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An empirical and institutional examination of post-crisis capital flows—Thailand case

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Abstract

In this paper, we developed and estimated a model of the Thai firm during the crisis. Our results indicate that firms with the highest debt-equity ratios suffered the steepest declines in earnings per share during the crisis from the financial distressed costs. We take this result as strong evidence for the credit channel. Surprisingly, firms with the largest market capitalizations suffered more than the smaller firms owing to their capital structure and financial leverage effect. We also witness asymmetric impact between the industries—exporters, importers and intermediate. We take this as evidence of different scale-effects on different industries, a feature that we do not explicitly model. In other words, the production effect is more pronouncing in import related industries than the export-oriented one. Note that firms that import intermediate goods also suffered greatly from the crisis from both credit and production channels. Taken together, our overall results indicate that the crisis damaged the earnings per share of firms more on credit channels than the production channels. There exists a peculiar tradeoff between benefits from currency devaluation to promote exports and severe adverse impact on both credit channel and asymmetric impact on production channel.

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1. Introduction

Currency crises have traditionally been viewed as the fault of emerging market governments. Traditional economic models blame emerging market governments for running un-

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31 sustainably high-fiscal and current account deficits, keeping real exchange rates overvalued,
32 and depleting foreign exchange reserves. Of course, there are other forms of government
33 failure. In the case of East Asian countries, there is some evidence that the deposit taking fi-
34 nancial intermediaries in these countries, although implicitly insured by their governments,
35 and financial market were not well regulated. This lack of regulation led to moral hazard
36 in lending by banks to corporations, resulting in high problem loans, a rise in risk, an out-
37 flow of capital, and finally, a currency collapse (see Dekle and Kletzer, 2001, for a model).
38 Without denying that poor financial regulation was an important contributor to the crisis, it
39 is doubtful whether it is the whole story, since even before the crisis, market participants
40 knew about the moral hazard problems in these countries. Thailand is a interesting case
41 to examine because before the crisis Thailand has been both bank based and stock market
42 based as equally important as noted by Hoontrakul (1996).

43 Recently, several researchers have constructed models of financial crisis that emphasize
44 how a shock, real or nominal, can be amplified by the so-called ‘financial accelerator’
45 mechanism (Bernanke et al., 1999). The basic story in these models is that the initial
46 currency depreciation, and drop in aggregate demand, if it affects the credit access of some
47 subset of firms, can ultimately lead to a massive depreciation, and an economic depression.
48 Later Chaipravat and Hoontrakul (2000) assert how Thai credit market in the 1997 crisis
49 aftermath has collapsed. Firm sizes are highly correlated with the availability of information
50 and credit access. The high or low monitoring industry type has also different access to
51 funding. Hence, each firm is impacted from the crisis differently from microeconomics of
52 information point of view.

53 Chang and Velasco (1999), Krugman (1999), and Aghion et al., 2000 all develop models
54 in which credit access of a particular firm depends on the firm’s ‘internal wealth.’ In fact,
55 the ‘self-financing’ or ‘internal wealth’ is predominant in most of the firms in every part
56 of the world as claimed by Allen and Gale (2000). ‘Internal wealth’ is defined as wealth
57 not subject to borrowing constraints, and typically includes the cash-flow and liquid assets
58 of the firm. Internal wealth rises with increased cash-flow and liquid assets. In addition, in
59 these models, ‘internal wealth’ declines with rising debt-equity ratios. This is because credit
60 constraints may tighten when the firms’ debt-equity ratios rise. Banks may become more
61 cautious in lending to firms with high debt-equity ratios, since the bankruptcy probabilities
62 of these firms are higher.

63 With binding credit constraints, a slight currency depreciation or drop in aggregate de-
64 mand, if they result in a decline in the internal wealth of firms, can lead to a sharp cur-
65 tailment of bank credit. This curtailment in bank credit can cause firm earnings to decline
66 sharply. Firm may then cut back employment and investment, leading to a further decline
67 in output. The curtailment in bank credit and fall in output will result in an increase in
68 default probabilities, an outflow of capital, and a possible collapse of the currency. It would
69 be even more interesting to examine a extreme currency depreciation in Thailand during
70 1997–2000.

71 Although many analytical models of the East Asian crisis have been developed, empirical
72 work testing the implications of the various models has lagged behind. This paper helps
73 to fill the void in the literature. Specifically, we will test if the models that emphasize the
74 importance of ‘internal wealth’ and credit constraints are useful in explaining the East Asia
75 crisis.

76 In carrying out our investigation, we will use rare, firm-level data for Thailand. If credit
77 constraints are important, then the earnings of Thai firms with certain characteristics should
78 decline by more during the crisis. For example, during the crisis, Thai firms with high
79 debt-equity ratios should have experienced a sharper fall in earnings than firms with low
80 debt-equity ratios. Of course, many other factors affect earnings during crisis times. Al-
81 though a depreciation of the currency may raise debt-equity ratios (in baht terms), a cur-
82 rency depreciation is certainly beneficial for exporting firms. This product market channel
83 may help increase firm earnings. In our empirical work we control the industry and other
84 characteristics, and try to isolate the impact of the crisis on firm's earnings through the
85 credit channel.

86 Our results indicate that firms with the highest debt-equity ratios suffered the steepest
87 declines in earnings per share during the crisis. We take this as strong evidence for the credit
88 channel.

89 This paper is organized as follows. In [Section 2](#), we describe the impact of the crisis
90 on Thai firms. In [Section 3](#), we describe the data. In [Section 4](#), we develop a simplified
91 model of the Thai firm during the crisis. In [Section 5](#), we present the estimation equation.
92 In [Section 6](#), we present the results. [Section 7](#) concludes.

93 **2. Impacts on Thai firm after 1997**

94 When Thai baht was floated on 2 July, 1997, all private firms were desperately vulnerable
95 to the extreme macroeconomic shocks. The baht slid from 25.7 baht/US\$, prior the float,
96 to peak around 56.9 baht/US\$ in January 1998. To stabilize its currency, high interest rate
97 [e.g. above 20 percent] was maintained for almost a year afterward and further damaging
98 firms' balance sheet. During 1999–2000, baht was traded around 37.0–43.0 baht/US\$. The
99 financial sector began to shrink rapidly and aggregated demand dropped significantly. GNP
100 growth rate in 1998 plunged to over –10 percent and bounced back around 5.0 percent in
101 1999–2000. The core inflation surged initially to 7.8 percent in 1998 as the direct result
102 of devaluation. But the inflation remained subdued around 1–2 percent in the following 2
103 years due to excess in capacity and depletion in inventory. The export growth in 1998
104 initially declined to –6.8 percent and grew back 7.4 and 16.9 percent in 1999–2000. The
105 current project for export growth in 2001 is widely expected to be negative. Many attributed
106 this phenomenon to capital structure readjustment, while others claimed as the wealth
107 effect from the USA. Note that the relative price effect was ruled out due to competitive
108 devaluation in the region. The import growth was –33.8 percent, +16.9 and 31.3 percent
109 during 1998–2000. Manufacturing bottomed in the third quarter of 1998.

110 One of major problems in Asian crisis of 1997 was the massive buildup of foreign
111 debt by private corporation to finance ambitious investment. Large firms and financial
112 institutions were able to directly raise fund from abroad, while security exchange of Thai-
113 land (SET) enjoyed unprecedented boom in mid 1990's. Small and medium enterprise
114 (SME) also enjoyed positive externality from lending boom from domestic banks' excess
115 liquidity and corporates' ambitious investment. After the full fledged financial economic
116 crisis, private firms were struggling to survive. Debt deflation began; the liquidity trap
117 straddled.

118 Capital market dried up on-shore as well as off-shore. Total market capitalization of
119 SET fell by 70 percent from 5000 billion bahts in 1997 to 1500 billion bahts from the
120 end of 2000. SET index hit lowest point (207) on the last day of August 1998 against the
121 heyday SET index of 1700 in mid 1990's. The total foreign debt was steadily reduced
122 by at least 30 percent from over 110–78 billion US\$ in 4 years after the debacle. Most of
123 the repayment came from large corporations and FDI. After decade of consecutive budget
124 surplus and no debt, Thai public sectors began to accumulate as foreign debt was increasing
125 fast, partly from 17 billion dollars bail-out IMF package loans. Almost half of FDIs were in
126 the automobile sector, with others spread across chemicals, electronics and light industry
127 as per [Phongpaichit and Chris \(2000\)](#) analysis. Little FDI was found for SME sector due to
128 the lack of economy of scale and information availability.

129 On the other hand, all financial intermediary institutions were seriously damaged. The
130 56 out of 92 finance firms were closed in December 1997. The 6 out of 11 private banks
131 were nationalized and four banks were later acquired by foreigners. Total non-performance
132 loans (NPLs) for banking system had peaked at 50 percent level in mid of 2000. About three
133 quarter of SMEs' loan were NPLs and mostly unrestructurable, while more than half of large
134 firms were worked out as asserted by [Chaipravat and Hoontrakul](#). Note that retail loans were
135 insignificant with little loan work out problem. Liquidity traps were straddled from mid of
136 1999 onward. Interest rate remained low to keep dysfunctional banks afloat; private invest-
137 ment was slumped. Very large corporate took further advantages by refinancing their foreign
138 debt with domestic debt. Overall, credit market failed, especially in SME market. Net credit
139 extension remains negative from 1997 to 2000. Most use its 'internal wealth' according
140 to [Jantaranprapavech \(2001\)](#). Running down their capital, streamlining their business pro-
141 cesses, selling off their non-core asset are among the alternative internal sources of funding.

142 3. The data

143 The firm level panel data are extracted from the CD-ROM obtained from the Thai stock
144 exchange. The CD-ROM contains balance sheet and income statement information between
145 1996 and 1999 for over 400 firms listed on the Exchange. Of the 412 firms listed on the
146 exchange in 1996, 46 were banks and finance companies. Of the 377 non-financial firms
147 listed in 1996, 46 became non-listed by 1999, because of bankruptcies and workouts. In
148 addition, we dropped 81 firms, because of missing observations. Thus, our final working
149 sample is a 4-year (1996–1999) panel of 296 non-financial firms.¹

150 We are aware of at least one other panel data set of Thai firms. The World Bank ran-
151 domly sampled 652 Thai firms in 1998, with retrospective questions for 1997 and 1996.

¹ There may be survivorship bias in our working sample. The firms that survived the Thai crisis were probably less financially constrained than firms that failed during the crisis. However, our main conclusion that the earnings of financially constrained firms suffered more during the crisis should be robust to this survivorship bias. For example, suppose that during the crisis, firms with highest debt equity ratios suffered the largest declines in earnings per share. This finding would be strengthened should somehow failed firms were to be included in the working sample. Since failed firms on average would have higher average debt-equity ratios and more negative earnings than surviving firms, including the failed firms will result in a larger impact of the debt-equity ratio on earnings per share.

152 The data set is described in Hallward-Driemeier (2000). The World Bank sample includes
 153 both listed and the smaller, unlisted firms, and contains balance sheet and income statement
 154 information. Hallward-Driemeier (2000) mentions some caveats in using the World Bank
 155 data. First, response rates were quite low. Second, the unit of observation is the plant or
 156 the enterprise, and not the firm. It is unclear how informative balance sheets and income
 157 statements are at the enterprise or plant level. The record keeping at the firm level is prob-
 158 ably much better, since it is the firm that pays taxes, not the enterprise or plant. Finally,
 159 the data are not in accord with any standard accounting rule; each survey respondent an-
 160 swered each question subjectively. The accounting statements of our firms were audited by
 161 internationally accredited accountants.

162 4. The model of the Thai firm during the crisis

163 In our empirical work, we relate changes in earnings per share during the crisis to industry
 164 characteristics, firm size, and firm indebtedness. The crisis affects the earnings per share of
 165 firms through both the product and credit market channels.

166 4.1. The product market channel

167 We assume that the representative Thai firm either exports its output, or sells its output
 168 domestically. Also, we assume that inputs to production are imported (raw materials, ma-
 169 chinery) or produced domestically (labor, office rents). Thus, we can express the earnings
 170 per share of the Thai firm in industry i as:

$$171 \left(\frac{E}{S}\right)^P = \frac{e \times P^E \times Q_i^E}{S} + \frac{P^D \times Q_i^D}{S} - \frac{(c_i + c_i^F \times e) \times (Q_i^E + Q_i^D)}{S}, \quad (1)$$

172 where e is the exchange rate (in Thai baht per dollar), P^E is the export price (in dollars),
 173 P^D is the price of domestic sales (in baht), Q_i^E , Q_i^D are export and domestic sales, and c , c^F
 174 are the costs of domestically produced (in baht), and imported inputs (in dollars) necessary
 175 to produce a unit of output. Eq. (1) says that earnings is equal to export sales revenues plus
 176 domestic sales revenues minus total costs (all per share).

177 Totally differentiating Eq. (1),

$$178 d\left(\frac{E}{S}\right) = \frac{P^E Q_i^E de}{S} + \frac{P^D dQ_i^D}{S} - \frac{c_i^F (Q_i^E + Q_i^D) de}{S} - \frac{(ec_i^F + e)dQ_i^D}{S}, \quad (2)$$

179 where we have assumed for simplicity that $dP^E = dP^D = dQ_i^E = 0$. That is, export and
 180 domestic prices and export sales remain constant. Of course, during the crisis, export prices,
 181 domestic prices, and export sales all changed. However, changes in these variables were
 182 certainly much smaller than the massive depreciation of the Thai exchange rate ($de > 0$),
 183 and the collapse in domestic sales ($dQ_i^D < 0$). Thus, to focus on the variables most relevant
 184 in impacting the earnings of Thai corporations during the crisis, we neglect changes in
 185 export prices, domestic prices, and in export sales. Moreover, we assume during the crisis,
 186 domestic sales was entirely demand determined. That is, the firm's optimal output level

187 (supply at given prices) was higher than the demand for its products; the firm had excess
188 capacity.

189 From Eq. (2), we can see how firms with different characteristics can differ in their
190 susceptibility to the crisis. First, the earnings of export-oriented firms should decline by
191 less than the earnings of domestic-oriented, importing firms. Export revenues are boosted
192 due to the depreciated exchange rate, while domestic-oriented firms suffer from declining
193 domestic sales. Second, the earnings of firms with a high proportion of imported machinery,
194 raw materials, and other intermediate products should suffer more than the earnings of firms
195 with mostly domestic-produced inputs. The depreciation of the baht will sharply raise the
196 costs of firms importing a high proportion of intermediate products.

197 4.2. The credit market channel

198 So far, we have focussed on how changes in the exchange rate and in domestic demand
199 influence earnings through the product market channel. However, during the crisis, an
200 important determinant of firm earnings was the availability of credit from banks. Because
201 of weaknesses in their balance sheets and in the balance sheets of banks, some firms faced
202 difficulty in borrowing. This difficulty in borrowing may manifest itself in two ways. First,
203 firms may have to pay a higher interest rate on borrowing. Second, the firm may simply not
204 be able to borrow from banks; banks may ration credit. To raise funds, the firm may have to
205 borrow from the black market with very high interest rates, or sell its assets. We summarize
206 this extra cost of bank credit, as a fraction of total shares outstanding, as:

$$207 \left(\frac{B}{S}\right) = \frac{k_i(D_i + eD_i^F)^B(Q_i^E + Q_i^D)}{S} \quad (3)$$

208 where k captures the credit stance of banks, D is the domestic debt-equity ratio and D^F
209 the foreign debt (in dollars)-equity ratio of the firm in industry i , and B is a parameter less
210 than one. Eq. (3) says that as the debt-equity ratio of the firm rises, the risk of bankruptcy of
211 the firm increases, leading to a cutback in bank credit, such as a rise in the cost of external
212 financing.

213 Totally differentiating (3), $d(B/S)$ equals,

$$214 \frac{(D_i + eD_i^F)^B Q_i \times dk}{S} + \frac{Bk(D_i + eD_i^F)^{B-1} Q_i de}{S} + \frac{k(D_i + eD_i^F)dQ_i}{S} \quad (4)$$

215 where we have substituted $Q_i = (Q_i^E + Q_i^D)$. The first term says that during the crisis, as
216 banks tightened credit ($dk_i > 0$), the cost of borrowing rose. This tightening of credit may
217 have differed by industry and may have been more severe for small firms, and less severe
218 for firms with revenues that increased during the crisis, such as exporting firms. For the
219 same tightening of credit, firms with higher domestic and foreign debt-equity ratios had
220 higher borrowing costs. The second term says that as the exchange rate depreciated ($de >$
221 0), foreign debt in baht increased, leading to higher borrowing costs. Finally, there is an
222 offsetting third term; as demand for the firm's output fell during the crisis, the firm had less
223 need to borrow, lowering the cost of borrowing.

224 From Eq. (4), we can see how firms differed in their susceptibility to a crisis-induced
225 credit tightening by banks. First, certain firm characteristics may affect how much banks

226 tighten their credit (dk_i). Export-oriented firms, who have higher cash-flows during the
 227 crisis, may suffer less from credit tightening. Banks, observing these cash-flows, are more
 228 likely to lend to these firms. Large firms or firms with high market capitalizations may
 229 suffer less than smaller firms. Banks have more information about large firms. Small firms
 230 are more likely to fail during crisis, making banks more cautious. Second, firms with high
 231 debt-equity ratios may suffer more from a given cut in bank credit than firms with low
 232 debt-equity ratios. Third, firms with a high proportion of foreign currency debt will suffer
 233 more than firms with mostly domestic debt. As the exchange rate depreciates, total debt in
 234 baht terms increase.

235 The total impact of the crisis on firm earnings from the product and credit markets,
 236 $d(E/S)^T$, is thus the sum of Eqs. (2) and (4):

$$237 \quad d\left(\frac{E}{S}\right)^T = d\left(\frac{E}{S}\right)^P + d\left(\frac{B}{S}\right).$$

238 5. The estimation equation

239 In our empirical work, we relate changes in earnings per share during the crisis to firm
 240 and industry characteristics. Our estimating equation is:

$$241 \quad \left(\frac{E}{P}\right)^T = \alpha + \gamma_t + \beta(X_i\gamma_t) + \varepsilon_{it}, \quad (5)$$

242 where α is a constant, γ_t are yearly-dummy variables (three, for the years 1997, 1998, and
 243 1999, where 1996 is the initial year). X_i is the set of characteristic of the industry or the firm
 244 in 1996, the initial year, and β identifies how industry- and firm-specific differences affect
 245 the earnings of a firm during crisis.

246 We take 1996, the year before the crisis as the initial year, when firms were operating in
 247 a normal environment—1997 and 1998 were the crisis years, while 1999 was the recovery
 248 year. To take an example, suppose X_i is the firm's debt-equity ratio in 1996. β_{1997} and β_{1998}
 249 capture the effect of an increase in initial corporate indebtedness the crisis on earnings. In
 250 this example, $\beta_{1997} > 0$ and $\beta_{1998} > 0$ are evidence of the 'credit-channel' at a time of crisis,
 251 firms with higher initial indebtedness had greater difficulty borrowing from banks.

252 We include the following three variables in X_i —a dummy variable indicating whether
 253 the firm is in an industry that is exporting (EXP), or importing (importing intermediate
 254 products, IMP), or producing non-tradeables; the market value of the firm in 1996 (MKTV
 255 96, a measure of firm size); and the debt-equity ratio of the firm in 1996 (Debt 96/Equity 96).
 256 In addition, we include as a control variable (without interaction with the time dummies),
 257 a dummy variable indicating whether the firm is in an industry borrowing mainly from
 258 domestic private banks, or from foreign and government banks.

259 As mentioned, the EXP and IMP dummies capture mainly the product market channel, but
 260 may also capture the credit market channel. During the crisis, the revenues of export-oriented
 261 firms increased, but those of domestic-oriented importing firms fell. In fact, since the costs
 262 of imported inputs rose, the earnings of importing firms should have fallen by more than the
 263 earnings of firms producing non-tradables, who suffered only from a decline in domestic

264 demand. With regard to the credit market channel, banks were more likely to have kept on
265 extending credit to exporters, with healthier cash-flows, than to importing firms. [Table A.1](#)
266 categorizes the Thai industries in our working sample by trading status.

267 The size and debt-equity ratios capture mainly the credit market channel. The earnings
268 of large firms (firms with large market capitalizations) are expected to withstand the crisis
269 better than the earnings of small firms. Banks have more information about large firms; the
270 probability of bankruptcy of small firms is also higher. Firms with higher debt-equity ratios
271 are more likely to fail during crisis.

272 Finally, the type of bank a firm borrows from affects earnings through the credit market
273 channel. The sign of the effect, however, is ambiguous. On the one hand, the damage to
274 earnings per should be more severe for firms in industries borrowing mainly from domestic
275 private banks. The crisis should damage the balance sheets of domestic private banks more
276 than the balance sheets of government-owned and foreign banks. On the other hand, firms
277 borrowing from foreign banks borrow mainly in foreign currency. As mentioned, the credit
278 constraint becomes more severe during a crisis for firms with high foreign debt. [Table A.2](#)
279 categorizes Thai industries in our working sample by the type of borrowing bank.

280 6. The results

281 The results from estimating [Eq. \(5\)](#) are depicted in [Tables 1 and 2](#).² In [Table 1](#), column
282 1, only the year dummy variables are included in the regression (1996 is the baseline).
283 Earnings per share in 1997–99 was much lower than in 1996, owing to the crisis. The 1997
284 dummy is highly negative and significant, showing the severe negative impact of the crisis
285 on earnings per share. The 1998 dummy is insignificant, suggesting a leveling-off of crisis
286 effects. The 1999 dummy is again highly negative, suggesting that the 1998 leveling-off was
287 only tentative and possible slowdown to the uncertainty in general election. Nevertheless,
288 what is interesting on [Table 2](#) (row Year98, 99) is the insignificance of dummy variables in
289 all cases for both years—1998 and 1999—when we include the credit market variable debt
290 to equity ratios. This suggests that the financial economic crisis on 2 July, 1997 is one-time
291 event with long-lasting impact on firm's balance sheet.

292 The earnings per share of the largest firms fell the most during the crisis. In [Table 1](#), column
293 (2), we include year-dummies, interacted with firm-size (market capitalization in 1996).
294 Taken together, the coefficients for 1997 and 1998 imply that a 100 baht increase in 1996
295 market capitalization would have lowered earnings per share by about 35 baht during the
296 crisis. To see this, from the third column of [Table 1](#), we can see that the sum of coefficients on
297 $\text{Year97} \times \text{MKTV96}$ and $\text{Year98} \times \text{MKTV96}$ is 0.38 or about 0.35. Thus, a 100 baht change
298 in MKTV96 will over two years (1997–98) change the earnings per share by 35 baht ($= 100$
299 $\times 0.35$). Possibly, most of the 'financial wealth creation' in 1996 was due mainly to higher
300 'financial' leverage effect as per the path-braking [Modigliani and Miller \(1958\)](#) proposition
301 I. In addition, the larger the firm the more opportunity is to borrow externally because more
302 public information is readily available. Note that in comparison to 1996, the interest rate

² The low R-squares are typical of cross-section work in corporate finance.

Table 1
Impact of crisis on firm earnings

	Dependent variable (earnings per share)			
	1	2	3	4
Constant	4.88 (4.25)	4.88 (4.39)	5.45 (4.64)	4.88 (4.43)
Year97	-16.34 (-10.07)	-13.86 (-8.65)	-13.91 (-8.68)	-10.13 (-5.04)
Year98	-0.25 (-0.15)	-1.55 (-0.97)	-1.61 (-1.01)	-3.18 (-1.58)
Year99	-4.61 (-2.84)	-4.67 (-2.91)	-4.72 (-2.95)	-5.46 (-2.71)
Foreign and government Bank borrowing			-1.82 (-1.51)	-0.43 (-0.31)
Year97 × MKTV96 (coefficient × 100)		-0.89 (-7.94)	-0.87 (-7.73)	-0.81 (-7.08)
Year98 × MKTV96 (coefficient × 100)		0.47 (4.19)	0.49 (4.33)	0.47 (4.15)
Year99 × MKTV96 (coefficient × 100)		0.21 (0.18)	0.39 (0.35)	0.44 (0.39)
Year97 × EXP				-0.71 (-0.25)
Year98 × EXP				4.27 (1.48)
Year99 × EXP				4.42 (1.52)
Year97 × IMP				-11.01 (-4.34)
Year98 × IMP				2.01 (0.79)
Year99 × IMP				-0.66 (-0.26)
R-squared	0.11	0.16	0.16	0.18

Note: T-statistics in parentheses; 1184 observations (296 × 4 years).

303 in 1997–1998 was relatively very high to defend its currency depreciation. Firms which
 304 borrowed more externally in 1996 than those resort from their internal sources had faced
 305 high financial distressed costs (e.g. cost of capital, bankruptcy cost, etc.) from high interest
 306 rate and credit crunch. In other words, apart from the currency depreciation loss, firms suffer
 307 severely from adverse effects on their capital structure via credit channel consistent with
 308 Hallward-Driemeier (2000) (pp. 13–14) findings. These results are robust to controlling
 309 for the firm's initial debt-equity ratio and industry (Table 2; column 4). Another intriguing
 310 factor is the insignificance of the firm size consideration in 1999 (Tables 1 and 2; row Year99
 311 × MKTV96). Perhaps, after the initial shock in de facto baht devaluation, it took the firms
 312 about 2.5 years to adjust well in both their product and credit channels. In few words, the
 313 financial crisis is an event but the restructuring of both channels are a multiple years process
 314 afterward. It remains to be seen what would really happen after the first initial adjustment
 315 for the first initial shock given the weakening domestic and overseas demand in 2001.

Table 2
Impact of crisis on firm earnings

	Dependent variable (earnings per share)			
	1	2	3	4
Constant	2.48 (3.88)	4.88 (4.41)	4.88 (4.59)	4.95 (4.33)
[Debt96/Equity96] × Year97	−938.69 (−12.42)	−647.11 (−7.72)	−745.61 (−9.21)	−710.61 (−8.67)
[Debt96/Equity96] × Year98	−89.16 (−1.18)	−228.26 (−2.72)	−185.94 (−2.29)	−184.01 (−2.24)
[Debt96/Equity96] × Year99	−356.86 (−4.72)	−394.22 (−4.71)	−398.87 (−4.92)	−388.04 (−4.74)
Year97		−10.91 (−6.35)	−7.24 (−4.28)	−4.15 (−1.98)
Year98		1.66 (0.97)	−0.92 (−0.05)	−1.68 (−0.81)
Year99		−1.31 (−0.76)	−1.13 (−0.67)	−2.22 (−1.06)
Foreign and Government Bank borrowing				−0.22 (−0.16)
Year97 × MKTV96 (coefficient × 100)			−1.11 (−9.43)	−0.95 (−8.61)
Year98 × MKTV96 (coefficient × 100)			0.44 (4.05)	0.43 (3.92)
Year99 × MKTV96 (coefficient × 100)			−0.48 (−0.44)	−0.37 (−0.33)
Year97 × EXP				−2.77 (−0.98)
Year98 × EXP				3.78 (1.34)
Year99 × EXP				3.32 (1.18)
Year97 × IMP				−8.57 (−3.29)
Year98 × IMP				2.79 (1.06)
Year99 × IMP				0.74 (0.28)
R-squared	0.12	0.17	0.23	0.24

Note: T-statistics in parentheses; 1184 observations (296 × 4 years).

316 Alternatively, scale-effects in costs may further help explain why the earnings per share
 317 of the largest firms suffered the most during the crisis. In Eq. (1), we assumed constant
 318 unit costs; unit costs do not depend on how much the firm is producing (c_i and c_i^F do
 319 not depend on the scale of output). However, suppose—as it seems likely—that unit costs
 320 decline with production. Large Thai firms will then have lower unit costs than small firms.
 321 Given scale effects, as production declines with the crisis, unit costs will increase. In fact,
 322 since the largest firms will bear the brunt of the decline in demand, the unit costs of the
 323 largest firms will increase faster than the unit costs of the smaller firms. Thus, during a

324 crisis, the earnings per share of the largest firms may fall faster than the earnings per share
325 of the smaller firms. From [Tables 1 and 2](#), column 4, if the scale effect is the case, then
326 the effect would be asymmetric impact. It damaged more to import related industry than
327 in export related industry during the adjustment period in 1998 and 1999 as evidence from
328 insignificance of Year98 and 99 \times IMP from both tables. Exporter may operate at their full
329 capacity, while the importer may face a supply discontinuity or capacity underutilization.

330 Earnings per share was not affected by whether a firm belongs to an industry borrowing
331 from a domestic bank, or from a government/foreign bank (column 3), confirming the
332 theoretical ambiguity. As expected, the crisis affected the earnings per share of importing
333 firms by more than those of exporting firms (column 4). Since the baht flotation was done in
334 the mid of 1997, the lagging effect in 1997 was not clear evidence in both export and import
335 until the subsequent year. Essentially, the import had collapsed in the 1998 and 1999, while
336 the export had surged. It is worth noted that Thailand have had a trade surplus, on average,
337 more than one billion US\$ per month during this period by using up all idle capacity. But
338 this trade surplus should not be expected to continue or to be sustainable in 2001 since Thai
339 export industries have a very high import content or mostly reprocessing type rather than
340 high-valued added industries and services.

341 As per earlier discussion, firms with high initial (1996) debt-equity ratios experienced
342 sharper declines in earnings per share during the crisis owing to their capital structure. In
343 [Table 2](#), we include year dummies, interacted with the firm's initial (1996) debt-equity ratio.
344 Given our estimates, a rise in the initial debt-equity ratio by 10 percentage points (say, from
345 300 to 310 percent) would lower earnings per share during the crisis (1997–99) by about
346 130 baht. That firms with the highest debt-equity ratios suffered the most from the crisis
347 is strong evidence for the credit market channel. This result is robust to the inclusion of
348 various controls, including firm size, trading status, and type of borrowing bank.

349 7. Conclusions

350 In this paper, we developed and estimated a model of the Thai firm during the crisis. Our
351 results indicate that firms with the highest debt-equity ratios suffered the steepest declines
352 in earnings per share during the crisis from the financial distressed costs. We take this
353 result as strong evidence for the credit channel. Surprisingly, firms with the largest market
354 capitalizations suffered more than the smaller firms owing to their capital structure and
355 financial leverage effect. The firm size is moreover noted to be positively correlated with
356 leverage owing to readily available public information to fund providers.

357 We also witness asymmetric impact between the industries—exporters, importers and
358 intermediate. We take this as evidence of different scale-effects on different industries,
359 a feature that we do not explicitly model. In other words, the production effect is more
360 pronouncing in import related industries than the export-oriented one. Note that firms that
361 import intermediate goods suffered greatly from the crisis from both credit and production
362 channels. Taken together, our overall results indicate that the crisis damaged the earnings
363 per share of firms more on credit channels than the production channels.

364 Our results have important policy implications. First, regulatory authorities in emerging
365 markets should be aware of the risks posed by high debt-equity ratios. Firms with high

366 debt-equity ratios are especially vulnerable during crisis. Second, regulatory authorities
 367 in emerging markets should be aware on asymmetric impact in production channel on
 368 different industries. When the exchange rates depreciates during crisis, firms importing
 369 goods are especially vulnerable. As a reprocessing industrial based, Thailand has many
 370 manufacturing firms importing machinery and parts. There exists a tradeoff between the
 371 benefits from currency devaluation from exports, and the severe adverse impact through the
 372 credit channel.

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379 Appendix A

380 See [Tables A.1 and A.2](#).

Table A.1
International trading status by Thai Industry

Exporting	Importing intermediate products
Agriculture	Building and furnishing
Electronic products	Chemical and plastic
Electronic components	Communication
Jewelry and ornaments	Energy
Textiles	Household goods
	Packaging
	Pharmaceuticals
	Printing
	Pulp and paper
	Transportation
	Vehicles
Non-tradeables	
Commerce	
Entertainment	
Food and beverage	
Health	
Hotels	
Insurance	
Professional service	
Property development	
Warehousing	

Table A.2
Thai bank borrowing by industry

Domestic private banks	Foreign and government banks
Agriculture	Building and furnishing
Commerce	Chemical and plastic
Entertainment	Communication
Food and beverage	Electronic and computer products
Health.	Electronic components
Hotel	Energy
Household Goods	Transportation
Insurance	Vehicles and parts
Jewelry and ornaments	
Machinery and equipment	
Mining	
Packaging	
Pharmaceuticals	
Printing	
Professional service	
Property	
Pulp and paper	
Textiles	
Warehousing	

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