	-0.008
M_EA(t-1)	-4.653***	0.406	-1.453
D_EA(t-1)	-1.438***	0.061	-0.325
M_MB(t-1)	-0.562***	0.438***	-0.432**
D_MB(t-1)	-0.456***	-0.035*	-0.596***
M_DR(t-1)	0.322**	-0.269	0.059
D_DR(t-1)	0.128***	-0.106**	0.047*
M_TAX(t-1)	14.333**	-12.347**	7.707
D_TAX(t-1)	-0.598	-1.127	4.404**
M_PPE(t-1)	0.296	-1.153***	-1.110**
D_PPE(t-1)	-0.113	-0.437**	0.563*
M_TV(t-1)	9.492***	1.789*	5.660***
D_TV(t-1)	0.586*	0.548***	-2.718***
M_SPP(t-1)	-0.751***	-0.566***	0.073
D_SPP(t-1)	-1.246***	0.033	-0.015
PSIO(t-1)	1.071***	1.026***	0.676**

Note: ***,**,* refer to the 1%, 5%, 10% significance level respectively. The medians for all financial variables are calculated for all firm-year observations. The measure based on the difference between firm value and the median of industry value is denoted by D_XX. LA represents the ln(total assets). AG represents the growth rate of sales. CAL represents the firm's current asset to current liabilities. MB represents the ratio of market value of asset to the book value of asset. DR represents the total liabilities to total assets. PPE represents the ratio of property, plant and equipment to total assets. SPP represents the buy and hold return for prior fiscal year. TV represents the monthly average turn over rate. PSIO presents manager and director ownership percentage. Public represents corporations that continues as public firms. Private represents corporations that went private

Table 3.5 reports the results of the competing risk analysis that identify characteristics associated with firms that go private. The variables that influence the odds of these transactions are the market to book value, the firm size and liquidity risks. Prior to the public-to-private transaction, firms exhibit an increase in their long-term liabilities and tax payments, deteriorating in operating performance and trading activity and have a lower growth than other firms in the industry. Privatizations also tend to come from industry with low growth prospects and high leverage. The greater the ratio of property, plant and equipment to total assets, the less distressed the firm after a private buyout, and the probability of going private should be higher. We also find that the greater the proportion of managerial ownership, the more likely the firm will go private. However, the profitability[66] variable is statistically insignificant. Thus, our empirical results are not supportive for the free cash flow hypothesis.

To address the extent to which the going-private transaction is motivated by incentive gains, we compare the two going-private subsamples mentioned above to other samples. The results are reported in Table 3.6. Cluster 1 privatizations are expected to be motivated primarily by cost saving, as our model predicts that going-private firms appear to be more distressed, and have a higher managerial ownership. From Table 3.6, we see that the use of debt relative to other firms within the industry is significantly higher and the liquidity dropped significantly before going private. The positive sign on the managerial stock holding and leverage ratio suggests that Cluster 1 firms are incurring a high cost of trading in the public market before going private. Our evidence suggests that in the case of a drop in profitability and capital market activity (measured by trading volume and growth prospects), firms with high

[66] Since the profitability is highly correlated with free cash flow in our data set, we therefore choose profitability as a representative factor.

managerial ownership and leverage ratio appear to be more financially distressed. When the profitability drops to a certain level, the benefit of staying public is less than the cost. It is optimal for firms to go private. We also find that the privatization is not motivated by tax considerations because of the high leverage ratio prior to the public-to-private transaction.

Cluster 2 privatizations are primarily motivated by the benefits of incentive realignment. As predicted by our model, the ratio of leverage and the share held by insiders have a negative impact on the propensity to go private. They are more likely to concentrate in industries with high profitability. We also find that firms that go private for incentive realignment demonstrate poorer growth prospects and are more thinly traded than other firms in the industry, suggesting that the benefits of being listed are less than other firms in the industry. Our evidence is also consistent with literature that tax reduction is an important consideration for this type of firms.

The estimation results for the odds of M&A and delist for cause are similar in Table 3.5 and Table 3.6. Consistent with the literature, firms delisting for cause are more distressed than firms that go private, M&A and staying public. They exhibit an increase in the short-term and long-term liabilities, deteriorating operating performance and have a low growth prospect as compared to other firms in the industry. They also tend to be smaller in size and have a higher tax burden. These firms usually come from industries with deteriorating profitability and low growth prospect. On the other hand, M&A occur in industries with better growth prospects, less liquidity, lower fixed asset ratio and lower past returns. Within the industry, M&A are larger in size, have a lower fixed asset ratio than other firms.

Table 3.6: Estimation Results for Competing Risks Model with Clusters

	Decause	M&A	Cluster 1	Cluster 2
Duration (years)				
0-2	-4.777***	-4.244***	-7.248***	-7.248***
3-8	-2.980***	-2.802***	-5.572***	-4.863***
9-14	-3.443***	-2.933***	-5.433***	-4.705***
15-20	-3.870***	-3.097***	-5.528***	-4.312***
21+	-3.875***	-3.182***	-5.666***	-4.568***
Financial Variables				
M_LA(t-1)	-0.504***	-0.001	0.039	0.005
D_LA(t-1)	-0.610***	0.849***	0.152	0.348*
M_AG(t-1)	-0.905	1.314**	1.412	-2.078*
D_AG(t-1)	-0.506***	-0.834***	-0.912**	-0.816**
M_CAL(t-1)	-0.494***	-0.374***	-1.152***	-0.752***
D_CAL(t-1)	-0.109***	-0.027**	-0.547***	0.019
M_EA(t-1)	-4.695***	0.403	-5.882**	1.442*
D_EA(t-1)	-1.449***	0.061	-1.563***	-0.399
M_MB(t-1)	-0.565***	0.438***	-0.916***	-0.26
D_MB(t-1)	-0.457***	-0.035*	-0.695***	-0.656***
M_DR(t-1)	0.326**	-0.269	0.29	-0.218
D_DR(t-1)	0.131***	-0.107**	0.094***	-0.250**
M_TAX(t-1)	14.375**	-12.342**	19.823	1.178
D_TAX(t-1)	-0.619	-1.134	-0.15	5.698**
M_PPE(t-1)	0.29	-1.153***	-1.256	-1.107
D_PPE(t-1)	-0.104	-0.438**	-0.095	0.602
M_TV(t-1)	9.461***	1.786*	2.762	6.608***
D_TV(t-1)	0.578*	0.548***	-5.890***	-2.222**
M_SPP(t-1)	-0.735***	-0.566***	1.059***	-0.551
D_SPP(t-1)	-1.243***	0.033	-0.099	0.027
PSIO(t-1)	1.098***	1.026***	2.609***	-0.451

Note: (***,**,* denote the 1%, 5%, 10% significance level respectively). The medians for all financial variables are calculated for all firm-year observations. The measure based on the difference between firm value and the median of industry value is denoted by D_XX. LA represents the ln(total assets). AG represents the growth rate of sales. CAL represents the firm's current asset to current liabilities. MB represents the ratio of market value of asset to the book value of asset. DR represents the total liabilities to total assets. PPE represents the ratio of property, plant and equipment to total assets. SPP represents the buy and hold return for the prior fiscal year. TV represents the monthly average turn over rate. PSIO presents manager and director ownership percentage. Public represents corporations that continues as public firms. Private represents corporations that went private. Cluster 1 represents firms with low anticipated gains from incentive realignment, while Cluster 2 represents firms with high anticipated incentive gains.

B. Duration effects on going-private transactions

Duration effects are modeled by a step function. Time is treated as a categorical variable with a category for each duration interval. A step function,

$$Z(t) = \alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_5 D_5 ,$$

is fitted for duration intervals of 1-2, 3-8, 9-14, 15-20, and 21 years or above, where $D_1, D_2, ..., D_5$ are dummies for each duration interval. Table 6 reports the duration effects and the corresponding coefficients. The hazard rates for M&A and delist for cause rise initially but start to drop when firms become more mature. The hazard rate of privatization for cost saving has a similar pattern as compared to that of M&A and delist for cause. Note that the hazard rate of privatization for incentive realignment increases with its listing duration. A possible explanation is that agency costs rise with the age of the firm.

The competing risks model allows us to estimate the correlations between risks. We first fit a model with the duration effect only, and then estimate a model with more covariates. The estimated random effects covariance matrices from both models are shown in Table 3.7.

Table 3.7: Random Effects Covariance Matrix

	Public→M&A		Public→Dcause		Public→Cluster2		Public→Cluster1	
	Est.	(SE)	Est.	(SE)	Est.	(SE)	Est.	(SE)
Duration effects only								
Public→M&A	0.675	0.245						
Public→Dcause	-0.423	0.213	0.352	0.212				
	-0.735#							
Public→Cluster2	0.245	0.089	-0.213	0.156	0.562	0.322		
	0.325#		-0.542#					
Public→Cluster1	-0.101	0.152	0.275	0.121	-0.083	0.056	0.232	0.212
	-0.202#		0.423#		-0.102#			
Duration+Covariates								
Public→M&A	0.293	0.230						
Public→Dcause	-0.043	0.121	0.341	0.245				
	-0.061#							
Public→Cluster2	0.012	0.085	-0.085	0.103	0.452	0.256		
	0.021#		-0.089#					
Public→Cluster1	-0.005	0.012	0.103	0.085	-0.089	0.152	0.425	0.231
	-0.012#		0.132#		-0.091#			

Note: # Correlation between random effects. The competing risks model allows us to estimate the correlations between risks. The upper panel of this table reports the covariance matrix by fitting a model including the duration effect only. The covariance matrix estimated by including all covariates is reported in the bottom of the table.

There is evidence of unobserved heterogeneity among firms in the hazards of all types of transitions. From the upper panel of Table 3.7, there exist strong correlations among the alternatives of delisting from stock market before including covariates. Note that there is a significantly positive residual correlation (estimated as 0.325) between the hazards for M&A and private for incentive realignment, whereas the residual of correlation between the hazard of being delisted for cause and hazard of going private for cost savings is significantly positive (estimated as 0.423). Our results suggest that the case of privatizations for incentive realignment are similar to the case of M&A, while privatizations for cost saving are more likely to share common determinants with firms delisted for cause. After controlling for covariates, we find that the unobserved heterogeneity has been reduced. The residual correlations are also reduced.

C. SOX on the effects of going private

To rebuild investors' confidence in the public stock market, the Sarbanes-Oxley Act of (2002) (SOX) was enacted after a series of corporate financial scandals. It marks a milestone for corporate governance in the U.S..[67] In this section, we examine whether SOX has driven firms out of the capital market. Engel et al. (2004) show that the quarterly frequency of going private has modestly increased after SOX. Kamar et al. (2006) find that SOX induces small firms to exit the capital market. Our model provides a new explanation for the impact of SOX on firms' decision to go private. Since SOX limits managers' ability to consume agency goods, the likelihood of going

[67] The SOX proponents have argued that the enactment of SOX facilitates investors' access to the public market with greater transparency and alleviating investor concerns. Critics argue that it raises the cost of maintaining the listing.

private for incentive gains should fall. On the other hand, SOX unduly increases the cost of staying public, firms that go private for cost saving should surge after the enactment of SOX.

The empirical results in Table 3.8 are consistent with this prediction. The ratio of going private in Cluster 1 has modestly increased after the passage of SOX. These transactions accounted for approximately 30% in 2002, and increase to 39% in 2005. Most of the exits for cost-saving reasons occur in 2000 and 2001, the years when the technology bubble burst. The burst of the technology bubble in 2000 leads to an economic recession. The decline in profitability and capital activities induce firms to exit from the public market. The modest increase in privatizations for cost saving is due to the fact that the US economy began to revitalize after the enactment of SOX, which to a certain extent reduces the burden of staying public.

Another interesting result consistent with our prediction is that the ratio of privatizations for incentive gains peaks in year 1995, 1999 and 2006, coinciding with the period of economic boom. This suggests that privatizations for incentive realignment are pro-cyclical.

Table 3.8: Distribution of Privatizations

Year	Cluster 1	Cluster 2	Ratio
1991	1	2	0.33
1992	3	4	0.43
1993	2	4	0.33
1994	5	5	0.50
1995	3	8	0.27
1996	8	8	0.50
1997	9	17	0.35
1998	11	16	0.41
1999	9	31	0.23
2000	15	29	0.34
2001	11	23	0.32
2002	6	14	0.30
2003	7	15	0.32
2004	7	16	0.30
2005	9	14	0.39
2006	1	19	0.05

Note: The sample consists of firms going private from 1991 to 2006, but privatizations with missing data in managerial ownership or debt ratio are dropped in this comparison. Cluster 1 represents firms with low anticipated gains from incentive realignment, while Cluster 2 represents firms with high anticipated incentive gains. The ratio is defined as the percentage of privatizations in Cluster 1.

3.6. Conclusion

This chapter complements prior studies by investigating the extent to which incentive realignment can account for firms' decision to go private. The current literature does not have a consensus on why firms go private. One strand of literature suggests that firms can gain from incentive realignment induced by the organizational changes after a private buyout. Another strand of literature argues that the burden of staying public deters firms from seeking public financing. We complement this literature by distinguishing the motivation of incentive realignment from the cost-saving rationale. To this end, we assume that incentive realignment after private buyout is an increasing function of cash flows. Managers trade off the gains of diversification against the benefits of being private. If the cash flow is sufficiently high, the anticipated gains from incentive realignment outweigh the advantage of diversification in the public market and the firm goes private. As the incentive gains fall below a certain threshold, the cost-saving rationale dominates and the firm will go private.

We characterize the optimal timing of going private and derive implications for firms' delisting decision. The predictive ability of our model is tested using a sample of 6975 IPO US firms from 1978 to 2002 obtained from the Center for Research in Security Prices (CRPS). It is shown that prior to delisting, firms that go private are thinly traded and exhibit a poorer growth opportunity, suggesting fewer gains from diversifications. The combination of board structure and capital structure determines the anticipated gains from incentive realignment. Firms with high managerial ownership and leverage ratio have lower anticipated incentive gains. These

privatizations are more likely to be caused by cost saving. This is especially the case for industries where cash flows are very low. However, firms with low managerial ownership and leverage ratio may have a higher gain in incentive, and privatizations are more likely caused by higher value of free cash flow and low liability. This case is more likely to happen in the high cash flow industry.

Chapter Four

What Accounts for Chinese Business Cycle

4.1 Introduction

China has enjoyed an impressive economic growth since the reform started in 1978. Over the past three decades (1978-2006), the growth rate has been, on average, about 8-10 percent. Despite the high growth rate, China's strategy of "extensive" growth[68] has generated far more attentions in recent years. Increasing questions have been raised about its sustainability – e.g., widening inequality, rural poverty and excessive accumulation of capital stock. Some economists argue that the continuation of current growth trends is likely to bring the already high investment to an unsustainable level. The growth strategy has greatly reduced the flexibility of the economy to withstand and recover from any large economic shock (Prasad, 2008). As the country is on the way of deep reform and integration into the world trade and financial systems, it is inevitable for China to be exposed to more economic uncertainties. Thus, a major challenge facing China is how to prepare itself to deal with various shocks, and to ensure the sustainability and balance of economic growth.

Although China's economy has not shown any signs of slowing down, its gradual reform strategy has left it far away from a market-oriented economy. Labor movements are restricted to HuKou system (Whalley and Zhang, 2004). As a result,

[68] A growth pattern is characterized by using the expansion of inputs to promote economic growth.

labor relocation from agriculture to higher productivity sectors has remained modest, and urban employment growth has been slow since the 1990s. The government continues to maintain capital control and financial repression, which reduces investment opportunities and results in low real rates of return for domestic investors. The government sets a low interest rate to channel funds to state-owned enterprises, while small and medium-sized enterprises in non-state sectors have limited financing from the capital market and bank loans[69]. More importantly, the Chinese government purposely keeps the prices of resources low to promote industrialization. During the reform period, China's growth strategy has involved a number of policy distortions and constraints that may affect the quality and sustainability of the economy, as well as its capacity to cope with economic uncertainties.

In an attempt to shed light on the above issues, this paper accounts for the relative importance of different types of distortions for the cyclical pattern of the Chinese economy during the reform era. Following the Business Cycle Accounting (BCA) procedure[70] developed in Chari, Kehoe and McGrattan (2007, hereafter CKM), we introduce an open economy dynamic stochastic general equilibrium model with time-varying wedges, representing shocks to total factor productivity (TFP) and real interest rate, distortions in labor and capital market. The purpose of this accounting exercise is to investigate the policy implications of wedges that drive the Chinese business cycle. Moreover, the relative importance of each wedge suggests directions of policy reform, and models useful for further researches.

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[69] These government actions hamper innovation and entrepreneurship.

[70] This business cycle accounting procedure has been widely used in investigating economic recessions, such as the Great Depression in the US, and the Lost Decade in Japan.

Most studies in the Chinese business cycle focus on the comovement of output and inflation during transition. For example, Brandt and Zhu (2000, 2002) report a highly cyclical growth pattern before 1994, after which China has experienced a prolonged contraction period. They argue that the government's imperfect control over credit allocation and the costs of administrative credit control can explain the marked cyclical pattern[71] prior to 1994. The sluggish growth thereafter might be due to widening productivity differentials between state and non-state sectors and the financial market inefficiency. Lin (2000, 2004), and Gong and Lin (2008) also find a significant cyclical pattern of the Chinese economy. They focus on the deflationary expansion[72] phenomena during 1994-2003 and argue that the sluggish growth pattern is largely due to over-investment in previous years[73]. Our work complements these studies by modeling China's business cycles as exogenous movements in a variety of wedges. Using the Business Cycle Accounting procedure of CKM (2007), Xu (2007) quantitatively analyze the patterns of the Chinese business cycle under a closed economy framework. In contrast, this paper studies the case of a neoclassical open economy framework[74] by incorporating the foreign debt wedge of Otsu (2008).[75] Our result shows that the foreign debt wedge is an important factor in explaining China's macroeconomic movements.

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[71] Periods of rapid growth, accompanied by accelerating inflation, are followed by the contractions during which growth rate and inflation decline.

[72] When economy is in deflation during contraction periods, the growth rate is still high (about 7%) compared to contemporary world economy.

[73] The over-investment creates not only excess capacity accumulation, but also aggregate demand, which results in high average growth rate. However, the rapid accumulation of capacity causes deflation when government conducts anti-inflation policy.

[74] Otsu (2008) quantitatively analyzes the recession pattern of East Asian countries, using a small open economy version of BCA procedure by introducing the foreign debt wedge. It is shown that the standard small open neoclassical growth model performs well in predicting the large contraction in output given the large drop in Total Factor Productivity (TFP).

[75] One may argue that households in China cannot directly invest in the international capital market. In this case, the foreign debt wedge may capture the shocks of monetary policy or foreign exchange policy, through which monetary authority can affect domestic interest rate. That is, domestic real interest rate may not be equal to the foreign debt return (Otsu, 2008).

The key finding are (1) TFP best explains the behaviors of aggregate economic variables in China throughout the reform period. (2) Foreign debt wedge and Investment wedge only play a modest role in tracking the direction of output movement after 1994, while they are important driving force of consumption and investment movement. (3) Labor wedge plays a major role in the movement of labor enforcement. (4) Finally, the fluctuation of trade balance can be best explained by the movements of foreign debt wedge. This result implies that foreign debt wedge and investment wedge primarily affect the composition of output between consumption, investment and trade balance, and have a modest role in explaining the fluctuation of output.

The remainder of this chapter is organized as follows. Section 4.2 briefly documents China's macroeconomic performance during reform period. Section 4.3 introduces the procedure of business cycle accounting under an open economy framework. We implement our quantities experiment during China's reform period in section 4.4. Section 4.5 discusses the movements of wedges, which best explaining the observed economic fluctuations in China. Some concluding remarks are drawn in section 4.6.

4.2. The Chinese economy

The Chinese economy has a highly cyclical growth pattern before 1994, a period during which the high growth is accompanied by high inflation. Since 1994, China has experienced a prolonged contraction. This section analyses the Chinese economy from both supply and demand perspectives.

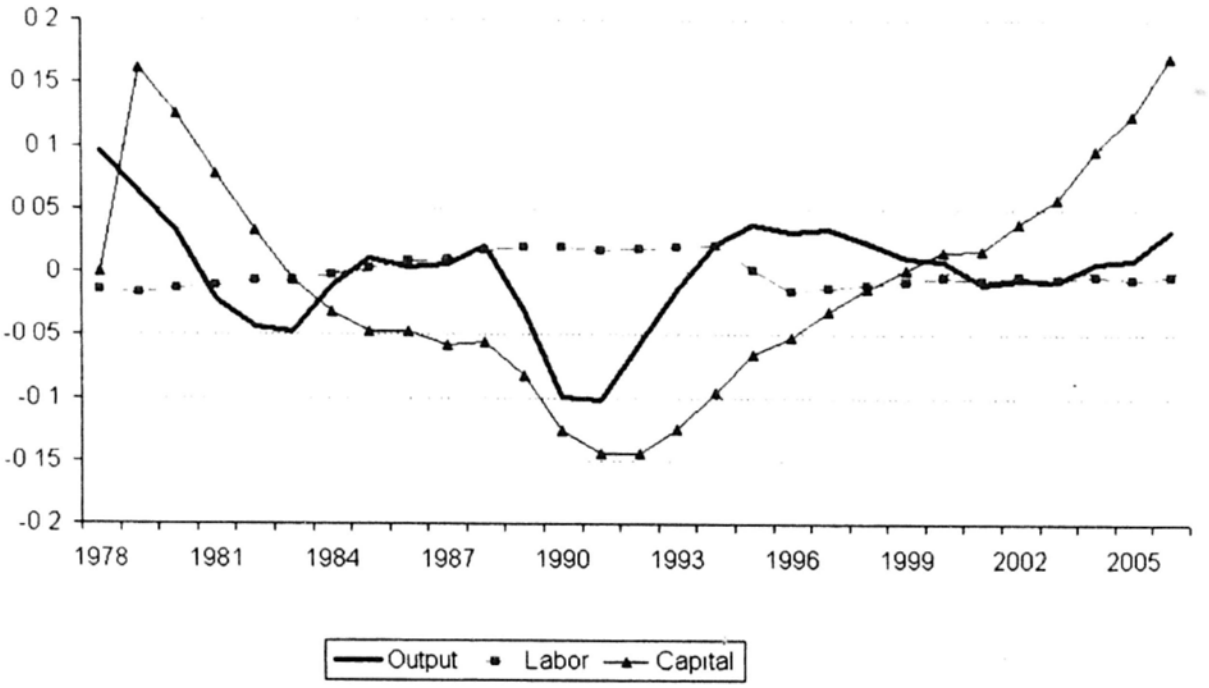
4.2.1 The Production Side

Figure 4.1 presents China's GDP and production factor per adult from 1978-2006. Each series is linearly detrended. The real GDP is calculated from GDP data and corresponding GDP deflator index is drawn from the National Bureau of Statistics of China (NBS). The adult population data is extracted from the World Bank, World Development Indicators (WDI) database. The real capital stock is estimated by using the standard perpetual inventory approach[76]. Following CKM (2007), labor (total hours worked) is calculated from the labor force and the weekly working hours per worker[77]. The labor data is from the Chinese labor dataset of Holz (2005)[78].
The labor data is from Holz labor dataset in China 1978-2000-2025[79].

GDP per adult remains highly volatile before 1994, after which it remains relatively stable. Changes in capital stock are more volatile than that of output. The growth rate of capital stock reaches its bottom during 1991-1992, after which it keeps rising. Changes in labors are smooth and have little effect in explaining the output fluctuation.

[76] The initial real capital stock is set to be consistent with the data in Hsueh & Li (1999) for 1978.
[77] As the actual weekly working hours per worker are not available in China, we use the official ones in our estimation.
[78] The changes in scope and definition of labors in China make the employment statistics before and after 1990 inconsistent. Holz (2005) took this matter seriously, and recalculated the series of labors.
[79] The changes in scope and definition of labors in China made the employment statistics before and after 1990 inconsistent. Holz (2005) took this matter seriously, and recalculated the series of labors.

Figure 4.1 Production factors



4.2.2 The Demand Side

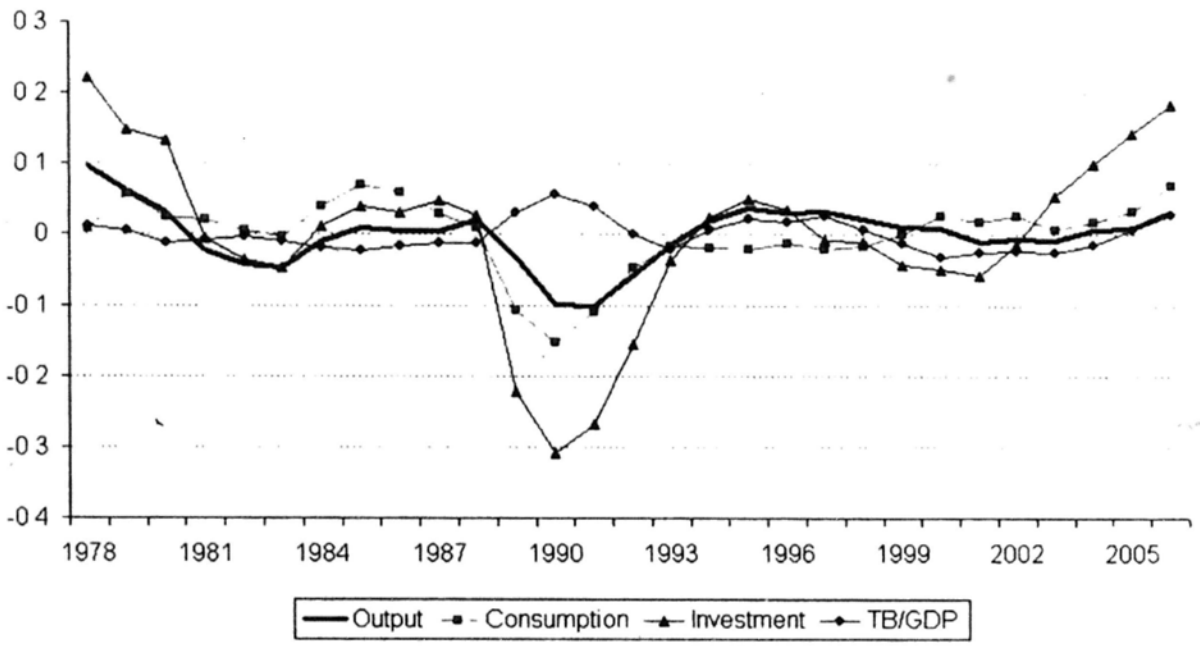
Figure 4.2 presents China's GDP and its components: consumption, investment, and trade balance. The data is from NBS. Consumption includes private and government consumption deflated by the consumption price index (CPI). Investment data is drawn from Hsueh-Li dataset for 1978-1995 and updated by using the *China Statistics Yearbooks* for 1996-2006. The trade balance is divided by GDP[80]. Each series is the log deviation from the trend except for the trade balance.

Before 1994, both consumption and investment are pro-cyclical. Their correlations with output are 0.69 and 0.93 respectively. The trade balance is countercyclical with a

[80] For simplicity, we include the changes in inventory in the trade balance.

correlation of -0.48. After 1994, consumption becomes countercyclical with a correlation of -0.32, whereas the investment and trade balance are pro-cyclical with correlations of 0.3 and 0.91 respectively. Another striking fact is the consumption volatility is higher than that of output. The standard deviation of detrended consumption is 5.2%, higher than that of output during the whole period[81].

Figure 4.2 GDP Components



4.3 Accounting Procedures

CKM (2007) shows that a large class of detailed economies is equivalent to a prototype growth model with time-varying wedges, which represent different types of distortions and shocks. Using this prototype growth model, they propose an accounting procedure for the sources of economic fluctuations. These time-varying

[81] Boyreau-Debray and Wei (2005) also reported that the volatility of consumption is higher than that of output during 1978-2001. Our striking result may be partly due to the use of the detrended series of output and consumption data, and the fact that the deflators for the two variables are different.

wedges are measured by incorporating the real data into the equilibrium conditions of the prototype model. Once the wedges are constructed, it is possible to assess to what extent the economic fluctuations can be attributed to each wedge separately and in combination.

To see how this procedure works, we consider a standard open economy model with time-varying wedges: the efficiency wedge A_t, the labor wedge τ_{lt}, the investment wedge τ_{xt}, and the foreign debt wedge τ_{dt}. The represent consumer solves:

$$\underset{\{c_t, x_t, l_t\}}{Max} E\sum_{t=0}^{\infty} \beta^t u(c_t, l_t)$$

Subject to

$$c_t + \frac{x_t}{\tau_{xt}} + d_t = r_t k_t + \tau_{lt} w_t l_t + \tau_{dt} \frac{\Gamma d_{t+1}}{R} + tr_t - \Phi(d_{t+1}) - \Pi\left(\frac{x_t}{k_t}\right)k_t$$

$$\Gamma k_{t+1} = (1-\delta)k_t + x_t$$

where c_t denotes the consumption, l_t labor, x_t investment, k_t capital stock, r_t rental rate, w_t wage rate, δ depreciation rate and tr_t lump-sum transfer. The low-case letters c_t, k_t, x_t, d_t and tr_t are all detrended with adult population growth rate n and labor augmenting technical progress γ, where $\Gamma = (1+n)(1+\gamma)$. $\Phi(d_{t+1})$ is the debt adjustment cost function as $\frac{\phi(d_{t+1}-d)^2}{2}$, where d is the steady state foreign debt[82]. $\Pi\left(\frac{x_t}{k_t}\right)$ is the functional form of the investment adjustment cost function as

[82] Schmitt-Grohe and Uribe (2003) introduce the debt adjustment cost to remove the random walk component in the international asset holding equations.

$\frac{\pi}{2}\left(\frac{x_t}{k_t}-b\right)^2$ where $b=\Gamma-(1-\delta)$. We assume GHH preferences[83] in utility function.

The functional form is:

$$u(c_t,l_t)=\log(c_t-\lambda l_t^{\upsilon}),$$

where λ and υ represent the level and curvature of the utility cost of labor[84]. The representative firm solves:

$$\underset{\{k_t,l_t\}}{Max}\,\pi_t=y_t-r_tk_t-w_tl_t$$

The functional form of production function is given by

$$y_t=A_tk_t^{\alpha}l_t^{1-\alpha}$$

where y_t is the detrended per adult output.

The equilibrium of this open economy model is summarized by the source constraint

$$y_t=c_t+x_t+tb_t$$

The government budget constraint[85]:

$$tr_t=(1-\tau_{lt})w_tl_t+(1/\tau_{xt}-1)x_t$$

The trade balance constraint:

$$tb_t=d_t-\tau_{dt}\frac{\Gamma d_{t+1}}{R}+\Phi(d_{t+1})x_t$$

Hence, the first order conditions are as follows:

---

[83] Greenwood, Hercowitz and Huffman (GHH 1998) introduce this preference to the general equilibrium model.

[84] It is well known that with the Cobb-Douglas preferences, the model will predict too much consumption smoothing. However, the consumption is more volatile than output in China. As a result, we follow Otsu (2008) and use the GHH preference as the function form of our utility function.

[85] For simplicity, we don't consider the government expenditure shocks and include the government purchase into the consumption, since it will not influence our results.

$$U_{ct}\left(\frac{\Gamma}{R}\tau_{dt}-\phi(d_{t+1}-d)\right)=\beta E_t[U_{ct+1}] \tag{4.1}$$

$$y_t = A_t k_t^{\alpha} l_t^{1-\alpha} \tag{4.2}$$

$$\lambda \upsilon l_t^{\upsilon-1} = \tau_{lt}(1-\alpha)\frac{y_t}{l_t} \tag{4.3}$$

$$U_{ct}\left(\frac{\Gamma}{\tau_{xt}}+\hat{\Pi}'\left(\frac{k_{t+1}}{k_t}\right)\right)=\beta E_t\left[U_{ct}\left(\alpha\frac{y_{t+1}}{k_{t+1}}+(1-\delta)\tau_{xt+1}-\hat{\Pi}\left(\frac{k_{t+2}}{k_{t+1}}\right)+\hat{\Pi}'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{k_{t+2}}{k_{t+1}}\right)\right] \tag{4.4}$$

The actual wedges are calculated from the real data using equilibrium conditions (4.1), (4.2), (4.3) and (4.4). We then plug the values of wedges back into the prototype growth model one at a time or in combination. Keeping other wedges as their long run trend, we can access the fraction of economic fluctuation that can be attributed to each wedge separately and in combination. Note that the efficiency and labor wedges can also be calculated from equations (4.2) and (4.3). However, the estimation of foreign debt wedge and investment wedge depends not only on real data but also on expectations. To estimate the stochastic process, we follow Otsu (2008) by specifying an AR(1) process for the expectations. We then derive the log-linear decision rules from their steady states and use the method of Uhlig (1999) to estimate the parameters of the vector AR(1) process for the wedges. The main difference between Otsu (2008) and CKM (2007) is that the former uses the foreign debt wedge, while the latter uses the government wedge. We consider the trade balance as an endogenous variable and assume exogenous distortions in the foreign debt market as shocks to the real interest rate

4.4 Quantitative Exercises

4.4.1 Wedges Construction

The target period of our accounting exercise is 1978-2006, when China is experiencing structural economic reform. We first set the values of parameters to match China's economic environments. The parameters used for our benchmark calculations are summarized in Table 4.1.

Table 4.1: Parameter Values for Benchmark Economy

α	Capital Share	0.5
β	Discount factor	0.952
δ	Depreciation rate	0.05
υ	Curvature parameter of GHH preference	1.570
λ	Level parameter of GHH preference	1.384
γ	Labor augmenting technical progress	0.079
n	adult population growth rate	0.019

Values are calibrated using data over the 1978-2006 periods.

Following Wang and Yao (2003), and Kuijs and Wang (2005), the share of capital in production function α, and the depreciation rate δ are set at 0.5 and 0.05 respectively[86]. Other parameters are set to be their steady state values, obtained from the 1978-2006 data. The trend growth γ is set to be the average growth rate of Solow residuals[87]. The discount factor β is calculated from the capital Euler equation at their steady state[88]:

$$\Gamma = \beta(\alpha \frac{y}{k} + 1 - \delta)$$

We calculate the labor disutility level parameter λ from the labor first order condition at its steady state[89]:

[86] The choice of capital elasticity and the depreciation rate are controversial in the literature of Chinese economy. To conduct a sensitivity analysis, we use 0.4 and 0.6 as alternative capital elasticity, and 10% and 15% as alternative depreciation rate. It turns out that our empirical results are robust to different specifications.

[87]

[88] We set the steady state values of n, l, $\frac{y}{k}$ and $\frac{tb}{y}$ as the long-run averages.

[89] The labor disutility curvature parameter υ is calculated by following Correia, Neves and Rebelo (1995).

$$(1-\alpha)y = \lambda \upsilon l^{\upsilon}$$

Table 4.2 reports the parameters governing the stochastic process on expectations. Following Otsu (2008), we choose the value of π to match the elasticity of investment-capital ratio, which implies:

$$\pi = \frac{k}{x}$$

Table 4.2: Parameters of the Stochastic Process[90]

Coefficient Matrix P				Variance-covariance Matrix Q			
0.786	−0.084	−0.067	−0.044	0.0006	0	0	0
−0.012	0.0830	−0.101	0.120	0	0.001	−0.0001	0.0002
0.081	0.084	0.872	−0.034	0	−0.0001	0.0022	−0.0001
0.209	−0.085	0.027	0.963	0	0.0002	−0.0001	0.0007

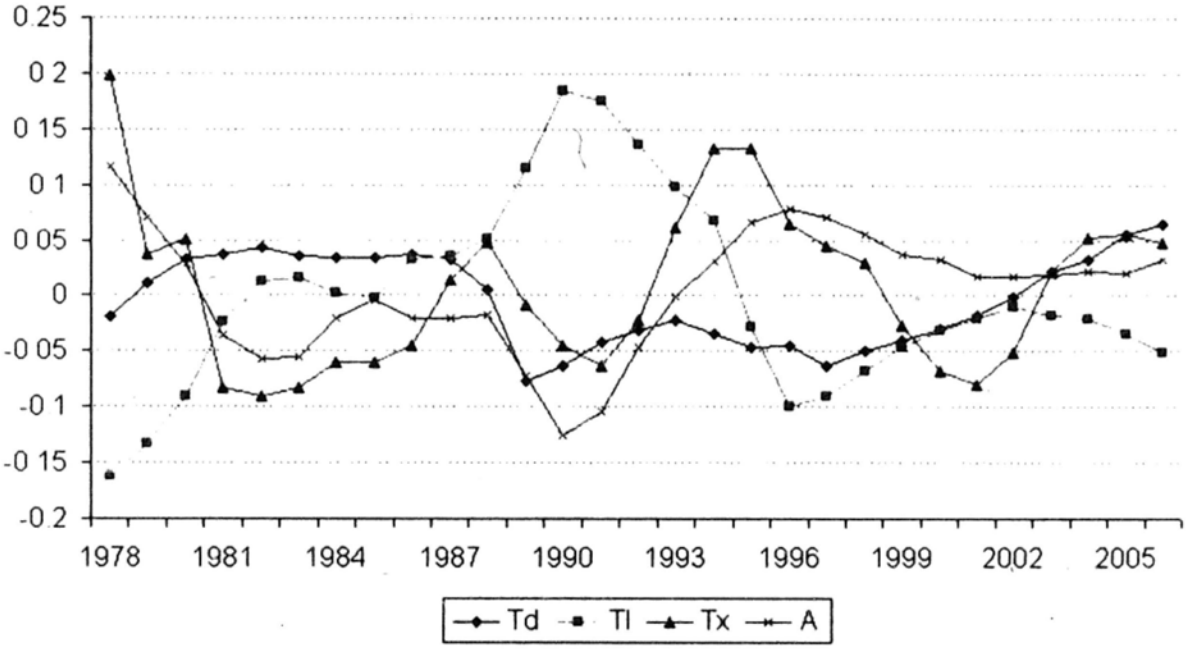
Values are calibrated using data over the 1978-2006 periods.

4.4.2 Results

In Figure 4.3, we display the four wedges described in equation (4.1)-(4.4) for the 1978-2006 period. Note that the efficiency wedges have shown a cyclical pattern prior 1994, paralleling the movement of real output. Since then the movements of the efficiency wedge shows a worsening trend and slowly recovers after 2001.

[90] $s_t = \left(\ln \tau_{dt}, \ln \tau_{lt}, \ln \tau_{xt}, \ln A_t\right)'$ follows AR(1) stochastic process
$s_{t+1} = P_0 + P s_t + \varepsilon_{t+1}, \quad \varepsilon_{t+1} \sim N(0, Q)$

Figure 4.3 Wedges



The labor wedge rises first and peaks at 1990, but keeps worsening throughout the rest of the decade. The initial rise of labor wedge is due to the reform of collective farming with the household responsibility contract system. The following drop of labor wedge is consistent with the slow down of the overall employment growth, which might capture the declining contribution of labor factor on economic growth, especially over the last decade.

The investment wedge is highly volatile throughout the period of reform. It drops initially but slowly recovers until 1988. A rapid recovery takes place in the early 1990s. The peak occurs in 1994, and then starts to decline thereafter until 2001. This is consistent with the cool-down policy adopted by the central government to slow down the investment boom. Note that the investment wedge exhibits negative correlations with the labor wedge. This may be due to the fact that China's growth is mainly investment-driven. A massive investment effort boosting the capital/labor ratio

has driven labor productivity and economic growth since 1990. However, the rigidities in labor market and the investment inefficiency to a certain extent alleviate the impact of capital deepening on labor productivity.

The foreign debt wedge reflects the shock on the real interest rate. It exhibits a sharp drop during 1988-1989, and then slowly recovers until 1993. The wedge has been improving after the 1997 Asian crisis. It has surged after China entering the World Trade Organization (WTO) in 2001, implying an increasing role of trade sector in the Chinese economy.

The decomposition results for output are displayed in Figure 4.3.1-4.3.5. In all five plots, the solid line represents the actual detrended per-adult actual data; other lines correspond to simulated output using each of the four wedges.

Note that the solid line represents the detrended per-adult actual data; whereas the other lines correspond to simulated data using each of the four wedges. The detrended output declines at the initial periods of reform, recovers in the middle of 1980s, but falls again during the crisis period of 1989-1991. Since then, output has remained above its long-run average throughout most of the decade, except for a slight drop after the 1997 Asian crisis.

Overall, the output due to the efficiency wedge closely replicates the actual output data. Other wedges have done a poor job in tracking the movement of output except for the foreign debt wedge. It predicts the decline of output during 1997-2001 and the following slow recovery. The increasing role of foreign debt wedge is partly

attributed to China's gradual integration into the world trade and financial systems. It also implies that the external shocks, such as the international capital market liquidity, external demand and trade sanctions, have begun to influence the performance of the Chinese economy. Although the large stock of foreign reserves in China can serve as a buffer against various external shocks, the imbalances generated by huge foreign reserves may impose potential welfare costs, and themselves become a source of instability (Prasad, 2008).

The actual movements of consumption and investment are best explained by the efficiency wedge before 1994. Since then, investment wedge play an important role in predicting the drop of investment and the movements of consumption till 2001. After which foreign debt wedge predicts the rapid recovery of investment and consumption.

As for the fluctuation of labor and trade balance, overall, the labor wedge plays a central role in the movement in the labor enforcement, while foreign debt wedge predicts the movements of trade balance very well.

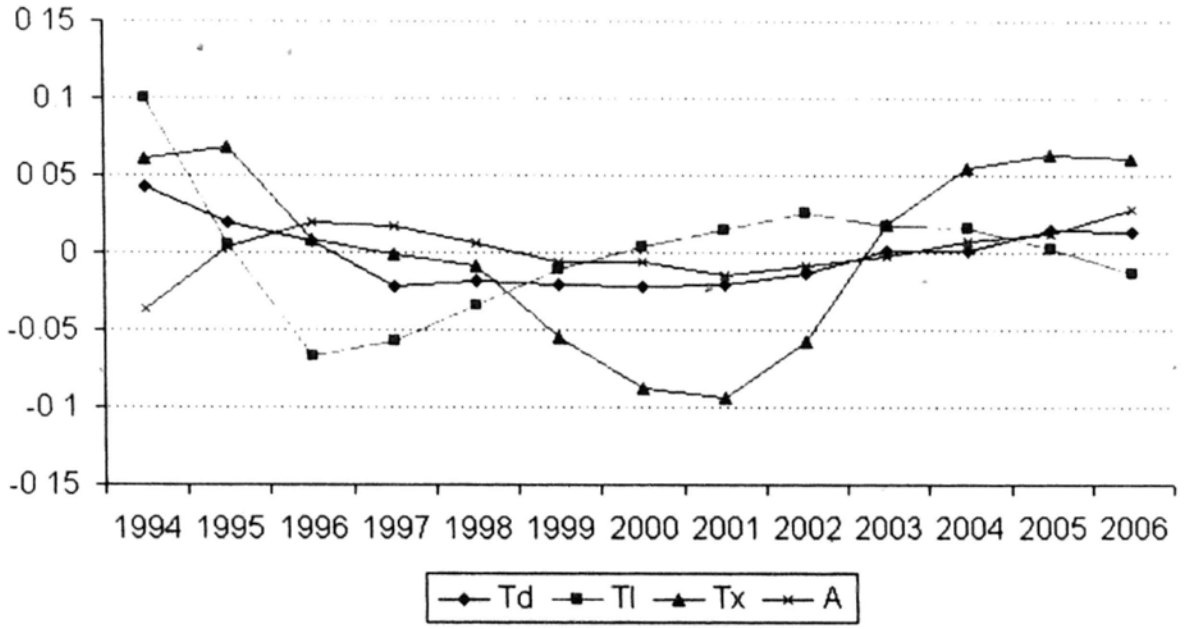
4.4.3 Accounting for Deflationary Expansion

China has experienced a prolonged contraction period of declining inflation and sluggish economic growth since 1994. However, even in this period, the annual growth rate is still above 7%, much higher than contemporary world economy. The phenomena of "Deflationary Expansion" has puzzled many economists, and generated various debates. Bordo and Lane (2004) suggest that the deflationary expansion may be due to the strong supply shock, such as the efficiency improves. Given the demand

curve, the positive supply shock results in the move of aggregate supply curve toward right, causing the increase of output while the decline of price. Lin (2000, 2004) provides another explanation for the deflationary expansion. The over-investment in preceding years not only creates the excess demand, but also accumulates excess capital, which cause the deflationary.

To account for source of deflationary expansion, we replicate the calibration procedure by focusing on the deflationary expansion period. The four wedges during the period of deflationary expansion are reported in Figure 4.4. The efficiency wedge keeps declining in the rest of 1990s, but slowly recovers after 2001. The labor wedge worsens first, and then recovers in the later 1990s, but worsens again in the early 2000s. The investment wedge keeps worsening throughout the deflationary expansion period and increase remarkably after 2001. The foreign debt wedge parallels the movements of efficiency wedges. Noticeable is that the efficiency wedges didn't recover at all in the deflationary expansion period, which gives no supports on the positive supply shock. While the investment wedge reach its peak before this period, then our result provide some supports for the over-investment explanation.

Figure 4.4 Wedges during Deflationary Expansion Period



An analysis of the effects of the wedges separately is reported in Figure 4.4.1-4.4.5. The results are similar to those from the benchmark models for the whole reform period. Note that the efficiency wedge can still track the movement of output. The labor wedge plays a central role in accounting for the movement in labor force, while the foreign debt wedge predicts the movements of trade balance very well. The slight difference is that both the foreign debt wedge and the investment wedge play a modest role in driving the movement of output. They predict a slight drop of output during 1997-2001 and the following slow recovery. Moreover, the investment wedge plays a central role in explaining the movements of consumption and investment during 1997-2001. For the remaining period, the foreign debt wedge best tracks their movements.

4.5 The Source of Efficiency Wedge Fluctuations

If the efficiency wedge drives the fluctuations of China's output, what drives the efficiency wedge? We argue that the gradual reform policy determines the changing pattern of the efficiency wedge. Policies such as the reform of collective farming with the household-responsibility contract system and the upward price adjustment in agriculture products result in a surge of labor force in rural China. We argue that the high price in agriculture product increases the input costs of industrial production, and makes some previously profitable investment projects unprofitable. These unproductive projects cause the initial drop of the efficiency wedge.

Beginning in the mid 1980s, China's government gradually lays down the right in state and collective-owned enterprises. The flourish of Township-Village enterprises shifts much of the rural labor from agriculture to more productive industries, resulting in an improvement of the efficiency wedge. The efficiency wedge continues to improve until the late 1980s, during which the problem of ambiguous property right, rooted in state and collective-owned enterprises, begin to lower the productive efficiency.

After a downturn in 1989-1991, the efficiency wedge has recovered rapidly. The Deng Xiaoping's tour of Southern China signals the Chinese leadership long-term commitment to the market-based reforms. Gradual privatizations of state and collective-owned firms have started to permeate the entire economy.

Before 1994, the cyclical pattern of the efficiency wedge can well be explained by the political and institutional factors. Since 1994, the Chinese government has

adopted a tightening policy to cool down the economy. As a result of the credit crunch, financial institutions become more biased against lending to small and medium enterprises in the non-state sectors, since they cannot identify the quality of projects. Since enterprises in non-state sectors produce more efficiently than their state-owned counterparts, the decline in credit allocation to non-state sectors is responsible for the continuing worsening of the efficiency wedge.

With China's entry into the World Trade Organization (WTO) in 2001, more and more international companies enter the domestic market. As a consequence of increasing competition, local enterprises (both state and non-state owned) are forced to improve their operational efficiency, resulting in the recent slight recovery in the efficiency wedge.

4.6. Concluding Remarks and Policy Implications

Over the past three decades, China adopts a gradual economic reform and achieves a remarkable growth performance. This Chapter studies the Chinese business cycle using the business cycle accounting procedures of CKM (2007). It is found that productivity best explains the behaviors of aggregate economic variables in China. The investment wedge and the foreign debt wedge are important driving forces of consumption and investment. However, they only have a modest role in explaining the movement of output after 1994. The labor wedge plays a major role in determining the movement of labor force. We find that the efficiency and labor wedges have been worsening during the last decade, which is consistent with increased investment inefficiency and the slowdown of labor force growth. A

potential explanation for the worsening of the wedges is the misallocation of resources. To support the investments of state sectors, prices of resources are kept at low level through subsidies and price controls by the central government, and cheap financing was also channeled into the state sectors. The government's favored treatment towards state sectors leads to a low aggregate productivity. Although these policies also result in the continuing accumulation of capital throughout the decades, most of the expanding effects are offset by the inefficient factor utilization and frictions in the labor market. To improve the situation, new policy measures should be taken to address the frictions that lead to inefficient factor utilization in order to improve the investment efficiency. A suggestion is that China should rebalance its growth strategies by relocating investment from state sectors to non-state sectors.[91] Finally, a better model with frictions in labor market should be developed to examine the impact of labor market frigidities on the Chinese business cycle in more details. We leave that for further research.

[91] Our argument is consistent with Brandt and Zhu (2008), who find a widening productivity gap between the state and non-state sectors.

Appendix 1: Technical Appendix

Using the notation (1.3)

$$\tilde{y}_{i,t} = \varphi \tilde{x}_{i,t}(\lambda) + \tilde{e}_{i,t} \qquad \text{(A.1)}$$

For any given λ, we run an ordinary lest squares (OLS) regression. The corresponding coefficient φ is:

$$\hat{\varphi}(\lambda) = (\tilde{X}(\lambda)'\tilde{X}(\lambda))^{-1}\tilde{X}(\lambda)'\tilde{Y}$$

The vector of regression residuals is:

$$\hat{e}(\lambda) = \tilde{Y} - \tilde{X}(\lambda)\hat{\varphi}(\lambda)$$

And the sum of squared errors is:

$$S(\lambda) = \hat{e}(\lambda)'\hat{e}(\lambda) \qquad \text{(A.2)}$$

Therefore the least squares estimators of λ is:

$$\hat{\lambda} = \arg\min S(\lambda) \qquad \text{(A.3)}$$

Once $\hat{\lambda}$ is obtained, the slop coefficient is estimated as $\hat{\varphi} = \hat{\varphi}(\hat{\lambda})$. The residual variance is estimated as:

$$\hat{\sigma}^2 = \frac{1}{n(T-1)} S(\hat{\lambda}) \qquad \text{(A.4)}$$

To implement this estimation, we use the following approach. Sort the distinct values of the threshold variable $\lambda_{i,t}$. Eliminate the smallest and the highest percentage of threshold variable. The remaining variables are used to construct the value of λ which can search for the $\hat{\lambda}$. The estimates are sufficiently precise for most of our applications. For our empirical work, we use the grid {1.00%,1.24%,.....,99.0%} which contains 393 quintiles.

Appendix 2: Definition of Variables and Data Sources

Variables	Descriptions	Data Sources
OPENNESS	Total gross exports and imports, percent of GDP	IMF, International Financial Statistics
TRADECONCENTRATION	Share of total exports to 3 largest trading partners	Ghosh, Gulde, and Wolf(2003)
INFLATION	Change in consumer prices, percent of per annum	IMF, International Financial Statistics
RGDPG	Real GDP growth rate, percent of per annum	World Economic Outlook
RGDPDVS3	Deviation of real GDP fro HP-filtered trend, 3-year standard deviation	Ghosh, Gulde, and Wolf(2003)
BASEINTEREST	Nominal interest rate in the base country	IMF, International Financial Statistics
FINOPENNESS	Total gross actual foreign direct and portfolio investment, percent of GDP	Lane and Milesi-Ferretti(2006)
CBI	Turnover rate of central bank governors	Ghosh, Gulde, and Wolf(2003)
DEMOCRACY	Index of democracy	Freedom House
DEBTPOSITION	Net debt liability, percent of GDP	Lane and Milesi-Ferretti(2006)
RESERVEGROWTH	Change in foreign exchange reserves, percent per annum	IMF, International Financial Statistics
HYPERINFLATION	1 if inflation above 50%, 0 otherwise	IMF, International Financial Statistics
BANKCRISIS	Bank crisis duration	Glick and Hutchison (2004)

Appendix 2: Nature of Exits

Country	Period of Exits	Duration of Pegged Regime	Nature of Exits
Argentina	1981:03	36	Orderly exit
	1986:04	10	Orderly exit
	2001:12	128	Crisis-driven exit
Armenia		73	Non-exit
Australia	1982:11	130	Orderly exit
Austria		360	Non-exit
Belgium		360	Non-exit
Bolivia		180	Non-exit
Brazil	1975:04	39	Orderly exit
	1986:09	6	Orderly exit
	1989:04	3	Orderly exit
	1999:02	55	Orderly exit
Bulgaria		60	Non-exit
Canada		360	Non-exit
Chile	1982:06	52	Crisis-driven exit
	1999:09	140	Orderly exit
China	1981:03	86	Orderly exit
		113	Non-exit
Colombia	1983:10	141	Orderly exit
	1999:10	178	Orderly exit
Costa Rica	1980:10	105	Crisis-driven exit
		218	Non-exit

Cyprus		360	Non-exit
Czech Rep	1997:06	81	Crisis-driven exit
Denmark		360	Non-exit
Dominica		360	Non-exit
Dominican Rep	1982:09	128	Orderly exit
	1987:07	19	Crisis-driven exit
		110	Non-exit
Ecuador	1982:03	108	Orderly exit
	1997:10	48	Orderly exit
		22	Non-exit
Egypt		360	Non-exit
El Salvador	1982:08	127	Orderly exit
		141	Non-exit
Estonia		114	Non-exit
Finland	1992:09	248	Crisis-driven exit
		107	Non-exit
France	1974:04	27	Orderly exit
		330	Non-exit
Germany	1973:01	12	Orderly exit
		36	Non-exit
Greece	1981:07	114	Crisis-driven exit
		208	Non-exit
Guatemala	1984:12	155	Orderly-exit
	1989:06	11	Crisis-driven exit
		128	Non-exit

Guyana	1987:02	181	Crisis-driven exit
		84	Non-exit
Haiti	1991:10	237	Crisis-driven exit
	1993:05	13	Orderly-exit
Honduras	1990:03	218	Crisis-driven exit
		129	Non-exit
Hong Kong		360	Non-exit
Hungary		360	Non-exit
Iceland	1973:05	16	Orderly-exit
	1977:05	15	Orderly-exit
	2000:10	196	Orderly-exit
India	1979:03	86	Orderly-exit
		269	Non-exit
Indonesia	1972:07	6	Orderly-exit
	1997:08	277	Crisis-driven exit
Iran	1977:01	60	Orderly-exit
Iraq	1982:01	120	Orderly-exit
Ireland		360	Non-exit
Israel	1986:09	11	Orderly-exit
		180	Non-exit
Italy	1975:10	45	Orderly-exit
	1992:09	116	Crisis-driven exit
		105	Non-exit
Jamaica	1978:01	72	Crisis-driven exit
	1990:10	137	Orderly-exit

		108	Non-exit
Japan	1977:12	71	Orderly-exit
Jordan	1988:10	201	Crisis-driven exit
		152	Non-exit
Korea	1997:12	311	Crisis-driven exit
Lao	1973:04	15	Orderly-exit
	1997:01	79	Crisis-driven exit
Latvia		95	Non-exit
Lebanon	1984:03	146	Orderly-exit
		125	Non-exit
Lithuania		81	Non-exit
Malaysia	1997:08	307	Crisis-driven exit
		39	Non-exit
Mexico	1976:09	56	Crisis-driven exit
	1982:02	59	Crisis-driven exit
	1995:01	73	Crisis-driven exit
Moldova	1998:06	39	Crisis-driven exit
		22	Non-exit
Myanmar	1974:07	30	Orderly-exit
	1983:05	86	Orderly-exit
	1988:04	24	Orderly-exit
	1993:01	19	Orderly-exit
	1996:08	30	Orderly-exit
Netherlands		360	Non-exit
New Zealand	1985:03	158	Crisis-driven exit

Nicaragua	1974:04	87	Non-exit
		128	Orderly-exit
Norway	1982:07	126	Crisis-driven exit
	1992:12	65	Crisis-driven exit
Pakistan		360	Non-exit
Panama		360	Non-exit
Paraguay	1981:09	116	Orderly-exit
	1989:03	34	Crisis-driven exit
		131	Non-exit
Peru		98	Non-exit
Philippines	1983:10	141	Crisis-driven exit
	1997:07	128	Crisis-driven exit
Poland	1991:06	17	Orderly-exit
	2000:04	58	Orderly-exit
Portugal		360	Non-exit
Romania		9	Non-exit
Russia		25	Non-exit
Singapore	1998:12	323	Orderly-exit
Slovak Rep	1998:10	66	Orderly-exit
Slovenia		105	Non-exit
South Africa	1972:11	10	Orderly-exit
Spain		360	Non-exit
Sweden	1992:12	251	Crisis-driven exit
Switzerland	1973:12	13	Orderly-exit
		244	Non-exit

Thailand	1997:07	306	Crisis-driven exit
Turkey	1976:09	56	Orderly-exit
	2001:02	36	Crisis-driven exit
UK	1972:07	6	Orderly-exit
	1992:09	23	Crisis-driven exit
US	1978:02	60	Orderly-exit
Ukraine		39	Non-exit
Uruguay	1982:12	49	Crisis-driven exit
	1991:12	12	Orderly-exit
		75	Non-exit
Venezuela	1983:03	134	Orderly-exit
		66	Non-exit

Appendix 3: Subplots of Business Cycle Accounting

Figure 4.3.1 Output

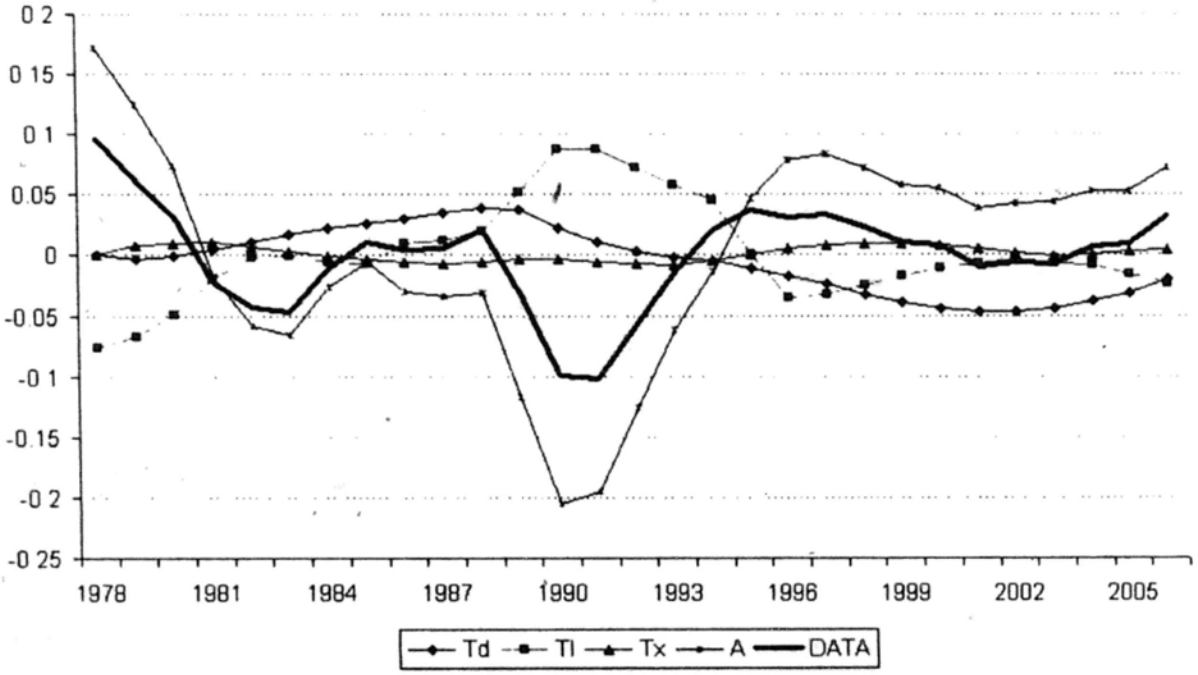


Figure 4.3.2 Consumption

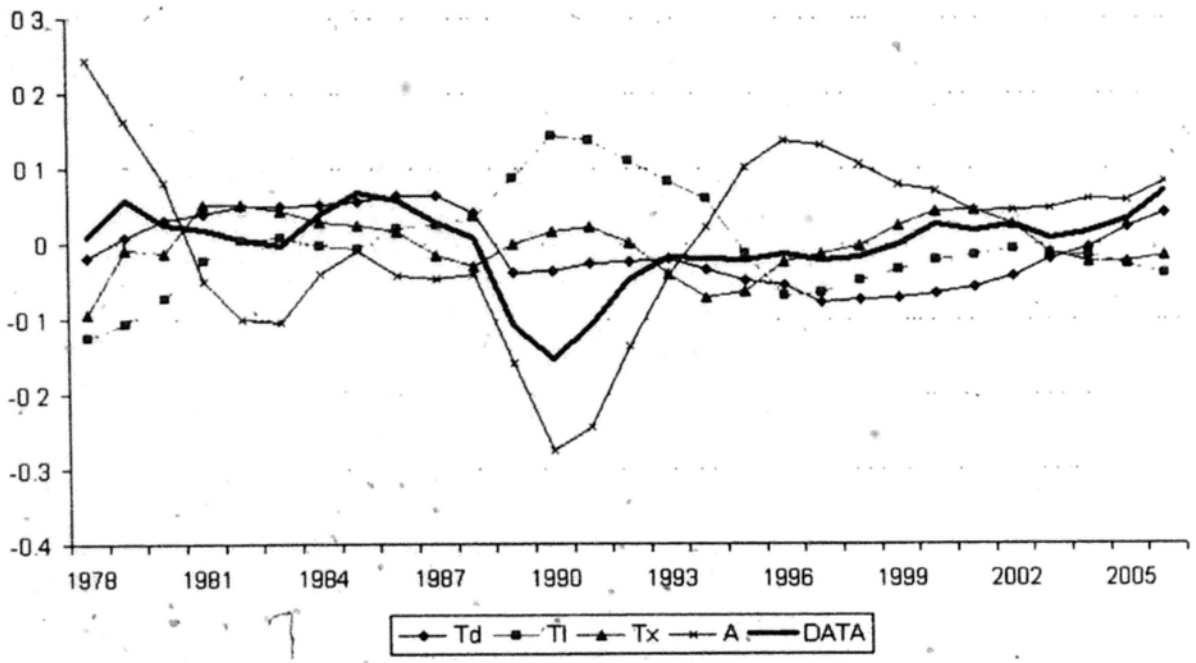


Figure 4.3.3 Labor

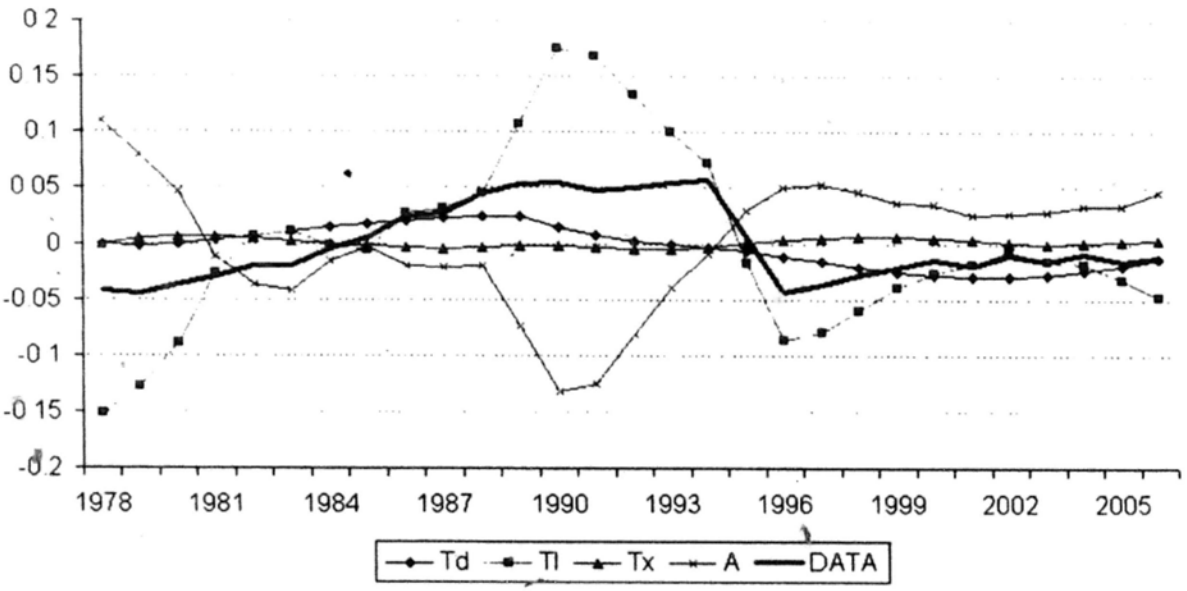


Figure 4.3.4 Investment

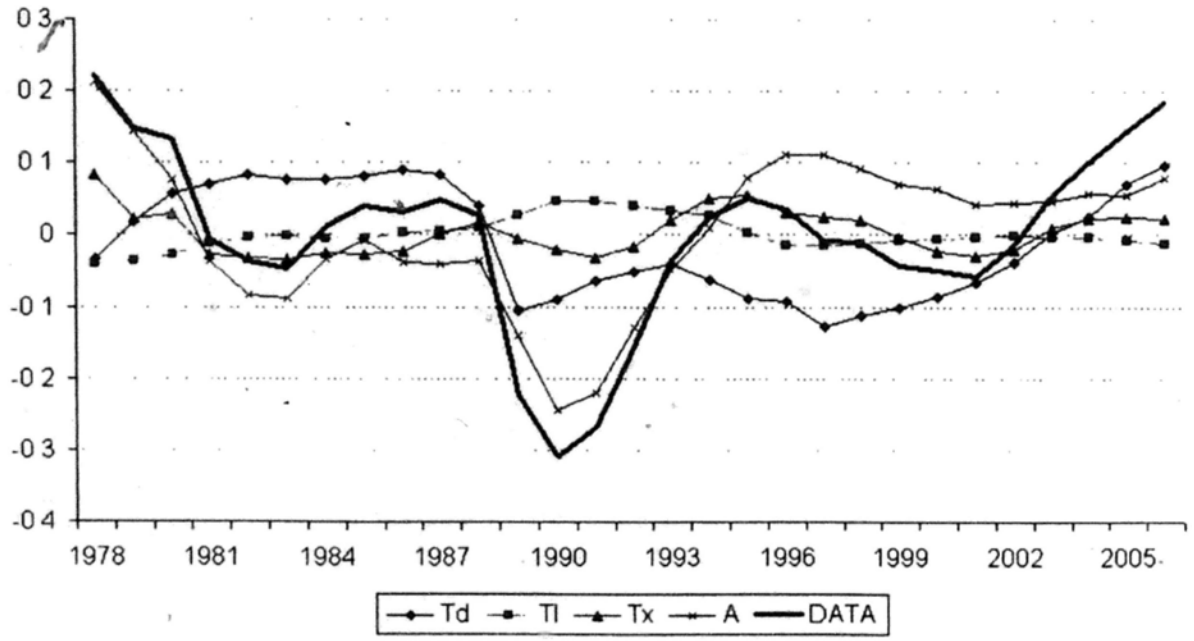


Figure 4.3.5 Trade Balance

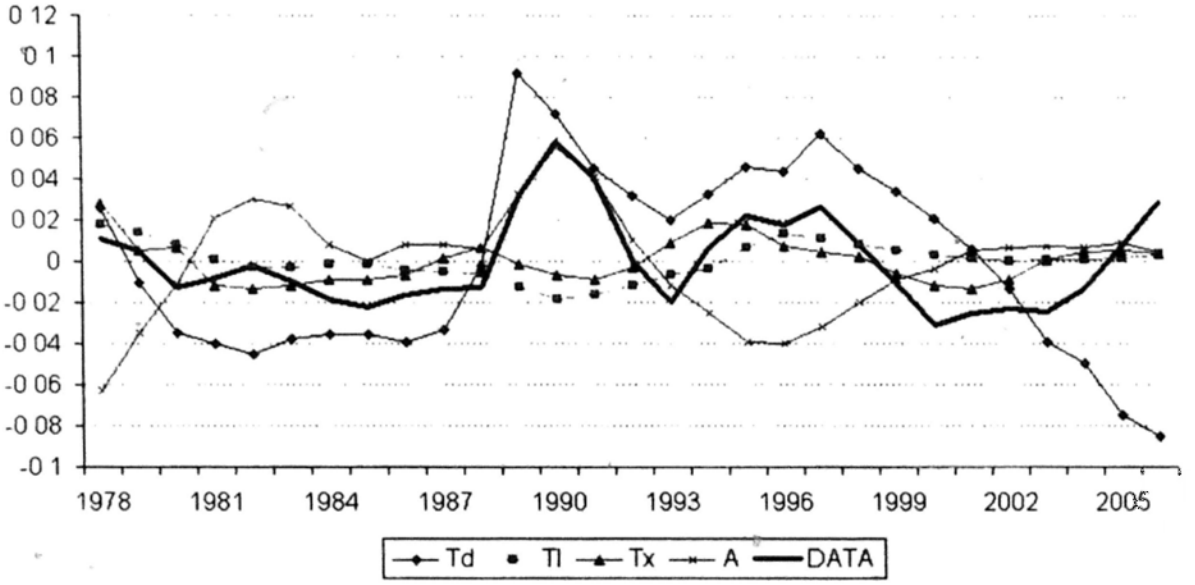


Figure 4.4.1 Output during Deflationary Expansion Period

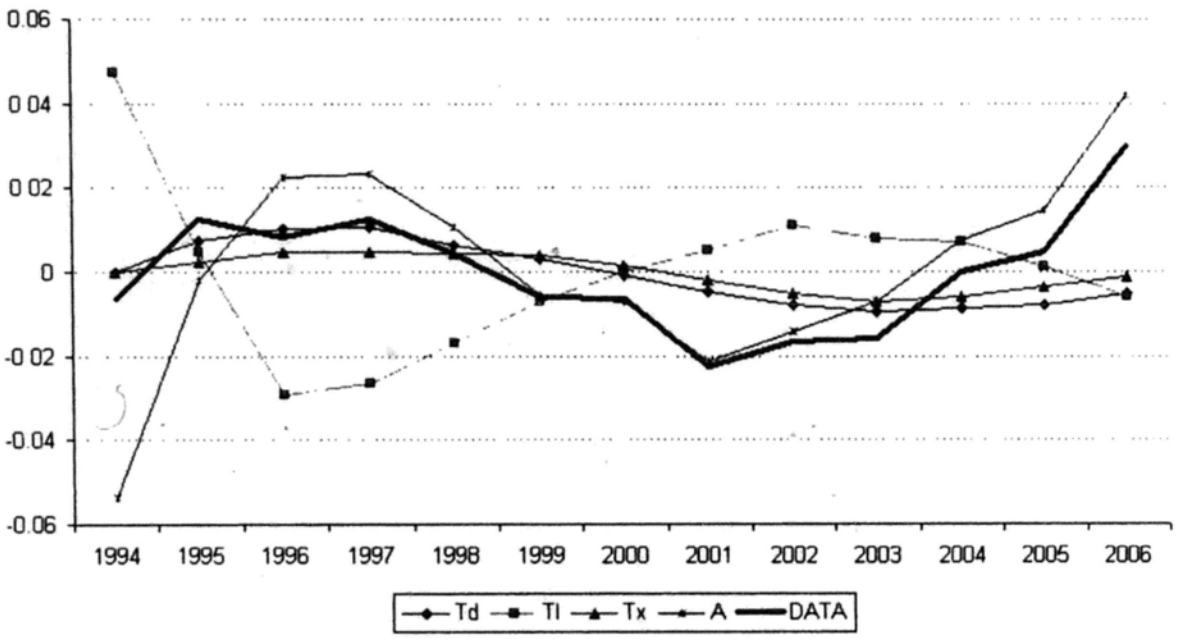


Figure 4.4.2 Consumption during Deflationary Expansion Period

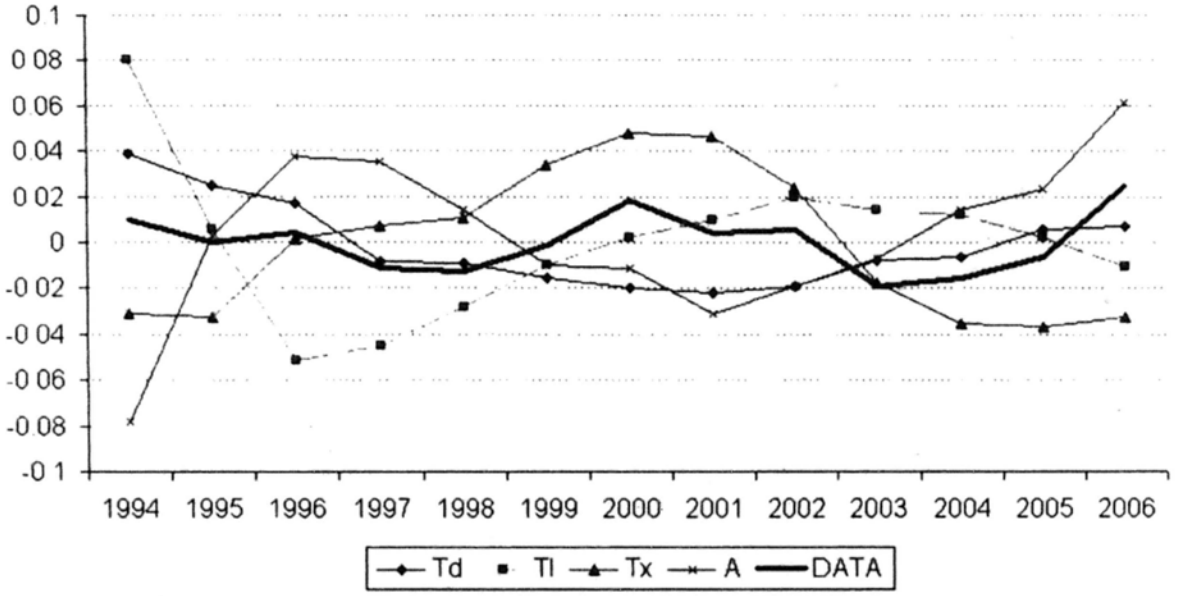


Figure 4.4.3 Labor during Deflationary Expansion Period

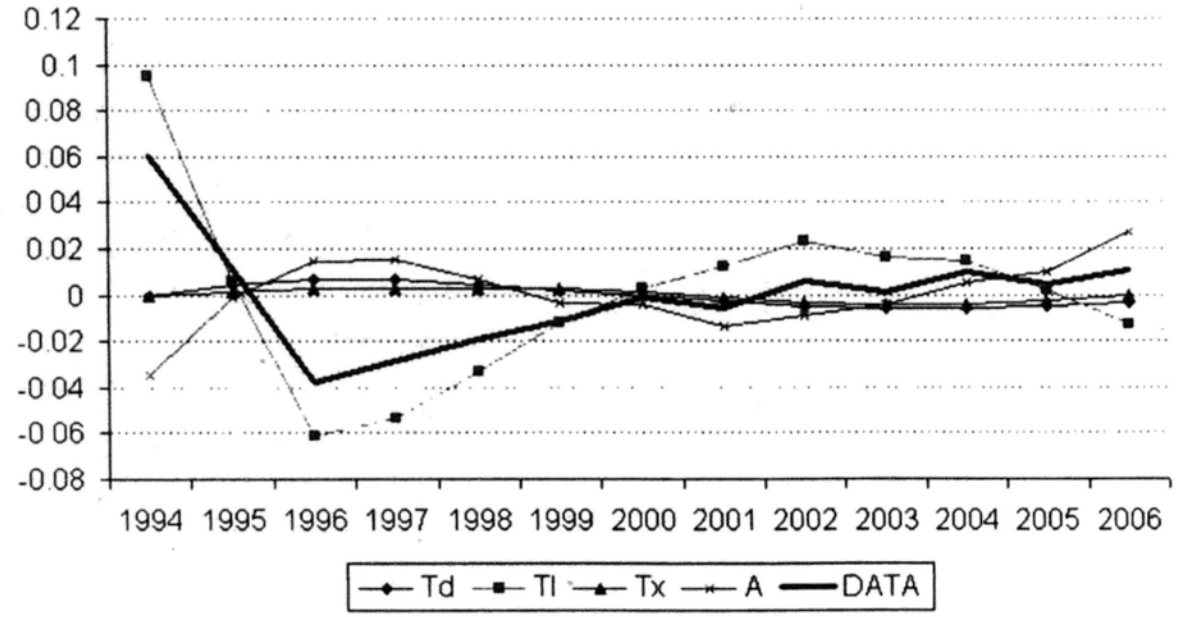


Figure 4.4.4 Investment during Deflationary Expansion Period

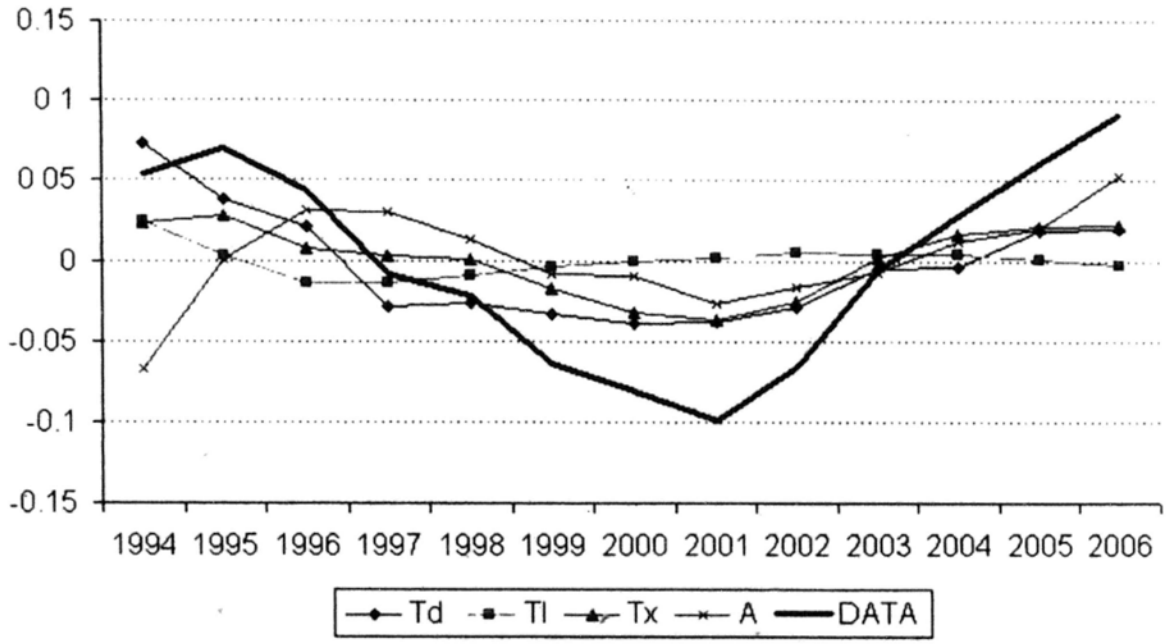
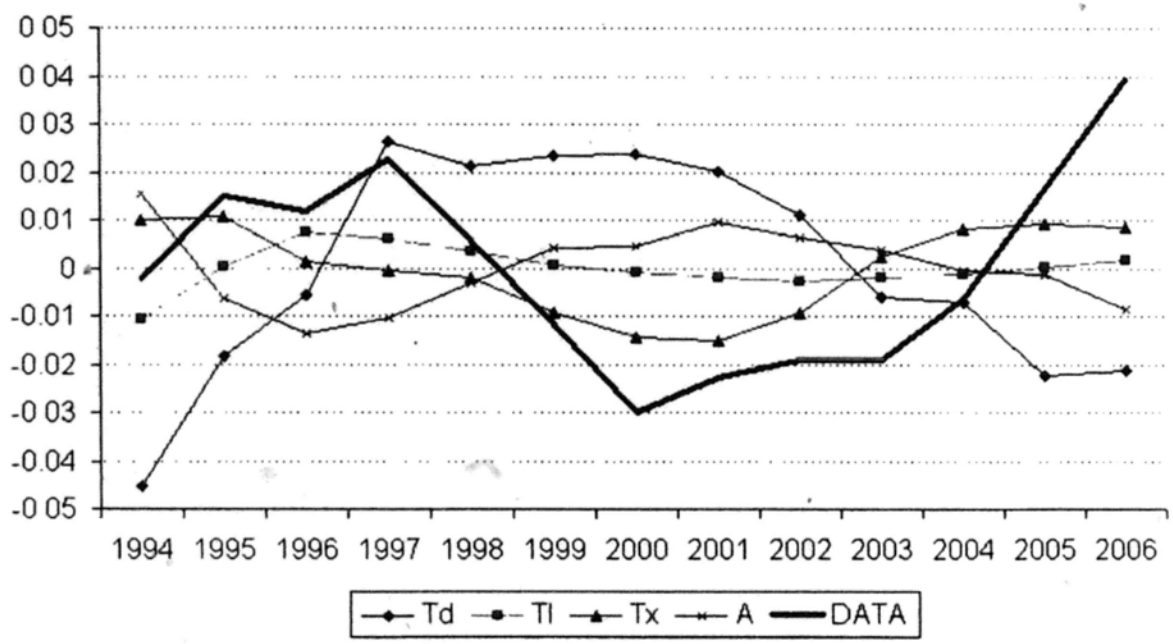


Figure 4.4.5 Trade Balance during Deflationary Expansion Period



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