

IMF Working Paper

Explaining ASEAN-3's Investment Puzzle: A Tale of Two Sectors

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Asia and Pacific Department

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Abstract

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The prolonged investment decline in post-Asian crisis emerging Asia, in contrast to the swift recovery of economic growth, has remained a puzzle. This paper shows that the post-crisis investment recession has been mainly concentrated in the nontradable sector, and hypothesizes that the slowdown is because firms operating in that sector are financially constrained. Empirical results based on macro and firm-level data from Indonesia, Malaysia, and Thailand (ASEAN-3) support this hypothesis.

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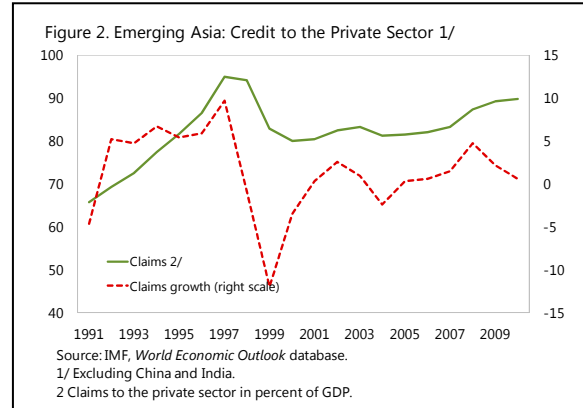
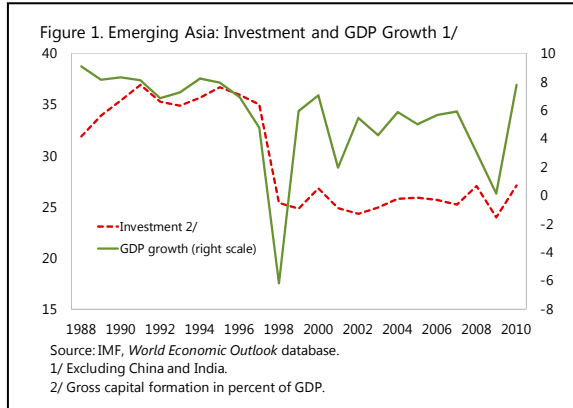
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Contents	Page
I. Introduction.....	3
II. Credit and Investment in Post Crisis Asia: Some Stylized Facts.....	5
III. Why Credit Slump? Why Nontradable Sector Get Hurt Most?.....	7
IV. Macro Evidence for Nontradable Sector’s Credit Constraint.....	9
V. Micro Evidence for Nontradable Sector’s Credit Constraint.....	13
A. Data.....	13
B. Methodology.....	15
C. Main Results.....	16
D. Robustness Tests.....	18
V. Conclusion.....	20
References.....	24
 Figures	
1. Emerging Asia: Investment and GDP Growth.....	3
2. Emerging Asia: Credit to the Private Sector.....	3
3. Emerging Asia: Savings and Investment.....	4
4. ASEAN-3: Gross Capital Formation.....	5
5. ASEAN-3: Nontradable Sector Output.....	6
6. ASEAN-3: Loans to the Nontradable Sector.....	6
7. ASEAN-3: Net Exports.....	6
8. ASEAN-3: Private Capital Flows.....	7
 Tables	
1. Classification of Nontradable and Tradable Sector for Graphs and Aggregate Estimation.....	10
2. Panel Regression for the Nontradable Sector Output with Time and Country Fixed Effects.....	12
3. Variable Definitions for Firms Level Regressions.....	14
4. Investment Equations.....	17
5. Nontradable Firms Investment Equations.....	19
 Appendices	
1. Sectoral and Size Distributions for Individual Countries.....	22
2. Descriptive Statistics for Key Variables.....	23

I. INTRODUCTION

The 1997–98 Asian financial crisis was associated with a sharp reduction of economic activity in emerging Asia² and investment fell significantly with growth. After the crisis, economic growth in the region quickly rebounded to near pre-crisis level. However, investment has never fully recovered afterwards, but remained at low levels in most countries excluding China and India (Figure 1). And, credit to the private sector has stagnated, particularly in those economies directly affected by the crisis (Figure 2).



The post-Asian crisis credit and investment decline has for some time been considered, at least in part, an expected correction of the earlier over-lending and over-investment.^{3,4} However, the crisis economies have worked their way through the structural overcapacity during the last ten years or so, and economic and financial fundamentals have significantly strengthened. So, the prolonged low level of investment seems hard to explain. Hori (2007) argues that the post-Asian crisis investment slump has been more severe and prolonged compared with investment declines following similar crisis episodes elsewhere. Chinn and Ito (2005), Eichengreen (2006), and IMF (2005a, 2005b, 2006a) note that investment in emerging Asia is lower than predicted by fundamental factors and below long-run levels. In sum, the prolonged low level of investment in several emerging Asian economies appears incompatible with their stage of economic development and has remained a puzzle.

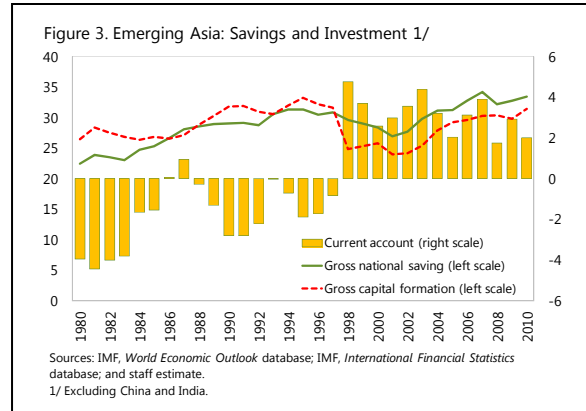
In fact, not all segments of the economy are affected evenly by the post-crisis credit slump. In most cases, the downturn has been concentrated in the domestically focused

² Emerging Asia refers to China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, and Thailand.

³ Park, Shin and Jongwanich (2009).

⁴ Other explanations for the credit and investment decline include a weak investment climate and/or risky post-crisis investment environment (IMF 2006 and 2005a); institutional and regulatory factors (Houston and others 2008); a shift to knowledge-based growth strategies, and competition from China (IMF 2006).

nontradable (N) sector while the externally oriented tradable (T) sector has held up relatively well. While some studies have examined the post-Asian crisis investment decline in several emerging Asian economies, few have systematically analyzed the issue from a sectoral perspective. Given the importance of resumption of investment for long-run sustainable growth in Asia, understanding the uneven impact of the credit slowdown on different sectors will be useful for formulating corrective actions to stimulate investment recovery. And to the extent that large current account surpluses in emerging Asia reflect a broader investment slump (Figure 3), a recovery of investment in the nontradable sector may also help to rebalance Asia's growth pattern by providing a greater role for domestic demand as a source of growth.⁵



This paper examines the role of the nontradable sector and its financing constraints in explaining the sluggish recovery of investment. The tradable sector, typically large and able to pledge export receivables as collateral, has greater access to international capital markets and is not limited to domestic bank lending. By contrast, nontradable firms, usually small and domestically focused, hit especially hard during the crisis and benefiting little from the subsequent devaluation, tend to face more asymmetric information problems in credit markets and thus rely predominantly on bank credit. As a result, the financial crisis at the end of the 1990s may have begun a reallocation of bank lending from nontradable firms to large tradable firms, with the former ultimately forced to pass up investment opportunities that cannot be implemented with internal funds alone.

We test the hypothesis that nontradable sector investment is relatively more financing constrained using macro and firm level data. Regressions using 1991–2007 aggregate data from three Asian crisis countries—Indonesia, Malaysia, and Thailand (hereafter referred to as ASEAN-3)—point to a significant positive correlation between nontradable sector output and the availability of loans to that sector after controlling for other explanatory factors; this supports the view that investment in the nontradable sector has been dragged down by stagnant credit growth in that sector. Regressions using 1990–2007 firm-level data from the ASEAN-3 suggest that while the level of investment for all firms is sensitive to the amount of internal funds available, the degree of responsiveness is significantly higher in the nontradable sector than in the tradable sector.

The results are consistent with the work by Tornell and Westermann (2003, 2005) and Schneider and Tornell (2004) which demonstrates that sectoral asymmetries in financing

⁵ See Nabar and Syed (2010) for a detailed discussion on investment and rebalancing in emerging Asia.

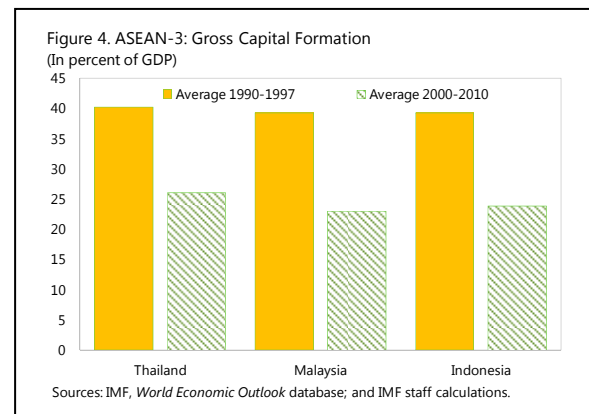
opportunities across tradable and nontradable sectors play a key role in amplifying boom-bust shocks in middle-income countries. The results are also consistent with the “sudden stop” literature emphasizing that the tradable sector firms have more stable access to credit than nontradable sector firms, which have more difficulty obtaining external finance after a credit boom ends (see, for example, Caballero and Krishnamurthy, 2001; Calvo and others, 2006; and Mendoza and Terrones, 2008). More broadly, the results are related to the extensive literature on the credit channel of monetary policy which shows that monetary tightening (in advanced economies) has a greater impact on small and medium-sized enterprises, most of which are de facto bank-dependent (see for example, Caballero, 1999; Domac and Ferri, 1999; Bernanke and others, 1994; Hubbard, 1998; and Kashyap and Stein, 2000).

The rest of the paper is organized as follows. Section II presents some stylized facts on the credit and investment slowdown in the ASEAN-3. Section III delves deeper into the credit slump and its effects on the nontradable sector. Section IV and Section V test the main hypothesis of this paper—that the nontradable sector is relatively more financing constrained than the tradable sector—using macro and micro and macro data from the ASEAN-3 economies. Section VI concludes.

II. CREDIT AND INVESTMENT IN POST CRISIS ASIA: SOME STYLIZED FACTS

This part of the paper presents some stylized facts that motivate the study, focusing on the ASEAN-3, which are at similar stages of development.

After becoming negative during the crisis, ASEAN-3’s GDP growth quickly rebounded to pre-crisis levels; whereas investment dropped and remains at a low level, having barely recovered. Average investment in ASEAN-3 has declined by an average of 15 percentage points of GDP from 1990–97 to 2000–10. Among the three countries, Malaysia’s investment relative to GDP dropped most, from 39 percent to 23 percent. For Indonesia, investment declined from 30 percent to 24 percent, for Thailand, this ratio was down from 40 percent to 26 percent respectively between the two periods (Figure 4).

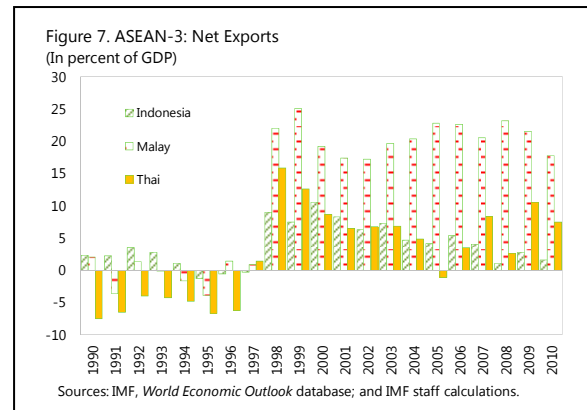
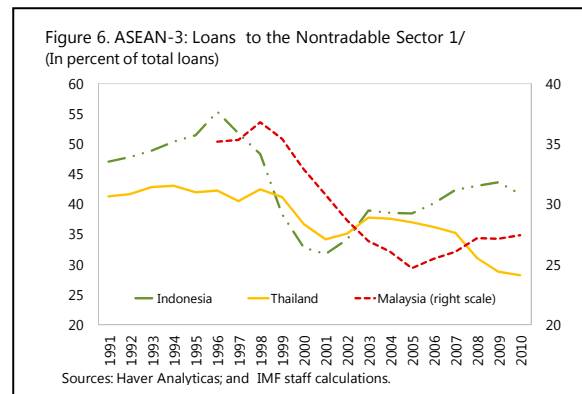
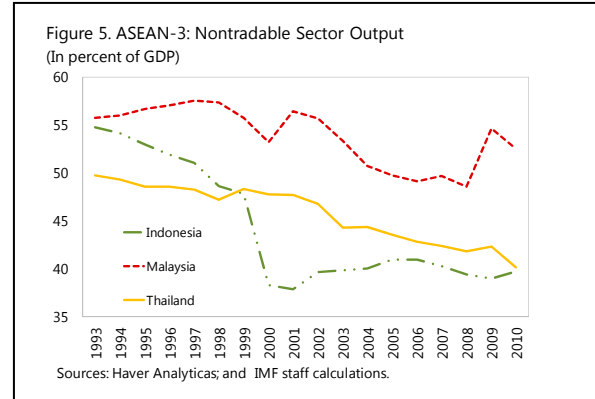


Along with this stagnation of investment, credit to the private sector contracted abruptly in ASEAN-3. Over the same period (1990–1997 to 2000–2010), credit to private sectors as a percentage of GDP in the three countries decreased from 94 percent to 79 percent.

In fact, not all segments of the economy are affected evenly by the credit slump—nontradable sector output dropped more sharply than that of the tradable sector, barely experienced any recovery, and still declined relative to GDP. For example, from 1996 to 2007, nontradable sector output as percent of GDP dropped 5 percent on average in ASEAN-3 (Figure 5).

At the same time, loans to the nontradable sector contracted disproportionately with lagged nontradable sector investment and output. Loans to the nontradable sector experienced a severe decline as a percentage of total loans. For ASEAN-3, nontradable sector loans dropped around 10 percent from 1997–2007. For Thailand, loans to the nontradable sector firms dropped from 42 percentage points in 1996 to 35 percentage points of total loans in 2007; for Malaysia, nontradable sector loans in percent of total loans declined from 35 in 1997 to 26 in 2007; for Indonesia, this share fell from 55 percent in 1996 to 42 percent in 2007 (Figure 6).

In contrast, the post-crisis export investment has been less affected. In the wake of the crisis, the tradable sector experienced an acceleration of growth after a mild recession, thanks to real depreciation and the tradable sector's use of cheaper nontradable sector resources. In fact, net exports have taken over investment as an important growth driver of the region (Figure 7).



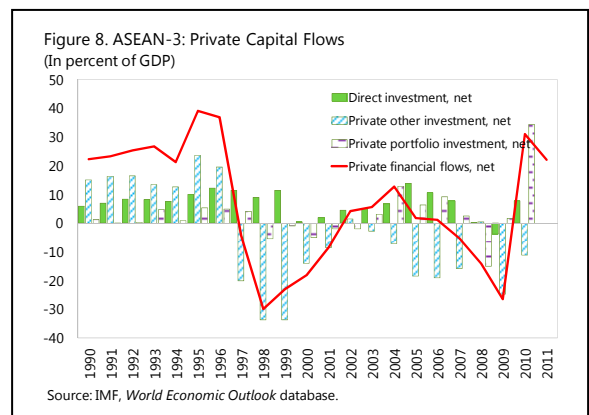
III. WHY DID CREDIT SLUMP? WHY DID THE NONTRADABLE SECTOR GET HURT THE MOST?

As demonstrated in the previous section, in emerging Asia, credit growth has not been as strong as might be expected given the strength of its recovery and the levels of credit as a percent of GDP continues to be significantly below the pre-crisis levels.

In theory, when investment and bank loans contract simultaneously, the direction of causality is not obvious and the credit slump may be driven by weak demand for bank loans rather than a drop in the supply of bank loans.⁶ For ASEAN-3, the initial decline in total credit may have been attributable to lower credit demand by firms immediately after the crisis, mainly due to an increasing focus on corporate reform to reduce debt and strengthen balance sheets, rather than on investing in capital. That being said, even at the beginning, constraints on credit supply by banks had led to reduced investment of borrowers that were potentially creditworthy but experiencing more severe asymmetric information problems.⁷ Indeed, analyzing surveys of banks and of manufacturing plants, Agung and others (2001) concluded that a lack of bank capital (not high borrower risk) was responsible for much of the slowdown in lending. Domac and Ferri (1999) find East Asian corporations suffered a credit crunch induced by weaknesses in the banking sector and a tighter regulatory framework. Evidence from various surveys and news reports also supports the existence of credit constraints in most crisis countries.

Why did banks reduce lending? Moreover, why did the nontradable sector get hurt most from the credit decline?

First, particularly in the early phase of the crisis, with the drying up of foreign funds (largely consisting of speculative short term loans); shortage of loanable funds substantially weakened many banks, which play a dominant role in financial intermediation since liquid domestic debt markets are lacking in emerging Asia. The post-crisis bust in international bank flows, largely channeled to the local economy through domestic banks, further reduced available bank funds. This



⁶ One possible way to detect the source of the decline is to compare bank credit with the commercial paper market, if the issuance of commercial papers increase while bank credit declined, the credit slump should be owing to reduced supply. Unfortunately, ASEAN-3's underdeveloped capital market prohibits this experiment.

⁷ Domac and Ferri (1999) and Ding, Domac, and Ferri (1998).

is evident from Figure 8—the breakdown of the private capital flows for the ASEAN-3 shows that the precipitous decline of net private capital flows reflected a sharp turnaround in bank lending flows,⁸ while portfolio and FDI flows to the region remained relatively stable.

Next, as banks' asset quality deteriorated with the downturn, they also became more risk averse in making new loans. As increasing interest and exchange rate losses took a toll on highly leveraged Asian corporations, mounting loan delinquencies impaired bank capital. Any economic downturn increases banks' lending risk because more of their existing and potential customers may face bankruptcy. For many banks, still facing hurdles in resolving non performing loans, this overhang served as an additional deterrent to lend.

Third, the stepped up implementation of stricter prudential regulations and supervision and the need to return balance sheets to health have also constrained banks' ability or willingness to lend relative to pre-crisis levels. For example, ASEAN-3 established new regulatory mechanisms that forced most banks to recognize their underperforming loans. The harsher requirements of higher capital adequacy ratios and higher loan-loss provisions⁹ may also have contributed to the more cautious lending by financial institutions. On the supply side, despite the recent increase in banks' profits and lending capacity, a number of factors constrain banks' ability or willingness to lend to firms including the credit risk of corporate lending; aggravated by the weaknesses in the infrastructure for assessing credit risk.

The post-crisis credit slump has affected firms in different sectors asymmetrically. The tradable sector, typically large and able to pledge export receivables as collateral, has greater access to domestic and international capital markets, so is not limited to domestic bank lending. The nontradable firms, heavily populated by small and medium sized enterprises¹⁰ and domestically focused, have less access to international financing, are more bank-dependent,¹¹ and cannot easily offset these shifts in bank loan supply.¹²

In addition, the post-crisis monetary tightening triggered a flight to quality in bank lending with banks shifting their loan portfolio away from enterprises that are less creditworthy. The pre-crisis credit boom to the nontradable sector is mostly financed by international banks in the

⁸ Proxied by net private other investment flows where bank lending flows dominate.

⁹ Property sector, in particular, experienced a stricter regulation due to the over lending in the sector during the booming period leading to the 1997/98 crisis.

¹⁰ See Appendix Table 1.

¹¹ A World Bank study finds that 40 percent of nonexporters experience inadequate liquidity to finance production compared to only 27.2 percent of exporters.

¹² Because the lion's share of FDI goes to the tradable sector or to financial institutions, the nonfinancial nontradable sector receives a small share of FDI; therefore, bank flows remain the main source of external finance for N sector firms. As foreign lines of credit dried up, the nontradable sector firms got impacted the most.

form of debt denominated in foreign currency. Thus, when the exchange rate collapsed, those debt burdens ballooned; making it more difficult for them to raise new funds. In addition, nontradable sector firms benefited little from the subsequent exchange rate depreciation due to their domestic focus and have made slower progress in restructuring than larger export-oriented corporations, which left their balance sheets in relatively worse shape. Therefore, there was a broad reallocation of short-term bank lending away from nontradable firms toward consumers or large tradable sector firms.

In this scenario, the prolonged post-crisis credit slump affected the nontradable sector more seriously than the tradable sector, with loans to the nontradable sector declining sharply as a percentage of total loans. This, in turn, caused a sluggish development of nontradable sector investment and production.

IV. MACRO EVIDENCE FOR THE NONTRADABLE SECTOR'S CREDIT CONSTRAINT

The above evidence that a credit slump in post crisis Asia might disproportionately affected nontradable and tradable firms leads to the following simple model. If nontradable firms' slow recovery results from credit constraints, then investment in nontradable firms should be significantly determined by the availability of loans, and this is the hypothesis tested below (Table 1).

We use pooled annual data from Thailand, Malaysia and Indonesia from 1991 to 2007 to quantify the relationship between Nontradable loans and Nontradable output (Table 1) after controlling for other factors. Here nontradable sector output is used as the proxy of nontradable sector investment due to the lack of capital stock

Table 1. Classifications of Nontradable and Tradable Sector for Graphs and Aggregate Estimation

	Nontradable Sector Industries	Nontradable Sector Loans
Indonesia	Electricity, gas and water supply (EGW); construction; trade, hotel and restaurant; transport and communication; finance and business services.	Trade and service rendering (EGW, construction, transport, business service, social service).
Malaysia	Construction and services	EGW, wholesale and retail trade, construction, real estate, transport, storage and communication, and finance, insurance and business services.
Thailand	EGW; construction, wholesale and retail trade, hotels and restaurants, transport, storage and communication, real estate, renting and business.	EGW, wholesale and retail trade; construction;

Sources: CEIC Data Co., Ltd.; Haver Analytics; and IMF staff estimates.

data at the sectoral level.¹³ The specification broadly follows the investment literature using lagged GDP growth, real interest rate, real lending rate and loans to the nontradable sector as independent variables. The real interest rate and real lending rate are used to measure the user cost of capital and domestic costs of borrowing, respectively. Since the real interest rate and the cost of capital may not reflect the true cost of borrowing faced by nontradable sector firms, which are heavily dependent on bank lending, loans to the nontradable sector are included in the regression. The set of explanatory variables also include the real exchange rate, terms of trade and uncertainty. Devaluation increases the level of foreign prices measured in domestic currency and thus the price of tradable goods relative to nontradable goods in the domestic economy, therefore it is expected to have a stimulating impact on private investment in the tradable sector, while depressing investment in the nontradable goods sector. A terms of trade improvement is expected to increase nontradable sector investment through the welfare channel, while a risky investment environment (proxied by the 3-year standard deviation of output growth) might also play a role in the investment decision.¹⁴

The estimation equation is as follows:

$$\log \frac{N_{it}}{Y_{it}} = \beta_0 + \beta_1 \log(gGDP_{i,t-1}) + \beta_2 \log(nLoan_{i,t-1}) + \beta_3 RealIntRate_{it} + \beta_4 LendRate_{it} + \beta_5 Uncert_{it} + \beta_6 \log(REER_{it}) + \beta_7 \log(TOT_{it}) + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

In the equation, N/Y is nontradable sector's share in output, gGDP is the real GDP growth rate, and nLoan is the share of total loans to the Nontradable sector. RealIntRate and LendRate denote real interest rate and lending rate respectively. Uncert captures the uncertainty. REER is the real effective exchange rate. TOT is the terms of trade. α_i , α_t and ε_{it} denote the firm, time and idiosyncratic effects respectively.

The estimation results are summarized in Table 2. They show that loans to the nontradable sector are a key determinant of output in the nontradable sector after the Asian crisis. Nontradable sector output has a statistically significant positive relation with the availability of loans to that sector, after controlling for other possible influencing factors. All the coefficients (on real interest rate, lending rate, real exchange rate, terms of trade) have the expected signs and are significant. The result that Nontradable sector output is negatively related with real GDP growth during 1998–2007 is consistent with the stylized facts that Nontradable sector performance has been lackluster in spite of strong GDP growth.

¹³ Sectoral detail on private investment is not available. Due to this limitation, discussion here focuses on sectoral output as an indicator of investment activity. In theory, investment and output growth have a one to one stable relationship in the long run.

¹⁴ The role of uncertainty on investment has been emphasized in the recent literature of investment, such as Dixit and Pindyck (1994).

Tabel 2. Panel Regression for the Nontradable Sector Output with Time and Country Fixed Effects 1/ 2/ 3/

Log (N/GDP)	Full Period (1991–2007)	Post Asian Crisis (1998–2007)				Post Asian Crisis (2001–07)
		(1)	(2)	(3)	(4)	
GDP growth (-1)	0.004 (0.005)	-0.003 (0.005)	-0.006 (0.004)	-0.005 (0.004)	-0.003 (0.004)	0.002 (0.004)
Log (nLoan) (-1)	0.077 (0.091)	0.245 *** (0.062)	0.326 *** (0.069)	0.151 ** (0.067)	0.199 *** (0.056)	0.5 *** (0.097)
Real interest rate	-0.009 (0.005)	-0.014 *** (0.003)	-0.012 *** (0.003)	-0.013 *** (0.003)	-0.009 ** (0.004)	-0.007 (0.01)
Real lending rate	-0.01 ** (0.004)	-0.019 *** (0.003)	-0.017 *** (0.003)	-0.016 *** (0.003)	-0.014 *** (0.004)	-0.009 (0.009)
Uncertainty			-0.016 * (0.008)			-0.034 *** (0.008)
Log (REER)				0.305 *** (0.132)		-0.066 (0.136)
Log (TOT)					0.21 *** (0.09)	0.095 (0.141)
Number of observations	41	27	27	27	27	21
R-square: Within	0.734	0.888	0.917	0.925	0.925	0.985
Between	0.018	0.019	0.155	0.023	0.051	0.985
Overall	0.165	0.014	0.001	0.048	0.03	0.233

1/ Stand errors in parentheses. *, **, and *** indicate significant at the 10 percent, 5 percent, and 1 percent level, respectively.

2/ See variable description in Table 2.

3/ Coefficients for year dummies and constant are not reported.

Due to the limited number of pre crisis observations, at the aggregate level, we can only run the full period sample and explain the difference with the post crisis results; this limitation is overcome in the next section that uses firm-level data. The results from the aggregate-level data are, nevertheless instructive. Specifically, the full sample estimation shows that the effect of loans to the nontradable on the nontradable output is small and insignificant, reflecting the fact that the pre-crisis over investment (at the aggregate level) had relied heavily on external financing, primarily from the banking system.

The interesting finding here is that since 2001, loans to the nontradable sector became an extremely important source of investment. Loans and uncertainty become the only determinants of output and the magnitude on the nontradable sector loans variable has almost doubled compared to the full period 1998–2007. Given the relatively low levels of uncertainty measured by output variance, this confirms our expectation that Nontradable sector investment has been constrained by the prolonged post crisis credit stagnation.

V. MICRO EVIDENCE FOR THE NONTRADABLE SECTOR'S CREDIT CONSTRAINT

To establish the link between sectoral asymmetry in investment and credit constraints more rigorously, this part of the paper estimates a panel data regression of firms' investment

adjustments to changing internal liquidity using the generalized method of moments (GMM) estimator developed by Arellano and Bond (1991). The simultaneous nature of the relationship that investment is determined in conjunction with the explanatory variables is alleviated by using GMM method¹⁵. The GMM technique is chosen also because of its advantage regarding the broad yet relatively short panel dataset. In the absence of higher order serial correlation, the GMM estimator (Equation 3) provides consistent estimates of the parameters in Equation 2. This remains the case even when the lagged dependent variable and other endogenous repressors are introduced into the model, provided that a valid instrument set continues to be used.

A. Data

The firm-level data covers about 1361 nonfinancial, publicly-traded firms from Indonesia, Malaysia and Thailand for the years 1991–2007 as reported in Worldscope. In the WorldScope database, each company is assigned to one of 10 FTSE industry groups: resources, basic industries, general industries, cyclical consumer goods, noncyclical consumer goods, cyclical services, noncyclical services, utilities, financials, and information technology. In our regression, firms in cyclical services, noncyclical services, utilities and heavy construction section of the basic industries are classified as nontradable sector firms; firms in other nonfinancial industries are classified as tradable sector firms. Variables and sources are defined in Table 3. Appendix Table 2 reports means and medians of the key variables by country.

Table 3. Variable Definitions for Firm Level Regressions

Variable Abbreviation	Variable	Description
EQ	Capital stock	Total property, plant and equipment net (WC02501)
IV	Investment to capital	Capital Expenditure (WC04601) divided by lagged EQ
TQA	Tobin's Q	Fiscal year end market capitalization (WS08001) plus book value of debt (WS03255), divided by book value of assets (WS02999)
CP	Cash to capital	Cash and short-term investments (WC02001) divided by lagged EQ
DP	Debt to capital	Total debt (WC03255) divided by lagged EQ
SP	Sales to capital	Sales (WC01001) divided by lagged EQ
RC	Return on invested capital	Earnings before interest and taxes (WC18191) divided by lagged EQ
TLTA	Total assets to total liabilities	Total assets (WX02999) divided by total liabilities (WC03351)

Sources: Worldscope; and IMF staff calculations.

¹⁵ This method (xtabond2) is widely used to estimate neo-classical investment models using micro-level data due to its feature to capture endogeneity and estimate a more efficient long run model by eliminating individual effects through first differencing and introducing more robust instruments .

B. Methodology

We follow the existing empirical research regarding the estimation of financing constraints on investments¹⁶ to regress investment on Tobin's Q, cash stocks, past investment and other control variables including cross-section and time-series variation of investment across firms and over time. In a perfect capital markets world, Tobin's marginal q, a popular proxy for unobservable investment opportunities and defined as the ratio of the market valuation of a firm to the replacement value of its assets, will be the main determinant of the investment decision, while firm's liquidity is irrelevant since internal funds and external funds would be perfectly substitutes. However, in a world of imperfect competition and asymmetric information, there will be wedges between external finance and internal finance, making the availability internal funds an important determinant of investment.

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 \left(\frac{I_{i,t-1}}{K_{i,t-2}} \right) + \beta_2 TQA_{it} + \beta_3 \left(\frac{CP_{it}}{K_{i,t-1}} \right) + \beta_4 \left(\frac{F_{it}}{K_{i,t-1}} \right) + \alpha_i + \alpha_t + \varepsilon_{it} \quad (2)$$

In the above setup, i and t denote the firm and time period respectively; I represents investment; K is capital stock; TQA denotes Tobin's marginal q, defined as the sum of year end market capitalization plus total debt over total assets; CP refers to cash stocks measuring the funds available to finance investment projects and is used as a proxy for the financing constraints¹⁷, α_i contains the firm specific effect; α_t captures the time specific effect; ε_{it} is an optimization error and F refers to a variety of investment influencing sources that include debt, leverage and profitability. Here both left- and right-hand side variables are expressed as proportions of capital stock (K) in the beginning of the period to reduce the heteroscedasticity in the data.

$$\Delta \frac{I_{it}}{K_{i,t-1}} = \Delta \beta_1 \left(\frac{I_{i,t-1}}{K_{i,t-2}} \right) + \Delta \beta_2 TQA_{it} + \Delta \beta_3 \left(\frac{CP_{it}}{K_{i,t-1}} \right) + \Delta \beta_4 \left(\frac{F_{it}}{K_{i,t-1}} \right) + \Delta \alpha_i + \Delta \alpha_t + \Delta \varepsilon_{it} \quad (3)$$

Based on the literature, a coefficient on β_3 that is significantly different from zero suggests the presence of financing constraints. Moreover, if the absolute value of β_3 corresponding to nontradable sector firms is bigger than those of tradable firms, this would tend to support the view that nontradable firms are more constrained with respect to external funding than are tradable firms.

¹⁶ Other similar research on internal and external financial constraints and corporate investments include: Fazzari and others (1988), Gilchrist and Himmelberg (1995); Hoshi and others (1991); Hayashi and Inoue (1991) and Borensztein and Lee (2002).

¹⁷ Stock of cash performs better than flows; this reflects the intuition behind Blinder's (1988) comment on Fazzari and others (1988) that liquidity constraints should pertain to stocks of potential resources rather than flows. For example, low current cash flow may not constrain acquisition of capital for a firm with a large accumulated stock of cash.

The expectation is that the dependence of investment on the cash stock is higher for nontradable firms, which face greater financial constraints and the strains will show up more seriously after the crisis than before the crisis.

C. Main Results

The main results are based on the model given in equation (3) and are reported in Table 4. Investment is regressed on Tobin's Q, cash stock and past investment over three periods: pre-crisis period 1990–1996; and two post crisis periods: 1997–2000 and 2001–2007. Because in stage one (1997–2000), banks and corporations are busy restructuring, they might not want to engage in investment. In post crisis stage two (2001–2007), over capacity has been largely absorbed, but investment still remains low. So what are the reasons associated with the low investments? Overall, the regression results are similar across three periods for both nontradable and tradable firms—cash stocks seem to be the single significant determinant of firm level investment. However, there are important differences across firms in the nontradable and tradable sectors.

Table 4. Investment Equations 1/

I/K	Nontradable Sector Firms			Tradable Sector Firms		
	Pre-crisis (1990–96)	Post-crisis (1997–2000)	Post-crisis (2001–07)	Pre-crisis (1990–96)	Post-crisis (1997–2000)	Post-crisis (2001–07)
$(I/K)_{t-1}$	0.0367 *** (0.088)	0.0055 (0.0045)	0.001 (0.001)	-0.0236 (0.0327)	0.0041 (0.0042)	0.0006 (0.0013)
TQA	0.0041 (0.0686)	-0.0302 (0.0721)	0.0449 (0.5551)	-0.0048 (0.0059)	0.0035 (0.003)	-0.0416 (0.1246)
CP/K	0.0161 *** (0.0015)	0.0534 *** (0.0001)	1.0089 *** (0.286)	0.0027 *** (0.0002)	0.0192 *** (0.0002)	0.0193 *** (0.0000)
Hansen (p)	0.39	0.452	0.491	0.581	0.465	0.006
AR (2) (p)	0.308	0.081	0.326	0.131	0.322	0.078
Number of observations	182	454	1,392	594	1,484	5,053
Number of groups	71	138	287	249	457	1,074

1/ Dynamic panel data estimation, two-step difference GMM results. Asymptotically robust standard errors are reported in parentheses below the coefficients; *, ** and*** denote statistical significance at 10 percent, 5 percent, and 1 percent levels; full set of time dummies included, results available upon request; Hansen is a test of overidentifying restrictions (p-value reported); AR(2) is the Arellano-Bond test for the absence of second-order serial correlation in the first differentiated results (p-value reported).

As evident from Table 4, the coefficient on cash is higher for the post crisis period than in the earlier period, probably reflecting the severity of the credit constraint post crisis. On average, the sensitivity of the investment rate with respect to cash is less than 0.02 in the pre-crisis period but more than tripled, to around 0.05, in the immediate post crisis period. What's more important is that, for nontradable firms, the credit constraint is even higher after 2001—a 1 percentage increase in cash to capital ratio will drive up investment ratio by about 1 percent, which implies that the financial constraint on nontradable firms has not been alleviated even several years after the financial crisis.

On the other hand, for tradable sector firms, the coefficients on cash are also higher after the crisis, but with of much smaller magnitudes. This is not surprising since tradable firms could have easier access to external finance obtained through external capital markets while nontradable firms will be disadvantaged in this regard. In fact, the big difference in liquidity constraints between tradable and nontradable firms is strong proof of the hypothesis that the nontradable sector has had more difficult access to credit. What's more, for tradable firms, coefficients on cash stocks from the two time segments (1997–2000 and 2001–2007) are not significantly different, which suggests that the tradable sector's financial constraint does not worsen as does the nontradable sector's.

The other interest finding is that the coefficient for both firms' Q is not significant and half of the time, it takes the wrong sign. This may be due to the measurement error of Q and/or strong assumption about perfect competition and perfect capital markets¹⁸.

However, since here we focus on the different responses to financial constraints for the nontradable and tradable sector firms, if the measurement error on Q is the same for both sectors, the result regarding the difference in responses to financial constraints should remain unbiased.

D. Robustness Tests

We next examine whether the estimated sensitivities of investment to cash for nontradable firms, are robust to including sales, debt, leverage and profitability in the post crisis period. In fact, all else being equal, sales, debt, leverage and profitability all affect investment decisions and that correlation is the most important for nontradable firms that likely face more information-related capital market imperfections. The estimation results are shown in Table 5.

The first variable added is sales, to reflect the accelerator effect, which is significantly positive. The coefficient on cash remains positive, though not statistically significant, which might be due to the high correlation between cash and sales (Model 1). The second variable added is debt. It is likely that highly indebted firms have larger capacity built in the past which could lead to less investment now. Model 2 does confirm that debt hinders the post crisis investment recovery, but the effect is not significant. Next we test the robustness of the internal liquidity result to the inclusion of leverage. If lower investment is due to high leverage, the estimated liquidity effect could be attributed to differences in leverage rather than in liquidity.

¹⁸ The low explanatory power of Q in investment has been recorded in previous studies such as Summers (1981), Poterba and summers (1983), and Poret and Torres (1989).

Table 5. Nontradable Firms' Investment Equations 1/

I/K	N Firms: Post-Crisis (2001–2007)				
	(1)	(2)	(3)	(4)	(5)
(I/K) _{t-1}	0.001 (0.001)	0.0006 (0.0009)	0.0009 (0.0014)	0.001 (0.001)	0.0012 (0.001)
TQA	0.0449 (0.5551)	-0.0151 (0.0915)	0.0962 (1.0887)	0.0772 (0.6040)	-0.0558 (0.4623)
CP/K	1.0089 *** (0.286)	0.09 (0.0965)	1.0057 *** (0.3008)	1.0056 *** (0.2939)	1.0048 *** (0.2741)
SP/K		0.5271 *** (0.0915)			
DP/K			-1.3429 (1.4286)		
TLTA				-0.0039 (0.005)	
RC					0.0005 (0.01)
Hansen (p)	0.491	0.076	0.434	0.462	0.561
AR(2) (p)	0.326	0.257	0.327	0.327	0.323
Number of observations	1,392	1,392	1,293	1,391	1,357
Number of groups	287	287	275	287	284

1/ Dynamic panel data estimation, two-step difference GMM results. Asymptotically robust standard errors are reported in parentheses below the coefficients; *, ** and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels; full set of time dummies included, results available upon request; Hansen is a test of overidentifying restrictions (p-value reported); AR(2) is the Arellano-Bond test for the absence of second-order serial correlation in the first differentiated results (p-value reported).

Model 3 shows this is not the case, as cash remains statistically significant at the 1 percent level. Another concern is that the protracted investment might be due to reduced profitability, which to some extent, might be correlated with the cash stock. To test this, we include the return on capital¹⁹ in the regression. Model 4 shows that the impact of this variable on investment, though positive, is not significant. But the effect of internal funds is not affected by the addition of profit: the coefficient on cash remains significant at 1 percent.

¹⁹ Alternative profitability variables such as return on equity and return on assets produce the same results.

In sum, the results in Table 3 indicate that our conclusion that firms in the nontradable sector have a more stringent financing constraint is robust to a number of alternative specifications.

Also for nontradable firms in the period of 2001–2007, higher debt and leverage impose a big negative effect on investment despite being insignificant; indicating that nontradable firms' slow corporate restructuring may be partly responsible for their sluggish investment recovery during the post crisis period.

As a result, nontradable firms that are operationally viable but liquidity constrained may suffer from a lack of sufficient working capital and other financing and therefore unable to maintain ongoing operations. This is consistent with the standard result in the literature on financial constraints that firms suffering greater information asymmetries (in this paper, the nontradable sector) respond to internal liquidity (cash stock) more than to future profit opportunities (Tobin's Q) after losing external finance.

An important caveat is that the results obtained in this section obviously relate only to listed nontradable firms, which are large corporations by economy-wide standards. This implies that the significance of internal funds for investment may well be greater for unlisted nontradable firms, which, typically face even more uncertainties, and may have more difficulties in accessing capital markets.

VI. CONCLUSION

In contrast to a rapid resumption of economic growth after the Asian crisis, credit and investment ratios in most emerging Asian countries remain subdued. Findings from this paper provide evidence that the sluggish recovery of investment in post crisis emerging Asia has partly reflected a disproportionate share of the credit decline for firms in the nontradable sector,²⁰ which face more asymmetric information problems in securing external finance. The quick recovery of GDP growth is partly attributed to rapid tradable sector growth helped by a real depreciation and better access to credit.

Those findings have significant implications for Asia's long-run economic performance. Strong export markets helped emerging Asia recover from the 1997 Asian financial crisis swiftly. However, robust growth driven by tradable firms may hide a languishing domestic sector—this is in stark contrast to trends in advanced economies, where the share in GDP of nontradable sectors has steadily risen (IMF, 2010). And, recent studies show that Asia's nontradable sector productivity growth has decelerated markedly in many cases stalling convergence toward advanced economies' productivity levels.²¹ Furthermore, Asia's export-led recovery remains at

²⁰ It is important to note that the financial constraint explanation might not apply to every country in emerging Asia. For example Korea's credit does not decline as in the other countries.

²¹ IMF, *World Economic Outlook*, September 2006.

risk under unfavorable external environments as has just been demonstrated in the most recent financial crisis: while the crisis did not originate in Asian countries, it affected them intensely through the decline in external demand.

Renewed investment in the nontradable sector would likely help increase productivity to achieve more balanced, robust and durable economic growth even in the context of sluggish demand from the rest of the world.

In addition, nontradable sector investment growth also bears important implications for social welfare and income equality since the nontradable sector plays an important role in job creation. This further underscores the need to increase investment in the nontradable sector. For Asian countries, to achieve sustainable long-run growth, nontradable sector investment will likely need to increase.

Since the empirical finding of this paper confirms that nontradable firms' weak investment recovery is due to the greater market imperfections in credit markets, removing financing constraints to firms in the nontradable sectors may help increase investment levels in Emerging Asia. While the right approach will depend on country-specific circumstances, three broad policies may help. First, consider measures to alleviate information asymmetry in credit markets, such as that improving and extending the coverage of credit registries in credit bureaus. This would allow banks to lend to nontradable firms based on individualized credit analysis, rather than simply limiting such lending. Malaysia's credit bureau is a good example in terms of providing comprehensive credit information and ratings on small and medium enterprises. Second, expand the potential sources of nontradable firms' financing by further developing capital markets²². Reduced bank lending will have relatively little effect on firm financing and the economy if alternative forms of credit are available. For example, improving legal and corporate governance frameworks in corporate bond markets, and changing legal frameworks to widen the range of assets that can be used as collateral would promote financing on risk-based terms and from venture capital. Third, further improving the business climate by deregulating and opening the nontradable sector to foreign capital, such as by reducing restrictions on foreign investment in regional nontradable sectors, may also help by increasing access to external finance.

²² Malaysia has been successful in developing the capital markets, particularly bond markets, in the past decade. The financial sector, infrastructure, and housing, are key sectors benefitting from the strong growth of the bond market.

Appendix Table 1. Sectoral and Size Distributions for Individual Countries 1/

	N sector (percent)		T sector (percent)	
	Small	Large	Small	Large
Indonesia	82	54	18	46
Malaysia	65	40	35	60
Thailand	61	24	39	76

Source: World Bank, 2001, *World Business Environment Survey*.

1/ "small" denotes small and medium firms up to 200 employees. "Large" firms have more than 200 employees.

Appendix Table 2. Descriptive Statistics for Key Variables

Country	Variable	T Firms				N Firms			
		N	Median	Mean	SD	N	Median	Mean	SD
Indonesia	IV	1,870	0.12	0.47	7.34	374	0.17	0.33	0.69
	CP	1,980	0.20	8.54	348.84	381	0.32	2.01	8.08
	TQA	2,228	0.90	1.22	1.45	444	0.96	1.22	1.27
	SP	1,981	2.38	68.81	2,774.29	381	3.50	8.82	22.75
	DP	1,996	0.40	0.40	0.28	413	0.37	0.36	0.25
	TLTA	2,210	56.22	63.11	51.13	443	52.62	60.12	47.53
	RC	1,941	7.79	11.20	161.76	405	7.31	8.70	41.98
Malaysia	IV	5,290	0.09	0.21	0.62	1,545	0.09	0.30	2.49
	CP	5,299	0.19	1.84	23.56	1,538	0.29	2.94	43.76
	TQA	6,157	0.86	1.26	2.25	1,747	0.81	1.08	1.24
	SP	5,310	1.80	3.74	10.39	1,544	1.76	5.03	14.13
	DP	5,899	0.24	0.28	0.24	1,662	0.32	0.34	0.26
	TLTA	6,152	40.05	46.08	49.15	1,746	50.45	53.36	36.45
	RC	5,590	5.97	4.27	27.35	1,592	5.44	0.57	157.80
Thailand	IV	2,654	0.11	0.21	0.43	801	0.14	1.58	37.07
	CP	2,674	0.11	0.48	2.82	808	0.30	2.19	33.85
	TQA	3,061	0.86	1.04	0.70	926	0.99	1.32	1.27
	SP	2,678	2.31	5.53	60.82	808	1.99	7.64	64.97
	DP	2,899	0.38	0.37	0.26	863	0.35	0.35	0.28
	TLTA	3,057	48.96	51.08	32.70	925	52.12	54.07	44.03
	RC	2,904	8.40	7.83	52.03	876	7.78	5.75	45.61

Sources: Worldscope database; and staff estimates.

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