รายงานวิจัยฉบับสมบูรณ์

ทุนมนุษย์พอเพียงกับการเจริญเติบโตของเศรษฐกิจไทย

Sufficiency Human Capital and Economic Growth of the Thai Economy

โดย

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มีนาคม 2554

สัญญาเลขที่ TRG5280010

รายงานวิจัยฉบับสมบูรณ์

โครงการ ทุนมนุษย์พอเพียงกับการเจริญเติบโตของเศรษฐกิจไทย

Sufficiency Human Capital and Economic Growth of the Thai Economy

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สนับสนุนโดยสำนักงานคณะกรรมการการอุดมศึกษา
และสำนักงานกองทุนสนับสนุนการวิจัย

(ความเห็นในรายงานนี้เป็นของผู้วิจัย สกอ. และ สกว.ไม่จำเป็นต้องเห็นด้วยเสมอไป)

กิตติกรรมประกาศ

งานวิจัยฉบับนี้คณะผู้วิจัยได้ทุ่มเทการทำงานอย่างเต็มที่ ภายใต้งบประมาณสนับสนุนจากสำนักงานกองทุนสนับสนุนการวิจัย (สกว.) และสำนักงานคณะกรรมการอุดมศึกษา (สกอ.) เพื่อศึกษาถึงระดับการศึกษาที่เหมาะสมสำหรับแรงงานในประเทศไทยส่วนหนึ่ง และอีกส่วนหนึ่งศึกษาในระดับจุลภาคซึ่งได้ศึกษาวิจัยในภาคอุตสาหกรรมในเขตนิคมอุตสาหกรรมภาคเหนือ (ลำพูน) และได้ศึกษาเพิ่มเติมในภาคบริการในเขตจังหวัดเชียงใหม่

คณะผู้วิจัยขอขอบคุณ ร.ศ.ดร.เสถียร ศรีบุญเรือง ที่ได้ให้คำปรึกษาอย่างดียิ่ง ตลอดจนกลุ่มตัวอย่างในเขตนิคมอุตสาหกรรม (ลำพูน) และในจังหวัดเชียงใหม่ ที่สละเวลาอันมีค่าโดยให้ข้อมูลที่เป็นประโยชน์ในการทำวิจัย และขอขอบพระคุณทุกท่านที่มีส่วนช่วยให้งานวิจัยนี้ประสบผลสำเร็จ ทั้งนี้ผลงานวิจัยที่เกิดขึ้นไม่ได้โดยปราศจากงบประมาณสนับสนุนจาก สกว. และ สกอ. และสุดท้ายขอขอบคุณผู้ที่ช่วยเหลืองานวิจัยทั้งทางตรงและทางอ้อมในครั้งนี้ คณะผู้วิจัยหวังเป็นอย่างยิ่งว่าประโยชน์จะกลับไปสู่ผู้ที่ให้ข้อมูล ผู้มีส่วนได้ส่วนเสีย และผู้อ่านในที่สุด

กิจจา โตไพบูลย์

เอกชัย ไชยจิตร

กัลยารัตน์ คงพิบูลย์กิจ

มีนาคม 2554

บทสรุปสำหรับผู้บริหาร

ความสำคัญ/ความเป็นมา

ความท้าทายของกรอบแนวคิดการพัฒนาที่ยั่งยืน ตามแนวพระราชดำริปรัชญาเศรษฐกิจพอเพียง โดยการนำทุนทางสังคม และทุนทางทรัพยากรธรรมชาติ ที่มีอยู่หลากหลาย มาประยุกต์ใช้ให้เกิดประโยชน์ได้อย่างเหมาะสม โดยมีกรอบแนวทางการพัฒนาคุณภาพ (มนุษย์) ให้มีความรู้ มีสมรรถนะและมีผลิตภาพสูงขึ้น สามารถปรับตัวได้ทันการเปลี่ยนแปลง ทั้งด้านเศรษฐกิจ สังคม และเทคโนโลยี และมีทักษะในการนำความรู้และข้อมูลต่างๆ มาวิเคราะห์และเลือกใช้ ในการดำรงชีวิตอย่างเหมาะสมและรู้เท่าทัน มีจิตสำนึกรับผิดชอบต่อสังคมทรัพยากรธรรมชาติและสิ่งแวดล้อม มีพฤติกรรมการผลิต การออม การบริโภคที่เหมาะสม

ทั้งนี้ทุนมนุษย์ การลงทุนทางตรงจากต่างชาติ การลงทุนในประเทศ การค้าระหว่างประเทศ และปัจจัยอื่นๆ เป็นปัจจัยที่สำคัญในการเพิ่มรายได้ของประเทศให้สูงขึ้น และแสดงถึงความมั่งคั่งของประเทศในทางทฤษฎี ซึ่งนักเศรษฐศาสตร์พัฒนาหลายท่านที่มีผลลัพธ์และแนวคิดไปทางบวกกับปัจจัยต่างๆที่กล่าวมา แต่ปัญหาคือหลังจากที่ประเทศไทยประยุกต์ทฤษฎีเหล่านั้นมาใช้แล้ว “ทำไมเศรษฐกิจประเทศไทยจึงไม่เจริญเติบโตอย่างยั่งยืนหรือไม่เป็นประเทศในกลุ่มพัฒนาแล้วเสียที” ดังนั้นคณะผู้วิจัยพยายามที่จะศึกษาถึงปัจจัยต่างๆเหล่านี้ โดยใช้แนวพระราชดำริปรัชญาเศรษฐกิจพอเพียงมาเป็นพื้นฐานในการทำวิจัยเพื่อหาทางออกเพื่อตอบคำถามดังกล่าว และนำผลที่ได้มาประยุกต์ใช้เพื่อเป็นแนวทางในการดำเนินนโยบายในการพัฒนาเศรษฐกิจของประเทศอย่างยั่งยืนต่อไป

คำถามการวิจัย (Research Questions)

1. ระดับการศึกษาที่เหมาะสมที่สุดของประเทศไทยคือกี่ปี
2. ทุนมนุษย์มีความสำคัญอย่างไรต่อการเจริญเติบโตของเศรษฐกิจไทย
3. ปัจจัยที่มีผลกระทบต่อการเจริญเติบโตของเศรษฐกิจไทยประกอบไปด้วยอะไรบ้าง และอย่างไร
4. การศึกษาระดับใดเหมาะสมที่สุด สำหรับภาคอุตสาหกรรมในนิคมอุตสาหกรรมภาคเหนือ (ลำพูน)

วัตถุประสงค์ของโครงการ

1. เพื่อศึกษาปัจจัยที่มีผลกระทบต่อการเจริญเติบโตของเศรษฐกิจไทย ทั้งด้านเศรษฐศาสตร์และสังคมศาสตร์ โดยเน้นหนักที่ปัจจัยทางด้านทุนมนุษย์ และปัจจัยรองอาทิเช่น การลงทุนในประเทศ การลงทุนทางตรงจากต่างชาติ การค้าระหว่างประเทศ และปัจจัยอื่นๆ
2. เพื่อประเมินและหาแนวทางแก้ไขเพื่อตอบปัญหาทางด้านเศรษฐกิจไทยอย่างเป็นระบบ
3. เพื่อศึกษาแนวทางในการจัดทำร่างแผนปฏิบัติการในการแก้ไขปัญหาเสนอแนะ ต่อฝ่ายที่เกี่ยวข้อง และสร้างความเป็นไปได้ในการสร้างกฎเกณฑ์และนโยบายที่เหมาะสม และมีประสิทธิภาพ

ระเบียบวิธีวิจัย

ระเบียบวิธีของการวิจัยซึ่งผู้วิจัยจะใช้การวิจัยเชิงประยุกต์ คือ การวิจัยเชิงประสมประสานระหว่างการวิจัยเชิงคุณภาพ (Qualitative Research) โดยใช้ข้อมูลปฐมภูมิและข้อมูลทุติยภูมิ ที่เรียกว่า First & Secondary Documentary Back-up และขณะเดียวกันผู้วิจัยจะแปลงและปรับเชิงคุณภาพบางส่วนเพื่อให้เป็นเชิงปริมาณ (Quantitative Research) ตามความเหมาะสม และให้เข้ากับสถานการณ์ของการบริหารยุคใหม่ที่เกี่ยวข้องกับเชิงนโยบาย ที่จะต้องเข้าใจปรากฏการณ์ของปัญหาอย่างชัดเจน ดังนั้นผู้วิจัยจึงกำหนดรูปแบบการวิจัยดังนี้

1. การวางแผนการวิจัย
2. การรวบรวมเอกสารและการแสวงหาข้อมูลสนับสนุนกรอบแนวคิดทั้งระดับมหภาค และระดับจุลภาค
3. การเก็บข้อมูลทั้งด้านปฐมภูมิ และทุติยภูมิ
4. การจัดระบบรหัสข้อมูล (data coding system)
5. การจัดระบบข้อมูล (data sourcing)
6. การวิเคราะห์และสังเคราะห์ข้อมูลทั้งหมด
7. การนำเสนอข้อมูล
8. วิเคราะห์ความน่าเชื่อถือในการวิจัย และนิยามปฏิบัติการ

ผลการศึกษา

1. จากการใช้บัญชีของการเจริญเติบโตโดยผู้วิจัย พบว่าการเจริญเติบโตของประสิทธิภาพการผลิตยังคงมีค่าเป็นบวก และมีนัยสำคัญโดยเฉพาะอย่างยิ่งช่วงก่อนวิกฤติเศรษฐกิจระหว่าง ค.ศ. 1973 ถึง 2006 ซึ่งการสะสมทุนเป็นปัจจัยสำคัญของการเจริญเติบโต

2. ผู้วิจัยได้ใช้การวิเคราะห์ถดถอย โดยใช้แบบจำลอง error-collection model เพื่อตรวจสอบผลกระทบของการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศบนผลิตภาพการเจริญเติบโตในระยะสั้นและระยะยาว พบว่าหลังจากควบคุมการลงทุนภายในประเทศ ผลกระทบเกิดขึ้นมีนัยสำคัญในด้านการค้าระหว่างประเทศ แต่ไม่พบในการลงทุนทางตรงระหว่างประเทศ ถึงแม้ได้รวมทุนมนุษย์เข้ากับการลงทุนทางตรงระหว่างประเทศแล้วก็ตาม และผลการศึกษาเพิ่มเติมพบว่าการศึกษาระดับการเข้าชั้นเรียนมัธยมอย่างน้อย 4.5 ปีเป็นระดับการศึกษาที่เหมาะสมสำหรับประเทศไทย

3. ผู้วิจัยได้ศึกษาสมมติฐานมากมาย โดยเฉพาะอย่างยิ่งการส่งออกส่งเสริมการเจริญเติบโตและการลงทุนทางตรงระหว่างประเทศส่งเสริมการเจริญเติบโต และการเชื่อมโยงระหว่างปัจจัยการเจริญเติบโต การลงทุนทางตรงระหว่างประเทศ และการส่งออก โดยใช้การทดสอบพหุตัวแปร (Multivariate) Granger causality และ Vector Error Correction เป็นขอบข่ายงานในการศึกษา ผู้วิจัยพบว่าการลงทุนทางตรงระหว่างประเทศส่งเสริมการเจริญเติบโตได้น้อยกว่าการส่งออกในประเทศไทย

4. ผู้วิจัยพบว่าการเจริญเติบโตในประเทศขึ้นอยู่กับการลงทุนและการค้าระหว่างประเทศ แต่การเจริญเติบโตส่งเสริมการลงทุนทางตรงระหว่างประเทศได้น้อย อีกทั้งทุนมนุษย์มีผลไม่แตกต่างจากการลงทุนทางตรงระหว่างประเทศ

5. การศึกษาในระดับจุลภาคที่นิคมอุตสาหกรรมลำพูนผู้วิจัยพบว่า ปัจจัยที่มีผลต่อทุนมนุษย์หรือการศึกษาในนิคมอุตสาหกรรมลำพูนคือ รายได้ สถานภาพ และประสบการณ์ของแรงงาน

ข้อเสนอแนะสำหรับการศึกษาครั้งต่อไป

มีสิ่งที่น่าสนใจอีกมากในเศรษฐกิจไทยที่ยังต้องศึกษาถึงผลกระทบ ซึ่งสามารถพิจารณาได้จากการทบทวนวรรณกรรมดังรายละเอียดต่อไปนี้

- การเข้าถึงตลาดโลก (access to world markets)
- บัญชีทุน ส่วนต่างของอัตราแลกเปลี่ยน และอัตราแลกเปลี่ยน (capital account, foreign exchange earnings and exchange rate)
- ผู้ลงทุนในประเทศ (domestic firms)

- การออมในประเทศ และการลงทุนในประเทศ (domestic savings and investment)
- สิ่งแวดล้อม (environment)
- การจ้างงาน และค่าจ้างแรงงาน (employment and wages)
- ความไม่เสมอภาค (inequality)
- โครงสร้างพื้นฐาน (infrastructure)
- ทรัพย์สินทางปัญญา และสิทธิบัตร (intellectual property rights and patents)
- แรงงาน และมาตรฐานสิ่งแวดล้อม (labour and environmental standards)
- ระดับทักษะแรงงานในท้องถิ่น (local skill level (human capital))
- โครงสร้างตลาด และการเปลี่ยนโครงสร้างด้านอุตสาหกรรม (market structure, industrial restructuring)
- การวิจัยพัฒนา (research and development activity)

จากการทบทวนวรรณกรรมสิ่งต่าง ๆข้างบนนี้เป็นสิ่งที่ควรต่อยอดในการวิจัยครั้งนี้

<u>**เอกสารแนบหมายเลข 2**</u>

บทคัดย่อ

รหัสโครงการ : TRG5280010

ชื่อโครงการ : ทุนมนุษย์พอเพียงกับการเจริญเติบโตของเศรษฐกิจไทย

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<u>Attachment number 2</u>

Abstract

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บทคัดย่อ

งานวิจัยนี้ได้สำรวจบทบาทของการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศ (Foreign Direct Investment) ผ่านการเคลื่อนย้ายเทคโนโลยี (Technology Transfer) และได้ทดสอบโดยการกำหนดความสัมพันธ์ของตัวแปรที่สนับสนุนการเจริญเติบโตของเศรษฐกิจไทย จากพื้นฐานทฤษฎีการเจริญเติบโตในอดีตได้กล่าวถึงการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศจะได้ประโยชน์ต่อประเทศผ่านการสะสมทุนและการเคลื่อนย้ายทรัพยากร ในขณะที่ทฤษฎียุกต์ใหม่ที่ให้ความสำคัญกับปัจจัยภายในได้พิจารณาการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศเป็นตัวขับเคลื่อนการเลื่อนย้ายทุนจากต่างชาติ โดยการเพิ่มความหลากหลายของปัจจัยในประเทศเพื่อขีดศักยภาพแข่งขันกับผู้ผลิตภายในประเทศ ซึ่งในบริบทนี้การลงทุนในทุนมนุษย์ (Human Capital) ผ่านการศึกษา เป็นสิ่งสำคัญทำให้การเจริญเติบโตของเศรษฐกิจดีขึ้นโดยผ่านการพัฒนาเทคโนโลยีอย่างต่อเนื่อง มีการศึกษาในประเทศกำลังพัฒนาอ้างถึงการพัฒนาระดับทุนมนุษย์ที่เหมาะสมสามารถส่งผลให้ได้ประโยชน์จากการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศ

เพื่อศึกษาทฤษฎีพื้นฐานดังกล่าว งานวิจัยเชิงทดสอบฉบับนี้ได้สืบค้นและศึกษาถึงผลกระทบของทุนมนุษย์ การค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศบนผลิตภาพการเจริญเติบโตของเศรษฐกิจไทยระหว่าง ค.ศ.1973 ถึง 2006 เริ่มจากการใช้บัญชีของการเจริญเติบโตโดยผู้วิจัยได้สืบค้นทรัพยากรที่ส่งผลถึงการเจริญเติบโตของไทย โดยใช้ทุนมนุษย์และกำหนดผลกระทบต่อประสิทธิภาพการผลิตรวม (Total Factor Productivity) ผู้วิจัยพบว่าการเจริญเติบโตของประสิทธิภาพการผลิตยังคงมีค่าเป็นบวก และมีนัยสำคัญโดยเฉพาะอย่างยิ่งช่วงก่อนวิกฤติเศรษฐกิจระหว่าง ค.ศ. 1973 ถึง 2006 ซึ่งการสะสมทุนเป็นปัจจัยสำคัญของการเจริญเติบโต ประการที่สองผู้วิจัยได้ใช้การวิเคราะห์ถดถอย โดยใช้แบบจำลอง error-collection model เพื่อตรวจสอบผลกระทบของการค้าระหว่างประเทศ และการลงทุนทางตรงระหว่างประเทศบนผลิตภาพการเจริญเติบโตในระยะสั้นและระยะยาวโดยใช้ข้อมูลสถิติ รายไตรมาศของไทยระหว่าง ค.ศ. 1973:2 ถึง 2006:4 ผู้วิจัยพบว่าหลังจากควบคุมการลงทุนภายในประเทศ ผลกระทบเกิดขึ้นมีนัยสำคัญในด้านการค้าระหว่างประเทศ แต่ไม่พบในการลงทุนทางตรงระหว่างประเทศ ถึงแม้ได้รวมทุนมนุษย์เข้ากับการลงทุนทางตรงระหว่างประเทศแล้วก็ตาม และผลการศึกษาเพิ่มเติมพบว่าการศึกษาระดับการเข้าชั้นเรียนมัธยมอย่างน้อย 4.5 ปีเป็นระดับการศึกษาที่เหมาะสมสำหรับประเทศไทย สุดท้ายผู้วิจัยได้ศึกษาสมมติฐานมากมายโดยเฉพาะอย่างยิ่งการส่งออกส่งเสริมการเจริญเติบโต และการลงทุนทางตรงระหว่างประเทศส่งเสริมการเจริญเติบโต และการ

เชื่อมโยงระหว่างปัจจัยการเจริญเติบโต การลงทุนทางตรงระหว่างประเทศ และการส่งออก โดยใช้การทดสอบพหุตัวแปร (Multivariate) Granger causality และ Vector Error Correction เป็นขอบข่ายงานในการศึกษา ผู้วิจัยพบว่าการลงทุนทางตรงระหว่างประเทศส่งเสริมการเจริญเติบโตได้น้อยกว่าการส่งออกในประเทศไทย ยิ่งไปกว่านั้นผู้วิจัยพบว่าการเจริญเติบโตในประเทศขึ้นอยู่กับการลงทุนและการค้าระหว่างประเทศ แต่การเจริญเติบโตส่งเสริมการลงทุนทางตรงระหว่างประเทศได้น้อย อีกทั้งทุนมนุษย์มีผลไม่แตกต่างจากการลงทุนทางตรงระหว่างประเทศ ถึงแม้ผู้วิจัยให้ความสำคัญกับทุนมนุษย์ ดังนั้นนโยบายรัฐบาลด้านการศึกษา และการสะสมทุนมนุษย์ในประเทศไทยรัฐบาลจึงต้องให้ความสำคัญที่สุด

Abstract

This research explores the role of trade and FDI as channels of technology transfer, and empirically assesses their relative contribution to economic growth under sufficiency economy philosophy in Thailand. Traditional neoclassical theories of growth view openness to trade and FDI as beneficial to the economy through capital accumulation and reallocation of resources, while new endogenous growth theories regard FDI and trade as vehicles for international technology transfer by increasing the variety of new inputs in the country to compete with those produced by domestic firms. In this context, investment in human capital through education is seen as important in facilitating growth through the process of technology adoption. It is argued that developing countries need to have attained a certain threshold of human capital development to benefit through spillovers from trade and FDI.

Against this theoretical background, this thesis empirically investigates the significance of the interaction of human capital, FDI and trade openness on the productivity growth of the Thai economy over the period 1973-2006. First, using growth accounting, we investigate the sources of Thai growth by incorporating human capital and assessing its impact on total factor productivity. We find that total factor productivity growth is still positive and significant especially in the pre-crisis period, 1973-1996, although attribute a major part of output growth during this period to factor accumulation. Second, we estimate by regression an error-correction model to examine the short run and long run effects of trade and FDI on productivity growth, using quarterly data for Thailand over the period 1973:2-2006:4. We find that, after controlling for domestic investment, the effect of trade is significant while that of FDI is not, although allowing for the joint interaction of FDI and human capital reveals a positive FDI effect above a minimum threshold of human capital, estimated to be around 4.5 years of secondary schooling attainment. Finally, we investigate a number of hypotheses, including export-led growth and FDI-led growth, as well as the reverse linkages from growth to FDI and exports, using multivariate Granger causality tests conducted within a vector error-correction framework. We find that support for FDI-led growth is not as strong as export-led growth for Thailand. We also find that domestic growth in Thailand has influenced domestic investment and trade

openness, but support for growth-led FDI is also weak. Allowing for human capital interaction does not much difference to the role of FDI, although we argue that this finding does not undermine the importance of Thailand's policy towards education and the accumulation of human capital.

ACRONYMS

ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller
AIT	Asian Institute of Technology
ASEAN	Association of South-East Asian Nations
BMR	Bangkok Metropolitan Region
BOI	Board of Investment
B-L	Barro and Lee
BOT	Bank of Thailand
BVAR	Bivariate Vector Autoregression
CDC	Collection Development Committee
ECM	Error Correction Model, or Error Correction Mechanism
ECOSOC	Economic and Social Council
EPD	Export Promotion Department
E-G	Engle and Granger
ELG	Export Led Growth
EP	Export Promotion
EPZ	Export Processing Zone
ESBDP	Eastern Seaboard Development Programme

EU	**European Union**
FDI	**Foreign Direct Investment**
FPE	**Final Predict Error**
GDP	**Gross Domestic Product**
GDPPC	**Gross Domestic Product per capita**
IBRD	**International Bank for Reconstruction and Development**
IMD	**International Institute for Management Development**
IMF	**International Monetary Fund**
IS	**Import Substitution**
LFS	**labour Force Survey**
LR	**Likelihood Ratio**
LDC	**Less Developed Country**
ME	**Maximum Eigenvalue**
MNCs	**Multinational Corporations**
MOI	**Ministry of Industry**
NBER	**National Bureau of Economic Research**
NESDB	**National Economic and Technology Development Board**
NICs	**Newly Industrialised Courtiers**
NSO	**National Statistics Office**
NIEs	**Newly Industrialised Economies**

OLS	**Ordinary Least Square**
ONEC	**Office of National Education Commission**
OECD	**Organisation for Economic Co-operation and Development**
PIM	**Perpetual Inventory Method**
PPP	**Purchasing Power Parity**
R&D	**Research and Development**
RIIA	**Royal Institute of International Affair**
SMEs	**Small and Medium Enterprises**
TDRI	**Thailand Development Research Institute**
TFP	**Total Factor Productivity**
TFPG	**Total Factor Productivity Growth**
UN	**United Nations**
UNCTAD	**United Nations Conference on Trade and Development**
UNDP	**United Nation Development Programme**
VAR	**Vector Autoregression**
VECM	**Vector Error Correction Model**

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Chapter 1

Introduction

The hypothesis that much of technological progress in new capital goods, and therefore investment in new capital is necessary to foster productivity growth, is tracking its roots at least as far back as Adam Smith's Wealth of Nations, which attributed its source to the division of labour: "The invention of all those machines by which labour is so much facilitated and abridged, seems to have been originally owing to the division of labour" (Smith, 1776, p.9). The basic hypothesis was refined and extended over time by Robert M. Solow (1956), among others[1]. In his study of total factor productivity, Solow identifies two distinct approaches. First, total productivity may be tread as an index number, the ratio of indexes of total output and total input. Since the rate of the growth of output and inputs vary from period to period, the rate of growth of total factor productivity may vary. Second, total factor productivity may be tread as a function of a particular form (i.e. an exponential function of time). The parameters of such a function may be treated as unknown to be estimated from data on output and input. Where total factor productivity grows exponentially, the rate of growth remains constant.

In either approach changes in the index of total factor productivity may be interpreted as shifts in an aggregate production function or as *disembodied*[2] technical progress. This interpretation of the index of total factor productivity with a constant rate of growth was first proposed by Tinbergen (1942). The corresponding interpretation of total factor productivity with

[1] In The Communist Manifesto, Marx argued that technological advances in machinery are a distinguishing feature of the "bourgeois" (i.e. materialistic) or capitalist system: "The bourgeoisie cannot exist without constantly revolutionizing the instruments of production, and thereby the relations of production, and with them the whole relations of society" (Marx and Engel, 1848).

[2] Improvements in technical knowledge that allow more output to be obtained from given inputs without the need to invest in new equipment.

a rate of growth that varies was first given by Solow (1956). Moreover, changes in the index of total factor productivity have been interpreted by Solow as technical change *embodied*[3] in new capital goods. In this analysis, Solow assumes that embodied technical progress takes place at a constant exponential rate, but according to him it is clear that the rate of growth could be treated as varying from period to period. Solow assumes, implicitly, that investment goods are perfect substitutes in production.

The neoclassical growth model of Solow (1956), built upon the assumption of diminishing returns to capital, predicts that in the absence of continuing improvements in technology, per capita growth must eventually *cease*. To reconcile the theory with observed continuing per capita growth for many countries during the past century or so, the neoclassical growth theorists resort to the assumption of continuing *exogenous technological progress*. An obvious shortcoming of this assumption is that it attributes the long run per capita growth to an element that is outside of the model. To provide a more satisfying theory in long run percapita growth, the *new endogenous growth theories* have been developed by Romer (1986, 1987, 1990), Lucas (1988), Rebelo (1991), Grossman and Helpman (1991a) and Aghion and Howitt (1992), Fors (1996) among others. These new growth models, by stressing the roles of human capital accumulation, learning by doing, research and development (R&D) and knowledge spillovers in economic growth, explain long term per capita growth endogenously.

The main focus of this research is to assess the importance of the role of technology transfer associated with factors such as human capital, foreign direct investment (FDI) and trade, in the post-1973 growth of the Thai economy. It is now well established in the endogenous growth literature that human capital plays a crucial role in enhancing economic

[3] Improved techniques can be exploited only by investing in new equipment embodying the new knowledge.

growth. However, depending on the economy's starting point, technical progress and growth can be based on the creation of entirely new knowledge, or adaptation and transfer of existing foreign technology. This potential for convergence is conditional on the economy's level of human capital. More specifically, as noted by Van den Berg (2001: p. 226), "it is the quality of the labour force, its accumulated experience and human capital, its education system, that determines an economy's ability to create new ideas and adapt old ones". Consequently, improvements in education and human capital are essential for absorbing and adapting foreign technology, and to generate sustainable long run growth.

Along with trade openness, the most important vehicle for international technology transfer is foreign direct investment. It is well known that multinational corporations (MNCs) undertake a major part of the world's private R&D efforts and produce, own and control most of the world's advanced technology. However, MNC technology may still leak to the surrounding economy through external effects or technology transfer that raises the level of human capital in the host country and creates productivity increases in local firms. In many cases, the labour market is another important channel for spillovers, as almost all MNCs train operatives and managers who may subsequently take employment in local firms or establish entirely new companies. This way, FDI may be a particularly valuable source of new technology, it not only introduces new ideas but it also strengthens the human capital base needed to adapt these ideas to the local market.

As argued by Razin and Sadka (2001), FDI is regarded as a vehicle for international technology transfer by increasing the variety of new inputs in the country to compete with those producers by domestic firms. In addition, they conclude that there are three possible sources of gains from FDI flows: (i) traditional capital mobility gain (from the use of foreign saving to augment the domestic capital stock), (ii) gain from technology transfer, and (iii) gain from the promotion of competition in the input market. However, Borensztein et al. (1998) suggest that FDI and human capital interact in a complex manner, where FDI inflows create a potential for spillovers of knowledge to the local labour force, at the same time as the host country's level of human capital determines how much FDI it can attract and whether local firms are able to absorb the potential spillover benefit.

In the augmented Solow model of Mankiw et al. (1992), and the extended neoclassical model of Barro (1991, 1997, 1998), human capital serves as an additional input to production, apart from physical capital and labour. In particular, these models expand on the neoclassical growth model of Solow (1956) by allowing the output of a country to be an increasing function, albeit with diminishing returns, of its stock of human capital. These models seek to explain the factors that determine why countries grow at different rates. An implication from this literature is that investment in human capital through education leads to increased output and growth. However, developing countries need to have attained a certain threshold of economic development to be able to fully absorb new technologies, as argued by Borensztein et al. (1998). On the other hand, the inflow of foreign investment can foster economic growth in the host economy by easing shortages of capital, foreign exchange, technology and skills, among other things. The growth process can be further sustained by backward and forward linkages that emerge from MNEs to the domestic economy if FDI contributes to raising the profitability of domestic investment. One of the issues addressed in this research is whether FDI contributes relatively more to economic growth than domestic investment, in the case of Thailand over the period 1973-2006. In particular, we argue that, the growth enhancing effects of FDI may depend in part on whether FDI *crowds out* or *crowds in* domestic investment[4]. Also, its impact may depend crucially on the absorption of new technology by the host country (Thailand), and more importantly on the minimum threshold of human capital required to sustain long run growth.

There is now a growing theoretical and empirical literature dealing with the relationship between FDI, human capital and economic growth[5]. Although there are numerous factors determining the inflow of FDI in developing countries, recent empirical studies (e.g. de Mello (1997)) suggest that one of the most important factors determining the surge of FDI inflows into the developing countries in recent years has been the privatisation and globalisation of production. In addition, several factors including the degree of political stability, the nature of government policy, trade and investment regime, the openness of the host country, and the size of the market, are possible determinants of FDI flows.

However, Balasubramanyan et al. (1996) also investigate the effect of FDI on growth in developing countries and report two main findings. First, growth enhancing effects of FDI are stronger in countries that pursued a policy of export promotion (EP) rather than import substitution (IS), suggesting that the trade policy regime is an important determinant of the effects of FDI. Second, they find that, in countries with export promoting trade regimes, FDI has a stronger effect on economic growth than domestic investment. These finding are supportive of the results of Borensztein et al. (1998). The second finding may be viewed as a confirmation of the hypothesis that FDI aids economic growth through technology transfer by complementing the growth enhancing effect of domestic investment. In effect, increasing the

[4] If FDI crowds out investment by domestic firms, the increase in domestic investment ought to be smaller than the increase in FDI. However, if there is crowding in, domestic investment ought to increase by more than the increase in FDI. See Borensztein et al. (1998) p. 128 for further details.

[5] See Chapter 2 for a review of this literature within the context of the endogenous growth theory.

varieties of foreign inputs in domestic production would deliver faster economic growth through economies of scale, reallocation of resources and investment competition.

In the light of these recent contributions emphasising the importance of human capital, FDI, and trade openness in influencing economic growth through technology transfer, the major goal of this research is to empirically investigate the interaction between FDI, human capital, trade openness, domestic investment and economic growth in the case of the Thai economy. More specifically, this research aims to:

1. Assess the importance of the role of human capital (provided by some measure of the country's educational attainment) in the growth process of the Thai economy during the period 1973 - 2006,
2. Determine empirically the critical threshold level of human capital through which FDI makes a positive contribution to economic growth of Thailand over the period 1973:2 - 2006:4,
3. Examine the relative contributions, again empirically, of factors like trade and domestic investment, alongside human capital and FDI, to the economic growth of Thailand over the same period (1973:2 - 2006:4).

The methodology employed in the investigation of the first objective is growth accounting, allowing us to examine the relative contribution of human capital and factor accumulation in the growth of the Thai economy. The second and third objectives are tackled by employing regression techniques. We first estimate an estimate an error-correction model for Thailand (using quarterly data over the period 1973:2-2006:4) and examine the influence of the interaction of human capital and FDI (alongside other factors), allowing us to distinguish short run effects from the long run. This is then extended to a multivariate context through the use of

Vector Auto Regressions (VAR) and Vector Error Correction Model (VECM), allowing us to employ Granger causality tests.

The remainder of this chapter is organised as follows: Section 1.1 analyses the recent history of Thailand's economic development. In section 1.2 we examine the academic debate on human capital and economic growth. Section 1.3 examines the contribution of physical capital to economic growth, focussing on the growth of the East Asian economies. Section 1.4 lays out the issues involved with FDI and human capital. Section 1.5 presents the role of openness and economic growth and section 1.6 analyses the relationship between sufficiency economy and economic growth. Finally, Section 1.7 emphasises the primary objectives and methodology of this research, and section 1.8 presents an outline of the research.

1.1 Recent History of Thailand's Economic Development

1.1.1. Early Development

It has been argued that the key factors contributing to Thailand's robust economic growth has been its abundant natural resources and cheap labour (World Bank 2009). The country, however, is rapidly losing its comparative advantage in these two factors, as steady population growth has put pressure on available land and other natural resources, and as wages have risen without commensurate increases in labour productivity. The countries with which Thailand hopes to compete in the future have moved steadily into areas and modes of production that are more and more technology intensive, leaving Thailand behind. Since the 1997 crisis, remarkable recovery has been achieved, with economic growth being positive again and perhaps above 4% in 1999 and 2006. This rate, however, is less than half that enjoyed in the decade before the crisis. In order the ensure sustainable growth in the future, Thailand will need to advance its development and adapt to new technologies, and implement other policies directed at increasing the productivity of its labour force. Special efforts are being made to raise the productivity of labour and the value of production in agriculture as this sector still employs about half of all workers and has the potential to contribute more to Thailand's economy. The industrial and service sectors are being strengthened by increasing the productivity of labour and preparing workers with the appropriate skills needed to compete in the knowledge based global economy. The key to success in these areas will be the outputs of the education and training system. With the education reforms now underway, production in Thailand should move up the value added ladder and compete more successfully in the global economy. However, the principal feature has been a shift from agriculture to industry and manufacturing as the driving force of economic growth. Thailand remarkable successful growth has been fuelled by very high levels of domestic as well as foreign investment, and especially by the extremely rapid growth of exports and foreign direct investment.

1.1.2. FDI, Trade and the Role of Government

Thailand has been a significant recipient of FDI among developing countries during the past decades. Also, Thailand has undergone a clear policy transition from an import substitution (IS) regime to export promotion (EP) over the period 1960 to 1980. The trade policy regime in Thailand was characterised by a heavy emphasis on import substitution in the 1960s to 1970s. From 1970s there has been a significant shift towards greater export orientation. Notwithstanding these setbacks and their short term repercussions, it is clear that FDI will play an integral and leading role in meeting Thailand's desperate need for long term capital and technology. Thus, there is likelihood that government policy has influenced the economic, industrialisation and investment direction of the Thai economy. The investment promotion law was also revised in 1973 to give more incentives to export industries. The export promotion strategy has continued to implement until the present time.

However, the increase in FDI to Thailand following the 1997 crisis has been due to the relatively successful implementation of macroeconomic stabilisation measures and structural break. FDI has been attracted to Thailand, as a result of privatisation, the liberalisation of the tradable sector, and FDI legislation concerning the repatriation of profits as well as the prior authorisation of investments. Nevertheless, the Thai government Board of Investment (BOI) uses a combination of foreign and domestic investment promotion, tariffs, taxes, trade controls, and price controls to promote manufactured exports. The government's Bank of Thailand provides rediscounting on targeted investment. The Export Promotion Department (EDP) provides information to select Thai exporters and foreign investors.

1.1.3. Educational Improvement

The improvement of labour quality in Thailand was a major concern of the government and its development plans often directly addressed education and human capital issues. First, the government focused on reducing the illiteracy rate from roughly 60% level of the early 1960s. In response to a shortage of skilled workers, the Ministry of Education (MOE) contracted with the National Economic Social and Development Broad (NESDB) to conduct a study on education and development. The economic plans focused on upgrading the efficiency of the workforce. The first Manpower Development Plan of 1972 required 9 years of education for boys and girls increased the number of industrial and vocational schools, and guided colleges and universities to put major emphasis on training and development of scientists and technologically skilled engineers.

The expansion of vocational schools and the focus on higher education and scientific learning came after the initial policies were implemented and economic progress took hold. In 1982, the government introduced the Science and Technology Development program that focused on high-level education and training, with key emphasis on technologies that would be needed by industry. As an indicator of their success, the ratio of students majoring in engineering and science to those majoring in social science and liberal arts increased. The government role in enhancing educational development in Thailand demonstrated the conscious effort to give education a leading role in its national development policies. The government took the lead in establishing the Asian Institute of Technology (AIT)[6] that conducts advanced research and development activities, arranges technology transfer, and searches for new technologies worldwide. There has also been some transfer of technology through the foreign investments made in Thailand indicating a degree of overlap among educational policies, government infrastructure spending, and trade policies that enhances the stock of available and implementable knowledge in the Thai economy.

1.1.4. Economic Take-off

Thai economy began to take off in the years from 1973 to 1978[7]. Between these years, the per capita growth in real GDP increased from less than 5% to 11%; public investment increased from roughly 5% to 8%, and private investment increased from 7% to 20%. Also, the output of industrial sectors began to exceed the output of agricultural sectors, and employment

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[6] AIT was founded in 1959.

[7] In the early 1960s, Thailand seemed a prototypical agricultural economy: raw and processed agricultural products comprised roughly about 40% of output; the associated employment exceeded 50%.

started moving from agriculture to other industries and manufacturing (see Chapter 3 for more details).

In summary, the economic development of Thailand relied on numerous market oriented government policies, many of which focused on supporting the accumulation of human capital in the labour force. Policies geared towards growth recognised the necessity of maintaining a skilled labour force and increasing its high technology capabilities. It is notable that progress in trade and FDI enhanced the returns gained from human capital investment and increased the accumulation of human capital in Thailand.

1.2 Human Capital and Economic Growth

This section examines the academic debate on the importance of human capital in economic growth. Later sections will look at other factors in turn.

Following the theoretical contribution by Lucas (1988) to incorporate human capital in the neoclassical growth model, several studies have examined empirically the connection between human capital and economic growth. Barro (1991), Mankiw, Romer and Weil (1992), Benhabib and Spiegel (1994) and Barro and Sala-i-Martin (1995) have shown a positive correlation between country schooling and economic growth rates. These authors offer contrasting explanations for the correlations. While Lucas (1988) treats human capital as another form of reproducible capital, Barro and Sala-i-Martin (1995) postulate that transitional higher rate of human capital accumulation will lead to a higher growth rate. As with physical capital, faster accumulation of human capital leads to an acceleration of the economy's progress toward higher levels of output. Benhabib and Spiegel (1994), on the other hand, argue that countries that posses a sufficiently high level of human capital will be able to achieve higher growth rates by having the ability to assimilate new technologies more efficaciously. In their model, which follows the work of Nelson and Phelps (1966), sufficiently high levels of human capital are a precondition for achieving growth via technological change and total factor productivity (TFP).

However, some of the growth models that incorporate influence of human capital in economic growth focus on different channels. For instance, Mankiw, Romer and Weil (1992) consider that human capital influences economic growth solely through the production of final goods. More recently, Fidel and Papageorgiou (2000) find support for the influence of human capital and economic growth through the production of final goods and as a facilitator of innovation and imitation.

To some extent the role of human capital and technology transfer are intertwined, as is the accumulation of physical capital. Human capital refers to the knowledge and skills accumulated by people. Such knowledge can be measured directly by competence such as literacy or other test scores. However, it is usually measured indirectly by years of schooling attainment as a proxy for the component of human capital stock obtained at schools (Barro and Lee (2010)). A higher educational attainment indicated higher quality of workers. Barro and Lee (2010) discussed the estimation method for measures to educational attainment and relate their estimates to alternative international measures of human capital stocks. So far there have been a number of attempts of measure educational attainment across countries. Earlier empirical studies used school enrolment ratios or literacy rates. Mankiw, Romer and Weil (1992) used the proportion of the adult population enrolled in secondary school as a proxy for human capital investment. Romer (1990) considers literacy as a proxy for human capital stock and uses the change in the literacy rate. However, there are some conceptual difficulties with the use of school enrolment data for two reasons. First, these measures do not adequately measure the aggregate stock of human capital available contemporaneously as an input to production process. In addition, in many empirical growth papers (e.g. Barro (1991)), it is not clear whether school enrolment rates are intended to represent or flow of investment in human capital or its stock. However, schooling attainment rates provide broader measure of human capital that enrolment rates. Both measures are generally better measures than the literacy rate for developing countries.

1.3 Physical Capital and Economic Growth

A measure of productive efficiency in economic growth is the increase in the real value of output produced by a unit of labour input. As an example, the value of output per hour worked in the US has roughly doubled in the period 1950-1991. Such increases in productivity can be attributed to increases in the amount of physical capital used per hour worked as well as technological progress.

The physical capital stock of the economy includes all structures, and machinery used, in combination with labour time. It is obvious that each unit of labour can bring about more output as the capital stock per hour worked increases, subject to diminishing return in the neoclassical case. But this is not the only and not necessarily the most important factor underlying economic growth. Studies by economists such as Robert M. Solow (1956) and Moses Abramovitz (1986) have shown that capital stock per hour worked accounted for approximately only 15% of US economic growth in the first half of the century. The remaining 85% could be attributed to technological progress. Edward Denison (1964) came up with similar results in his study of growth in the US and some European economies in the period 1950-1962, although during this period the contribution of capital stock was slightly greater on average.

Technological progress causes a given increase in the capital stock per hour worked to generate output more effectively due in part to replacement of old machinery by new varieties, which embody technological change. Conversely, it makes possible the attainment of any given increase in national output with a smaller increase in capital stock per hour worked. This increase in output per hour worked due to technological progress is called an increase in total factor productivity. It should be noted that capital stock per hour worked is not an entirely independent factor. As advances in technology make labour and capital more productive, firms will exploit progress by investing in newer and better capital stock. In fact, the studies mentioned above have estimated that capital accumulation in the US and other industrialised economies has largely been in response to increases in TFP. If the effects on growth of such resulting changes in the capital stock are attributed to TFP, then the rising TFP has been the single most important factor behind economic growth in the European and American economies.

1.3.1. Growth of the East Asian Economies

Of the various factors contributing to economic growth discussed above, what is the most important in explaining the miraculous performance of the East Asian economies, such as Hong Kong, S. Korea, Singapore and Taiwan over the past few decades? Most economists would rule out invention activities, since these economies have not been technological leaders. On the other hand, the outward oriented development strategy that they espouse could be the crucial factor underlying their economic growth, as they exploit the benefits of specialisation and larger market sizes. In addition, the effect of learning by doing might also be an important factor, and in this regard these economies benefit as technological followers, through imitation of the outcome of costly R&D investment of advanced industrial trade nations. Both specialisation and learning by doing contribute to TFP growth, the single important factor behind economic growth of the US and Europe earlier this century.

However, a study by Young (1993)[8] of 118 countries provides evidence that TFP growth of the East Asian NIEs has not been particularly impressive in comparison with other economies. In addition, Young argues that their growth can be largely attributed to increases in capital stock per hour worked. Table 1.1 summarises the results of Young's (1993) study for the four East Asian Tigers, showing a higher percentage of economic growth attributed to output per capita. The Table also presents the relevant TFP growth rate for the four economies together with their corresponding ranking among the 118 countries in the Young sample. It can be seen from the first row of the table that the growth of output per capita in the NIEs during the 1960 to 1985 period was truly remarkable. This high rate of over 5% put them among the five fastest-growing economies in the world and more than quadrupled the standard of living of their citizens during this period.

Table 1.1 TFP growths of the East Asian NIEs.

Annual growth of	Hong Kong	Singapore	North Korea	Taiwan
output per capita (1960 to 1985)	5.9%(3)	5.9%(4)	5.7%(5)	6.2%(2)
output per worker (1960 to 1985)	4.7%(8)	4.3%(14)	5.0%(7)	5.5%(4)
TFP (1970 to 1985)	2.5%(6)	0.1%(63)	1.4%(24)	1.5%(21)
Source: Young 1993				
Note: 1. Figure in brackets refer to rankings in the sample of 118 economies, 2.TFP = Total Factor Productivity				

[8] "Lessons from the East Asian NIEs: A Contrarian View", NBER Working Paper No. 4482, October (1993). This is an updated version of Young (1992) "A Tail of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore" NBER Macroeconomics Annual.

1.3.2. Capital Input and TFP Growth

Growth in output per unit labour input (or output per worker in Young's case) can arise either because of increases in capital per worker or because of TFP growth. Which of these account for a larger share of growth in the East Asian countries? Young (1993) shows that with the exception of Hong Kong, during the 1960 to 1985 period each of the NIEs experienced an extraordinary rise in its investment to gross domestic product (GDP) ratio. During 1960 to 1980 the ratio of investment to GDP doubled in Taiwan, tripled in Korea and quadrupled in Singapore (reaching roughly 38% in 1984). Such an increase is not typical elsewhere in the world. Outside Asia, the investment to GDP ratios for other continents were either more or less constant or they declined over the period. The high rates of capital accumulation in the NIEs surpassed the growth of the labour force, leading to high growth in capital per worker and hence output per worker.

Using growth accounting and econometric techniques, Young decomposes the growth of output per worker into growth of capital per worker and TFP growth, the latter being shown in the third row of Table 1.1. In terms of TFP growth, although Hong Kong remains one of the top performers in the world economy, Taiwan and South Korea are ranked 21st and 24th respectively, implying that these countries are no longer dramatically out-performing other economies. A total of 81 out of the 118 sample economies lie within one standard deviation (2%) of Taiwan and South Korea. Surprisingly, by this measure, economies such as Bangladesh, Uganda, Iceland, and Norway are seen to have out-performed those of South Korea and Taiwan. Singapore, where participation and investment rates have risen faster than in any of the other NIEs, experienced only 0.1% TFP growth for the period 1970 to 1985, ranking it of 63rd out of 118 countries in line of TFP growth.

In summary, the miraculously high output per capita growth rates of the East Asian NIEs can to a certain extent be attributed to the rise in their participation rates and, perhaps to a much greater extent, to their faster rate of capital accumulation. However, this by no means implies that pure factor accumulation will necessarily lead to high rates of economic growth, since the larger amounts of labour and capital inputs could be misallocated. Factor accumulation in the East Asian NIEs has been contributing substantially to growth because these economies on the whole allow the increasing amount of labour and capital to move from the less productive sectors to the more productive ones. They rely more on the market mechanism in the allocation of resources. Apparently, this implies that technology transfer has had relatively little role to play in explaining the miraculous growth of the East Asian NIEs, an issue that is discussed further in Chapter 4.

1.4. Foreign Direct Investment and Human Capital

FDI plays a key role in fostering economic growth through various channels. Foreign investment, whether in the form of direct or portfolio investment, increases the amount of capital available to the country of investment. For developing countries, where the paucity of domestic savings is often a barrier to long term growth, the higher levels of investment made possible by foreign investment will lead such countries to higher steady states growth with higher per-capita income. By increasing the capital to labour ratio in the economy, the higher levels of capital will also lead to increases in labour productivity, and consequently to higher shares of income for labour. Furthermore, studies have shown that the positive growth effects of foreign investment are much higher than equivalent amounts of domestic investment[9]. In addition to these benefits, FDI has the added benefit of technology transfer. Borensztein et al. (1995) postulate that FDI is an important vehicle for transfer of technology from more developed countries to less developed ones, making it one of the most important factors of growth, one whose contribution to growth is relatively greater than domestic investment. As foreign enterprises or multinational corporations (MNCs) invest in developing countries, they introduce capital whose effects are multifold. Beyond the primary effects of capital stock augmentation, there are secondary capital deepening effects that come from the introduction of new varieties of capital goods and more advanced technologies to the recipient country. Given that MNCs possess advantages that allow them to introduce these more advanced technologies at lower costs than domestic enterprises, investment by foreign firms contributes more to growth than equivalent investment by domestic firms. However, these secondary growth benefits from FDI achieved through the technology transfer channel accrue only to economies that possess a sufficient human capital base to absorb the advanced technology. In fact, Borensztein et al. (1998) find that below a certain threshold of human capital[10], FDI has a negative impact on growth. These findings seem to support the growth literature that stresses the necessity of high level of human capital in order to affect growth through technological change. The authors also suggest that given FDI's role as a vehicle for the adoption of new technologies, it should positively affect the rate of human capital accumulation. Thus, FDI will lead to a higher overall demand for education in the economy, and given a sufficient supply response, should lead to higher rates of human capital accumulation.

[9] DeGregorio (1992) shows in a panel data of Latin American countries that FDI is about three times more efficient than domestic investment.

[10] The threshold estimated by the Borensztein et al. is the male population above 25 years of age with an average of 0.52 years of secondary schooling.

Among other studies de Mello (1999) focusing solely on OECD countries, finds that FDI is growth enhancing only for countries where domestic and foreign capital are complements. Lipsey (2000) reports that there is little evidence on the impact of FDI inflows on domestic capital formation. Blömstron, Lipsey and Zejan (1994) find that FDI has a positive impact on growth mostly in what these authors define as “low-quality data” countries. And Saltz (1992) even finds that FDI has a negative impact on growth. As de Mello puts it: “whether FDI can be deemed to be a catalyst for output growth, capital accumulation, and technological progress seems to be a less controversial hypothesis in theory than in practice”.

1.5. Openness and Economic Growth

Openness has been considered as one of the main determinants of economic growth in developing countries. Most of the empirical research in this area has treated exports as the principal channel through which openness affects the rate of economic growth that is the export led growth hypothesis. Nevertheless, the empirical support for this hypothesis is mixed. While most cross section studies have found a positive association between exports and growth, a considerable number of studies (e.g. Giles and Williams (2000), Yousif (1999), Doraisami (1996)) applying a range of time series methodologies, found mixed results either supporting or rejecting the export-led growth hypothesis.

The export led growth hypothesis postulates that exports are a main determinant of overall economic growth. There are quite a few arguments that can be used to provide a theoretical rationale for this study. One argument based on the literature on endogenous growth theory, emphasises that exports are likely to increase long run growth by allowing a higher rate of technological innovation and dynamic learning from abroad (Lucas 1988; Romer

1986, 1989; Edwards 1992). Particularly, Grossman and Helpman (1991), Romer (1992), and Barro and Sala-i-martin (1995), argue that technological change can be influenced by a country's openness to trade. Increased openness raises imports of goods and services, which include new technology. The new, foreign technology is introduced to the domestic economy and will be learned by domestic producers. Thus, a country's openness will improve domestic technology, its production process will be more efficient, and hence its productivity will rise. Therefore, a domestic economy that is open the world trade may grow faster than protected or relatively closed economies, and thus increased openness is expected to have a positive impact on economic growth.

The relation between GDP growth and openness is, however complex and there could be other factors influencing this relationship. The liberalisation process in developing countries has led to increased growth not only through trade but also through FDI and portfolio capital flows. So, for a complete knowledge of the relation between openness and growth, one should include not only the role of trade and FDI but also the existence of linkages between trade, FDI and portfolio capital.

There is, however increasing agreement on the various types of benefits which are likely to accrue to the host economy from openness and especially from FDI. This is particularly the case for technology management expertise, as multinational enterprises seem to be one of the principal vehicles for the international transfer of technology. The link between technology and economic growth has been highlighted by an OECD study of both the OECD and developing countries, which found a significant effect on economic growth from the innovation and diffusion of technology (OECD 1991).

Furthermore, foreign investors can contribute to economic growth because they tend to be more productive than local firms. An analysis of 282 pairs of foreign and domestic firms of similar size drawn from 80 manufacturing industries in Brazil concluded that foreign firms have a significantly higher ratio of value-added to output than domestic firms (Wilmore 1986). Similar results are obtained by De Gregorio (1992) for twelve Latin American countries and by Borensztein et al. (1995) for a sample of 69 developing countries.

Another mechanism through which FDI can affect growth is through productivity spillovers. Blömstrom and Persson (1983) and Blömstrom (1986) find evidence that FDI has led to significant positive spillover effects on the labour productivity of domestic firms and on the rate of growth of domestic productivity in Mexico (Blömstrom and Wolf, 1994). Kokko (1994, 1996) argues that this effect may arise from a process of competitive interaction between foreign and domestic firms, finding empirical evidence that spillovers are more likely in Mexican manufacturing where foreign and domestic firms are in direct competition and where the technological gap between them is not good[11]. More direct evidence bearing upon this hypothesis is provided by Kokko, Tansini and Zejan (1996) who find, for Mexico and Uruguay, that spillovers are difficult to identify in industries where foreign affiliates have much higher productivity level than local firms[12].

Nevertheless, the effect of FDI on economic growth is an empirical question, as it seems to be dependent upon a set of conditions in the host country economy. Firstly, the benefits

[11] This effect could be related with a dynamic component of FDI, which arises from the international rivalry of firms. The entry of a foreign investor into a market can pose a competitive challenge to local firms or to existing investors (OECD 1998).

[12] All these studies sustained that FDI could promote further GDP growth. However, the causality could also run the opposite way: the size and average real income level of the host country is expected to attract inward FDI (Dowling and Hiemenz 1982; Lee and Rana 1986). Rapid economic growth in the host country is expected to increase the confidence of overseas investors because a greater demand should make the host market a more profitable place to do business.

from FDI rely on the technical capability of host country firms. According to Blömstrom, Globerman and Kokko (2000) there are a greater number of studies estimating direct productivity spillovers for developing countries than for developed countries. The former tends to produce more mixed results than the latter. These authors argue that the reason for these mixed results is that FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host country[13]. Secondly, the beneficial impact of FDI is enhanced in an environment characterised by open trade and investment regime as well as macroeconomic stability. In this environment, FDI can play a key role in improving the capacity of the host country to respond to the opportunities offered by global economic integration (OECD 1998). In the absence of such an environment, FDI may prevent rather than promote growth. It may serve to enhance the private rate of return to investment by foreign firms while exerting little impact on social rates of return in the recipient economy (Balasubramanyan, Salisu and Sapsford, 1996).

As we have tried to highlight in this section, openness has played a crucial role in terms of the growth of both trade and FDI. An outstanding question is the relationship between these two variables. Trade flows and foreign direct investment can be linked in a variety of ways. Direct investment may encourage export promotion (EP), import substitution (IS), or greater trade in intermediate inputs, especially between parents and affiliate producers (Goldberg and Klein, 1998). However, the empirical evidence about the relationship between trade and FDI is ambiguous. Most of multinational firms' investment is export oriented, so foreign investment can increase the speed with which a host economy can become integrated within a global production network in sectors in which it may formerly have had no industrial

[13] Borensztein et al (1998) and Balasubramanyan, Salisu and Sapsford (1999) obtain similar conclusions.

experience (OECD, 1998). This is the main conclusion obtained by Clare (1996) who argues that multinational enterprises have been leaders in some of the most important industries on which Mexico has based the expansion of its industrial exports. Thus, it seems that FDI could be associated with export trade in goods and the hosting country can benefit from trade and FDI-led export growth.

1.6. Sufficiency and Economic Growth

King Bhumibol Adulyadej proposed the philosophy of sufficiency economy (PSE) to people of Thailand on 4 December 1997. The philosophy guides people in living their lives according to the middle path. The concept of PSE can be applied to the individual level, the community level and the national level. The following is a synthesis of the philosophy, with royal approval:

"Sufficiency economy" is a philosophy that stresses the middle path as the overriding principle for appropriate conduct by the populace at all levels. This applies to conduct at the level of the individual, families, and communities, as well as to the choice of a balanced development strategy for the nation so as to modernize in line with the forces of globalization while shielding against inevitable shocks and excesses that arise. "Sufficiency" means moderation and due consideration in all modes of conduct, as well as the need for sufficient protection from internal and external shocks. To achieve this, the application of knowledge with prudence is essential. In particular, great care is needed in the utilization of untested theories and methodologies for planning and implementation. At the same time, it is essential to strengthen the moral fiber of the nation, so that everyone, particularly political and public officials, technocrats, businessmen and financiers, adhere first and foremost to the principles of honesty and integrity. In addition, a balanced approach combining patience, perseverance, diligence, wisdom and prudence is indispensable to cope appropriately with the critical challenges arising from extensive and rapid socio-economic, environmental and cultural changes occurring as a result of globalization. The three interlocking elements represent the three principles of the PSE: moderation, reasonableness and self-immunity. These three principles are interconnected and interdependent. Moderation conveys the idea of people living their lives on the middle path, not the extremes. People should rely on themselves without overindulgence. This way of living occurs when people have reasonableness—accumulated knowledge and experience, along with analytical capability, self-awareness, foresight, compassion and empathy. They must be aware of the consequences of their actions, not only for themselves but also for others. The third principle, self-immunity, refers to the ability of people to protect themselves against any external turbulence and to cope with events that are unpredictable or uncontrollable. It implies a foundation of self-reliance, as well as self-discipline. Apart from these three components, two other conditions are needed to make the principles of sufficiency economy work: knowledge and morality. Knowledge encompasses accumulating information with insight to understand its meaning and the prudence needed to put it to use. Morality refers to integrity, trustworthiness, ethical behaviour, honesty, perseverance, and a readiness to work hard (Mongsawad (2010)).

1.7. Primary Objectives

In the light of the also debate on factors explaining economic growth above, we are now in a position to detail our specific objectives as follows:

a. The first objective has been to investigate the determinants of Thailand's growth using annual data over the period 1973 - 2006, using both growth accounting and levels accounting frameworks. This is tackled in Chapter 4. By using a measure of human capital stock as an additional input, to represent the quality of labour, we attempt to shed light on the relative importance of factor accumulation (physical capital, human capital and labour) versus the growth of TFP. The main focus here is not only to assess the importance of human capital as a source of economic growth, but also to determine whether, after accounting for human capital accumulation, there is role for total factor productivity in the growth of the Thai economy.

b. The second objective has been to examine empirically the role of FDI and the associated importance of human capital in the process of technology transfer and economic growth of Thailand, this being tackled in Chapter 5. Following the literature on endogenous growth theory, we attempt to test whether changes in the accumulated stock of FDI, on its own or jointly with human capital, exert a positive and significant effect on economic growth and GDP per capita in Thailand. Employing an error correction model on Thai data for the period 1973:2 to 2006:4, and controlling for growth of domestic investment and human capital, we determine the relative effects of FDI and trade on economic growth of Thailand. To calculate the critical threshold point of human capital beyond which the effect of FDI is deemed positive, it has been necessary to include the joint interaction of FDI and human capital (proxies by secondary school attainment rates) alongside their individual effects. We also investigate the effect of FDI on domestic investment, and test whether the inflow of foreign capital has "crowded out" or "crowded in" domestic investment.

c. The third objective, addressed in chapter 6, is to assess the relative contribution of factors like trade, domestic investment, human capital (educational attainment) and FDI in Thailand, also using quarterly data from 1973:2 to 2006:4. The methodology employed here has been to conduct Granger causality tests within the framework of Vector Autoregressions (VAR) or vector error correction model (VECM). Several hypotheses are tested including export-led growth, FDI-led growth, as well as the reverse linkages from growth to FDI. We find that, after controlling for domestic investment, we support for FDI-led growth is not as strong as export-led growth. We also find the domestic growth in Thailand has influenced domestic investment and trade openness, but support for growth-led FDI is weak. A broad range of Granger causality tests allows us to investigate the mechanisms through which human capital and other variables affect growth.

1.8 A Contribution of the Study

As stated earlier, this research aims to identify the sources of economic growth in Thailand stressing in particular the importance of the role of trade and FDI as channels of technology transfer. In this context, the importance of human capital is distinguished from physical capital, both as a determinant of growth in its own right and as a means of facilitating the process of technology transfer. Several recent studies are referred above arguing that FDI (as well as trade) makes a positive contribution the economic growth of developing countries only when a sufficient absorptive capacity of advanced technologies is available in the host country (e.g. Borensztein et al (1998)).

Against this background, this research makes a number of empirical contributions relating to Thailand:

(i) First, based on growth and level accounting (Chapter 4), it identifies a modest role of total factor productivity growth for the Thai economy over the period 1973-2006, after incorporating the effects of human accumulation, suggesting technology transfer has possibly influenced Thai economic growth although a major part of the growth is rightly attributed to mobilisation of resources.

(ii) Second, based on econometric analysis using quarterly Thai macroeconomic data over the period 1973:2 – 2006:4 (Chapter 5), the thesis identifies a positive effect of FDI above a minimum threshold level of human capital, calculated to be slightly above an average of 5.4 years of secondary schooling attainment. Similarly, after controlling for domestic investment growth and allowing for other influences such as government expenditure effects, we also find some evidence of complementarity between domestic investment and FDI led growth, above education threshold levels of 4.10 years of secondary schooling attainement. However, we find that trade openness has more significantly influenced Thai economic growth over the period of investigation, a consequence of the export promotion policy adopted by Thailand since 1973, whereas FDI promotion has been more actively pursued only since 1997.

(iii) Finally, in Chapter 6, an extensive econometric investigation of the causal influences is carried out, based on a rigorous methodological framework identifying the cointegration properties of the data as well as incorporating a variety of vector autoregression specifications to ensure the robustness of the results. Here, direct support for FDI-led growth as well as growth led FDI is relatively weak compared to export-led growth or growth led trade expansion, reinforcing the conclusion that trade openness has played a more significant role in influencing Thai economic growth after controlling for domestic investment and government expenditure effects. But the results obtained here also suggest a subtle role for technology transfer through the effect of exports and imports on FDI, and FDI on government expenditure, which thereby influences human capital development with spillovers onto domestic investment and growth. This leads us to argue that there is a potential role for FDI interacting with human capital in influencing the future development of the Thai economy, given its active policy of FDI promotion.

1.9 An Outline of the research

In Chapter 2, we provide a review of the academic literature organised to cover the following topics: (1) human capital and economic growth, (2) foreign direct investment and economic growth, (3) linkages between human capital, foreign direct investment and growth, (4) the role of foreign direct investment, trade and economic growth, and (5) the sufficiency economy and economic growth.

Chapter 3 presents a survey of the Thai economy, giving an overview and documenting the growing importance of role of FDI, trade and education in Thailand. Specifically, we examine the economic history of Thailand in the post war period, experiencing a transformation from a predominantly agricultural economy to an industrial state, and outline how this has come about through the implementation of Thailand's National Economic Development Plans. We also examine recent studies documenting the sources of economic growth in Thailand and comparing with other Asian countries, and discuss FDI and export-led growth policies to support the domestic development in Thailand. Finally, we discuss Thailand's policy on education, aimed at improving national educational attainment levels with consequent effects on labour productivity.

In Chapter 4, we investigate the sources of economic growth of the Thai economy during the period 1973:2 - 2006:4 by undertaking both a growth accounting exercise and level accounting approach, incorporating human capital. The accumulation of human capital in Thailand is measured by the average years of schooling in population age 25-64, and we assess its relative contributes to economic growth. The rate of growth of human capital increased significantly in the period 1973:2 - 2006:4. After incorporating human capital, we find that the growth of total factor productivity still plays a positive and significant role during the pre-crisis period 1972-1996, in contrast to the negative contribution from capital, labour, and human capital during the period 1997-2006 (see Table 4.3). We conclude that both productivity growth and factor accumulation are significant in accounting for Thai growth performance during the pre and post crisis period.

In Chapter 5, we estimate and analyse an error correction model to examine the short run and long run effects of FDI, trade openness and human capital on economic growth of Thailand. The use of the error correction model follows an examination of the time-series properties of the data, which allow cointegration or stationarity among the variables of the model. Following estimation, we calculate the minimum education threshold level of human capital, and the results indicate that FDI exerts a positive although not a very significant influence on growth above the education threshold level of 5.4 years, while trade openness yields a more significant effect on growth than FDI. In addition, our results indicate that both trade openness and FDI has complemented domestic investment yielding positive effects on economic growth, suggesting that domestic investment has also been positively influenced (or crowded in) by these factors.

In Chapter 6, we investigate the causal empirical link between FDI, domestic investment, trade openness and economic growth within the framework of VAR or VECM modelling. We find evidence of bi-causality between domestic investment and economic growth in Thailand. After controlling for domestic investment growth and other factors, causality test results show support for the export-led growth hypothesis, but not for FDI-led growth in Thailand. In this sense, trade openness has complemented domestic investment in enhancing economic growth in Thailand, confirming the conclusion of single equation estimation of Chapter 5. On the other hand, however, multivariate tests results have shown that imports have not contributed to growth directly, as revealed by the results of Chapter 5, its effect instead is coming indirectly through domestic investment. Causality results have also revealed reverse linkages from growth to trade openness and FDI, and we find that Thailand’s recent growth has influenced domestic investment, imports, and exports but not FDI.

In Chapter 7, we conclude the study by focusing on the major findings, and suggest some policy implications and areas for further research.

Finally, the appendices at the end of the feature the some detailed analytical and empirical results to supplement the argument made or conclusions reached in the main body of the text.

Chapter 2

Theoretical Background and Analysis

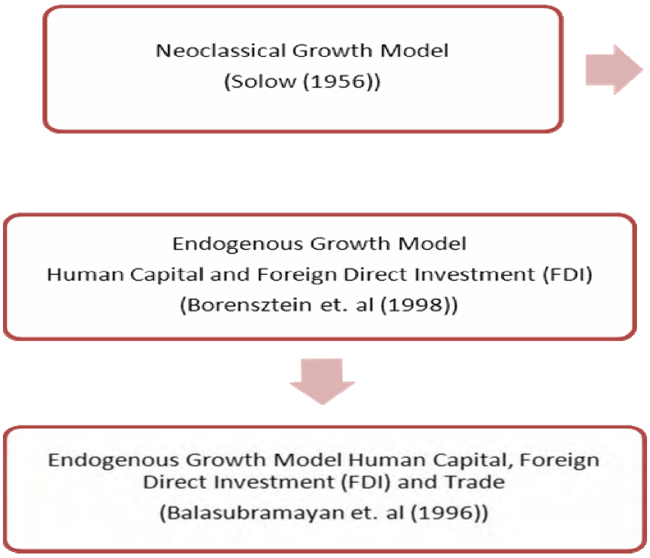
The new developments have also indicated the volatility of FDI and called for important macroeconomic and financial adjustment[1]. Meanwhile, the original contribution of these models is that financial liberalisation and stabilisation must be undertaken by host countries before any increases in FDI become feasible (De Gregorio and Guidotti (1995)). More importantly, there is a role for openness and liberalisation to attract capital in the form of FDI to promote efficiency of production. Furthermore, Borensztein et al. (1998) find that a positive impact of FDI on growth is obtained only for host countries that have accumulated a minimum threshold stock of human capital. Their argument seems to suggest that higher levels of education in the host country permit the technology brought in by FDI to spread to the rest of the economy more easily. But their results could also reflect the likelihood that foreign investors transfer more technology when there are educated workers in the country who can handle the newer methods and more complex procedures. Either way, economic growth benefits from a highly educated workforce combined with FDI inflows.

This chapter discusses some of the recent developments highlighting the role of human capital, FDI, domestic investment, and trade factors in economic growth. In attempting to survey the theoretical and empirical background, the structuring of the chapter follows the order of Chart 2.1 below. Thus, section 2.2 briefly summaries the theoretical considerations on human capital, FDI and economic growth. Section 2.3 presents a neoclassical model allowing for the role of human capital in economic growth, based on Lucas (1988). Section 2.4 presents a role of foreign direct investment in the neoclassical growth model based on de Mello (1997). Section 2.5 combines human capital and foreign direct investment in an endogenous growth model, based on Borensztein, De Gregorio and Lee (1998), where technological progress is endogenous. Section 2.6 discusses the role of foreign direct investment and trade in economic

[1] While capital inflows can provide a strongly expansionary impulse to the domestic economy, a reduction in capital inflows will typically generate an increase in domestic interest rates and, consequently, a decline in asset values.

growth drawing on Balasubramanyan, Salisu and Sapsford (1996) with implications for the trade regime. Empirical evidence is also discussed under each section. Finally, section 2.7 presents some concluding remarks.

Chart 2.1. Study Guide to Chapter 2



2.1. FDI, Human Capital, Trade and Growth: Theoretical Considerations

Barro (1991), Benhabib and Spiegel (1994) and Barro, Mankiw and Sala-i-Martin (1995) have shown a positive correlation between country schooling and economic growth rates. Barro's study demonstrate a positive correlation between levels of *school enrolment* and economic growth, while Benhabib and Spiegel's study point to the significant impact of the level of secondary and higher education attainment on the rate of productivity growth. These authors offer contrasting explanations for the correlations. Following Lucas (1988), who treats human capital as another form of reproducible capital, Barro, Mankiw and Sala-i-Martin (1995) postulate that transitional higher rates of human capital accumulation will lead to higher growth rates[2]. As with physical capital, faster accumulation of human capital leads to an acceleration of the economy's progress towards higher levels of output. The Benhabib and Spiegel (1994) argument, on the other hand is that the countries that possess a sufficiently high level of human capital will be able to achieve higher growth rates by having the ability to assimilate new

[2] They also provide an extension of the production function in Solow's model and framework that include educational capital as an input.

technologies more efficaciously. In their model, which follows the work of Nelson and Phelps (1966), sufficiently high levels of human capital are a precondition for achieving growth via technological change and total factor productivity growth.

On the other hand, in neoclassical growth models, FDI is traditionally conceived as an addition to the capital stock of the host economy. In this sense, there is no substantial difference between domestic and foreign capital. More importantly, the impact of FDI on growth is similar to that of domestic capital. With diminishing returns to capital, FDI has no other permanent impact on the growth rate. FDI will have, however, a short run impact on growth, which depends on the transitional dynamics to the steady state growth path.[3]

However, in endogenous growth models, the potential role of FDI in influencing growth is greater. There are a number of conceivable channels through which FDI permanently affects the growth rate. A convenient way to think about these effects is by separating out how FDI affects each argument in the production function. FDI can affect output by increasing the stock of capital. However, this impact is likely to be small under the assumption of perfect substitutability. Although the empirical evidence on this matter is ambiguous, if foreign and domestic capital are complements the final impact of FDI on aggregate output will be larger as a result of these externalities.

Also consider the impact of FDI on labour, in terms of job creation. The role of FDI as the source of knowledge and technology transfer becomes even more apparent as FDI has clearly a more important role in the augmentation of human capital than on the numbers of workers employed. Consider the case in which foreign investment is carried out in activities in which the host economy has limited previous experience. In this case FDI will entail important knowledge transfers in terms of the training of the labour force, the level of education, skill acquisition, new management practices and organisational arrangements.

However, the most important channel through which FDI affects economic growth is through technology. FDI inflows directly raise the levels of technology in the host country. This can be through a variety of mechanisms. One such mechanism is that FDI flows increase the

[3] For the literature on economic growth, see Barro and Sala-i-Martin (1995) and Aghion and Howitt (1998). For surveys of the methodology and empirical evidence, see Temple (1999). For a survey of the literature on growth in transition, see Campos and Corecelli (2002).

variety of intermediate product and types of capital equipment available in the host economy (Borensztein et al. 1998). Therefore, FDI inflows lead to an increase of the productivity in the host economy. Another important mechanism through which FDI affects growth is learning. FDI inflows diffuse knowledge about production methods, product design and new organisational and managerial techniques. In this light, imitation becomes a crucial element. Another important mechanism is that FDI raises the productivity of domestic R&D activities.

As far as openness with regard to trade is concerned, proponents of the new growth theory criticise the neoclassical growth theory as erroneously supposing that all gains from trade lead to level effects as opposed to growth effects[4]. This implies that trade has no effect on long run growth. Furthermore, it is charged that the neoclassical growth framework presupposes that the sole determinant of long run growth in per capita income is the rate at which exogenous technological progress occurs. This suggests that interaction with other countries, by way of trade, has no effect on an economy's long run growth rate. However, the new growth theory pioneered by Romer (1986) and Lucas (1988) seemingly provides intellectual support for the proposition that openness affects growth positively. Grossman and Helpman (1991) have extended this endogenous growth framework to trade theory. This is supported by evidence in Barro and Sala-i-Martin (1995) that countries that are more open to the rest of the world have a greater ability to absorb technological advances generated in the leading economies. Nevertheless, the effect of openness and trade liberalisation on economic growth remains controversial. Although theoretical support for a positive linkage is established, some researchers are sceptical of the trade liberalisation-growth nexus e.g. Krugman (1994), and Rodrik (1995). However, numerous empirical studies attempt to establish that nexus[5]. Some of the recent contributions in this area are Dollar (1992) and Edwards (1998). A more recent survey by Rodrigues and Rodrik (1999) finds considerable weaknesses in the econometric literature and conclude that they find little evidence that open trade policies in the sense of lower tariff and non-tariff barriers to trade are significantly associated with economic growth.

[4] Lucas (1988) is regarded as the chief proponent of this study.

[5] See Edwards (1993) for a survey of this literature.

Following this brief overview of the empirical literature, the remainder of this chapter focuses on the theoretical models and the evidence with discussion bearing on the above factors influencing growth.

2.2. The Role of Human Capital in Economic Growth

Lucas (1988) developed one of the first endogenous growth models by specifying education as the critical force that generates technological progress in an economy. His model shows that education and the accumulation of human capital could explain both the differences in labour productivity and the differences in overall levels of technology that we observe in the world.

Lucas developed a model that is now often referred to as the "education model" of economic growth (see Aghion and Howitt (1998)). Lucas assumed that human capital grows over time because individuals devote time to learning. He also assumed that individuals live forever and have perfect memories, hence, any additional education necessarily increases the stock of human capital. In the neoclassical context, there is no need to educate new members of society to replace those that die, and therefore there is no need for re-training or re-learning.

Suppose that individuals divide their time between producing and learning. Specifically, suppose individuals allocate a proportion *u* of their available time to production and therefore, *1 – u* to learning. If we denote *h* as the current stock of accumulated learning per worker, then the standard production function with education-augmented labour is

$$Y = K^{\alpha}\left[uhL\right]^{1-\alpha} \quad (2.1)$$

Following Uzawa (1965), Lucas makes the simple assumption that human capital grows steadily over time as follows:

$$\Delta h = \omega(1-u)h \quad (2.2)$$

This equation merely states that the change in accumulated per capita education is proportional to the existing stock of education, with the exact amount of the proportional change dependent on the production of time spent learning rather than producing and the productivity of learning. Rearranging equation (2.2) gives us

$$\Delta h / h = \omega(1-u) \quad (2.3)$$

The rate of growth of labour-augmenting human capital will be constant if ω and *u* are constant. Lucas assumes that ω is constant, and he then defines an intertemporal decision function with constant rate for time preference and risk that leads to an intertemporal solution that indeed results in *u* also being a constant proportion of workers' available time. This is a convenient result because with *u* constant and *h* growing at a constant rate, say, *e*, then the term *uh* will grow at rate *e* as well. This is similar to the Solow growth model in that with a production function such as equation (2.1), per capita output will grow at the same rate as the term *uh*. That is, in the long-run steady state, economic growth is equal to the rate of labour augmenting technological progress.

In most economic growth models human capital and technology alternatively arise as the main engines of growth. They acquire such crucial property when introduced into an aggregate production function alongside physical capital and labour. Solow and Swan (1956) have demonstrated that under a neoclassical production function with diminishing returns, these two former inputs are unable to produce long run sustained growth. Uzawa (1965) and Lucas (1988), among others, have modelled human capital formation and they have included this type of input in the aggregate production function in order to support the concept of endogenous growth. Romer (1986, 1990) and Aghion and Howitt (1992) put technology at the centre of economic growth explanations, and a time dependent technological index arises in the production function as the vehicle to sustained growth. This means that in both the human capital and the technology approaches all the inputs that are relevant to growth have to appear as arguments in the final goods production function. As an early attempt to the interpretation of economic growth, Nelson and Phelps (1966) avoid such a straightforward view. They assume that human capital serves as a means to generate and spread technology and that technology is then usable in the physical good production function.

Aghion and Howitt (1998, Chapter 10) distinguish between these two basic frameworks derived from endogenous growth theory, i.e. the Lucas approach and the Nelson-Phelps approach. Nelson-Phelps (1966) describes growth as being driven by the *stock* of human capital through two ways i.e. directly through human capital's effect on a country's ability to innovate, and indirectly through its ability to facilitate technology adoption, i.e. to foster technology "catch-up" with the leading country (the technology diffusion). The second approach, based on Lucas (1988), treats human capital like an ordinary input in the production function. Changes in growth rate across countries are assumed to be primarily due to changes in the rate of human capital accumulation. As argued by Aghion and Howitt (1998), these two approaches have very different implications for the effects of human capital investment on long-run growth. In one case, raising the level of human capital will have effect on output, whereas in the other case it will affect its growth rate. "Lucas' story might be mostly about raising basic educational levels, whereas the Nelson-Phelps approach might be most appropriate for the highly skilled" (Aghion and Howitt (1998) p. 327).

2.2.1. Human Capital and Economic Growth: The Evidence

The empirical literature testing the importance of human capital for economic growth has produced very mixed results to say the least. On the one hand, some influential studies find no relationship between human capital and growth when the Lucas approach is tested for broad samples of countries (Pritchett (2001)). Pritchett argues that this poses a micro-macro paradox, because the findings from macro growth regressions conflict with evidence from micro-based Mincerian earnings functions[6]. He then proceeds to suggest several reasons for the paradox, all of which are illustrated with examples from developing countries[7]. On the other hand, according to Benhabib and Spiegel (1994) who adopt the approach of Nelson and Phelps (1996), there is a strong relationship between human capital and growth. Firstly, the endogenous rate of technological progress is an increasing function of the country's level of human capital. Secondly, a country's ability to catch up technologically with more advanced countries is also an increasing function of its stock of human capital. Benhabib and Speigel's empirical results for a cross-section of countries show a significant and correctly signed relationship between human capital and growth, conditional on initial income levels. However,

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[6] This method is to derive a decomposition of wage differences into components measuring respectively the impact of human capital, discrimination (difference in rates of return on human capital) and eventually unobservable characteristics.

[7] They are, firstly, a sufficiently perverse institutional/governance environment which results in educated people opting for rent seeking and 'socially unproductive' activities; secondly, rapid falls in marginal returns to education due to oversupply of educated labour; thirdly, low quality schooling creating no human capital.

Benhabib and Spiegel's and Pritchett's dismissal of the applicability of the Lucas approach seems to have been premature. Several authors have reversed Benhabib and Spiegel's finding (Temple (1999, 2001); Krueger and Lindahl (2001)), showing that it might be due to misspecification of the model, measurement error or unrepresentative observations. Krueger and Lindahl (2001) are able to reconcile microeconometric estimates of the rate of return to years of schooling with macroeconometric estimates of impact of changes in educational attainment on growth after accounting for measurement error. Hanushek and Kimko (2000) emphasise the importance of accounting for labour force quality. They find a strong link between direct quality measures (i.e. cognitive skills as measured by international mathematics and science test scores) and economic growth.

There are also a number of studies reporting separate regressions for the OECD countries who find support for the Lucas approach. For example, Mankiw et al. (1992) report regressions of their well-known human capital augmented Solow growth model for a sample of 22 OECD countries. In contrast to other parameter estimates, their estimate for their schooling variable remains statistically significant and positive, providing support for the Lucas approach.

Gemmell (1996) includes a measure of tertiary human capital stocks both in initial period levels and first differences in a growth regression for 21 OECD countries. He finds that only the change in tertiary human capital, not the level, has a statistically significant and positive direct impact on growth (though secondary human capital also affects output growth indirectly through its effect on physical investment). De la Fuente and Donenech (2000, 2001), using their own set of five-yearly quality adjusted human capital stock data for 21 OECD countries over the period 1960-90, find strong evidence in favour of the Lucas approach, even in panel estimates that include country- and time-fixed effects. They argue that many of the insignificant results reported in the earlier literature may be due to measurement errors, which are minimised in their human capital data.

Other studies that test the Nelson-Phelps approach are Barro and Sala-i-Martin (1995, Chapter 12) and Barro (1997). They include an interaction term between initial GDP and human capital as well as several human capital variables in their regressions estimated over a number of cross-sections for a large sample of developed and developing countries. In all cases the interaction term leads to a speed up in convergence, i.e. higher level of human capital lowers the cost of imitating ideas developed elsewhere, and some of the human capital variables in levels are statistically significant and positive[8]. Barro and Sala-i-Martin (1995) also report a regression which includes both the Nelson-Phelps and Lucas approaches to the modelling of human capital in economic growth. The estimates of the latter are statistically insignificant, while estimates for the former are still statistically significant and of the expected signs. When Barro and Sala-i-Martin (1995) and Barro (1997) re-estimate their equations with a single cross-section of data, the catch-up term becomes statistically insignificant in case of the former, and remains statistically significant in case of the latter. So, their evidence lends support to the Lucas approach.

Recent theories of economic growth place a strong emphasis on the importance of both investment in human capital and improvement in technology (Becker et al. 1990; Barro 1991; Mankiw et al. 1992). Higher levels of educational attainment have shown to increase individual worker productivity, and continued technological advancement further enhances productivity, even in countries where educational attainment levels are already high. For example, where the empirical evidence is strong and compelling is the United States. Investment in schooling grew more rapidly there from 1910 to 1950 than investment in physical capital. Research has shown that the increase in average years of schooling explains 25% of the growth of *per capita* income during this period (Becker et al. 1990).

A regression analysis of 30 developed and developing countries conducted by UNDP (1999) indicated a positive correlation between economic growth and the “education index”, a weighted variable that takes into accounts both primary and secondary school enrolments. Secondary enrolment is statistically stronger in explaining GDP growth than primary enrolment, perhaps because most countries in the sample had already achieved close to universal primary enrolment. In the future, for most countries, and certainly for Thailand, secondary education attainment is likely to be the key factor that will determine their global competitiveness.

[8] They find that male secondary and higher education has a positive impact on the per capita GDP growth rate, while female secondary and higher education has a negative impact.

2.3. The Role of Foreign Direct Investment in Economic Growth: Theory

De Mello Jr. (1997) provides a survey of the literature relating to the effects of FDI on economic growth. The early neoclassical approach to FDI was based on capital arbitrage (capital flows resulting from interest rate differentials across countries) and the beneficial effects for the host country arise from a large capital stock, increased tax revenues, increased labour income or employment. Note that in the tradition of Solow model and given diminishing returns to physical capital, FDI affects only the level of income and leaves the long-run growth unchanged. Long run growth can only arise because of technological progress or population growth, both considered exogenous. That is, FDI will only be growth enhancing if it affects indirectly technology permanently and positively.

In endogenous growth models, FDI can affect growth by generating increasing returns in production via externalities and productivity spillovers. Moreover, policy changes might induce permanent increases in output growth by providing incentives to host country FDI. Specifically, FDI is thought to be an important source of human capital accumulation and technological change. Capital accumulation can encourage FDI in the incorporation of new inputs and technologies in the production function of host countries. However, FDI transfers knowledge from technological leaders to followers, promotes the use of advanced technologies by domestic firms and provides increasing labour training and skill acquisition and diffusion, introduces new management practices and organisational arrangement, and so on.

The next three sub-section highlight the theoretical approaches to modelling the effect of FDI on economic growth, based on de Mello (1997):

2.3.1. Growth Accounting Approach

De Mello adopts the growth accounting approach based on the production function.

$$Y = A\phi(K, L, F, \Omega) \qquad (2.4)$$

where *Y* is output, *A* captures technology, *K* is capital stock, *L* is labour, *F* is FDI inflow and Ω is a vector of ancillary variables. Assume a Cobb Douglas function, and taking logs and time derivatives; (2.4) yields

$$g_Y = g_A + \zeta g_k + \psi g_f + \gamma g_\omega \qquad (2.5)$$

where lower cases indicate per-capita growth of corresponding upper case variables; and ζ, ψ, and γ are the corresponding elasticities. Note that

$$g_A = g_y - \zeta g_k - \psi g_f - \gamma g_\omega \qquad (2.6)$$

is total factor productivity or the Solow residual. The empirical literature concentrates on the estimate of the elasticity of output with respect to capital (ζ). High estimates of this elasticity above the share of capital in total output have been interpreted as evidence of FDI related externalities.

2.3.2. FDI and Externalities

De Mello also considers an alternative definition to equation (2.4), in which production is carried out in the recipient economy by combining labour and physical capital of two types: domestic (k_d) or foreign owned (k_w), as a consequence of FDI. The overall stock of knowledge of the recipient economy is denoted by *N*. In per capita terms, for each time period, let the augmented production function of the recipient economy be of the Cobb-Douglas type. For algebraic tractability:

$$y = A\phi[k_d, N] = Ak_d^{\beta} N^{1-\beta} \qquad (2.7)$$

where β is the share of domestic physical capital and A captures the efficiency of production. Let 0<β<1, so that there are diminishing returns to domestic capital. It is assumed that the total stock of knowledge in the recipient economy depends on domestic and foreign owned physical stocks. In general, in the presence of FDI, the recipient economy is granted access to a range of intangible non-tradable assets (Dunning 1981), which are expected to lead to increasing returns and hence faster growth. Let *N* be represented by a Cobb-Douglas function of the type:

$$N = [k_d k_w^{\alpha}]^{\eta} \qquad (2.8)$$

where α and η are, respectively, the marginal and the intertemporal elasticities of substitution between foreign and domestically-owned capital stock and α>0. If η>0, intertemporal complementarity prevails and if η<0, intertemporal substitution prevails.

By combining equation (2.7) and (2.8), we obtain:

$$y = Ak_d^{\beta+\eta(1-\beta)} k_w^{\alpha\eta(1-\beta)} \qquad (2.9)$$

Using equation (2.9), a general growth accounting equation can be defined as:

$$g_q = g_A + [\beta + \eta(1-\beta)]g_d + [\alpha\eta((1-\beta)]g_w \qquad (2.10)$$

where g_d is the growth rate of the domestic capital stock and g_w is the growth rate of the foreign owned capital stock. Again, g_A denotes TFP growth.

By equation (2.10), FDI is expected to affect the elasticity of output with respect to capital as much as adding to knowledge and human capital, which generates externalities. As in Benhabib and Javanovic (1991), a high estimate of the capital elasticity in growth equations such as equation (2.10), could be attributed to the presence of FDI in so far as FDI related externalities would inflate the capital estimate by $\eta(1-\beta)$ if complementarity prevails ($\eta>0$).

2.3.3. The Intertemporal Optimisation Framework

To derive the steady state golden rule for steady state equilibrium, De Mello employs the representative agent maximising framework using a standard concave utility function where ρ is the rate of time preference and *c* is private consumption

$$Max \int_{t=0}^{\infty} u(c)e^{-\rho t} dt \qquad (2.11)$$

subject to

$$\dot{k} = Ak_d^{\beta+\eta(1-\beta)} k_w^{\alpha\eta(1-\beta)} - c \quad \text{and} \quad k_d(0) \geq 0 \qquad (2.12)$$

Assuming $u(c) = \ln c$, the rate of growth of consumption is

$$\frac{\dot{c}}{c} = A[\beta + \eta(1-\beta)]k_d^{\beta+\eta(1-\beta)-1} k_w^{\alpha\eta(1-\beta)} - \rho \qquad (2.13)$$

Assume that $\beta+\eta(1-\beta) = 1$ which implies $\eta = 1$, then (2.12) becomes

$$\frac{\dot{c}}{c} = Ak_w^{\alpha(1-\beta)} - \rho \qquad (2.14)$$

Then, as long as $\lim_{k_w \to \infty} Ak_w^{\alpha(1-\beta)} > \rho$, the long run growth rate depends positively on FDI. Note that long run growth depends on the time preference, the productivity of domestic capital, and the degree of complementarity between domestic and foreign owned capital. If

$\alpha(1-\beta) = 1$, then the growth rate of the capital stock and output are constant and equal to the growth rate of consumption so permanent increases in FDI lead to permanent increases in output.

2.3.4. FDI and Growth: Evidence

The standard neoclassical model emphasises that it is in fact not a model of ongoing growth, since it implies that per capita output rates will approach constant values in the absence of exogenous (therefore unexplained) technological progress. Several analytical results are exposited, including the distinction between golden rule and optimal steady states. Following this review, it is argued that the neoclassical approach not only fails to provide an explanation of everlasting steady-state growth, but also cannot plausibly explain actual observed cross-country growth rate differences by reference to transitional (i.e. non-steady-state) episodes. It can, with the inclusion of human capital inputs, explain a substantial portion of observed cross-section differences in income levels, but there are some questionable aspects of this accomplishment and, in any event, explaining levels is not the main task of a theory of growth (Mankiw et al. (1992)).

An important question that must therefore be addressed when empirically analysing the impact of FDI is the extent to which it substitutes for, or contributes to, domestic investment. This can be done by including domestic investment directly in the equation exercise (Borensztein et al. 1998) or by estimating investment equations that incorporate FDI (Agosin and Mayer 2000). Looking at the impact of FDI on capital accumulation and productivity growth, De Mello (1999) finds that foreign investors increase productivity in host countries and the FDI is often a catalyst for domestic investment and technological progress. Alfaro et al. (2001) estimate a model whereby FDI induces higher growth directly by increasing production in the MNEs sector and indirectly by increasing production in the domestic sector via spillovers. The authors examine the relationship between FDI and domestic investment and find that FDI increases total investment more than one for one, reinforcing the claim that FDI affects growth through domestic investment.

The results of many other studies have also suggested that foreign investment contributes relatively more to domestic productivity than domestic investment. Baldwin et al.

(1999), for example, found that domestic technological progress is aided by foreign technological progress. They cite the study of Eaton and Kortum (1997) who find that domestic productivity growth is mainly related to foreign innovation rather than domestic imitation. On the other hand, some studies suggest that the effects of FDI have not always been beneficial for local firms. Haddad and Harrision (1993) find no positive results for Morocco in the late 1980s, and Aitken and Harrison (1999), though finding a positive correlation between foreign presence and TFP growth, conclude that this may be wrong if MNEs are attracted by the more productive sectors in the first place.

Carkovic and Levine (2000), employing a new World Bank data set on FDI, also found negative results. Their study includes 72 countries over the period 1960-1995 and examines the impact of FDI on income growth, productivity growth and physical capital accumulation. In their regressions, the authors attempt to control for domestic conditions that are likely to affect the composition and growth of FDI. Their estimated regressions are also modified accordingly in order to check whether the impact of FDI on growth is contingent upon the level of educational attainment, economic development or financial development in the recipient country. They find no significant impact of FDI on growth[9], though they do find that FDI has a positive impact on capital accumulation. However, these results do not mean that FDI has no effect on growth, but only that FDI goes hand in hand with growth.

But despite these outcomes, most empirical studies find a positive relation between FDI, productivity and growth. Markusen and Venables (1999) find that FDI has a positive effect on domestic firms' productivity. They claim that increased competition associated with the entry of an MNE upgrades that efficiency and product quality in national firms, and opens up possibilities for export. Xu (2000) also finds that FDI contributes to total factor productivity growth in recipient countries. Studies by Borensztein et al. (1998) and OECD (1998) find that not only foreign direct investment stimulates growth but it also has a larger impact than domestic investment. As regards the Mexican manufacturing sector, Blömstrom and Wolff (1994) find that the spillovers in the Mexican industry were large enough to help Mexican firms

[9] Their results do not change when controlling for the level of educational attainment, economic development, or financial market development.

converge towards US productivity levels during the period 1965-1982. Sjöholm (1997) also found spillovers from FDI to have a positive effect on productivity growth, especially in industries with higher degree of competition.

2.4. The Role of Human Capital and FDI in Economic Growth

In this section, we present an endogenous growth model, drawn from Borensztein et al. (1998), where the rate of technological progress is the main determinant of long run growth. Technological progress takes place through capital deepening, as a result of the introduction of new varieties of capital goods led by FDI. MNCs possess more advanced knowledge and are able to introduce them at lower cost. The application of this new technology requires a sufficiently high stock of human capital in the host country. The stock of human capital reflects the capabilities of the host country and limits the transmission of technology.

The economy produces a single consumption good according to

$$Y_t = AH_t^{\alpha} K_t^{1-\alpha} \tag{2.15}$$

where A is the exogenous state of technology; H is human capital; K is physical capital which consists of different varieties of capital goods, each of one being denoted by $x(j)$

$$K = \left\{ \int_0^N x(j)^{1-\alpha}\, dj \right\}^{1/(1-\alpha)} \tag{2.16}$$

The total varieties of capital goods *(N)* are produced by domestic *(n)* and foreign *(n*)* firms

$$N = n + n^* \tag{2.17}$$

Each firm producing capital goods will rent capital goods out to each final good producers at the rental rate $m(j)$. The demand for each variety of $x(j)$ is given by the equality between the rental rate and the marginal product of capital good.

$$m(j) = A(1 - \alpha)\, H^{\alpha}\, x(j)^{-\alpha} \tag{2.18}$$

Assume that the process of technological adaptation requires a fixed set-up cost *F* before production of the new technology takes place

$F = F(n^* / N,\ N / N^*)$, where $\delta F/\delta(n^*/N) < 0,\ \delta F/\delta(n^*/N) > 0$ (2.19)

i.e. the first partial derivative captures the assumption that foreign firms make easier the adoption of technology to produce new capital varieties. The second partial derivative captures the catch up technological effect in which cost increases with the number of varieties produced at home compared to those produced by MNCs. In terms of quality ladder, the number of varieties can be interpreted as improving an existing capital good lower is smaller is its quality.

Once the capital good is introduced, there is a constant maintenance cost per period of time (marginal cost of production of *x(j)* = 1). Profits for the producer of the new variety of capital *j* are

$$\Pi(j)_t = \int_t^{\infty} [m(j)x(j) - x(j)] e^{-r(t-s)} ds - F(n_t^* / N_t, N_t / N_t^*) \qquad (2.20)$$

Maximisation by the choice of *x(j)* of (2.20) subject to (2.18) yields

$$x(j) = HA^{1/\alpha}(1-\alpha)^{2/\alpha} \qquad (2.21)$$

and substituting (2.21) into (2.18) give the rental as mark-up over maintenance cost

$$m(j) = 1 / (1 - \alpha) \qquad (2.22)$$

Assuming free entry so that $\Pi(j) = 0$, evaluating the integral, substituting in (2.21) and (2.22), and solving for the rate of return *r* yields:

$$r = A^{1/\alpha} \alpha (1 - \alpha)^{(2-\alpha)/\alpha} F(n^* / N,\ N / N^*)^{-1} H \qquad (2.23)$$

The process of capital accumulation is driven by savings behaviour as in the neoclassical model. Assume that individuals maximise the discounted present value of future consumption.

$$U_t = \int_t^{\infty} \frac{C_s^{1-\sigma}}{1-\sigma} e^{-p(s-t)} ds \qquad (2.24)$$

subject to $\dot{K} = Y - C$ and $K(0) > 0$. This yields the first-order condition.

$$\frac{\dot{C}_t}{C_t} = \frac{1}{\sigma}(r - \rho) \tag{2.25}$$

Assuming that, a steady state equilibrium, the rate of growth of consumption must equal the rate of growth of output, then combining (2.23) and (2.5):

$$g = \frac{1}{\sigma}(A^{1/\alpha}\alpha(1-\alpha)^{(2-\alpha)/\alpha} F(n^*/N, N/N^*)^{-1} H - \rho) \tag{2.26}$$

Based on this theoretical result, Borensztein et al. (1998) postulate the following approximation of (2.26) for estimation:

$$g = c_0 + c_1(FDI) + c_2(FDI * H) + c_3(H) + c_4(Y_0) + c_5(X) \tag{2.27}$$

where *FDI* is foreign direct investment, *H* is the stock of human capital, Y_0 is the initial *GDP* per capita and *X* is a set of variables often included in long-run growth studies (government consumption, black market premium as a proxy for exchange market distortions and dummies for Latin America and Sub-Saharan Africa).

In their empirical work, FDI is assumed to originate from OECD member countries (as proportion of *GDP*) into LDCs because they want to capture benefits of foreign investment through knowledge and other spillover effects. This is analogous to the fraction of total domestic goods produced by foreign firms (*n*/N*). The growth rate is measured as annual rate of per capita real *GDP.* The initial level of *GDP* is captured by the catch up effect (*N/N*)*. For human capital stock, they use the educational attainment measured by initial level of average year of the male secondary schooling, constructed by Barro and Lee. The group of *X* variables includes government consumption (measured by the average share of real government consumption in real GDP), black market premium on foreign exchange, political instability, political rights, a proxy for financial development, the inflation rate and a measure of quality of institutions.

Using cross-sectional data covering 69 countries, the Borensztein et al. (1998) results show that *FDI per se* has a positively insignificant effect on growth. However, once the product of *FDI * Schooling* coefficient is added to the coefficient for the *FDI* variable, for a value of H (schooling) which makes the sum zero we could calculate the threshold value for this measure of human capital and it comes out to be around 0.52. The values of these coefficients indicate that countries with secondary school attainment above 0.52 will benefit positively from *FDI*. In their sample, 46 out of 69 countries satisfy this benchmark.

They also find that FDI is an important vehicle of technological transmission, contributing more to economic growth than domestic investment does when the country has a minimum threshold stock of human capital. In addition, they also investigate the effect of FDI on domestic investment, arguing MNCs might displace domestic firms by competing in the goods and financial markets. Also, it might be the case that FDI favours expansion and creation of domestic firms by complementarity in production, spillover of technology, etc. Their empirical results show crowding in effects.

2.4.1. Human Capital and FDI: The Empirical Evidence

The hypothesis that human capital in host countries is a determinant of foreign direct investment in developing countries has been embodied in the theoretical literature. For example, Lucas (1990) conjectures that lack of human capital discouraged foreign investment in less-developed countries. Zhang and Markusen (1999) present a model where the availability of skilled labour in the host country is a direct requirement of TNCs and affects the volume of FDI flows. Dunning (1988) maintains that the skill and education level of labour can influence both the volume of FDI inflows and the activities that TNCs undertake in a country.[10]

A study by Root and Ahmed (1979) using a sample of 58 countries, found that none of the proxies used (literacy, schooling enrolment and the availability of technical and professional workers) for human capital and skilled labour significantly affected FDI inflows to developing countries.[11] In the cross-section of 54 developing countries for the year 1976, 1979 and 1980,

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[10] Dunning (1988) argues that, subject to the constraints imposed by the nature of an industry, TNCs adjust the factor-intensity of both product and process technologies to local conditions (e.g. more labour-intensive production in markets where labour is relatively less expensive, and scaled down product quality or production processes where markets are small and economies of scale impossible). Moreover, Dunning and Narula (1995) suggest that the relationship between the type of investment and the skill level of the labour force may operate both across countries and within individual countries over time.

[11] Root and Ahmed (1979) employ multiple discriminant analysis rather than multiple regression on the basis that the former is better suited to handle investment flows and certain explanatory variables that are measured with categorical rather than continuous variables. Countries in the sample

Schneider and Frey (1985) find that their human capital variable,[12] though significant in some cases, is never significant in their chosen model as an explanation of FDI flows.[13]

Nurula (1995) investigates the determinants of the stock of inward investment in pooled regressions of 22 developing countries for four time periods, namely, 1975, 1979, 1984 and 1988. He finds that while the coefficient of the proxy for technological capability[14] is highly significant but has the wrong (negative) sign, the coefficient of the proxy for human skills[15] is positive but insignificant.[16] Narula shows that country-level economic structure provides a better explanation for the extent of inward direct investment activity for developing countries. These results contrast with those obtained for 18 industrialised countries, where technological capability and human skills are highly significant and correctly signed. Narula argues that the inward investment into industrialised countries is increasingly aimed at seeking complementary assets. The presence of human capital plays an increasingly important role as countries move along their development path.

Another study which provides some empirical support for the hypothesis that the level of human capital in host countries may affect the geographical distribution of foreign investment is that by Hanson (1996). He shows, however, that for a sample of 105 developing countries, political stability and the security of property rights (as a proxy for human capital Hanson uses the adult literacy rate) may have

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were classified into three groups as unattractive, moderately attractive, and highly attractive for FDI. It should be noted, however, that the sample period for their study was 1966-70; it may be the case that at that time human capital was not such an important location specific advantage.

[12] They use secondary education as a proxy for skilled workforce.

[13] The main objective of their study is to compare three types of models, namely, a pure-economic model, a pure political model and a "politico-economic" model, which encompasses the other two. The human capital variable is classified as an economic variable. It is significant at 5% in the pure-economic model but is never significant in the preferred "politico-economic" model.

[14] The number of patents granted in the host country as a ratio of the number of students at the tertiary level is used as an indicator of a country's technological capability.

[15] In the context of his study, which compares industrialized with developing countries. Narula rationalizes these results by arguing that, since much of LDC's inward FDI is aimed at exploiting natural-asset-based advantages through resource-seeking investment, the lack of created assets and infrastructure in host countries is offset by the relatively low cost of unskilled labour and primary commodities. "The results would suggest that inward FDI into developing countries occurs because of the low level of created assets".

[16] The role of these unobservable factors is assessed by separating countries that were previously colonies from the rest of the countries. While ex-colonies were regarded as open economies appealing to the foreign investor, independent countries were seen as involving risks of political and institutional nature. The fact that the human capital variable turns out significant in the group of ex-colonies but not in the other countries is interpreted by Hanson as evidence of the greater importance of political and institutional factor s compared to education and training.

been more important determinants of FDI stock than human capital.[17] It may be worth pointing out two aspects of this study. First, the cross-sections consider the accumulated stock of FDI as of 1967. One could repeat the remark made earlier that the availability of human capital may have been of limited importance in explaining foreign investment in developing countries in that period. Second, in his study Hanson does not consider the influence of a whole set of other determinants of FDI, but uses the human capital variable as the only regressor while controlling for differences in the colonial status of the recipient countries[18].

2.5. The Role of FDI and Trade in Economic Growth

The final section of this chapter considers the theoretical literature and evidence on FDI and trade in economic growth. We begin with a discussion of one of the most researched subjects in the FDI-trade nexus: the question whether trade and FDI are substitutes or complements. This is followed by a review of some theoretical and empirical work related to the trade-FDI nexus.

Balasubramanyan et al. (1996) analyse the relation between trade strategy, FDI and growth in developing countries. For a sample of LDCs, they show that the effects of FDI, in terms of enhanced growth, is stronger in those countries that pursue export promotion (EP) than in those pursing an inward oriented import substitution (IS) policy.

Their model is an augmented production function, which includes exports as the ancillary variable

$$Y = f(L, K, F, X, t) \tag{2.28}$$

where Y is output, L is labour force, K is domestic capital stock, F is the stock of foreign capital, X is exports and t is a time trend capturing technological changes. Taking logs and differencing over time obtains:

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[17] A relative measure of FDI is employed to control for any large-country effects. The expression net FDI inflow does not mean that FDI outflows are subtracted out. FDI = Net foreign direct investment inflows as a percentage of GDP. Net inflows are defined as the sum of net equity capital, reinvestment of earnings, other long-term capital and short-term capital as shown in the balance of the relevant age group.

[18] It is against this background that the present study seeks to assess the importance of human capital as a locational advantage for developing countries like Thailand.

$$y = \alpha + \beta l + \gamma k + \psi f + \phi x \qquad (2.29)$$

where the lower case indicates rate of growth of the corresponding variable and β, γ, ψ, ϕ are measure of the respective elasticities. Approximating domestic and foreign capital stock by the ratio of domestic and foreign direct investment to GDP respectively, they obtain from (2.29) the following equation for estimation:

$$y = \alpha + \beta l + \gamma(I/Y) + \psi(FDI/Y) + \phi x \qquad (2.30)$$

where the elasticity of output with respect to foreign capital is of particular interest. They expect not only that $\psi > 0$ but that it be larger in EP countries relatively to IS countries. Also, because of the spillover effects and the externalities associated with FDI, they predict that the elasticity of output with respect to foreign capital exceeds that of domestic capital. They acknowledged the problem of FDI data reporting as well as the difficulties to find a criterion to split the sample in to EP and IS groups. They classified them according to their ratio of imports (M) to GNP and assumed that countries with higher M/GNP are likely to be EP because a high ratio indicates low level of protection.

They found that the elasticity of output with respect to foreign capital was positive, statistically significant and larger in the EP group of countries than in the IS group where estimated elasticity was positive but insignificant. Also, their results confirm the hypothesis that it is FDI and not domestic investment that is driving force in the growth process.

2.5.1. Empirical studies on trade and FDI

Traditional theories explaining FDI flows fail to account for the explosive growth of FDI which began during the 1980s, and do not provide adequate explanation for the patterns of FDI observed in the real world. In contrast, recent models such as what Markusen (2000) calls the "knowledge-capital" model have been very successful at explaining the observed patterns of trade and FDI, such as the observation that as with trade, most global FDI occurs between countries with similar factor endowments and much of it is intra-industry investment. Empirical studies have shown strong support for the "knowledge-capital" model.

An OECD study which synthesises some of the recent work on the relationship between FDI and trade concludes that the relationship is complex and cannot be inferred from theory (see Fontagne 1999). Using a database of bilateral trade flows and FDI for a set of 14 countries, the study finds empirical support for trade generated FDI until the mid 1980s, after which FDI is found to generate trade. More specifically, foreign investment abroad stimulates exports from the home country. In host economies, incoming FDI has a short term negative impact on the trade balance due to an increase in imports. In the long-run, however, exports increase. The conclusion is that the nature and extent of the relationship between FDI and trade, including whether they are substitutes or complements, differ from one country to another.

A review of empirical literature by Fontagne (1999) concludes that at the macroeconomic and sectoral level, empirical studies generally support complementarities between FDI and trade. McCorriston (2000) also notes that generally trade and FDI have been found to be complementary in the empirical literature. Nufbauer and Adler (1994) assess the effects of FDI stock on merchandise trade for the United States, Japan, and Germany. They find inconsistent results across different countries and time periods. Japan is the only country where outward FDI consistently raises imports more than exports.

The complementary hypothesis that outward FDI boosts exports is tested for Taiwan by Lin (1995) who finds that outward FDI does indeed have a positive impact on exports as well as imports between Taiwan and four Asian economies (Indonesia, Malaysia, Philippines and Thailand). Lin proposes that FDI enhances bilateral trade because MNC affiliates require imported intermediate goods and other inputs in the production process and finds a positive and significant effect for outward FDI on exports. In principle, the relationship between FDI and trade is far from being unambiguous.

Clearly there is no consensus on a definitive relationship between FDI and trade at the aggregate level. When one considers the complexity of the relationship between FDI and trade, including country-specific, industry-specific, and firm-specific factors, it is no wonder that no consensus exists. Unfortunately, one problem with studying the relationship between trade and FDI is the lack of disaggregated data. Often, only country or sector-level data are available. Firm-level and even product level studies conduct more accurate analysis of the dynamics between trade and investment in specific cases only. However, during the last few years, great strides have been made in integrating the theory of the multinational enterprise into international trade theory. This has been possible with new trade theories which relax the assumptions of constant returns to scale and perfect competition. New growth models incorporate country and firm specific characteristics in the assessment of the advantages and disadvantages of investing in foreign production versus engaging in trade. A full review of this work is beyond the scope of this study. For a detailed discussion of the latest theoretical developments related to incorporating MNCs into formal general-equilibrium setting, see Markusen (2000) and McCorristion (2000).

2.5.2. Export-oriented FDI in developing countries

One of the most debated issues related to trade and FDI in developing countries is whether inward FDI contributes positively to export growth. In light of the success of newly industrialised economies and their reliance on export-led growth, many developing countries are actively pursuing export-oriented FDI with special incentive or export performance requirements. However, despite the prevalence of policies to attract export-oriented FDI, empirical studies are not consistent in showing a positive relationship between FDI and the expansion of manufactured exports from developing countries.

At the country level, the impact of inward FDI on exports can be measured in terms of the direct contribution of foreign-owned firms to export volume, or in terms of significance of the FDI spillover effect on export intensity changes in the host economy (most likely in the same industry as the FDI). If the goal of encouraging export-related FDI is to jump-start labour-intensive, export-oriented production and growth, then spillovers and linkages with domestic firms must be present. Otherwise, exporting MNCs merely represent an export enclave without any dynamic impact on export-related growth.

In an empirical study of the spillover effect of inward FDI on export growth in Zimbabwe, Mapuranga (2000) finds evidence of a positive spillover effect between inward FDI and export growth of firms and sectors engaging in pre-export technology processing. However, a negative effect in the primary industry activities is observed. The results indicate that there is more opportunity for enhancing domestic manufacturing export growth through foreign investment than in the extractive industries.

In the case of Sri Lanka, Athukorala (1995) finds that much of the export dynamism experienced is due to foreign investment. However, there remain high import requirements and limited technology transfer and backward linkages to domestic firms. Athukorala postulates that this is due to the fact that export-oriented FDI in Sri Lanka is still in its early stages. He also warns that the results are not generalisable to other countries. Both the level of industrial development and the policy environment are two country-specific factors which play critical roles in reaping the benefits from export-enhancing FDI.

Ghatak et al. (1997), using time-series data for Malaysia, comprehensively test the export-led growth hypothesis, using cointegration causality analysis. The results supported the ELG hypothesis; they found that aggregate exports Granger-causes real GDP and non-export GDP. They also found that manufacturing exports had the most significant impact on real GDP. However, this study does not strictly consider the relationship between openness and growth. Oskooee and Niroomand (1999) test the ELG hypothesis for approximately 30 countries by assessing the long run statistical relationship between the degree of openness, as proxied by the ratio of imports and exports to GDP, and economic growth. For the sample considered, they find a positive long run relation between openness and economic growth.

However, the impact of FDI on export expansion varies across countries depending on the degree of technological development, the level of human capital, and the institutional environment. Therefore, programmes and policies to attract export-related FDI may not be enough to realise the potential export enhancing impacts of FDI on the economy as a whole. If there are low levels of domestic investment, for example, the domestic response to FDI spillovers and externalities may be minimal.

2.5.3. FDI and the Trade Regime of the Host Country

The analysis above assumes that the export trade regime of the host country is the most important country-specific determinant of FDI. Another line of research examines the impact of FDI on growth, given the trade regime of the host country. FDI is shown to be more growth enhancing in countries that pursue export promotion (EP) than in those promoting import substitution (IS) (Bhagwati 1978). The extent to which export-led growth is determined by export promotion policies establishes the link between trade regimes and long-run growth in the presence of FDI. In general, openness and outward-orientation seem to be growth enhancing in the long run.

In developing economies, protectionist trade and investment policies are often implemented to safeguard indigenous industries from foreign competition. Sectors regarded as strategic, related to national defence or sovereignty, are also frequently targeted by protectionist policies. These policies nevertheless tend to distort social and private returns to capital and hence reduce the efficiency of FDI. Balasubramayan et al. (1996) find that the elasticity of output with respect to FDI in outward-oriented countries with EP trade policies is positive, statistically significant, and higher than in countries promoting IS within an inward-oriented trade regime. However, the difficulties involved in trade regime characterisation are numerous.

Later contributions showed that trade and foreign investment might be complements rather than substitutes. For instance, once a certain threshold is reached, export could result in FDI. However FDI could be a means of consolidating and enlarging exportation markets (Purvis 1972).

In addition, Markusen (1983) discusses several models in which factor movements generated by international facto-price difference lead to an increase in the volume of trade. Retaining the assumption of identical relative factor endowments between two countries, several models embodying alternative bases for trade are presented (including differences in production technology, production taxes, imperfect competition, returns to scale, and factor market distortions). In all of these cases, factor mobility leads to differences in factor proportions, which means an additional motive for trade in goods. Therefore, Markusen (1983) concludes that Mundell's (1957) result of trade in goods and factors being substitutes would be a special case, which is only true if trade based on differences in relative factor proportions (i.e. for the Hechscher-Ohlin trade model).

2.6. Conclusion

This chapter has surveyed the theoretical background and the evidence on growth models relating to FDI, human capital and trade.

De Mello Jr. (1997) provides a survey of the literature relating to the effects of FDI on economic growth. The early neoclassical approach to FDI was based on capital arbitrage (capital flows resulting from interest rate differentials across countries) and the beneficial effects for the host country arise from a large capital stock, increase tax revenues, increased labour income or employment. Therefore, FDI plays a key role in fostering economic growth through various channels. Studies have shown that the positive growth effects of FDI are much higher than equivalent amounts of domestic investment, however, in our finding we found the other way around. In addition to these benefits, FDI has the added benefit of technology transfer. Borensztein et al. (1998) postulate that FDI is an important vehicle for transfer of technology from more developed countries to less developed ones, making it an important factor for growth, one whose contribution to growth is relatively greater than that of domestic investment. In fact Borensztein et al. (1998) find that below a certain threshold of human capital, FDI has a negative effect on growth. These findings seem to support the growth literature that stresses the necessity of high levels of human capital in order to effect growth through technological change. They also suggest that given FDI's role as a vehicle for the adoption of new technologies, it should positively affect the rate of human capital accumulation.

Finally, Balasubramanyan et al. (1996) analyse the relation between trade strategy, FDI and growth in developing countries. They show that the effect of FDI in terms of enhanced growth is stronger in those countries that pursue export promotion than it is in countries pursuing an inward oriented policy.

In summary, there is convincing evidence from empirical studies to support the hypothesis about the positive impact of FDI, human capital, and trade on economic growth.

Chapter 3

The Contributions of FDI, Human Capital and Trade to the Economy.

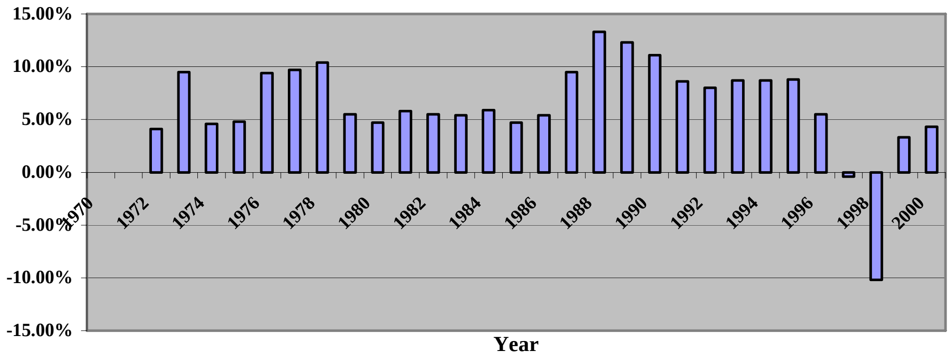
3.1. Introduction

Thailand's remarkable economic transformation in recent years is quite widely known (see overview of the Thai economy in *Appendix A.3.1, A 3.2*). The principal feature has been a shift from agriculture to industry and manufacturing as the driving force of economic growth. A significant part of this successful growth has been fuelled by very high level of domestic and foreign investment, and also by the extremely rapid growth of exports. In 1960, Thailand was a predominantly agricultural economy with 90 per cent of the employment and 50 per cent of national income relying on a few crops, particularly rice (Marzouk, 1972). Agriculture exceeded industry in contribution to GDP and over 70 per cent of the population, mostly small-scale peasant farmers relied on it. Despite the oil crises, Thailand experienced an annual growth rate of real GDP averaging 7.6 per cent between 1967 and 1996. From 1986, external events played a significant role in restructuring the Thai economy and transforming the manufacturing sector into a dominant contributor to GDP. For instance, since Thai domestic savings were inadequate to meet investment needs, FDI played an important role of closing up this gap. Thus, it is likely that government policy has influenced the economic, industrialisation and investment direction of the Thai economy.

One such important factor is the nature of the trade policy regime in host countries. Starting with the pioneering contribution by Bhagwati (1973), a sizable theoretical literature has developed to explain how the restrictiveness (openness) of the trade regime conditions the gains from FDI to host countries (Bhagwati 1978, 1985 and 1994; Brecher and Diaz-Alegandro 1977; Brecher and Findlay 1983). A key hypothesis arising from this literature is that gains from FDI are likely to be far less or even negative under an import substitution (IS) regime compared to a policy regime of export promotion (EP). Despite its immense policy relevance, so far only a few studies have been undertaken to test this hypothesis empirically (e.g. Balasubramanyan et al. 1996; Athurokola and Chanda 2000). In the light of these developments, it is important to identify the international trade performance of the Thai economy and the strategies of liberalisation, Thailand has adopted over the past five decades.

We begin by reviewing the economic growth, trade and history of the Thai economy in section 3.2. Section 3.3 discusses some sources of economic growth, whereas structural changes from an agricultural to an industrial economy are shown in Section 3.4. Section 3.5 presents an account of the distribution of FDI and other major features of the Thai economy. Section 3.6 examines trade and macroeconomic policy in Thailand. Section 3.7 reviews the economic policy of Thailand's export-led growth. Section 3.8, presents the policy on Thailand's education aimed at labour productivity and educational attainment while concluding remarks are contained in Section 3.9.

Figure 3.1: Percentage of Real GDP Growth 1972-2000 (1995 prices)



Source: International Financial Statistics (IMF)

3.2 Economic Growth and History of the Thai Economy

For the past three decades (see Figure 3.1) high GDP growth rates have been achieved. During 1960s, the economy grew by 7.9 per cent per year, slowing to 6.9 per cent per year during the 1970s. In the first half of the 1980s, because of difficulties associated with the energy crisis, the GDP growth rate averaged 5.5 per cent per year. During the latter period, the Thai government carried out major policy reforms, which included correcting fiscal imbalances, realigning the exchange rate, promoting incentives for export production and improving the climate for private investment. These reforms provided the basis for rapid expansion of the Thai economy from 1987 onwards.

The growth rate in the second half of the 1980s stood at about 11 per cent per year, placing the country among the fastest growing economies in the world. This remarkable performance was attributed to favourable external factors and sound macroeconomic management. The domestically sound policies included conservative fiscal management (especially in controlling public expenditure), proactive export promotion and appropriate sectoral interventions. Meanwhile, the government managed to take advantage of prevailing external conditions, which included the appreciation of the yen (relative to the United States dollar and the baht), rising labour costs in the newly industrialising economies, the fall in oil prices and growth in the Organisation for Economic Cooperation and Development (OECD) countries. In addition, domestic conditions were supportive of the growth rate, including political stability and promoting competition in the private sector.

From the beginning of 1990s, financial policies were tightened so that domestic demand increased less rapidly and economic growth returned to a more sustainable pace. The economy still grows at the rate of 8.3 per cent annually, increasing to about 8.7 per cent in 1995. Apart from the steady growth record, fiscal performance was well managed, export growth was rapid, domestic savings and investment rate notably high, and inflation was held in check. From the middle of 1997, when the financial crisis emerged, a sharp downturn occurred. The 1997 crisis marked a drastic change in Thai society and economy. GDP growth fell sharply, reaching minus 10.2 percent in 1998. Interest rates rose steeply as part of financial reforms induced by the IMF, but have come down now to pre-crisis levels, foreign exchange reserves have increased significantly, since the current account surplus is now supported by improved export performance, and monetary and fiscal policies are accommodating growth.

In addition, the Thai government is using devaluation as a policy tool to stimulate economic growth. The IMF induced package of monetary reforms following the 1997 crisis has focused on reversing the devaluation process by restoring confidence in the currency. Thailand made its currency more attractive by temporarily raising interest rate. This led the Thai economy toward a trade surplus. (see Table 3.1 below).

Table 3.1 Trade Balance of Thailand (Millions of Baht)

Year	FDI	Exports	Imports	Trade Balance
1980	3,878	133,197	188,686	-55,489
1984	9,643	175,237	245,155	-69,918
1989	45,697	516,315	662,679	-146,364
1994	33,241	1,137,600	1,369,037	-231,437
1997	85,838	1,892,340	2,132,546	-240,206
2000	99,390	2,777,733	2,494,160	283,573
2006	172,859	5,777,554	5,503,772	273,782
Source: Ministry of Commerce and Bank of Thailand				

The detailed accounts of the past three decades with regard to changes in policies and environments in Thailand are potentially crucial to the understanding of the growth process. We divide Thai economic history into three sub-periods, namely,

I) 1972-1985, the period of macroeconomic uncertainty, hardship and difficult adjustments.

II) 1986-1996, the decade of extraordinary high growth.

III) 1997-2006, the time of economic crisis and recovery.

The following subsections discuss these events. The remainder of the section covers an account of Thai economic history from 1950 to the beginning of the first oil crisis in 1973.

In 1950, Thailand economy found itself in the state of recovering from damages left over from the Second World War.

The economic management during the most part of the 1950s was probably best described as eccentrically diverse, trying to serve too many goals that did not seem to add up. The multiple exchange rate system was used to both generate revenue for the government and to subsidise urban population via unfavourable rate for rice export, which suppressed domestic price of rice.

The nationalism that arose after the triumph of the communists in China in 1949 had also played a significant role. The military government at the time put forward the anti-Chinese policies that limited the Chinese entrepreneurs from doing various key businesses, the government set up many public enterprises that enjoyed monopoly rights. The Chinese commercial communities adapted to the situation by forming business alliances with military top men. These alliances laid the foundation for business-bureaucrat relationship that exists throughout Thailand's economic development history.

The economic mismanagement and the repression against Chinese businesses resulted in poor macroeconomic performance. The GDP grew only at 3.9 per cent per annum during the period 1951 to 1958 (IBRD, 1959).

The turbulence prevailing in the 1950s was put to an end in 1958, when Field Marshall Sarit Thanarat took control of the power through a coup d'etat. Sarit brought with his premiership a vision to run the country according to the international standard, comprehensively prescribed in a World Bank Report (IBRD, 1959)[1]. He also presided over a period of rapid institutionalisation of various public unit that proved to be vital to later economic development. Two new public sector were established, the Budget Bureau (1959) and the Fiscal Policy Office (1961), and one revamped, the National Economic Development Board (1959)[2]. These three sectors and the Bank of Thailand jointly determined the annual budget, which in those days gave high priorities to development projects, primarily infrastructure constructions. The goal and means of economic development engineered by the Sarit government were officially declared in the country's First National Economic and Social Development Plan.

Business activities were also enhanced by the policy shift toward more investment-friendly domestic private and foreign investors. The role of military-founded monopolies was greatly diminished and a comprehensive investment promotion policy was launched by passing of the new Industrial Investment Promotion Act in 1959. Compared to the previous act, this law gave genuine protection to investors and as a result numerous domestic and foreign firms sprung up to take up these protective benefits.

Despite the more favourable atmosphere, the commercial sector and investment demand were not the major contributors to the high economic expansion, which recorded 7.2 per cent

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[1] The influence of the World Bank did not begin with the 1959 report. Infact, Thailand was the first country in East Asia that borrowed from the World Bank (Faculty of Economics, Thammasat University, 1996, p. 38). The 1959 report itself was also a result of a World Bank mission that came to Thailand before Sarit's time. What Sarit did was put the scheme into action.

[2] Its name was changed to the National Economic and Social Development Broad (NESDB) in 1972.

growth per annum between 1958 and 1973. It was the agriculture sector that proved to be the primary engine of growth over the period. Helped by the government expenditure on road building, the farmers rapidly opened up land further away from rivers and railway lines, which they had been using for transporting their products to the market before the road network was built.

The dynamic of agricultural production in this period is perhaps a good example of how economic growth in Thailand has been driven by increasing uses of input instead of advancing technology. When corrected for land expansion and irrigation provision, one would find that there was no real gain in production yields.

Linkages between growth in agricultural sector and the industrial sector are worth noting. Agriculture growth was driven mainly by accelerated export demand. The foreign and government revenue derived from the expansion in agricultural export and production in 1960s provided the necessary resources for early industrialisation that was primarily aimed at import substitution (IS).

(I) 1972-1985: Political Uncertainty and Economic Turbulence

The economic and political stability in Thailand could be said to have ended on very same week in October 1973 when, domestically, the military Thanom government resigned amidst the massive protestation from the general public and internationally. The six day war broke out in the middle east which marked the beginning of the first oil shock.

The economic hardship in Thailand caused changes in the politic area. In 1980, General Prem Tinnasulanon took the office of Thailand’s premiership, where he stayed for the next eight years. His term is considered one of the most stable political period in Thai history, in spite of a number of coup de’etat attempts. This is a remarkable achievement, considering the rapidly changing economic conditions during the period. On economic achievements, his government managed to restore fiscal discipline during 1982 to 1985.

This sub-period also witnessed a major structural change in sectoral production. Agriculture sector, which expanded rapidly in 1960s into the late 1970s, now faced with two major obstacles to further growths: the declining world prices since 1980 and the rapidly dwindling forest areas suitable for agriculture production. By about the same time the rapid growth in agriculture could not be counted as reliably as in the past, so the idea of shifting the country's industrial policy from import-substitution to export-promotion began to gain momentum. The hallmark of this policy shift was the enactment of the 1977 Investment Promotion Act. However, the success of the new industrial policy was limited by at least three factors:

a) the unfavourable world economy at the time,
b) the over-valuation of the Baht during 1981-1984, and
c) the tight fiscal policy since 1982.

Thailand during this period was thus facing an unprecedented rise in both political and economic uncertainties. Economic hardship was felt most in the latter part of the sub-period (1979-1985), where the windfalls from commodity price boom in 1970s was over. The period can however be considered a period of transition, where many of the adjustments were necessary for the new economic structure of the next sub-period.

(II) 1986-1996: Economic Boom, Speculation and Bubble

In contrast with the previous period, the 1986-1996 years can be considered the most prosperous time of the Thai economy, if one is to pay attention only to aggregate numbers.
The good time was most probably triggered by the external events. The first event was the 1985 Plaza Accord that had effectively realigned major currencies, where dollar began to depreciate. The Thai baht therefore depreciated likewise, as the US dollar represented high weight in its basket system. In fact, the government even tacitly increased the US dollar weight from about half to 90% (Siamwala (1997)), to reap more benefits from this welcome turn of events. The second external factor was the sharp decrease in petroleum products since 1986, which remained low until the invasion of Kuwait by Iraq in 1991. On both accounts the external front greatly benefited Thai exports, especially the manufactured ones. Weak currency together with the reviving world economy from lowered oil prices accelerated manufactured exports. Another important by product of the exchange rate realignment was the re-location of industrial productions from Japan, Taiwan, and Hong Kong, where currencies had been risings to new locations that were more cost-effective. Thus, investment capital in the form of FDI flooded into Thailand at an unprecedented magnitude. The manufactured productions surged in response to growing export and investment demands. This was helped by the government's investment policy put in place a few years back, and also by the sluggish agricultural product (which grew

at only 0.4 and 0.1 per cent in 1986 and 1987), which released bulks of young and energetic unskilled labour suitable for light industries.

From the supply-side the major source of growth during this period was clearly the accumulation of capital stocks, increasing at an average of 10.3 per cent per annum during the period 1986-1996 (see *Table A.3.2* in Appendix 3). It accounted for almost 80 per cent of the contribution to growth during 1991-1995 (*Table A.3.3* in Appendix 3). This is of course a spectacular turn of event. It is however equally spectacular how these accumulations of capitals were put to use so inefficiently by speculation. As *Table A.3.3* shows, the contribution of TFP growth during 1991-1995, adjusted for changes in human capital, was merely 0.4 per cent, compared to 31.3 per cent during 1981-1986.

(III) 1997: Crisis

Economic crisis starting at 1997 has been extensive in various dimensions in the last few years. In terms of the origin or the causes of the crisis, the following factors have been mentioned (Bank of Thailand (2001)):

- reduced competitiveness, most obviously shown by the almost frozen export growth in 1996,
- the maturity and currency mismatches of the external debts,
- the failure of the Thai monetary authorities to review and adjust its exchange rate policy in a timely fashion, including the overoptimistic view they took when assessing the probability of successfully counter attacking the speculative attacks on the Thai Baht during the first half of 1997 (see more detail in *Appendix3, A.3.4*),
- the lax and inefficient supervision of financial institutions, resulting in their non-transparent credit operations ,

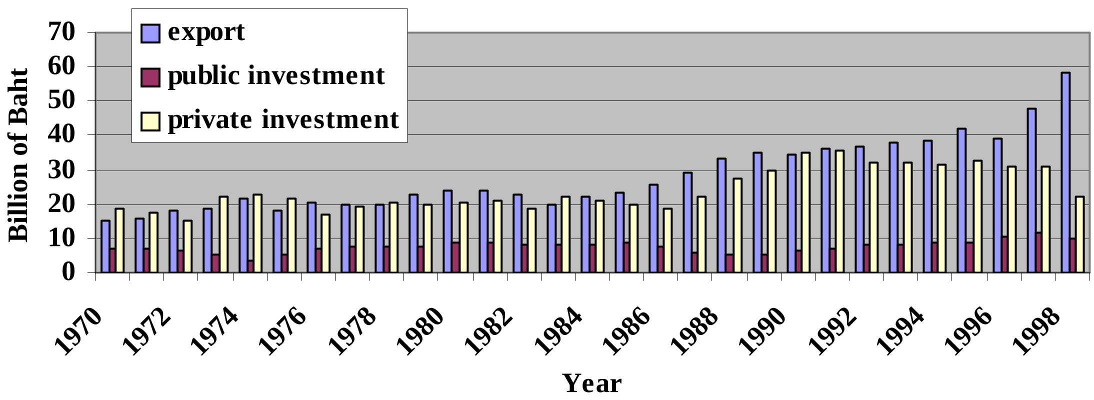
The subsequent lax fiscal policy, resulting from decreased revenue projection rather than deliberate public spending, was only put in place in November 1998, more than one year after the crisis began.

If one were to perform growth accounting after the crisis (see Chapter 4), it would be found that the dramatic decline in growth of GDP in 1997 and 1998 were primarily associated with lowered uses of capital stock (capital utilisation rates), and to a lesser extent the lowered uses of labour input (unemployment) (NESDB Thailand (2001)). From demand side, the shrinking investment demand was the primary downward force during the recession of 1997-1998.

3.3 Sources of Growth

3.3.1. Demand Side. Export and investment played a critical role in the growth takeoff in 1984 (Figure 3.2). Investment not only grew quickly through this period, but the average investment rate was very high by the late 1990s. The high levels of investment led to a rapid expansion in capacity, while the high export growth rates reassured investors of Thailand's repayment capacity and, together with large capital inflows, provided the foreign exchange required for massive capital goods imports.

Figure 3.2 Export and Investment of Thailand



Source: International Financial Statistics Year Book (IMF) (2001).

3.3.2. Total Factor Productivity. Total Factor Productivity (TFP) growth also began to decline. A recent accounting study by the Thailand Development Research Institute (TDRI) (Tinakorn and Sussangkarn (1998)) concluded that:

- Capital accumulation was the main source of growth since 1980 (Table 3.2).
- In the late 1990s, GDP growth declined by almost two percentage points as a result of a collapse in TFP, even though the contribution of capital increased to almost 7 percentage points a year.
- Improvements in labour quality through education and experience made a significant contribution to GDP growth.
- Results at the sectoral level for agriculture, industry and services also suggest that factor accumulation was the main source of output growth, not TFP.

Table 3.2 Contributions to Growth 1981-1995 (Annual percentage rate)							
Period		**Contribution from Inputs**			**TFP growth**		
	GDP growth	**Land**	**Capital**	**Employment**	**Adjusted for Quality (labour)**	**Not adjusted Labour quality**	**Adjusted Labour quality**
1981-85	5.5	0.3	3.3	1.1	1.4	0.9	0.6
1986-90	10.3	0	4.8	1.4	2.2	4.2	3.4
1991-95	8.6	0	6.7	0.4	1.8	1.5	0.1
1981-95	8.1	0	4.9	1	1.8	2.2	1.4
Relative Contribution (%)	100	0.4	60.7	11.9	22.2	27	16.7

Source: Tinakorn and Sussangkarn (1998)

Tinakorn and Sussangkarn (1998) examine the sources of growth in Thailand during 1981-1995 by using the growth accounting framework, or what is known as the nonparametric approach. It was found that the average TFPG for the whole economy was about 2.7 per cent while the average growth of GDP during the same period was about 8.1 per cent. The contribution of TFPG to Thailand's growth is around 33.6 per cent. This rate of TFPG can be accounted for by the improved quality of labour (in term of changing age, sex, and educational composition) and, as a result the, remaining TFPG contribution of about 20 per cent to the overall GDP growth rate. This means that another 80 per cent of GDP growth came from the increased use of factor inputs (see Table 3.2).

3.3.3. Thailand's TFPG and International Comparison

Table 3.3 Total Factor Productivity Growth in Thailand: Selected Studies

Author	Time period of study	TFPG	Contribution to growth	Methodology
1. World Bank (1993)	1960-1990			Parametric, Time series
Table A.1.2 (a)		2.5	n.a.	
Table A.1.2 (b)		0.5	n.a.	
2. Drysdale and Yi Ping (1995)	1950-1988	1.7	,(29.3)	(c)
3. Kawai (1995)	1970-1990	1.9	,(27.1)	(c)
4. Tinakorn and Susangkarn (1996)	1978-1990	2.69,(1.19)	35.6,(15.8)(d)	Non-parametric, Growth accounting, Time series
5. Marti (1996)	1970-1990	1.6	42.5	Parametric, Panel data
6. Callin and Bosworth (1997)	1960-1994	1.8	36	Parametric, Panel data
7. Sarel (1997)	1978-1996	2.03	,(39)	Elasticity Estimate, Growth accounting, Panel data
8. Tinakorn and Susangkarn (1998)	1981-1995	2.11,(1,27)	25.9,(15.6)(d)	Non-parametric, Growth accounting, Time series
9. This study (2011)	1973-1996	2.41,(1.21)	32.7,(13.7)(d)	Non-parametric, Growth accounting, Time series

Source: Tinakorn and Susangkarn (1998) and This study (2011)

Note: (a) From full sample, (b) From high-income only sample, (c) The figures are quoted in Chen (1997), (d) The TFP figures are not adjusted for improving labour quality but the figures in brackets are.

The interest in total factor productivity is a by-product of economists' attempted to understand what lies behind the spectacular growth record of these economies over the past three decades (see e.g., World Bank (1993) The East Asian Miracle). Table 3.3 above presents an example of TFPG calculated for Thailand by various studies.

The most obvious reason for different TFPG estimates among these studies is the different time period. However, the important differences are the methodology and data set employed by these studies. Most of these studies use parametric approach via production function estimates. Only items number 6-9 in the Table 3.3 employ the non-parametric approach via growth accounting equation. Although these studies employ the same methodology, there are differences in the price series used and different estimates of factor income shares.

Sarel (1997) looked at growth of output per person and measured all inputs per person as well. He employed a method for estimating factor income shares across countries and used a constant share for the whole period to calculated TFPG. Tinakorn and Sussangkarn (1996) looked at growth of total output (GDP) and input, not in terms of per person. Their factor income shares are based on the country's national account but adjusted for own account and unpaid family workers based on information contained in the social accounting matrix. Despite these differences, the TFPG figures from Tinakorn and Sussangkarn (1996), Sarel (1997) and this study are not too far from one another.

What we have learned from Table 3.3 is that even for the same country, we have a range of TFPG estimates from 0.5 to 2.69, with its contribution to growth ranging from 13.7 to 42.5 per cent. It all depends on the time frame, methodology and data set used. If we find it uncomfortable to compare different results for the same country, it is even more so when we come to international comparison across various countries from various studies.

Table 3.4 Total Factor Productivity Growth for Some East Asian Countries (% per annum)

Study period (country)	EAM1	EAM2	Young	Sarel	Klenow and Redrques-Clare
	1960-1985	1960-1990	1966-1990	1978-1996	1960-1985
Hong Kong	3.41	2.41	2.30		3.00
Singapore	2.13	-3.01	0.20	2.23	2.20
S. Korea	2.20	0.24	1.70		2.10
Taiwan	2.68	1.28	2.60		2.10
Thailand	1.31	0.55		2.03	1.80
Indonesia	1.49	-0.80		1.16	1.00
Malasia	0.54	-1.34		2.00	1.20
Philippines				-0.78	-0.40

Source: World Bank (1997).

Table 3.4 presents a comparison of TFPG for various East Asian countries from various studies[3]. EAM1 and EAM2 in the Table refer to the World Bank (1993) study on the East Asian Miracle where EAM1 uses the cross country regression approach and EAM2 use growth accounting approach based on econometric estimates of elasticity parameters. The most notable point from Table 3.4 is that TFPG rate differ markedly. The EAM1 study reports positive rates of TFPG for all countries while EAM2 reports negative TFPG rate for Singapore, Indonesia, and Malaysia. The Young study does not include Thailand but reports considerable TFPG for Taiwan (2.6) and Hong Kong (2.3) but close to zero for Singapore (0.2). This is in contrast to the studies by Sarel and Klenow and Rodriguez-Clare who both found a significant rate of TFPG, about 2.2, for Singapore. One of the reasons for such a wide range of TFPG estimates for Singapore is the varying magnitude of the elasticity of output with respect to capital.

The lesson learned from the above international comparative finding is that different data sets, different methodologies, and different sizes of elasticity of output with respect to inputs produce vastly different estimates of productivity growth. Chen (1997) correctly points out that technical change as a residual is quite sensitive to the ways in which data are measured and to the time period chosen.

For Thailand's position, we seem to stand somewhere in the middle between the high-TFPG countries such as Hong Kong, Taiwan and South Korea and the comparatively low-

[3] This table is taken from an office memorandum report by the World Bank.

TFPG countries like Indonesia, Malaysia, and the Philippines. In all studies cited in Tables 3.3 and 3.4, TFPG for Thailand has been found to be positive which is of some comfort in contrast to the negative numbers found for some other countries. However, from the annual TFPG figures calculated for Thailand in this study, we can observe some decline of TFPG in the latter 1990s as compared to the early of 1970s. This occurs despite the high growth of GDP during the same period. These results suggest that we should explore various factors that influence TFPG.

3.4 Structural Change from Agricultural to Industrial Economy

An examination of the decade of the 1980s shows an acceleration of the process of rapid structural change. During the first half of the 1980s, industry's share in GDP grew to exceed that of agriculture for the first time in Thailand's economic history (See Table 3.5). With regard to economic structure, the relative contribution of agriculture to GDP began to decline with the implementation of the First National Economic Social Development Broad Plan. In the 1960s, the share of the agriculture sector in GDP was 39.8 per cent, compared with 13.7 and 46.5 per cent of the industrial and service sectors respectively. The share of agriculture decreased to 28.3 per cent in 1970s, and 23.2 and 12.5 per cent in 1980s and 1990s respectively, and finally to 10.5 per cent in 2000. The annual rate of growth of the agricultural sector was estimated at 5.5 per cent annually in the 1960s, decreasing to 4.3 per cent per year in the 1970s. Since then, it has shown a falling trend with fluctuations. When considered on a yearly basis, fluctuations could be over a wider range, e.g., agriculture had a negative growth of –0.2 per cent in 1987, while during 1988 it surged to 10.2 per cent before declined again to –1.8 per cent in 1990. Growth stayed at 3.3 per cent in 1995 (NESDB Thailand (2001)).

Table 3.5 Structure of the Thai economy

(% of GDP)	1960	1970	1980	1990	1999	2000	2006
Agriculture	39.8	28.3	23.2	12.5	11.2	10.5	11.5
Industry	13.7	22.3	28.7	37.2	39.3	40.1	40.3
Manufactures	16.2	19.4	21.5	27.2	31.1	31.9	32.2
Services	46.5	49.4	48.1	50.3	49.5	49.4	49.5
Total	100	100	100	100	100	100	100
Source: NESDB Thailand (2010)							

While this general pattern of change has been quite consistent over the decade, the forces driving it had altered considerably. The decline of agriculture in the first half of the 1980s was due, in part, to the end of extensive agricultural growth. It was also caused by a decline in the agricultural terms of trade. However, manufacturing growth during the first half of 1980s was mostly due to protection-induced growth of import-substitution industries. In the second half of the 1980s the lack of new agricultural land continued to contribute to the relative decline of this sector. Furthermore, the orientation of the manufacturing sector shifted significantly away from import substitution activities towards those focusing on exports. A large part of the story of the enormous structural changes in the Thai economy over the last two decades, therefore, concerns the shift from agriculture to industry. This aspect of the changing balance of economic forces has certainly favoured much of the popular discussion of recent economic growth of Thailand. However, with a closer look at the data, one would find that the recent growth experience could be a described just as easily to a boom in service as to one in manufacturing. The reason that it is generally referred to as a manufacturing boom is that the growth of manufacturing is viewed as more autonomous and casual. The growth of services activities, on the other hand, is seen as being caused, in large part, by the restructuring of the economy away from traditional agriculture and towards more urbanised and commercialised manufacturing activities.

Tinakorn and Sussangkarn (1998) also applied sectoral data to show that TFPG figures for agriculture, industry and service sectors are lower than that of the whole economy, suggesting the positive impact of resource allocation at the aggregate level. It is also found that factor inputs have a major contribution to the growth of output, accounting for 65.2, 89.5 and 94.4 per cent of output growth in agriculture, industry and service sectors respectively. The TFPG figures in these sectors are small and turn negative when the improved labour quality is accounted for, with the exception of agriculture. This may be an evidence of the pay-off in the research and development conducted in the agricultural sector as opposed to imported and borrowed technology in the non-agricultural sectors.

3.4.1. Structural Changes in Industry and Policy

Table 3.6 Growth Rates of Thailand's Selected Economic Indicator (per cent)

	GDP	GDPPC	IFDI	OFDI
Plan 1 (1961-66)	7.8	4.7	na	na
Plan 2 (1967-71)	7.9	4.7	11.8	na
Plan 3 (1972-76)	6.7	3.7	33.9	na
Plan 4 (1977-81)	7.3	4.9	56.5	-27
Plan 5 (1982-86)	5.4	3.6	13	-5.9
Plan 6 (1987-91)	10.9	9.1	65.8	32.20
Plan 7 (1992-96)	7.95	6.7	6.3	45.1
Plan 8 (1997-2001)	-0.4	-1.4	5.9	-6.5
Plan 9 (2002-2006)	3.4	4.1	6.6	1.2
Note: GDPPC - GDP per capita, IFDI - Inflows of FDI, OFDI - Outflows of FDI				
na - not applicable, no data or insignificant values.				
Source: World Bank data.				

Since the First Six Year Development Plan (1961-66), the government has supported private enterprise and limited government in the economy to the key utility and infrastructure sectors and to maintaining an incentive structure to encourage the private sector. In the First Plan, the government followed a traditional import-substitution (IS) strategy, imposing tariffs on imports, particularly on finished products. The role of state enterprises was greatly reduced from the 1950s and investment in infrastructure was raised. Attention was given to nurturing the institutional system necessary for industrial development. By the end of the First Plan, FDI inflows accounted for a mere 0.1 per cent of GDP and were concentrated in the primary sector suggesting at Thai's locational advantages were still insufficient to attract foreign investment.

In the Second Plan, (1967-71), the import substitution policy had led to balance of payment problems as most components, raw materials, and machinery to support finished product production had to be imported. Moreover, the broad of investment of Thailand (BOI) was empowered to offer special rights, benefits and encourage the private sector expansion into mineral resource exploration and development. However, FDI inflows still remained minimal, averaging 0.1 per cent of GDP per year. USA was the principal source of FDI inflows during the 1960s mostly in mineral and resource extraction and a little in manufacturing. Some FDI also came from Japan (Chulacheeb and Somsak 1983).

The Third Plan, (1972-76), still continued interest in export industries, small-scale industries, resource-based and labour-intensive industries and the promotion of regional industries. While some products, particularly those based on natural resources, could be produced by Thai domestic manufacturers, others were produced by foreign firms, usually involving technology transfer particularly with respect to investment from Japan and the Asian (NICs) countries in textile and garment product, and in the assembly of simple electronic goods or vehicles. FDI inflows increased from 0.1 per cent of GDP in 1972 to 0.2 per cent in1976 (see Table 3.9). Japan stepped up its investment from \$16.4 million at the beginning of the export-led policy in 1972 to more than double in 1973 and 1974, \$34.3 million and \$36.8 million respectively (see Table 3.11). The trade sector remained strong although with a decreasing trend, followed by the construction and services sectors. Textiles manufacturing continued dominating the manufacturing sector although food processing, electrical appliances and chemicals industries started receiving significant attention.

During the Fourth Plan, (1977-81), a new Investment Promotion Law was passed (in 1977) which provided the BOI with more power to provide incentives to priority areas and remove obstacles faced by private investors. Regional inequalities also became a key concern and the BOI steadily shifted its emphasis from promoting export activities to promoting regional areas. Moreover, exporting firms and trading companies were encouraged, and on export-processing zone (EPZ) was established, and the Eastern Seaboard Development Programme (ESBDP) was set up to serve as an alternative industrial location to the Bangkok Metropolitan Region (BMR). Government involvement remained in a few industries, which formed part of this scheme. The government reduced protection of local industries by devaluing the baht by 8.7 per cent in July 1981. However, tariff protection remained high, averaging around 30 per cent until October 1982 when some changes were made to the structure of the tariffs by reducing the protection on finished consumer products (particularly processed food) and increasing that of intermediate products and capital products. The 1979 oil shock, however, precipitated Thailand’s economic problems particularly since it drove the West into a recession, with dire effects on commodity prices. Moreover, the presence of Vietnamese forces on Thailand’s borders led to an upturn in defence spending. Therefore, there was the problem of unemployment for the rapidly growing labour force, and the widening gap between the Bangkok area and the country’s peripheral regions. FDI inflows increased from 0.2 per cent of GDP in 1977 ($106 million) to 0.7 per cent in 1981 ($294 million) as shown in Table 3.9.

In the Fifth Plan, (1982-86), policy makers had become aware of the inefficiencies fostered by high protection, therefore, they started to promote openness and competitiveness. However, the strategy of opening up was not well thought through; the selection of sectors was carried out in a rather ad hoc manner, based on short-term assessments of industrial weaknesses rather than on long-term strategy.

The increased export promotion incentives continued to encourage more FDI inflows which grew at annual average rate of 0.6 per cent of GDP with Japan playing the leading role followed by the US, Hong Kong, Singapore, UK and the Netherlands. Manufacturing continued to dominate sectoral FDI inflows followed by mining and oil exploration, trade, construction and services. Within the manufacturing sector substantial investment increments were made in electrical appliances and chemical industries (see Table 3.10).

Furthermore, the indigenous firms neither had the technical expertise nor the financial resources needed for even simple exploration, extraction and processing of raw materials. Hence, investment was concentrated in commerce. A few foreign firms, therefore, used their superior ownership advantages to invest in the primary sector. Outflows were even lower and only slightly significant in the last decade. They had been undertaken primarily because of the non-tradable nature of the financial, trade and real estate industries. Ownership specific advantages of domestic firms still remained few, limited to labour-intensive food processing and textile industries, and influenced by the infant industry protection through import controls. Government intervention through infrastructure provision (mostly physical) and a variety of economic and social policies, affected market structures, i.e. import protection and local content requirements. In addition, government policy was inappropriate and limited in its involvement in the upgrading of the country’s created assets. For instance, its involvement in technological updates, innovation and human skills left much to be desired. The rate of inflows thus outweighed that of outflows leading to a significantly dominant inflow pattern.

In the Sixth Plan (1987-1991), to encourage foreign investment, Thailand made no distinction between local and foreign firms, and only screened foreign investment proposals that sought promotional privileges from the BOI. The BOI also gave special consideration to projects that contributed to the balance of payments, resource and regional development, linkage creation, employment and transfer of technology. Majority foreign ownership was permitted for export oriented firms but majority local ownership was required for firms producing for the domestic market, with a 51 per cent local equity requirement in manufacturing for the domestic market and 60 per cent local equity requirement for projects in agriculture, animal husbandry, fisheries, mineral exploration and mining, and services (Lim and Pang 1991). FDI inflows accelerated after 1986 as Thailand increasingly attracted export-oriented manufacturing investment particularly from Japan and the Asian NIEs. Between 1987 and 1991 Japan maintained the dominant share of FDI inflows. The US was however, displaced to third position by Hong Kong. Taiwan and Singapore followed closely and investment from the EU member states started increasing. Outflows also surged from $1.06 million in 1986 to $168.4 million in 1987, almost entirely in financial institutions (except $1.6 million in food processing and $0.22 million in trade), and exclusively in Hong Kong ($97.9 million), the US ($39.2), Singapore ($29.4 million) and China ($1.5 million) (Bank of Thailand).

The Seventh Plan (1992-96) continued to emphasise the role of export promotion, with additional reference to the diversification of export markets as well as industry location and further reduction of tariffs. The government also put more emphasis on decentralising economic activity away from the BMR, controlling environmental degeneration, and tackling poverty and income distribution. Furthermore, the government wanted to reduce the country's vulnerability in relying on Multinational Corporations (MNCs) by encouraging local production. It, therefore, started promoting not only the local conglomerates but also the SME as well for purposes of deepening the industrial based technology through supplying parts and components to the larger industries. In 1993, high-tech manufactures surged past labour-intensive exports, growing at a rate of 25-40 per cent as compared with the labour-intensive produce exports growth of 8 per cent. FDI inflows remained comparatively high although lower than during the Sixth Plan. They dropped in value in 1993-94 (global FDI recession) before recovering in 1995-96. Hong Kong started dominating the inflows with a total investment of $1.36 billion between 1992-1995, followed by Japan with a total investment of $1.3 billion. In third position was the US with $1.17 billion followed by Singapore with $0.65 billion. (Pasuk and Banker 1998). Total FDI outflows grew at an average annual rate of about 45 per cent from $136 million in 1992 to $816 million 1996 totalling $2.4 billion during this period. The US accounted for the largest share totalling $355.8 million followed closely by Hong Kong with $343.5 million. Among other more developed countries, Singapore received a total investment of $132.2 million, and the EU member states also received an increased share with Germans alone benefiting from $103.9 million investment in 1995 (Pasuk and Banker 1998).

The Eighth Plan (1997-2001), put emphasis on overcoming some of the problems of high growth created by the previous development plans. It also emphasised the development of manpower training and a reversal of environmental degradation through education reform, increased spending on research and development and income distribution. However, in view of what has happened so far, there is s lot to be done in terms of financial policy. In 1997, although FDI inflows increased to $3.6 billion, the outflows dropped by 32.6 per cent from $816 in 1996 to $447 million in 1997 (see Table 3.10). This was a sign that while some foreign MNCs were benefiting from the financial crisis, the local firms were being hit by the currency turmoil. The financial crisis provided an opportunity for some forms to enter the Thai market or expand their existing operations. For instance, the domestic currency devaluation reduced the cost of fixed assets (land, buildings and capital goods manufactured locally). In addition, given the heavy indebtedness of the indigenous firms, many local companies were available for purchase at very favourable prices since foreign firms now required fewer financial resources in home currencies for the purchase of these properties. Furthermore, the large debts and rising interest rates forced some local firms to restructure and provided MNCs with in opportunity to undertake direct investment through mergers and acquisitions, boosting parent firms' equity shares in their affiliates at a cheaper price than might have been possible in normal times. Moreover, disregarding the possible effects of inflation, currency devaluation and lower costs of production made export-oriented FDI more profitable and hence attractive. There is, therefore, no doubt why the industry sector's FDI inflows share increased from $709 million in 1996 to

$1,820 in 1997 with the export-oriented electrical appliances industry increasing its share from 10.6 to 16.7 per cent (see Table 3.10). On the other hand, FDI targeted at the domestic market started decreasing due to the declining domestic demand. For example, Volvo scaled down its investment from $750 million to $450 million, and Toyota halted two of its plants (United Nations, 1998).

The Ninth Plan (2002 – 2006) identifies competitiveness as one of the main pillars and embodies the return to long-term issues. More recently the present administration of Prime Minister Thaksin has seen increasing attention to industrial development and competitiveness. In early 2002, a very high-level National Competitiveness Committee was established to spearhead government's policy efforts across a wide range of related areas, combined with the establishment of a special Office for SMEs Promotion, something akin to the BOI focusing on supporting SMEs. In term of long-term structural changes, Thailand has experienced GDP and export shifts that appear to be lagging those of the East Asian newly industrialising economies (see Figure 3.1 and 3.2). In the other three countries, agriculture has fallen almost to negligible levels, industry has generally increased with the exception of Taiwan, and services now account for around 50-60 per cent. In Thailand, services are a little less important while agriculture remains at 10 per cent (see Table 3.7 below).

Table 3.7 Changes in Thailand's Distribution of GDP (%) by Sector as Compared to the NIEs.

Sector			Korea					Singapore		
	1960	**1970**	**1980**	**1990**	**2000**	**1960**	**1970**	**1980**	**1990**	**2000**
Agriculture	36.9	28.9	14.9	8.5	4.6	5.8	2.3	1.3	0.4	0.1
Industry	14.7	24.4	41.3	43.1	42.7	10.4	29.8	38.1	34.4	34.3
Services	48.4	46.7	43.7	48.4	52.7	83.8	67.9	60.6	65.3	65.6
			Taiwan					**Thailand**		
Agriculture	n/a	17.7	7.7	4.2	2.1	37.1	30.2	23.2	12.5	9.1
Industry	n/a	40.9	45.7	41.2	32.4	14.1	25.8	28.7	37.2	41.7
Services	n/a	41.4	46.6	54.6	65.6	48.8	44	48.1	50.3	49.2
Source: ADB (2000 and 2001) Key Indicators of developing Asian and Pacific Countries 2000										

The Tenth Plan (2007 – 2011) Thailand will face major changes in many contexts that will present both opportunities and constraints for national development. Both people and systems must be fully prepared to adapt to future changes and reap benefit by keeping up with globalization and building resilience in all sectors, in accordance with the Sufficiency Economy philosophy.

On the export side, Thailand again appears to lag somewhat (see Table 3.8). While since 1980 resource-based and labour-intensive products have fallen in share by some 20 percentage points and science based products have increased by around 25 percentage points, it is likely that much of this increase is in the lower-end, intensive-intensive sector of science based exports. However, the trend is clearly towards electronics and related products.

Table 3.8 Distribution of Manufactured Exports by Technological Categories (%).

Sector	Korea			Singapore			Taiwan			Thailand	
	1980	1990	1999	1980	1990	1999	1980	1990	1999	1980	1999
Resource-based	9	6.8	11.6	44.4	26.9	13.2	9.8	8.2	9.2	21.7	10.7
Intensive-intensive	49.2	40.8	23.2	10.6	10.3	7.6	54.3	41.2	31	47	35.8
Scale-intensive	23.6	19.3	21	9.3	5.9	5.5	9.1	10.3	10.6	7.8	7.7
Differentiated	11.3	15.6	18.7	20.5	22.3	21.2	12.4	20.6	20.4	22.2	19.5
Science-based	6.9	17.4	25.5	15.1	34.6	52.5	14.5	19.8	28.9	1.2	26.4
Source: Calculated from UN data base (2001)											

The issue of competitiveness became a critical area of policy focus throughout Thai economy following the economic crisis that struck in mid-1997. Thailand re-examined their approach to growth and development and began searching for answers to what went wrong in the last 1990s. However, Thailand's economic growth over the past few decades has been built on relatively low-tech industrial development dependent on a cheap and efficient workforce. Thailand was successful in shifting resources from traditional agriculture to labour intensive manufacturing. Vast amounts of FDI helped fuel the Thailand economic miracle, and it appeared that the growth was limitless. However, with intense international competition, particularly from other Asian nations that offered lower cost labour and more abundant resources such as China, India, Indonesia, the Philippines and Vietnam, Thailand gradually lost its competitive position in labour intensive exports because of a strong Thai baht and rapid wage increases until the economic crisis struck in mid-1997. Moreover, the country failed to undertake the necessary measures to continue moving up the value-added chain. A recent analysis of the Thai response to the economic crisis (Flatters (1999)) concluded:

"While overall productivity growth was moderate, most of it was in agriculture or arose from inter-industry shifts. There was little indication of growth of technological capabilities, or movements 'up the ladder of comparative advantage'. Among the widely recognized barriers to growth in competitiveness were very low levels and quality of education, serous deficiencies in infrastructure development, and a policy regime at microeconomic level which was much too geared to creating and preserving rents than fostering market competition."

As the focus on developing competitiveness in Thailand shifts increasingly from macroeconomic to microeconomic factors, and as Thailand is forced to move up the value-added chain, the critical challenge will be one of developing the innovation capacity to develop and commercialise new technologies, products and processes.

Thailand has thus reached a critical crossroad in its quest to build back the competitiveness of its industrial base. The Asian economic crisis dealt a heavy blow to the Thai development model. With an increased recognition that macroeconomic liberalisation and an economy driven by manufactured exports would not ensure sustainable growth, Thai policy makers and firm managers are belatedly shifting their attention to technology matters and human resource development and FDI can be leveraged more strongly to support these objectives.

3.5 Trends in FDI and Major Impacts

FDI inflows into Thailand increased substantially in the second half of the 1980s after the Plaza Accord, which resulted from currency appreciation in Japan and NIEs such as Taiwan, Hong Kong, and Korea. From 1986 to 1989 Thailand attracted on average US$ 0.9 billion per annum of net FDI flows, accounting for around seven per cent of private business investment. From 1990 to 1996, FDI hovered around a plateau of over US$ 2 billion per year, with a slight drop to US$ 1.7 billion in 1993 and US$ 1.3 billion in 1994 as the effects of the political unrest in the early 1990s affected foreign investor confidence. During this period, there were substantial FDI flows into large-scale basic industries such as steel and petrochemical, as well as infrastructure projects. Following the depreciation of the Baht in 1997, FDI inflows have shown a dramatic increase in both Baht and dollar terms, totalling US$ 3.6 billion in 1997, US$

5.1 billion in 1998 and US$ 3.6 billion in 1999 before falling to US$ 2.8 billion in 2000 and increasing to US$ 3.7 billion in 2001 (see Table 3.9).

Table 3.9 Inward and Outward FDI Flows in Thailand.

Year	(million baht)			(million US$)
	Net FDI	Net FDI	Net FDI	Net FDI
	Inflow	Outflow	Inflow	Outflow
1970	891	neg	45	neg
1971	808	neg	40	neg
1972	1,427	neg	71	neg
1973	1,605	neg	80	neg
1974	3,836	neg	192	neg
1975	1,745	neg	87	neg
1976	1,614	neg	81	neg
1977	2,164	neg	108	neg
1978	1,135	124	56	6
1979	1,128	80	55	4
1980	3,878	62	189	3
1981	6,414	51	289	2
1982	4,331	-7	188	0

Year	(million baht)			(million US$)
	Net FDI	Net FDI	Net FDI	Net FDI
	Inflow	Outflow	Inflow	Outflow
1983	8,225	33	356	1
1984	9,638	14	412	1
1985	4,402	23	160	1
1986	6,908	28	262	1
1987	9,044	4,333	354	172
1988	27,964	615	1,106	24
1989	45,698	1,285	1,780	49
1990	64,695	3,576	2,542	140
1991	51,390	4,279	2,033	167
1992	53,691	3,461	2,151	136
1993	43,812	7,416	1,732	294
1994	33,241	10,582	1,326	422
1995	49,887	20,823	2,004	835
1996	57,472	20,649	2,271	816
1997	117,696	12,434	3,627	447
1998	209,888	4,671	5,143	124
1999	134,592	12,781	3,562	344
2000	115,286	2,098	2,813	52
2001p	167,664	7,634	3,759	171
2002pp	9,895	2,380	227	55
Source: Bank of Thailand; p - preliminary; pp - preliminary Jan-May.				
Note: neg. - negligible; Thai outward flows of equity only.				
Net inward flows of both loans and equity, not including the banking sector				

Initial indications from the first five months of 2002 are that FDI is headed for a dramatic fall in 2002. This worrying development deserves careful evaluation, as it would represent a significant reduction in foreign exchange inflows as well as indicating a much smaller FDI base to leverage. Table 3.10 shows FDI by sector since 1970. The manufacturing sector has consistently been a large recipient of FDI with an increasing share in net FDI flows. The sector share increased from average of 37 per cent during 1970-1995 to 57 per cent in 2001.

Table 3.10 Net Flows of Foreign Direct Investment in Thailand by Sector

Sector (Million US$)	1970-1995	1996	1997	1998	1999	2000	2001p
1. Industry	6,591	709	1,820	2,209	1,268	1,813	2,153
1.1 Food & Sugar	499	45	226	74	93	94	108
1.2 Textiles	492	49	42	125	20	29	55
1.3 Metal & non metallic	774	113	216	342	263	93	355
1.4 Electrical Appliances	2,311	241	604	264	425	298	662
1.5 Machinery & transport equi	584	109	396	661	394	667	430
1.6 Chemicals	1,018	183	163	225	8	383	48
1.7 Petroleum products	-25	-250	10	329	8	30	277
1.8 Construction materials	57	3	-10	24	38	58	-3
1.9 Others	877	216	173	165	19	161	221
2. Financial Institutions / 1	1,215	72	110	842	247	134	-187
3. Trade	3,075	545	1,033	1,051	1,042	68	981
4. Construction	1,776	70	163	192	-151	-3	-3
5. Mining & quarrying	976	19	20	21	-42	-3	-3
6. Agriculture	137	2	2	0	1	0	2
7. Services	726	125	292	275	485	449	164
8. Investment	59	-21	26	364	571	99	-49
9. Real estate	3,299	753	110	28	150	70	111
10. Others	-156	-3	51	161	-9	458	160
Total	17,698	2,271	3,627	5,143	3,562	2,813	3,759

Source: Bank of Thailand (2006)

The trade sector has also gained share but at a lower magnitude from an average of 17 per cent during 1970-1995 to between 20 to 30 per cent of FDI over the past few years, dropping to only two per cent in 2000 before recovering to 24 per cent in 2001. FDI in financial institutions went up significantly in 1998 to over 16 per cent as a result of the increase in limits of foreign participation in the banking sector. In the two previous years, the financial sector accounted for only three per cent of FDI. Once the banking sector essentially reached its limits for foreign participation, FDI dropped to seven and five per cent in 1999 and 2000, respectively, and saw a net outflow in 2001. A popular sector for FDI in the early to mid-1990s was real estate, which peaked at 33 per cent of FDI in 1996, but once the property bubble burst in 1996 and 1997, the inflows almost completely dried up.

Table 3.10 (continue) Net Flows of Foreign Direct Investment in Thailand by Sector

Sector (% Share in Total)	1970-1995	1996	1997	1998	1999	2000	2001
1. Industry	37.2	31.2	50.2	43	35.6	64.5	57.3
1.1 Food & Sugar	2.8	2	6.2	1.4	2.6	3.3	2.9
1.2 Textiles	2.8	2.2	1.2	2.4	0.6	1	1.5
1.3 Metal & non metallic	4.4	5	6	6.6	7.4	3.3	9.4
1.4 Electrical Appliances	13.1	10.6	16.7	5.1	11.9	10.6	17.6
1.5 Machinery & transport equi	3.3	4.8	10.9	12.9	11.1	23.7	11.4
1.6 Chemicals	5.8	8.1	4.5	4.4	0.2	13.6	1.3
1.7 Petroleum products	-0.1	-11	0.3	6.4	0.2	1.1	7.4
1.8 Construction materials	0.3	0.1	-0.3	0.5	1.1	2.1	-0.1
1.9 Others	5	9.5	4.8	3.2	0.5	5.7	5.9
2. Financial Institutions / 1	6.9	3.2	3	16.4	6.9	4.8	-5
3. Trade	17.4	24	28.5	20.4	29.3	2.4	23.7
4. Construction	10	3.1	4.5	3.7	-4.2	-0.1	-0.1
5. Mining & quarrying	5.5	0.8	0.6	0.4	-1.2	-9.8	13.8
6. Agriculture	0.8	0.1	0.1	0	0	0	0.1
7. Services	4.1	5.5	8.1	5.3	13.6	16	4.4
8. Investment	0.3	-0.9	0.7	7.1	16	3.5	-1.3
9. Real estate	18.6	33.2	3	0.5	4.2	2.5	3
10. Others	-0.9	-0.1	1.4	3.1	-0.3	16.3	4.3
Total	100	100	100	100	100	100	100
Note: i) the figures cover investment in non-bank sector only. p – preliminary							
ii) Direct investment = Equity Investment plus loans from related companies							
Source: Bank of Thailand, by Economic Research Department							

Within the manufacturing sector, the electronics industry consistently attracts large volumes of FDI, amounting to 17.6 per cent in 2001. For the period 1998-2000, however electronics was overtaken by machinery and transport equipment, deriving mainly from the automotive industry, as many Japanese automotive parent companies injected capital to assist their subsidiaries and suppliers in Thailand following the crisis. The chemical industry surged in 2000 as a number of local producers were restructured, accounting for 13.6 per cent of FDI, before completely dropping off in 2001.

Table 3.11 Net Flows of Foreign Direct Investment in Thailand by Region/Country

Region/Country							Million US$
	1970-1995	1996	1997	1998	1999	2000	2001p
Japan	5,334	523	1,348	1,485	489	869	1,371
USA	3,000	429	780	1,284	641	617	57
European Union (EU)	1,884	170	360	912	1,369	507	178
UK	651	57	123	103	183	401	329
Germany	344	42	59	101	289	104	32
France	393	30	2	277	241	27	102
Netherlands	361	-40	156	333	644	-73	-384
NICs	5,919	653	879	1,114	896	845	1,805
South Korea	107	25	31	72	4	-5	23
Taiwan	1,070	138	133	106	122	159	57
Hong Kong	2,893	215	444	395	233	333	162
Singapore	1,849	275	271	541	537	358	1,563
ASEAN (Less Singapore)	118	37	26	35	35	29	44
Other Countries	1,443	459	234	313	132	-54	301
Total	17,698	2,271	3,627	5,143	3,562	2,813	3,759

Source: Bank of Thailand (2006)

Sources of FDI in Thailand have generally been quite diversified, including Japan, the United States, Europe, Taiwan, Hong Kong, and Singapore as shown in Table 3.11. Japan had been the largest international source of FDI since the late 1970s with the exception of being overtaken by the US in 1999 and by Singapore in 2001. Japanese FDI dropped sharply in 1999 as a result of the weak economic conditions in the home economy, but bounced back in 2000 and 2001 as Japanese firms increased equity shares in local subsidiaries.

Since 1998, Singapore has ranked high as a number of high profile Singaporean investments took place in banking, telecommunications, and others, and certain foreign investors used their Singapore-based affiliates as vehicles for activities in Thailand. The importance of Singapore is potentially a worrying signal in light of the weaknesses in the global electronics sector and the potential for Singaporean investors to sustain such high levels of investment. European investment rose strongly in 1998 and 1999, led by the Netherlands, but fell off rapidly in 2000 to 2001, with a substantial net outflow of Dutch FDI in both years. This decline was mirrored by a dramatic fall-off in US FDI to only 1.5 per cent in 2001.

Table 3.11 (continue) Net Flows of Foreign Direct Investment in Thailand by Region/Country

Region/Country			(% shares in total)				
Japan	30.1	23	37.2	28.9	13.7	30.9	36.6
USA	17	18.9	21.5	25	18	21.9	1.5
European Union (EU)	10.6	7.5	9.9	17.7	38.4	18	4.7
UK	3.7	2.5	3.4	2	5.1	14.3	8.8
Germany	1.9	1.8	1.6	2	8.1	3.7	0.9
France	2.2	1.3	0.1	5.4	6.8	1	2.7
Netherlands	2	-1.8	4.3	6.5	18.1	-2.6	-10
NICs	33.4	28.8	24.2	21.7	25.2	30	48
South Korea	0.6	1.1	0.9	1.4	3.4	5.7	1.5
Taiwan	6	6.1	3.7	2.1	3.4	5.7	1.5
Hong Kong	16.3	9.5	12.2	7.7	6.5	11.8	4.3
Singapore	10.4	12.1	7.5	10.5	15.1	12.7	41.6
ASEAN (Less Singapore)	0.7	1.6	0.7	0.7	1	1	1.2
Other Countries	8.2	20.2	6.4	6.1	3.7	-1.9	8
Total	100	100	100	100	100	100	100
Note: i) the figures cover investment in non-bank sector only. p-preliminary							
ii) Direct investment = Equity Investment plus loans from related companies							
Source: Bank of Thailand, by Economic Research Department							

3.6 Trade and Macroeconomic Policy in Thailand

In the late 1950s, a number of state enterprises producing a variety of industrial products were set up to promote industrialisation. In the 1960s, the government started to promote private investment. However, the emphasis that time was on import-substitution (IS) industries. In the First Economic Development Plan (1961-1966), it was stated that the government would begin to reduce its direct involvement in the manufacturing sector and switched instead to support private investment through investment promotion and provision of public infrastructure. The Board of Investment (BOI) was set up in 1959 to administer the provision of tax and other incentives to private sectors. The tariff structure was also revised several times in the 1960s and 1970s to give more protection to domestic industries.

In the 1960s, the industrialisation strategy was largely import substitution. A number of foreign companies in consumer goods industries including assembly-type activities that utilised most imported parts and components came to invest in Thailand. The import-substitution strategy was later criticised for failing to produce significant linkage among industries and relying heavily on imported inputs. In the early 1970, when industrial growth slowed down and the country's balance of payments turned to deficits after many years of surpluses, the country started to adopt the export promotion strategy. The export promotion (EP) was introduced in the Third Plan (1972-1976). The investment promotion law was also revised in 1972 to give more incentives to export industries. The export promotion strategy has continued to be implemented until the present time.

Since the late 1980s, there have been increasing investments in intermediate products, including parts and components of automobiles and electronics. Thailand's major manufactured exports have also changed towards more sophisticated products like parts and components for computers, electronic products, and machinery parts. Special consideration on promotional privileges from the BOI is given to projects that contribute to the balance of payments, to resource utilisation, and regional development, energy conservation, linkage creation, employment generation, and technology transfer. Tax incentives granted to promote firms include exemption from corporate income tax, and exemption or reduction of import duties on imported machinery and equipment, raw materials and components. Majority foreign ownership is permitted in export-oriented industries but majority local ownership is generally required from firms producing for the domestic market. Additional incentives are given to firms to locate outside the overcrowded Bangkok metropolitan region, making decentralisation a key objective of investment promotion. After the economic crisis in 1997, the Alien Business Law and the Alien Occupation Law have been revised to provide more lenient conditions for foreign investors.

When Thailand embarked on a series of National Economic and Social Development Plans during the 1950s, the focus has been placed more on the real sectors than on the financial sectors. In the real sectors, production targets in terms of employment and output levels used to have higher priority than consumption goals in terms of price stability and income distribution. The private-sector investments have been promoted through many developmental schemes from infant and senile import-substitution (IS) industries to export promotion (EP) ones. Industrial development has become the main artery for national-income earners, especially towards the export markets. Market interventions yielded spectacular payoffs to the country in terms of an annual GDP growth range of 7-10% during the past two decades. However, this accomplishment came at the costs to the consumption sectors when income disparity widened and inflation started to hike. Export earnings have accumulated as savings in the domestic financial system induced banks and other financial services firms to lend heavily to many non-productive and speculative investments in real estate and capital markets.

However, there are several arguments for economic policy reforms in less developed economies, most of which deal with commercial policy in order to change the terms of trade using optimal tariffs (Stolper and Samuelson, 1941) or non-tariff measures (Ray, 1988) and industrial or strategic trade policy to target for and subsidise the winning industries (Krugman, 1987, 1993). The effects and benefits of such policy reforms are attributed towards the production sector of the real economy. The argument for policy reorientation in Thailand, however, is geared towards the consumption and financial economies (World Bank (1993)). In spite of the recent structural adjustments in Thailand, which make it unrealistic to claim that Thai citizens would become more optimistic about the country's prospect, it is still valid to conjecture that, with the right incentives coupled with awareness of undistorted information, the trends toward optimism are quite promising. By contrast, the arguments against any policy reorientation are that of (i) the political and institutional status-quos, which are always the case when confronting reforms, (ii) the socio-phychological challenges whereby the likelihood that the Thai people could successfully make their transition from a passive saving society to an achieve investing society is minimal (World Bank (1993)). If the argument for the policy reorientation sounds convincing enough, then it is quite appropriate for Thailand to consider refocusing its economic objectives in response to the dynamism in domestic and international markets environment and the changing preferences in the Thai society. The policy goal that should be focused in order to materialise this optimism is human capital development to provide greater opportunities for Thai consumers and investors to become more sophisticated and better-informed, which as a result would help promote price stability and sustain economic growth.

3.7 Economic policy on Thailand's export-led growth

During 1980s, there were some fundamental shifts in thinking about economic policy in Thailand. While the 1970s were dominated by ideas of import substitutions, the 1980s became increasingly influenced by the importance of outward orientation and growth of manufactured exports. Thai industries have under gone rapid diversification and industrial production has become more evenly spread across a number of sectors from consumer goods to intermediate and capital goods.

The Thai economy has grown rapidly during this transition. GDP increased at an average annual rate of 8 per cent between 1973-1995 while export revenue grew 13 per cent annually. Agriculture accounted for 65 per cent of export revenue in 1969 but by 1995 manufacturing exports dominated with an 82 per cent share. In spite of this transition, Thailand remains one of Asia's main agricultural exporters.

The Thai government Board of Investment uses a combination of investment promotion, tariffs, taxes, trade controls, and price controls to promote manufactured exports. The Customs Department offers duty and tax exemptions. The government's Bank of Thailand provides rediscounting on targeted investment. The Export Promotion Department (EPD) provides information to select Thai exporters and foreign importers. Tariffs have been revised several times to cope with trade deficits and to promote manufacturing. But they used tariffs as a means of raising extra government revenue and protecting domestic industries whenever it suffered a large balance of payments deficit. Its focus on domestic market demand encouraged growth based on demand rather than on comparative advantage. Domestic demand declined following domestic market saturation and the phasing out of US involvement in the Vietnam War (Bende-Nabende and Slater 2002). Consequently, scale economies were lost, and excess capacity pushed up production costs, negating comparative advantage. The protected industries then lost the incentive to improve productivity. Eventually, the heavy industries started to face serious problems such as shortages of capital, skilled labour and managerial skills, and idle capacity, slowing the growth of the manufacturing sector. These factors warranted a change in policy towards export-led growth. This was reflected in the period 1972-76 (the Third Plan) through revision of the Investment Act in 1972. The revised Act authorised the BOI to increase tax incentives to both domestic and foreign industries producing for export. For instance, they were allowed to import machinery and intermediate goods at tariff-free world market prices. In return, they were required to export around 80-100 per cent of their total production. Decentralisation of investment activities away from Bangkok became an additional feature of industrial policy. The government also introduced credit assistance to manufacturers and exports in the form of concessionary interest rates by discounting loans to manufacturers or by export promissory note (Suphachalasai 1995). Policies were also undertaken to promote the expansion of domestic facilities for tourism, and to speed up business related transactions.

During this period, most industries were still protected of both domestic industries and foreign industries and also local joint ventures producing for the local market behind tariff walls. While some products, particularly those based on nature resources, could be produced by Thai domestic manufacturers, others were produced by foreign firms, usually involving technology transfer particularly with respect to investment from Japan and Asian NICs in textile and garment production, and in the assembly of simple electronic goods or vehicles. However, the Alien Business Law and the Alien Occupation Law contributed to the restriction of FDI with little concern for the promotion of foreign-owned firms and joint ventures with majority foreign share. Growth continued throughout the early and mid 1970s, as Thailand was able to find major export markets for crops such as cassava, sugarcane and pineapple, as well as for new manufactured goods, notably textiles and garments.

3.8 Policy on Thailand's education

Thailand faces a number of critical policy decisions in education. These include: devising a strategy for expanding places in upper secondary education; defining the roles that government and the private sector will play in this expansion; developing a realistic formula for cost sharing between government and the private sector, and for the public financing of education; finding the appropriate balance between the academic and vocational tracks in secondary education. Another challenge will be to ensure that all students, regardless of the type of school they attend, have a strong foundation in general skills that will equip them to be effective life-long learners.

Policy decisions on these major questions for the education sector have to take place in the context of major structural and administrative reforms under newly enacted legislation. The

Constitution of 1996 and the National Education Act of 1999 call for sweeping changes in the way education is organised, administered and financed. Compulsory education will be raised from six to nine years of schooling with 12 years of education freely available to those who want it. The fragmented administrative structure at the centre will be consolidated and major functions and finance decentralised to local education areas that will have freedom to manage the delivery of educational services. The National Education Act calls for the development of separate legislation on vocational education and training. An Office of Education Reform has been established specifically to address issues of implementation of the reform, having to do with teaching personnel, administration and management, and resource mobilisation.

3.8.1. Distribution of Human Capital Opportunities

Development of human capital and distribution of opportunities is that, instead of overwhelmingly committing national resources to accumulating wealth and physical capital in the production sector and focusing on income distribution, Thailand can reallocate her domestic resources to enhancing human capital and refocus on opportunity distribution. We had seen such a tendency toward this goal in the Chuan[4] administration during his first premiership, but unfortunately the momentum was not carried on in the later governments. Investment in human capital includes more and equitable accesses for Thai citizenry to: 1) advanced knowledge and technologies; 2) productive activities and economic decision-makings: 3) political activities and public choices; and 4) social activities and collective consumption alternatives and protections.

Increase in human capital opportunities would yield many favourable results to the Thai economy. First, improved knowledge-based domestic conditions and continued transfer of new technologies would increase the number of highly-skilled Thai workforces. As a consequence, employment growth targeted could be reached since market demand for high-technology and service-oriented human resources is almost insatiable. Second, better access to economic decision-making for Thai citizenry would improve labour-management relations thereby raising productivity, increasing the number of risk-taking entrepreneurs who could spin off to set up their own small businesses, and resulting in more ethical corporate management practices. Third, ameliorated environment for voicing public-policy concerns with less friction and censorship would increase direct political participations by Thai voters and accountability of

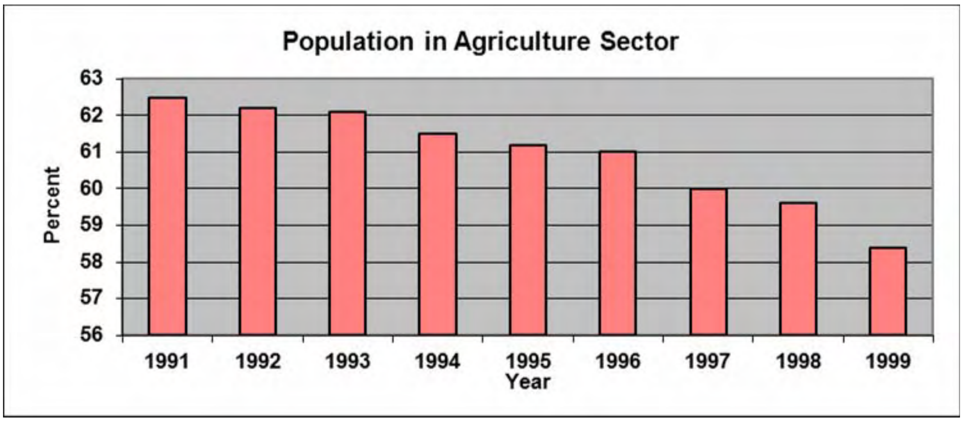
[4] Chuan Leekpai, Thai prime minister during the period of 1992-1995.

Thai politicians, which altogether make the policy outcomes more respective to citizen demands. And fourth, more externally-motivated social networking activities would improve collective bargaining power of Thai consumers, which could head to an improvement in consumer protections and choices both in terms of prices and quality of the products and services in the markets.

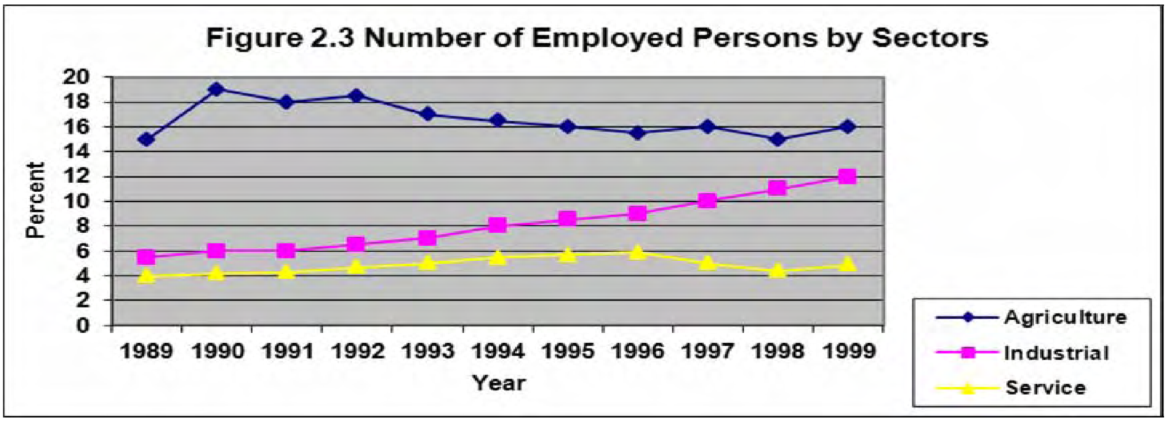
The implications of human capital development are very important to Thailand in that there will be more sophisticated and knowledgeable consumers who can rationally map out risk-return payoffs from spatial and intertemporal consumption opportunities, and better-informed investors who can make prudent investment decisions based upon market signals as well as take proactive responses to promptly correct market distortions.

3.8.2. Structure and Trends in the Labour Force of Thailand

Thailand could still be considered an agricultural country. Up to 75% of labour force was engaged in agricultural activities in the 1970s. Over the couple of decades, the role of the agricultural sector has diminished rapidly, as the economy has become more industrialised and oriented towards international trade. Rapid economic growth from the mid-1980s to the mid-1990s resulted in major structural changes in the labour market. The share of the labour force engaged in agriculture declined by over 10 percentage points in just over a decade (Figure 3.3), with industrial and service sector employment taking up most of the slack.



Source: Ministry of Agriculture and Cooperatives.



Source: National Statistics Office.

Consequently, the employment trend for the agriculture sector has shown as continuing decline, while the trends in both the industrial and services sectors has shown continuing increases. Since the onset of the crisis, however, only employment in the service sector has continued to be stable (Figure 3.4).[5]

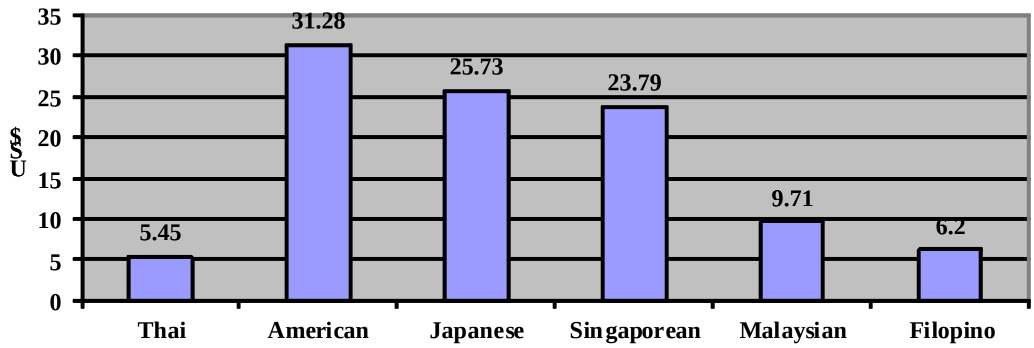
Real wages have risen sharply in all regions of the country since the late 1980s. The much lower wages in agriculture, less than half the wages in industrial sector and service sector (with service sector wage even higher than industrial wage), have reinforced the trend and increased the movement of labour out of agriculture (NESDB 2000). While agricultural incomes have grown at a slower rate, industrial and service sector incomes, particularly those for construction and automotive white-collar workers, have been subject to greater fluctuation and were severely hurt during the recent economic crisis (Middleton and Tzannatos 1998).

[5] Data from National Statistics Office's Labour force Survey, round 3 (August). Three round of surveys were conducted in February (round 1), May (round 2) and August (round 3). The third round is used in this figure due to availability and consistency of data. August, however, is the harvest season in Thailand, which may mean that these graphs overestimate the size of the agricultural labour force population as compared with other times in the year. Definition of sectors in graphs: agriculture includes framing and related agro-industries and businesses; industrial includes mining, quarrying, manufacturing, construction, repair and demolition, electricity, gas, water, and sanitary services; service includes commerce, transport, storage, communication, services, and other activities not falling neatly elsewhere.

3.8.3. Labour Productivity and Educational Attainment

The 1997 economic crisis has raised issues about the quality and productivity of Thai workers: The World Competitiveness Yearbook (IMD, 1999)[6] shows that the average productivity of Thai labourers is only US$ 5.45 per hour (adjusted for PPP), as compared with US$ 31.28 for USA labourers, US$ 25.73 for Japanese, US$ 23.79 for Singaporean, US$ 9.71 for Malaysian and US$ 6.2 for Filipino (see Figure 3.5 below). The data show that the educational

Figure 3.5 Average Productivity of Selected Countries



attainment and productivity of Thai labourers lack behind those both in developed countries and in neighbouring developing countries. While real wages have increased, productivity has not kept pace. The shortage of skilled labourers has been cited as the major obstacle to economic growth in Thailand.

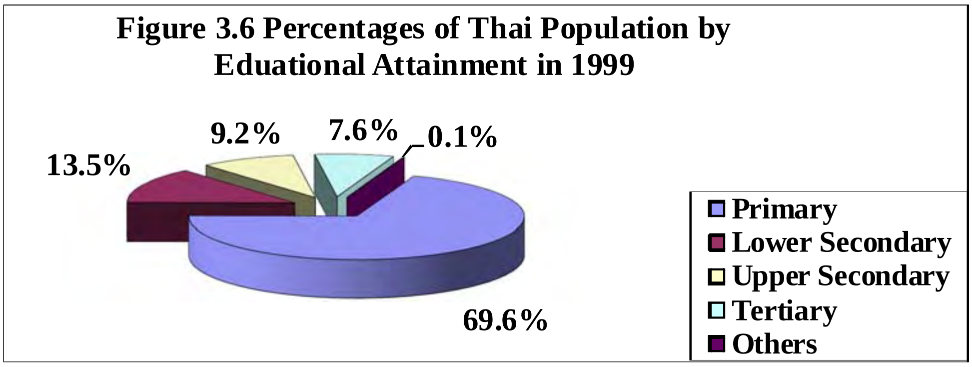
Source: The World Competitiveness Yearbook 1999 (IMD)

About 70% of the Thai population age 13 years and above have only a primary or lower than primary education (Figure 3.6). Only 3% of those between the age 25 and 64 have completed secondary education, as compared with over 50% in the United States and England, 42% in the Korea, 26% in Malaysia and 15% in Indonesia (Figure 3.7). The very low proportion of labour with secondary education was caused by a very low secondary enrolment rate during the 1960s and 1970s, when the Government was trying to achieve universal primary education and improve its quality, at the cost of investing in secondary education. However, there have been rapid increases in the transition rate from primary to secondary during the last few years.

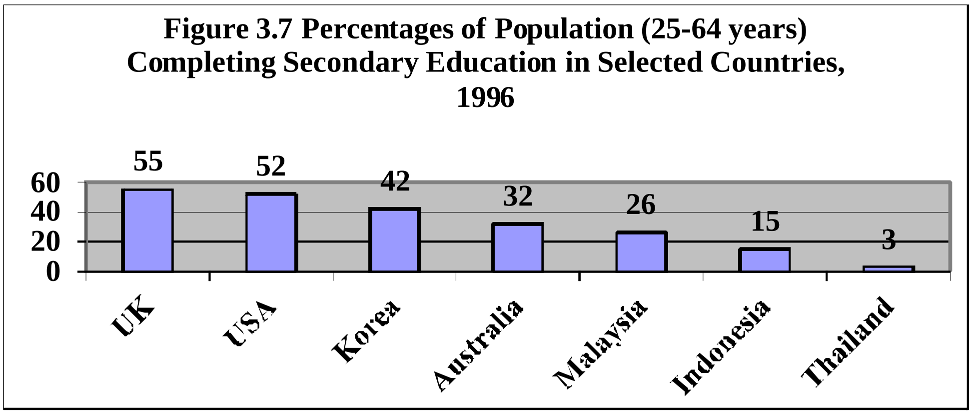
[6] *International Institute for Management Development*

Secondary enrolment, stagnant at the rate of around 35 to 40% in the early 1990s, has now nearly doubled to 75% in 1998 (ONEC 1999).

Therefore, it can be expected that the percentage of workers who have completed secondary education will increase sharply in the next few years, and this should increase the productivity of the labour force. The low educational attainment of the majority of Thai workers makes it hard for them to acquire the high-tech skills needed to compete in the global economy. More developed countries are producing more technology-intensive product.



Source: National Statistics Office.



Source: OECD Education at a Glance, OECD Indicators, 1998.

Many of Thailand's neighbours still enjoy the advantages of low-cost labour, whereas Thailand is losing its comparative advantage in labour intensive industries to lower-income countries such as Laos, Vietnam, and China. The Thai labour force, with relatively higher wages and lower educational attainment, lacks the skills necessary for the country to be competitive in the technology-based industries in the global economy. Recent activity in both the public and private sectors may help to address the constraints to Thailand's competitiveness. The Government has provided training to labourers through the Development of Skill Programme in the Ministry of Labour and Social Welfare. The Skill Development Funds and relevant Skill Development and Training Promotion Acts are encouraging businesses to provide more training to employees. Recent research by the World Bank has found that most Thai companies, particularly medium-sized and large companies, provide training, both formal and informal, for their employees[7]. A 1996 study shows that over 70% of firms provide training to works.[8]

3.8.4. Trends in Thailand's Human Capital Stock

Improving the quality of human capital is the most promising strategy for sustainable economic growth in Thailand. The Government has shown its commitment to the strategy of human capital development by improving the quality of education and providing educational access to more of the nation's school-age children. Over the past decade, a substantial budget share has been allocated to the education sector. In recent years, spending on education has nearly equalled 20% of the total government budget and about 4% of GDP, comparable to the allocations in many high-income countries, including the Republic of Korea, Japan, and the United States. Despite the economic crisis, which has necessitated budget tightening since 1997, education's share of the total budget has continued to be higher than the share of any other sector. The national Education Act of 1999 demonstrates the Government's commitment to education by promising 12 years of quality education for all Thais, free of charge, by 2004.

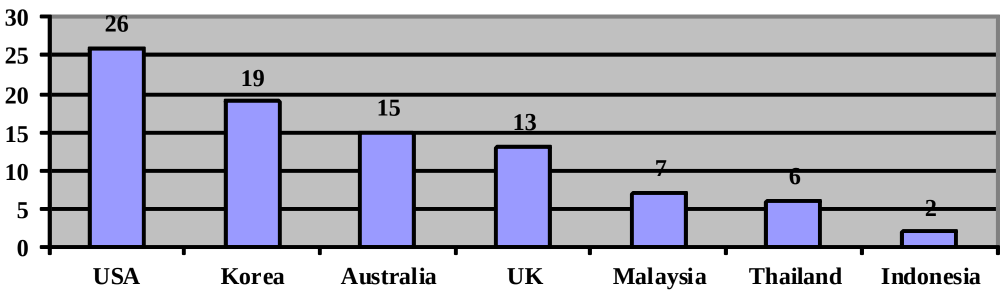
The effectiveness of budget utilisation is low, however, with too much of what is spent allocated to administration and salaries, and too little to other, quality enhancing inputs. Moreover, despite having achieved nearly universal enrolment in primary education and high adult literacy, Thailand has, until very recently, lagged behind other countries at comparable income levels in terms of secondary education development. As noted above (Figure 3.7), only 3% of Thailand's adult population between the ages of 25 and 64 have completed secondary

[7] Zuefack, Albert G., Charles Aberlmann (World Bank), Lee Kian Chang, Pinchuca Tinakorn Na Ayuthaya (2000). *Changing Workplaces, Changing Skills; Views form the Thai Private Sector on Work-Organisation, Employee Retirement and Selection*. World Bank Research Paper. Washington, D.C.

[8] Zuefack, Albert G. (1999) *Employer-Provided Training Under Oligopolistic Labour Market: Evidence from Thai Manufacturing Firms.* Minio, DECRG, The World Bank, Washington, D.C.

education. This is one of the lowest levels in East Asia and far below the level of most developed countries.

Figure 3.8 Percentages of Population (25-64 years) with Tertiary Education in Selected Countries



Source: OECD Education at a Glance, OECD Indicators, 1998.

As a result, even though a high proportion 92.8, 81.8 and 79.5 percent in 1997, 1998 and 1999, respectively (ONEC 1999) of those who complete secondary education continue their studies and attend tertiary education (university, college or advanced technical training), the proportion of the adult population with some tertiary education is, nevertheless, at 6%, quite low as compared with most middle and high income countries (Figure 3.8). The situation in Thailand, however, began to change rapidly in the mid 1990s, and it could be transformed altogether by the end of the first decade of the 21st century. Moreover, secondary education attainment is likely to increase significantly when the full impact of the National Education Act of 1999 takes hold. In just six years, Thailand's gross secondary enrolment ratio increased by a half, rising from 40% in 1993 to nearly 75% in 1998 (ONEC statistics).

In order to ensure sustainable growth in the future, Thailand needs to advance its development and adaptation of new technologies, and to implement other policies directed at increasing the productivity of its labour force. Special efforts should be made to raise the productivity of labour, and the value of production, in agriculture, as this sector still employs about half of all workers and has the potential to contribute more to Thai economy. The same applies to the other sectors. The key to success in these areas will be the outputs of the education and training system. With the education reforms, production in Thailand should be able to move up the value-added ladder and compete more successfully in the global economy.

3.9 Conclusion

Thailand has essentially followed a strategy towards FDI and export promotion that lies well to the passive end of the spectrum. Thailand receives billions of dollars worth of FDI, and the impact on the economy, growth and employment is substantial. However, relatively little attention has been placed on exploring the potentially broader implication of FDI in terms of linkages between foreign and domestic investments, technological capacity building and knowledge and skill transfer. Also, there is potential for undertaking more targeted investment promotion activities to fill technology gaps and meet technology needs.

However, a number of key lessons can be derived from the Thai experience:

- FDI and trade policy making has tended to be determined in a reactive manner, rather than used as a tool to strengthen industrial competitiveness;
- The outputs of FDI have been judged more on the quantitative results such as FDI inflow, education and exports generated by FDI than on the qualitative impacts, which one could argue are becoming more important;
- Exports are thought to have played an important role in Thai output growth;
- In general, as the balance between investment promotion activities moves away from the provision of investment incentives, there is a strong need for better promotion activities;
- Investment promotion resources should increasingly focus on the strategic targeting of investment, and must address areas beyond the basic incentive package such as technology, human capital and human resource development needs of industry;
- Improving the quality of human capital is the most promising start for sustainable economic growth of Thailand;
- The critical need to work more closely with multinational companies already in the country to maximise spillovers and enhance benefits to the domestic industry and community at large;
- The importance of building and maintaining networks with all key players domestic and international.

Chapter 4

Accounting for human capital in the growth of the Thai economy.

4.1. Introduction

From 1973-2006 the Total Factor Productivity (TFP) measure for Thailand is found to be at an average rate of 1 percent a year. This translates into about 33 percent contribution to output growth over the same period. Thailand's average annual output growth over this period was about 6.3 percent. This compares favourably with the experience of other SE Asian economies, such as South Korea, Singapore and Hong Kong. The extraordinary growth performances of these economies, as well as their sources and sustainability, have been the subject of some debate. The debate, initiated by Young (1992, 1995) and Krugman (1994) on the sources of growth in East Asian economies, has spurred a growing literature on this subject. The main premise of Young's conclusions is that there has been no miracle behind East Asian growth, as high growth rates in these economies were fuelled essentially by factor accumulation rather than total factor productivity growth[1]. Kim and Lau (1994) reach essentially the same conclusions for Singapore, Hong Kong, South Korea and China. Krugman (1994), relying on Young (1992, 1995) and Kim and Lau (1994) studies, contends that the so-called "East Asian Miracle" is a myth as output growth for SE Asian counties has been driven mainly by mobilisation of resources rather than by technological change.

This chapter aims to contribute to this debate by investigating the sources of Thailand's growth over the period 1973-2006, using both growth accounting and levels accounting frameworks. High rates of investment in human and physical capital are often identified as major contributors to East Asian growth. The South East Asian economies (Singapore, Hong Kong, South Korea and Taiwan) have consistently invested a larger

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[1] Young (1992) performs detailed growth accounting calculations for Singapore and Hong Kong, and subsequently Young (1995) updates his results for these countries as well as performs similar calculations for Korea and Taiwan.

share of output than compared to other developing countries—nearly 50 per cent higher in 1990. As for human capital, in 1990 their primary enrolment rate was 25 per cent higher and their infant mortality rate 50 per cent lower than the average for all developing countries (Thomas and Wang 1993). However, this leaves the question of why such investments in human and physical capital have contributed to East Asian growth, while other countries, such as the Soviet Union with similar rages of investment have not achieved such miracle growth rates. We do not seek to address this specific question (see Krugman, 1994), but we focus on an important aspect of the debate: namely the contribution of total factor productivity (TFP) growth in Thailand. By performing detailed growth accounting calculations for Thailand, in line with Young's (1992) analysis of Hong Kong and Singapore, and Young's (1995) similar calculations for Korea and Taiwan, we estimate the rate of TFP growth. Following Kim and Lau (1994), we incorporate a measure of human capital stock as an additional input in the underlying production function, to represent the quality of labour, and attempt to shed light on the relative importance of factor accumulation (physical capital, human capital and labour) versus the growth of TFP.

Our results indicate that the aggregate picture for Thailand is broadly in line with conclusions reached by Young (1992, 1995), Kim and Lau (1994), and more recently by Singh and Trieu (1999) who conduct a similar study for Japan, South Korea and Taiwan. Thus, supporting Krugman's (1994) view, we argue that output growth in Thailand has been driven mainly by mobilisation of resources, although in the absence of human capital accumulation there remains a significant role for productivity growth. However, as argued in Chapter 3, in terms of TFPG, Thailand's position lies somewhere between the high-TFPG countries such as Hong Kong, Taiwan and South Korea and the comparatively low-TFPG countries like Indonesia, Malaysia, and the Philippines (Susankarn and Tinakorn, 1998). This might suggest a limited role for technological change in any case, although there remains the outstanding question of investigating variations in TFPG for Thailand over the long period of study (1973-2006) that we investigate. In fact, our results for 1997-2006 suggest that TFP growth is negative, indicating that productivity slowdown may have been a factor contributing to the Thai recession over this post-crisis period.

In section 4.2 we provide a short summary of the background work to motivate our analysis. Section 4.3 provides a theoretical discussion of factors determining TFP growth. Section 4.4 presents the growth accounting framework that is used in the calculation of our results. Section 4.5 discusses the issues in the measurement of human capital and explains how we construct the human capital series. Section 4.6 briefly outlines the development of Thai education and the recent trend in Thailand's human capital stock. Section 4.7 presents the results, analysed further in section 4.8. Section 4.9 extends our framework to levels accounting, and section 4.10 concludes with some ideas on further work.

4.2. Background Literature

In the last decade, there have been substantial advances in theories of endogenous growth. This "new" growth theory allows for investment in education, changes in the labour force, and technological change to be determined within the economy, rather than set by unexplained external forces. These theories emphasise the role of economic policy in affecting the long-run growth. For instance any economic policy, which changes the economy's tendency to invest in education, training or technology, will enhance growth. Such policies would involve change in taxes and subsidies for research and development (R&D)[2]. Thus, the regulation of imported technology and foreign goods can potentially create long-run growth implications (see, e.g. Grossman and Helpman 1992, Romer 1990).

Most empirical studies testing various aspect of the new growth theory typically employ regression methods using cross-country data, often covering a large cross-section of countries (see e.g. Barro, 1991). However, there are also many studies employing

[2] The role of R&D and TFP growth in Japan, South Korea, and Taiwan are examined in Trieu (1995) and in Trieu and Singh (1996).

growth accounting methods to identify TFP growth, and we discuss just a small sample here relating to SE Asia; see Felipe (1999) who provides a critical survey of the literature. In this section, we briefly discuss: Young (1992 and 1995), Kim and Lau (1994), Fischer (1993), Marti (1996), Collins and Bosworth (1997), Singh and Trieu (1999), Hayami and Ogasawara (1999) and Sonobe and Otsuka (2001). The methodology followed in most of these studies is growth accounting using a translog production function[3]. All studies with the exception of Sonebe and Otsuka (2001) measure TFP growth as a whole, and so are unable to decompose the latter into efficiency change and technological progress. Again, with exceptions noted below, most of these studies show that output growth in East Asia since the 1960s can be accounted for chiefly by input growth in physical capital or human capital or labour input, leaving little left over to be attributed to technological change.

Young (1992) employs growth accounting to measure the contributions of input factors and productivity to the economic growth of Singapore and Hong Kong over the period 1966-90. He attributes Singapore's growth entirely to the growth in the labour force and the accumulation of capital. He concluded that the average value of the Solow residual for Singapore was zero, if not negative, for the previous thirty years. The TFP contribution to output between 1974 and 1989 was about –0.004% to 6% without allowing for heterogeneity in inputs, or –8% from 1970 to 1990 with differentiated inputs. Capital accumulation explained essentially all of the increase in output per worker during this period. Negative TFP contribution was also found in the manufacturing sector (Young 1995). In the case of Hong Kong, Young found some support for productivity growth although increases in input factors at 50% to 70% were responsible for a major part of the growth process. Young (1995) extended his earlier work to include the economies of South Korea and Taiwan as well. He found positive rates of productivity growth for 1960 to 1990. For Korea, the annual contribution of TFP for the overall economy for the period

[3] With the exception of Kim and Lau (1994), all employ the assumption of constant returns to scale and perfect competition.

1966 to 1990 was 16.5% of overall growth. For the manufacturing sector, it accounted for 20% of overall growth of the sector.

Kim and Lau (1994) extended Young's (1992) work to include, apart from Hong Kong and Singapore, South Korea and Taiwan. They take an alternative approach to Young by applying the concept of a meta-production, and while their methodology has some advantages, including not imposing constant return to scale, it involves lumping together the four East Asian "tigers".

Young (1995) used an alternative estimation method to calculate TFP growth for Hong Kong and Singapore. He regressed the output growth rate per worker on a constant and the growth of capital per worker for the period 1970 to 1985 using cross-country data constructed from the Penn World Tables (Summers and Heston, 1988). The capital stock was constructed by the perpetual inventory method with the accumulating investment flows for 1960 to 1969 as benchmark, and 6% depreciation rate. These results were consistent with his previous 1992 study, in that TFP growth in Hong Kong was high but almost non-existent in Singapore.

Fischer (1993) employs the growth accounting method to estimate three sets of TFP calculations, each with a different weight on labour and capital inputs, using data from the Penn World Tables. He obtains a negative TFP growth rate for Singapore. Marti (1996), also using the Penn World data set, examines Young's (1995) results over an extended period and obtains a positive TFP growth rate for Singapore.

Singh and Trieu (1999) obtain growth accounting results for Japan, South Korea and Taiwan and finds a positive and significant role for technological change in these countries. They find that Japan had the highest TFP contribution to output growth over the period 1965 to 1990, at 44% of the output growth, and Korea not far behind with 42% TFP contribution to output growth. Collins and Bosworth (1997) also obtain positive results of TFP growth for East Asian economies, but conclude that their results are not extraordinary compared to that of other regions. Further, they conclude that factor accumulation was more important to output growth over the period 1965 to 1990.

Using historical data for the United States and Japan, Hayami and Ogasawara (1999) showed that the contribution of TFP growth was small in the early stages of economic development of these countries, before the improvement of human capital in later periods. Sonobe and Otsuka (2001) employ a slightly different methodology in that they decompose the overall labour productivity growth into the effects of overall capital accumulation and overall TFP growth for Japan.

Based on Young (1992) and Kim and Lau (1994), Krugman (1994) provides a controversial interpretation that there has been no miracle behind East Asia's growth but only simple capital accumulation and mobilisation of resources, and argues that these countries would not be able to sustain their economic growth. Instead, they might end up like the former Soviet Union, which also experienced rapid input-driven economic growth some five decades ago. In this context we should note that the studies of growth accounting for the Chinese economy by Chow (1993), Borensztein and Ostry (1996) and Hu and Khan (1997) suggest that the absence of human capital can overestimate the contribution of TFP to economic growth. After incorporating human capital, they found that the growth of total factor productivity played a positive but less significant role as the inclusion of the added input has the effect of reducing the impact of TFP. The results of the growth accounting exercise reported below confirm this picture for Thailand.

An extension to this work is to conduct levels rather than growth accounting, following the approach of Mankiw, Romer and Weil (1992) and others (e.g. Hall and Jones (1999)). This is a relatively straightforward extension also undertaken below and is intended to check whether the results of growth accounting hold in so far as the importance of productivity is concerned.

4.3. Factors Contributing to Economic Growth

There are many aspects of economic growth however, the crucial one is the increase in the real value of output produced by a unit of labour input. As an example, the value of output per hour worked in the US has roughly doubled in the period 1950 to 1991. Such increases in productivity can be attributed mainly to increases in the amount of capital used per hour worked as well as to technological progress.

The capital stock of an economy includes all the buildings, structures, and machinery used, in combination with labour time. It is obvious that each unit of labour can bring about more output as the capital stock per hour worked increases. But this is not the only and not necessarily the most important factor underlying economic growth. Technological progress is the key to offering future populations the potential for improved standards of living. Technical change enables firms to combine inputs in a novel manner to produce existing products more cheaply and to develop new products to meet consumer needs. Economists and other social scientists are in broad agreement that technological change is the most important contributor to economic growth in the modern era. Based on Robert Solow's and Moses Abramovitz's ground-breaking work more than 40 years ago, economists have estimated that more than half of the United States' long-run growth is attributable to technological change (Solow, 1957, Abramovitz, 1956).

Technological progress causes a given increase in the capital stock per hour worked to generate output more effectively. Conversely, it makes possible the attainment of any given increase in national output with a small increase in capital stock per hour worked. This increase in output per hour worked due to technological progress is called an increase in total factor productivity (TFP).

4.3.1. TFP Growth and Technological Change

The neoclassical growth model serves as the framework for TFP computation, TFP growth is generally attributed to technological change, and there has always been a concern that the actual conditions of an economy may be at variance with the neoclassical assumptions. In particular, it has been felt that the neoclassical assumption of perfect factor mobility and equality of marginal product and factor returns across sectors is rather stringent. The feeling towards the assumption of constant returns to scale in all sectors has also been the same (Islam 1999).

However, Jorgenson (1988) emphasises that measured growth of neoclassical inputs can explain more of output growth and can be viewed as departures from neoclassical assumptions. He deals extensively with aggregation issues and in particular shows that the existence of the aggregate production function requires the value added function and the capital and labour input functions for each sector to be identical to corresponding functions at the aggregate level. Identical sector production functions in turn imply identical input and output prices. Jorgenson (1988) computes growth rates of output and input with and without allowing for these price differences across sectors and finds the results to differ, particularly for shorter periods. He interprets resulting differences as a contribution to aggregate productivity growth of reallocation of value added, capital input, and labour input among sectors. Jorgenson's computation shows that over a relatively shorter period, the contribution of reallocation of factors to growth is significant.

Another work that addresses this issue in the context of international TFP of a small sample of developed countries in Maddision (1987). He works with the conventional (absolute form) time series growth accounting approach. Apart from the standard neoclassical sources of growth, namely labour and capital, Maddison considers a long list of other sources of growth, e.g. structural effect, foreign trade effect, economies of scale effect, etc. He shows that allowing for this non-neoclassical sources of growth has an important effect on international TFP comparisons. A country's relative position changes depending on whether or not these other effects are taken into account. This is because countries differ with regard to the degree of departure from the neoclassical assumptions, and correspondingly, with regard to the importance of these sources of growth.

Therefore, the main purpose was to obtain a broad indication about the importance of various sources of growth, neoclassical as well as structural.

4.3.2. Determinants of TFP Growth

There are three possible determinants of technological change that can be identified from the growth literature: inventions, economies of scale and learning by doing (Hall and Jones, 1997, Aghion and Howitt, 1999, and Young, 1993).

1. The invention of new products raises productivity indirectly by shifting labour and capital from old uses to new ones that are presumably of higher value, thus increasing the overall value of output. Invention activities are in general related to R&D expenditures and the average education level of the working population. However, whether international differences in R&D expenditures can help explain international difference in per capita GDP growth remains an open issue. Some empirical studies support the relationship while others dispute it. The contribution of education to TFP growth is much better established. (see Jones, 2000).

2. A second important determinant of TFP growth is economies of scale, i.e. falling unit costs at higher levels of production. Economies of scale can exist when the size or capacity of production facilities increases, or because of specialisation. Specialisation can raise TFP because less time is lost due to workers switching from one task to another, or because some workers may be better at some tasks than other workers are. The efficiency gain from specialisation of tasks within a firm extends to the specialisation of production across firms as well: if production is organised so that a large number of firms produce very specialised products, the productivity of labour and capital will be higher. The degree of specialisation depends on the size of the market. The economic integration of geographically dispersed market is perhaps the most significant channel through which economies of scale contribute to the growth of TFP. When regions that did not previously trade with each other begin to do so, market size for producers in both

regions expands, making it possible for more and more firms to profitably adopt bigger plant and if profitable specialise.

3. The third source of TFP growth is learning on the job or learning by doing. As individuals working together in a factory gain experience in the production of a new producing a given volume of output. Consequently, TFP increases simply as a result of experience. However, while TFP growth from learning effects may be substantial, it may ultimately stop. This does not mean that TFP growth as a result of learning by doing will after some time cease for the economy as a whole, though, since new products and new processes are added every year, there may be fresh opportunities for learning effects to increase TFP.

4.4. The Growth Accounting Framework

Total Factor Productivity (TFP) shows the relationship between a composite input and the output, calculated as a ratio of output and input. Productivity increases when the growth in output is greater than the growth in input, or when the rate of growth of output minus the rate of growth of the composite input is positive. Economic growth can be obtained either by increasing inputs or by improving factor productivity. Productivity growth occurs when a higher output can be attained with a given amount of input, or a certain level of output can be attained with smaller amounts of factor input. This productivity growth is obviously preferable to growth due to increase in factor inputs, since the latter might be subject to diminishing marginal returns. For a country with available natural resources as Thailand, an improvement in efficiency is distinctly more significant than for countries abundant in natural resources, and thus improvement in efficiency is especially important for Thai economies' growth. In the remainder of this section, we describe in detail our methodology for estimating TFP growth.

4.4.1. Total Factor Productivity and its measurement

Productivity is an indicator of the efficiency with which inputs in a production process are used to produce output. However, growth in a neo-classical framework stems from two sources: factor accumulation and productivity (TFP) growth. The key point of the debate at hand is the relative importance of each of these two components. A convenient way to conceptualise the notion of TFP is to start with a production function. We start with the aggregate production that tells us that output *Y* will be at some particular time *t* a function of the economy's stock of capital *K*, its labour *L*, and also of the total factor productivity, *A* as in Solow (1957). The aggregate production function can this be represented as

$$Y = F(L, K; t) \tag{4.1}$$

where *Y* denotes output, *L* labour, *K* capital, *t* time to allow for technical change. It is commonly assumed that technological change is disembodied and factor-neutral so that the technology indicator, *A*, can be separated from input factors as

$$Y = A(t)F(L, K) \tag{4.2}$$

The contribution of productivity gains in economic growth can best be described in the context of a growth accounting equation. Differentiating equation (2) with respect to time and dividing the resulting equation by *Y*, Solow (1957) obtains,

$$Y / Y = \dot{A} / A + A * \partial f / \partial K * \dot{K} / Y + A * \partial f / \partial L * \dot{L} / Y \tag{4.3}$$

where dots indicate time derivatives. Now, under perfect competition in the factor markets, so that the returns to capital (w_k) and labour (w_l) are the respective shares:

$$w_k = (\partial Y / \partial K)(K / Y);$$
$$w_l = (\partial Y / \partial L)(L / Y)$$

Substituting w_k and w_l into (4.3) gives the result

$$\dot{Y} / Y = \dot{A} / A + w_k * \dot{K} / K + w_l * \dot{L} / L \tag{4.4}$$

Now, let *F* be homogeneous of degree one, *i.e.* $Y / L = y, K / L = k, w_l = 1 - w_k$

Note that $\dot{y} / y = \dot{Y} / Y - \dot{L} / L; \dot{k} / k = \dot{K} / K - \dot{L} / L$

Then (4.4) becomes

$$\dot{y} / y = \dot{A} / A + w_k * \dot{k} / k \tag{4.5}$$

Equations (4.4) and (4.5) have been used widely in growth accounting; (4.4) allows us to separate out TFP growth ($\dot{A} / A$) from changes in the contributions of labour and capital, and (4.5) is the same calculation in terms of productivity of labour ($y = Y / L$). This is the Solow aggregate model, which assumes neutral technical change. In further development of the Solow model, Jorgenson, Gollop and Fraumeni (1987) use a translog production function to get a more precise estimate of TFP growth. This is done by disaggregating capital into its various components like machinery and plant, construction, inventory, etc, and labour based on skilled, un-skilled, age and gender. Thus, the Translog production function allows disaggregate analysis. In the Young (1992) framework, TFP growth is measured using a translog production function, and is defined as the difference between output growth and the weighted growth of inputs. Output growth is modelled as a translog function of inputs, hence the growth rates of inputs are weighted on the basis of their share in the total value of output. Importantly, in the translog function both growth in the quantity and quality of inputs is taken into account. This requires a detailed breakdown of different types of labour for example, according to the schooling levels and age, and of different types of capital.

This methodology allows us to analyse the sources of growth in real factor inputs between quantity and quality of factor inputs[4]. One of the more relevant questions is to know the contribution of the improvements in the design of new capital embodiment and the contribution of disembodied technical progress to economic growth. We consider that all inputs are different, one hour of work by an unskilled worker is not the same as one hour by a skilled worker. In common with the literature on quality changes, we assign a significant role to embodied technical change as a determinant of the prices of investment goods. This approach implies that technical progress can be attributed to capital. This is done by estimating the service flow from different vintages of capital. That is, technological improvements in the design of investment goods embodied technical change, may be a significant source of productivity change. One consequence of the embodiment hypothesis is that new capital is more productive than older capital (Hulten

[4] The earliest growth accounts only took into consideration the physical quantities of the two main factors of production, capital and labour input.

(1992)). This methodology considers that there are large differences in the marginal productivity of the different types of labour and capital. The Translog indices aid the decomposition of the growth rates into quantity and quality growth rates. The importance of this distinction is that we assume that the introduction of new, more efficient capital goods and more qualified human capital is an important source of productivity change.

It is clear that there has been much technological change in the production of new equipment and the not all capital has the same quality. The production of capital goods becomes increasingly efficient with the passage of time. The failure to measure capital efficiency units has the effect of suppressing the quality effects into the conventional TFP residual.

Early growth accounting included in the residual not only pure disembodied innovation, but also the innovation embodied in capital good (capital quality), human capital accumulation (labour quality) and improvements in markets (resource allocation). Understanding the changes in the quality of capital is very useful to study the importance of technology transfer in the catching-up process by developing countries. For instance, if growth rates can be explained by improvements in the quality of capital, then the success of Thailand in this period must also be due to the adoption of new machinery. Conversely, if productivity improvement is relatively independent of factors of production, one must underline the importance of disembodied technical change that productivity (not due to more and better machines). In summary, growth accounting essentially divides output growth into a component that can be explained by some quality adjusted input growth, and a 'Solow residual' which captures changes in productivity.

4.4.2. Translog Production Function.

The methodology is based on a constant returns to scale Translog production function, which gives the theoretical justification for the use of factor shares to weight of growth rates[5].

[5] See Young (1992).

$$\ln Y = \alpha_0 + \alpha_K \ln K + \alpha_L \ln L + \alpha_t t + 0.5\beta_{KK}(\ln K)^2 + \beta_{KL}(\ln K \ln L) + \beta_{Kt} \ln K * t + 0.5\beta_{LL}(\ln L)^2 + \beta_{Lt} \ln L * t + 0.5\beta_{tt} t^2 \quad (4.6)$$

where *Y* is output, *K, L,* and *t* denote capital input, labour input and time, and where under the assumption of constant returns to scale, the parameters satisfy the restriction:

$$\alpha_K + \alpha_L = 1, \beta_{KK} + \beta_{KL} = 0, \beta_{KL} + \beta_{LL} = 0$$

The necessary conditions for producer equilibrium are given by equalities between the value shares and the elasticities of output with respect to the corresponding inputs. Under constant returns to scale the value shares for capital and labour sum to unity:

$$\theta_K = \partial \ln Y(K, L, t) / \partial \ln K = \alpha_K + \beta_{KK} \ln K + \beta_{KL} \ln L + \beta_{Kt} t$$

$$\theta_L = \partial \ln Y(K, L, t) / \partial \ln L = \alpha_L + \beta_{KL} \ln K + \beta_{LL} \ln L + \beta_{Lt} t$$

We can define the rate of productivity growth, say θ_t, as the growth of output with respect to time, holding capital input and labour input constant:

$$\theta_t = \partial \ln Y(K, L, t) / \partial \ln t = \alpha_t + \beta_{Kt} \ln K + \beta_{Lt} \ln L + \beta_{tt} t$$

If we consider data at any two discrete points of time, say *t* and *t-1* , the average rate of technical change can be expressed as the difference between successive logarithms of output less a weighted average of the differences between successive logarithms of capital and labour input with weights given by average value shares:

$$\ln Y(t) - \ln Y(t-1) = \bar{\theta}_K \left[\ln K(t) - \ln K(t-1)\right] + \bar{\theta}_L \left[\ln L(t) - \ln L(t-1)\right] + TFP_{(t-1,t)} \quad (4.7)$$

where

$$\bar{\theta}_K = 0.5\left[\theta_K(t) + \theta_K(t-1)\right]$$

$$\bar{\theta}_L = 0.5\left[\theta_L(t) + \theta_L(t-1)\right]$$

If aggregate capital and labour inputs are translog functions of their components, we can express the difference between successive logarithms of aggregate capital and labour inputs in the form:

$\ln K(t) - \ln K(t-1) = \sum_i \bar{\theta}_{Ki} \left[\ln K_i(t) - \ln K_i(t-1)\right] \Rightarrow$ Translog index of capital input.

(4.8)

$$\ln L(t) - \ln L(t-1) = \sum_j \overline{\theta}_{Lj} \left[\ln L_j(t) - \ln L_j(t-1)\right] \Rightarrow$$ Translog index of labour input.

(4.9)

where

$$\overline{\theta}_{Ki} = \frac{\left[\theta_{Ki}(t) + \theta_{Ki}(t-1)\right]}{2} \qquad \text{(i=1,2,...n)}$$

$$\overline{\theta}_{Lj} = \frac{\left[\theta_{Lj}(t) + \theta_{Lj}(t-1)\right]}{2} \qquad \text{(j=1,2,...n)}$$

$\overline{\theta}_{ij}$ denotes the elasticity of each aggregate input with respect to each of its component sub-inputs, assuming perfect competition, the share of each sub-input in total payments to its aggregate factor. These indexes adjust for improvements in the quality of aggregate capital and labour input by, to a first-order approximation, weighting the growth of each sub-input by its average marginal product.

4.4.3. Human Capital Adjusted TFP

Over the last five decades there has been a radical change in Thailand's economic landscape as the country moved from a primarily agricultural to a non-agricultural society. Currently, Thailand is moving towards a more knowledge-based economy. Hence information technology skills and various managerial skills are important and much needed. However, these types of skills are not readily available, even though the overall educational level, especially secondary education, has shown impressive achievements with the proportion of employees in secondary education increasing from 8 percent in 1979 to almost 30 percent in 1999 (UNDP 1999), although this is relatively low compared to other SE Asian counties (see Figure 4.1 below and Figure 3.7 in Chapter 3). However, it is clear that structural changes associated with industrialisation require different kinds of skills, and a shift of labour from the agricultural sector to the industrial and service sectors also demands corresponding changes in skills. This suggests that the quality of labour is important in accounting for growth although the relatively low level of educational attainment and skill base in Thailand is unlikely to guarantee a sufficient supply of skilled labour needed for faster growth.

Our analysis based on these ideas will draw upon recent theories of endogenous growth suggesting a positive effect of human capital on economic growth, although empirical evidence on this issue has been mixed. In the context of growth accounting, this also suggests additional determinants of growth beyond the basic factors of production. To keep the analysis simple, we adopt the Cobb-Douglas production function:

$$Y_t = A_t K_t^{1-\alpha} (L_t H_t)^{\alpha} \qquad (4.10)$$

where Y_t equals real GDP, K_t equals the total physical capital stock, L_t equals the number of workers (employed persons), H_t is average schooling years of population of age 15+ group or age 25+ group and represents human capital stock. Thus, (L_t H_t) is a skill-adjusted measure of labour input, and A_t equals an index of total factor productivity. Taking logs and differentiating totally both sides of equation (4.10) with respect to time yields:

$$y_t = a_t + (1-\alpha)\hat{k}_t + \alpha(\hat{l}_t + \hat{h}_t) \qquad (4.11)$$

and rewriting (4.11) gives the following:

$$a_t = y_t - (1-\alpha)\hat{k}_t - \alpha(\hat{l}_t + \hat{h}_t) \qquad (4.12)$$

where a_t is the growth of human capital adjusted TFP, and y_t is the growth of real output. $\hat{k}$, the growth of real capital, $\hat{l}$, the growth of labour and $\hat{h}$, the growth of educational attainment. Equation (4.12) thus represents the growth rate of TFP as the growth rate of output minus a weighted average of the growth rates of physical capital and skill-augmented labour. Under the assumption of perfect competition and constant returns to scale, these weights are the shares of the two inputs in aggregate output. In addition, the production function parameters are central to the decomposition of output growth into contributions from physical capital, labour and productivity. However, if these sources of bias are somehow successfully removed, the remaining portion of output growth unexplained by the weighted average of the rate of input growth is the measure of real TFP growth, and would be attributed to productivity or technological change.

4.5. Measurement of human capital

According to Barro and Lee (1993), there are three suggested ways to measures the human capital: (i) school enrolment ratios, (ii) adult literacy ratios, and (iii) educational attainement. Schooling enrolment ratios are widely available across countries but, as a measure of the stock of human capital, this measure is deficient for developing countries since it does not account for the fact that many parents are not able to send their children to school. The adult literacy rate has frequently been used in empirical studies, because it measures a stock of human capital for the adult population, whereas the school enrolment ratios measure the flow of education. However, this measure is less widely available because the underlying information typically comes from general population censuses and surveys, activities that usually occur only once per decade. Educational attainment, favoured by Barro and Lee (1993, 2000), provide information on the average number of years of education attained for a specified population group, such as the labour force or persons aged 25 and over.

In this study we have obtained data on educational attainment from Barro-Lee (2010) and The World Bank (2001), covering the period 1973-2006. These two databases reflect the major alternative approaches to estimating education attainment. The first method, as illustrated by the World Bank study, relies on school enrolment data, which are quite widely available. The approach is similar to that used to construct measures of the physical capital stock, past investments are used to build up a stock of educational skills in the current working population. It requires keeping track of the educational attainment of each age cohort as it accesses through the ages of school attendance and enters into the labour force and as it retires or dies. The researchers had access to school enrolment data extending back into the 1930s. The alternative approach, used by Barro-Lee, use census reports of the educational level of the population age 25 and over as the primary information source. Thus, it can be viewed as developing direct estimates of the stock of education at various points in time and interpolating between them.

Using a perpetual inventory method (PIM), Barro and Lee (2010) construct a measure of human capital stock. Their data set comprises at least one observation for 142 countries, of which 107 have complete information at five-year intervals from 1960 to 2008. The percentage of the population who have successfully completed a given level of schooling (secondary, tertiary, or post-primary schooling) is a straightforward way to show the population's attainment of skills and knowledge associated with a particular level of education[6]. With these data they can construct measures of average years of schooling at all levels for each country, which is taken as the human capital stock series.

Finding a relationship between gains in educational attainment and economic growth is due to the frequent use in the empirical studies of "years of schooling" to measure the change in labour quality. Barro and Lee applied an exponent of 0.5 to the measure of year of schooling (*s*) to compute an index of labour (*H*):

$$H_{i1} = s_i^{0.5} \tag{4.13}$$

This approach still implies very large gains in quality for countries that begin with a very low level of educational attainment. Essentially, those with no schooling are being assigned a zero weight in the index of labour quality. Instead, it is necessary to construct a measure that explicitly incorporates relative wage rates to aggregate the skills of workers at different levels of educational attainment. Of course, this type of detailed data is not available for more than a few countries; even then it can be distorted if education is used as a simple screening device to separate workers whose skills differ for other reasons. However, those few studies that have examined the structure of relative wage rates by education find surprisingly little variation across countries[7]. Thus they have used Denison's studies to construct a single set of weights that they apply to the proportions of

[6] In particular, however, each cycle of education has significant variation in duration across countries. They also take account of this variation by using information on the typical duration of each level of schooling within countries.

[7] See Denison (1967) and World Development Report (1995).

the population at different educational level (P_j). The measures are standardised at 1.0 for those who have completed the primary level of education. The relevant wage weights are 0.7 for no schooling, 1.4 for completion of the secondary level, and 2.0 for completion of the third level. Weights for intervening levels of education by interpolation:

$$H_{i2} = \sum_j w_j * P_{ij} \qquad (4.14)$$

where P_j equals the proportion of the working age population in the j^{th} education level. Data are reported as years of average schooling at each level. The constructed index is based on a comparable relationship that translates year of schooling at each level. We have a preference for the Barro-Lee data because it seems more in accord with expectations; and Barro-Lee approach should provide high quality results for the developing countries like Thailand.

4.6. Human Capital Stock of Thailand

4.6.1. Development of Thailand's Education

In Thailand, education begins with kindergarten (ages 3-6) and continues with primary (age 6-12) and secondary education (age 12-18), which includes junior and senior secondary schools, specialised secondary schools, vocational schools, and technical training schools. Higher education, which includes universities and colleges as well as postgraduate programmes, requires 4-5 years for a Bachelor degree, 7-8 years for a Master's degree, and 10-11 years for a Ph.D.

Around 50 per cent of Thai's population were without formal schooling after World War II (1973-1945) and the Civil War (1945-1949). In the 1950s, there was a widespread movement to eradicate illiteracy. In the 1960s, the implementation of an obligatory mandatory nine-year education policy began. This policy called for six years in primary school and three years in junior secondary school. While the implementation of this policy has been consistent in urban areas, it did not materialise in rural regions in terms of financial assistance. The enrolment growth at the primary level is slow compared to other levels because the coverage at this level was already extensive for a long time. Slower growth in enrolment in primary education also stems from the decline in birth rate since 1970s and a reduction in dropout and repetition rate that reduced the proportion of students in the primary school age range. By the mid 1990s, Thailand achieved virtually universal enrolment in primary education, but the quality varies a great deal. Only two-thirds of primary school students currently complete their entire primary cycle. In some remote and poor regions, completion rate were also as low as 45 per cent.

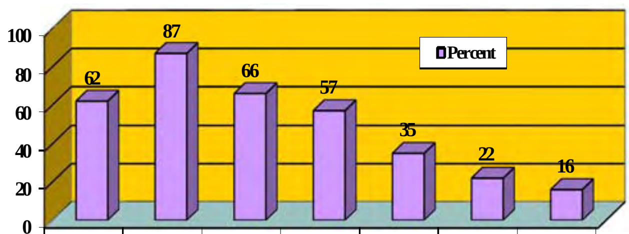
At secondary level, gross enrolment rates rose progressively but both enrolment rates and growth at this and the tertiary level remained low, relative to those of other Asian countries. Although government policies created better educational opportunities for working class and peasants, famine and social conflict in the early 1960s thwarted that momentum. Regular enrolment was restored in 1970s, but Thailand had already lagged behind Korea, Malaysia, Indonesia, and other countries (see Figure 4.1 below).

At the tertiary level, however, coverage is also low (see Figure 3.8 in Chapter 3). Thailand does lag behind other countries regarding some dimension of educational progress. For instance, its rate of enrolment particularly in higher education is about average among all Asian countries and the rates found in some low-income countries.

4.6.2. Trends in Thailand's Human Capital Stock

As argued above, improving the quality of human capital is the most promising strategy for sustainable economic growth in Thailand. The Government has shown its commitment to the strategy of human capital development by improving the quality of education and providing educational access to more of the nation's school-age children. (as part of Thailand's ninth five-year plan, 2002-2006). Over the past decade, a substantial budget share has been allocated to the education sector. In recent years, spending on education has equalled nearly 20 percent of the total government budget and about 4 percent of GDP, comparable to the allocations in many high-income countries, including Japan and the USA. Despite the 1997 crisis, which has necessitated budget tightening, the education's share of the Thai total budget has continued to be higher than the share of any other sector. The National Educational Act of 1999 demonstrates the Government's commitment to education by promising 12 years of quality education for all Thai children, free of charge, in 2004.

Figure 4.1 Percentages of population (25-64 years) completing secondary education in selected countries, 1999



	UK	USA	Korea	Australia	Malaysia	Indonesia	Thailand
Percent	62	87	66	57	35	22	16

Source: OECD Education at a Glance, OECD Indicators, 2001

However, despite having achieved nearly universal enrolment in primary education and high adult literacy rates, Thailand has, until very recently, lagged behind other countries at comparable income levels in terms of secondary education development. As can be seen from Figure 4.1, only 16 percent of Thailand's adult population between the age of 25 and 64 have completed secondary education. This is one of the lowest levels in East Asia and far below the level of most developing countries.

However, the situation in Thailand began to change rapidly in the mid-1990s, as Thailand's gross secondary enrolment ratio increased by half, rising from 40 percent in 1993 to nearly 70 percent in 2000 (ONEC statistics). Moreover, secondary education attainment is likely to increase significantly when the full impact of the National Education Act of 1999 takes place. This suggests that human capital is likely to be an important determinant of further economic development in Thailand.

4.7. Data and Results

We report below the results of Solow's growth accounting exercise undertaken for Thailand, using the translog function method as employed by Young (1992). The analysis focuses on data for output i.e. real GDP and three aggregate inputs, physical capital, labour and a measure of human capital. Real GDP is reported in the International Financial Statistics (IMF) at constant prices with 1995 chosen as the base year.

The Capital stock of Thailand was compiled for the first time covering the period of 1970-1996 by the National Economic and Social Development Board (NESDB). In the case of Thailand, capital stock is composed of three major parts. These are buildings and structures, machinery and equipment, and cultivated land development. In Thailand, perpetual inventory method (PIM) was conducted to obtain the benchmark figures of capital stock and related data. The basic concept of PIM is to accumulate gross fixed capital formation from the first year to the current year minus the value of capital retirement. The result is gross capital stock. To derive net capital stock, the accumulated depreciation over the same period has to be subtracted from the total value of the gross capital stock[8]. This is equivalent to the net capital stock in the previous year plus gross investment in the current year minus annual depreciation (see *Appendix A.4.1*).

In the case of labour, the Labour Force Survey (LFS) has been undertaken by the National Statistical Office since 1963. The survey started in 1971, two rounds of the survey for the whole kingdom had been conducted each year, the first round enumeration was held during January-March coinciding with the non-agricultural season and the second round during July-September coinciding with the agricultural season. From 1984-1997, the survey has conducted three rounds a year, the fourth round of the survey for the whole kingdom has been conducted additionally during October-December. Since then, the LFS has been undertaken four times a year; the first round is February, the second in May, the third round and the fourth rounds in August and November respectively. We chose the second round LFS because the timing is considered fairly consistent. Ideally, a series of the average employment is calculated between the dry and

[8] Depreciation is simply calculated using the straight-line method. Values of scrap in each item of all asset types are assumed 1 per cent of its value at purchasing time. Depreciation is equivalent to value of assets, subtracted by scrap, divided by expected economic lifetime. In general, lifetime is recorded at 45-50 years for building and structure and at 10-15 years for machinery and equipment. No lifetime is estimate for dam and road.

the rainy seasons. However, there would be a downward bias in the TFP for the agriculture sector and an upward bias for the non-agricultural sector.

As a measure of human capital, we use the initial-year level of average years of the secondary schooling attainment constructed by Barro and Lee (2000) as a proxy of human capital.

Table 4.1 below displays results in five-year averages as well as for the entire period 1972-2000, using the aggregate measures capital and labour, excluding human capital[9]. The five-year averages smooth out annual effects but the result may still indicate substantial variations in TFP growth (TFPG hereafter) between the five-year spans, given nearly three decades of annual data.

Table 4.1 suggests TFPG has been consistently high, in excess of 20%, showing a productivity slowdown during the period 1996-2006 (by 358%), the decline in output growth during this period is also partly attributed to the negative contribution of capital during the period of the Thai financial crisis. Over the entire period 2000-2006, it can be noted that productivity, capital and labour contributed, respectively, about 21%, 46% and 33% to output growth. Hence, it appears that Thailand's economic growth is 67% input driven and 33% productivity driven over this period.

Table 4.1. Percentage contribution of labour, capital and TFP

period of study	Output	Growth of labour	Capital	Average capital share	Average labour share	Labour	Percentage contribution of capital	TFP
72-76	0.273	0.132	-0.083	0.429	0.571	0.277	-0.13	0.853
76-80	0.292	0.201	0.082	0.48	0.52	0.358	0.136	0.506
80-84	0.22	0.144	0.283	0.473	0.527	0.344	0.61	0.046
84-88	0.314	0.125	0.311	0.516	0.484	0.193	0.511	0.296
88-92	0.318	0.095	0.476	0.484	0.516	0.129	0.604	0.267
92-96	0.319	-0.005	0.381	0.477	0.523	-0.008	0.57	0.438
96-00	-0.051	0.024	0.247	0.484	0.516	-0.239	-2.343	3.582
00-06	1.748	0.716	1.698	0.473	0.527	0.214	0.459	0.327

[9] Hence, the results are based on the use of equation (4.6) above.

Table 4.2. Output per worker (attributable to TFP), Gtfp = [GY - GL] - capital share [GK - GL] and output per worker (capital accumulation).							
Time period			Average				
	[GY- GL]	[GK - GL]	Capital share	real [GK - GL]	Gtfp	Output per worker (attributable to TFP)	Output per worker (capital accumulation)
72-76	0.141	-0.215	0.4288	-0.092	0.233	1.65	-0.65
76-80	0.091	-0.119	0.4802	-0.057	0.148	1.63	-0.63
80-84	0.076	0.139	0.473	0.066	0.01	0.13	0.87
84-88	0.189	0.186	0.516	0.096	0.093	0.49	0.51
88-92	0.223	0.381	0.4842	0.184	0.039	0.17	0.83
92-96	0.324	0.386	0.477	0.184	0.14	0.43	0.57
96-00	-0.075	0.223	0.4838	0.108	-0.183	2.44	-1.44
00-06	1.032	0.982	0.473	0.464	0.568	0.55	0.45

Note: GY denote growth of output, GL denote growth of labour, GK denote growth of capital, Gtfp denote growth of total factor productivity.

Table 4.2 shows the same calculations in per capita terms, in order to indicate the contribution of output due to capital accumulation, as also shown by Young (1992).[10] Over the period 2000-2006, the results indicate TFPG (adjusted for labour force growth) at 55% but per capita output growth attributed to capital accumulation at 45%. Note that the rapid capital decline over the period 1996-2000 translates to a decline in per capita output growth attribute to capital by over 100%.

Table 4.3 shows the TFP calculations after including human capital as an additional variable in growth accounting equation, human capital being represented by secondary educational attainment levels for age groups 25+.[11] The results show that skill-adjusted labour input growth does lead to reduction in the TFP residual, as predicted, except for the time periods 1980-84 and 1996-2000. In the former case, a relatively high percentage of human capital leads to a negative TFP, but in the latter case the percentage contribution of human capital to output growth is actually negative, implying a productivity slowdown as output growth is negative over this period. On average, over the entire period 2000-2006 these effects cancel out, suggesting that output growth is 86% input-driven, but still a significant 14% total factor productivity driven.

[10] Here, the results are based on the use of equation (4.7) above.

[11] The results are based on the use of equation (4.11) or (4.12) and using the same data set for physical capital and labour.

Table 4.3. TFP calculations with Human Capital.								
Time period	**Output**	**Growth of capital**	**Labour**	**Human Capital**	**Capital**	**Percentage contribution of**	**Human Capital**	**TFP**
72-76	0.273	0.132	-0.083	0.014	0.207	-0.174	0.029	0.937
76-80	0.292	0.201	0.082	0.049	0.331	0.146	0.087	0.436
80-84	0.22	0.144	0.283	0.195	0.31	0.678	0.466	-0.454
84-88	0.314	0.125	0.311	0.111	0.205	0.479	0.172	0.143
88-92	0.381	0.095	0.176	0.072	0.121	0.238	0.097	0.544
92-96	0.319	-0.005	0.381	0.053	-0.007	0.625	0.087	0.296
96-00	-0.05	0.024	0.247	0.05	-0.228	-2.5	-0.51	4.238
00-06	1.748	0.716	1.698	0.544	0.194	0.507	0.163	0.137

Table 4.4 shows analogous calculations as reported in Table 4.2 but with human capital included in the production function. In computing these values we have used data for educational attainment at 25+. The results suggest that of the per capita output growth over the period 2000-2006, 146 per cent attributed to capital accumulation, leaving -46% to be attributed to TFP growth. Thus, adjusting for capital/labour ratio with human capital-augmented labour contributes to a reduction of the Solow residual as expected.

Table 4.4. Growth of output per worker attributable to Capital Accumulation and TFP (with Human Capital).							
Time period	**GY-(GL+GH)**	**GK-(GL+GH)**	**Average share of augmented capital**	**Real GK-(GL+GH)**	**Gtfp**	**Output per worker (Capital Accumulation)**	**Output per worker (attributable to TFP)**
72-76	0.342	0.201	0.4288	0.086	0.256	0.252	0.748
76-80	0.161	0.07	0.4802	0.034	0.127	0.209	0.791
80-84	-0.258	-0.334	0.473	-0.158	-0.1	0.612	0.388
84-88	-0.108	-0.297	0.516	-0.153	0.045	1.419	-0.419
88-92	0.133	-0.153	0.4842	-0.074	0.207	-0.557	1.557
92-96	-0.115	-0.439	0.477	-0.209	0.094	1.821	-0.821
96-00	-0.348	-0.273	0.4838	-0.132	-0.216	0.38	0.62
00-06	-0.494	-1.526	0.473	-0.722	0.228	1.461	-0.461

4.8. An analysis of the findings

Research by Young (1992, 1995), Kim and Lau (1994) and Krugman (1994) have generated considerable controversy surrounding the rapid growth of the East Asian

Economies, arguing that factor accumulation has been responsible for a major part of the economic growth. Our results are broadly consistent with this view, although productivity growth is also arguably an important factor.

In Thailand, during the early period of our study (1972-76), productivity accounted for over 80% of output growth although in the subsequent periods (1976-80 and 1980-84) this contribution is much lower. This reduction has come about as a result of a higher capital accumulation and, to some extent, higher labour force growth although the latter has subsequently declined. Higher capital accumulation was supported by a high savings rate as well as import-substituting industrialisation strategy, which prompted the importation of capital goods. The increase in the labour force initially came from a growing population as well as a rising labour force participation rate, both of which have subsequently declined, thus reversing the trend in labour force growth in subsequent years.

In the early part of the 1980s, the growth of capital stock was lower than GDP growth, the effect of which has meant that the productivity contribution to output growth has been particularly high during the period 1984-88, as output growth rose faster than capital accumulation while labour force growth declined over this period. In subsequent periods, much of the output growth is explained by rapid capital accumulation (possibly a result of the shift to export-led growth) and some productivity growth as labour force continued to decline. This is evident from Table 4.2, showing a much higher contribution of capital accumulation in per capita output growth over the periods 1988-96 compared to other time periods. By contrast, over the period 1996-2000, output growth actually registers a decline, but this period of the Thai financial crisis has also resulted in much greater reduction in the growth of capital stock, implying that just over 100% of the decline in output growth is attributed to a decline in capital accumulation, the remainder being due mainly to a slowdown in productivity. The inclusion of human capital slightly reduces the proportion of this contribution (and consequently increases the proportion of the productivity contribution) in the decline of output growth. Excluding human capital, nearly 45% is the net contribution of productivity growth to more than 100% growth of per capita output during the period 1973-2006 (Table 4.2). Adjusting for human capital-augmented labour, the net contribution of productivity over the same period is -46% as noted earlier.

4.9. A View from levels accounting

The above exercise can be compared with levels accounting where output per capita is decomposed into capital-output (rather than the capital-labour) ratio, human capital per worker, and productivity. This follows the approach of Mankiw, Romer and Weil (1992) and others (e.g. Hall and Jones (1999)). This is relatively straightforward extension of the Solow residual approach and is intended to check whether the results of growth accounting have undermined the importance of productivity (Hall and Jones (1999)). Incorporating human capital in a Cobb-Douglas production function, we follow Hall and Jones (1999) by proceeding as follows:

$$Y_t = K_t^{\alpha}(A_t H_t)^{1-\alpha} \qquad (4.13)$$

where Y_t and K_t are same as in equation (4.10) above, where A_t is “a labour-augmenting measure of productivity”. H_t, human capital-augmented labour is defined as

$$H_t = e^{(E_t)} L_t \qquad (4.14)$$

where E_t indicates average years of schooling (of the Thai total employment in year *t). E_t* was used as a measure of human capital in the earlier stage. Rewrite equation (4.13) in per capita terms as

$$y_t = (K_t / y_t)^{\alpha/1-\alpha} . h_t . A_t \qquad (4.15)$$

where $h \equiv$ H/L is human capital per worker.

Table 4.5. Level Accounting for Thailand.										1972=100		
					Contribution of						Contribution of	
Year	Y	L	K	H	Y/L	H/L	K/Y^α/(1-α)	A		Y/L	K/Y^α/(1-α)	A
1972	712.49	16618.6	2644.35	34.467	0.04605	0.00214	2.24783	9.5874		1	1	1
1975	892.06	18818.7	2349.23	34.813	0.04906	0.00191	1.81485	14.11915		1.06542	0.80738	1.47268
1980	1306.71	22507.7	2693.11	43.38	0.05806	0.00193	1.92381	15.65767		1.2607	0.85585	1.63315
1985	1704.03	25837	3920.71	119.104	0.06595	0.00461	2.28562	6.25961		1.43218	1.01681	0.6529
1990	2781.53	30940.1	6403.79	210.608	0.0899	0.00681	2.08866	6.32327		1.9522	0.92919	0.65954
2001	4194.6	32575	10692.8	307.968	0.12877	0.00945	2.43977	5.58259		2.79621	1.08539	0.58228
2002	4487.66	32232.3	11496.7	330.298	0.13923	0.01025	2.86434	4.74339		3.02337	1.27427	0.49475
2003	4486.25	33162.3	12589.3	357.808	0.13528	0.01079	2.47862	5.05851		2.93766	1.10267	0.52762
2004	4319.66	32138	13591.1	383.752	0.13441	0.01194	2.89306	3.89082		2.91873	1.28705	0.40583
2005	4376.26	32087.1	13644.8	415.713	0.13639	0.01296	2.83293	3.71598		2.96166	1.26029	0.38759
2006	4264.84	33001	14711.9	445.856	0.12923	0.01351	2.92098	3.27476		2.80633	1.29946	0.34157

The levels accounting approach based on equation (4.15) thus decomposes output per capita into capital-output ratio, educational attainment (the human capital ratio), and productivity. In calculating the effects of these factors, we use the same values for the capital and labour share of output (α, $1-\alpha$) as in the growth accounting approach, assuming perfect competition in the factor markets and constant returns to scale.[12]

Table 4.5 presents the results based on equation (4.15) for some selected years. The contribution of TFP is notably high in the earlier years and deteriorates steadily, as we noted in the growth accounting case (see Table 4.4). This of course is due in part to the rise in the human capital ratio over the period, which represents a significant factor in explaining labour productivity of the Thai economy.

4.10. Conclusion and Implications

This chapter investigates the changes in the sources of economic growth during the period 1973-2006 by undertaking both a growth accounting exercise and level accounting approach, incorporating human capital. The accumulation of human capital in Thailand as measured by the average years of schooling attainment in population age 25-64, and it contributes significantly to growth. The rate of growth of human capital increased significantly in the period 1973-2006. After incorporating human capital, the growth of

[12] Thus α varies in each period, but results based on a common value of α = 1/3 does not significantly alter the conclusion. In fact, as our calculation of the factor shares exceeds 1/3, the estimates of the Solow residual are lower than would be the case otherwise.

total factor productivity still plays a positive and significant role during the pre-crisis period (1972-1996), in contrast to the negative contribution from capital, labour, and human capital during the period 1997-2006 (see Table 4.3). Thus, we conclude that productivity growth and factor accumulation are significant in accounting for Thai growth performance during the pre and post crisis period[13].

In summary, the aggregate picture for Thailand is broadly in line with conclusions reached by Young (1992) for Singapore and Hong Kong, Kim and Lau (1994) for Singapore, Hong Kong, South Korea and China, and more recently Singh and Trieu (1999) for Japan, South Korea and Taiwan. As Krugman argues, output growth for SE Asian counties has been driven mainly by mobilisation of resources rather than by technological change, and our results are not inconsistent with this view although we do find a Solow residual that is still high even after incorporating human capital in our analysis. In fact, a significantly large residual for the period 1997-2006 seems to indicate that productivity slowdown may have been a factor in contributing to the Thai recession over this period. However, there remains the outstanding question of investigating the importance of other factors. More importantly, there may be a role for openness and technology transfer in the form of FDI in promoting efficiency of production in the earlier decades. In particular, there may be complementarities between human capital, FDI, domestic investment and openness that need to be explored further, given the recent study by Borensztein et al. (1998) who find, in a cross-country context, a strong positive association between FDI and the level of educational attainment (our proxy for human capital) suggesting that the effect of FDI is dependent on the level of human capital available in the host economy. These issues are investigated in Chapter 5 and 6.

[13] Financial crisis in Asia happened in the mid of 1997.

Chapter 5

Economic Impact of FDI, Trade and Human Capital in Thailand

5.1. Introduction

The most Heavily Indebted Poor Countries of the world remain largely dependent on bilateral and multilateral aid for their development strategies. However, since 1990 total Overseas Development Assistance (ODA) has dropped by more than half. Much greater importance is now being placed on alternative sources of capital. Foreign Direct Investment (FDI) is now the largest source of foreign private capital reaching developing countries (Figure 5.1).

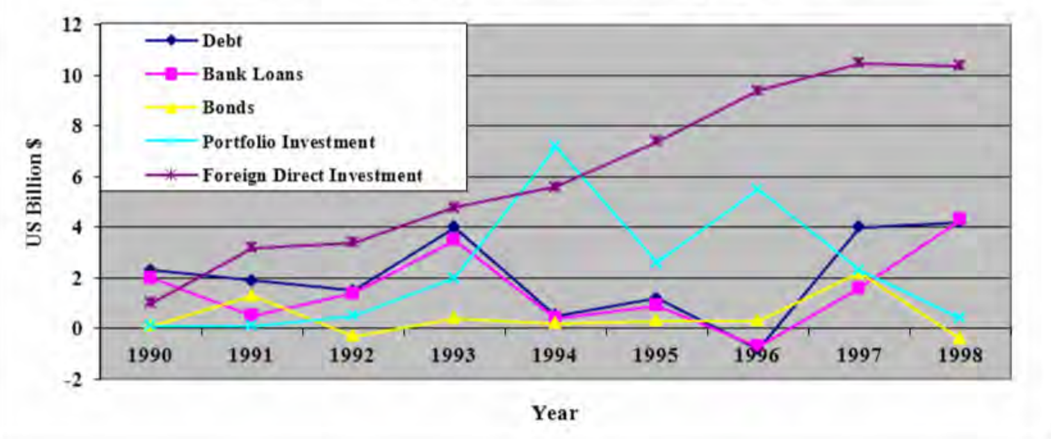


Figure 5.1 Private Capital Flows to Developing Countries

Source: ECOSOC (Economic and Social Council (2000)).

Global flows of FDI have grown phenomenally over the last ten years. Total inflows rose by nearly four times, from US $174 billion in 1992 to US$ 644 billion in 1998. However, total flows to developing economies fell between 1997 and 1998 (UNCTAD 1999). The UNCTAD Secretary General's report "Financial Resources and Mechanisms" to the eight UN Commission on Sustainable Development indicates increased international dialogue about whether FDI is a significant source of development economic growth. For all its potential, there is far greater awareness of the complex nature of FDI and the possible negative impacts of rapid and large growth for least developed countries. A crucial question is how FDI might be better applied to support more sustainable forms of development, particularly in those countries with burgeoning debts and widening income disparity with the rest of the world like Thailand.

Therefore, the issue of foreign direct investment interacting with economic growth in developing countries has become increasingly important because many developing countries have adopted a more liberal policy towards FDI since the mid-1980s in order to accelerate their economic growth. Relevant literature in this issue might be divided into two groups. The first is based on the growth theory in which FDI has been introduced as one of the factors explaining output growth. These studies suggest that FDI has been able to enhance the economic growth of host countries through efficiency spillover and technology transfer in addition to capital formation, export promotion, and employment augmentation [Das (1987); Din (1994); Rodriguez-Clare (1996)]. This spill over efficiency occurs when the advanced technologies embodied in FDI are transferred to domestic plants through the presence of multinational firms. According to new growth theory, the spillover affects host economies through changes in the nature of market concentration and transfer of technological, managerial and financial practices in the industries that the multinational firm enters. These considerations lead to the hypothesis of FDI-led growth[1].

The other group of studies that focus on the existence of multinational firms suggests an argument for growth-driven inward FDI. Viewed as a substitute for domestic capital, FDI inflows would increase with an expanding domestic demand for capital generated by economic growth. More importantly, expanding domestic markets due to income growth make it possible for multinational firms to exploit economies of scale [Markusen (1995)]. Moreover, improvements in human capital development, labour

[1] The role of FDI in host economies has been subject to considerable dispute. A good survey on the issue can be found in Cave (1996). Some studies argue that FDI does not improve or may even reduce the welfare of a recipient country when multinationals create enclave economies within host countries, and when market distortions exist in the host economy due to tariffs or taxes. According to the dependency theory, FDI might actually lower domestic savings and investment, lead to the shrinking of indigenous industries, widen the income gap, and bias the economy toward an inappropriate technology and product mix. Some even believe that multinational firms may engage in a series of tactics that enhance the welfare of industrialised countries at the expense of host countries.

productivity and infrastructure through economic growth would increase the marginal return to capital, thereby expanding the demand for investment including FDI [Zhang and Markusen (1999)]. In short, other things being equal, better economic performance in host countries provides foreign investors with a better investment environment and greater opportunities for making profits, which implies the hypothesis of growth-driven FDI.

Along with these two lines, many empirical studies have been done to test how FDI affects host economies and how host economies performance determines inward FDI flows. The studies that test the hypothesis of FDI-led growth include Balasubramanyam, Salisu, and Sapsford (1996), and Borensztein, De Gregorio and Lee (1998). In their paper, Borensztein et al. (1998) carry out cross-section empirical analysis to examine the effect of foreign direct investment (FDI) on economic growth. Their results suggest that FDI is an important vehicle of the transfer of technology, contributing relatively more to growth than domestic investment. However, the higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital. Thus, FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy.

In this chapter, we test a similar hypothesis for Thailand, namely that FDI-led growth is dependent on a minimum threshold level of educational attainment (human capital). We also extend our study to test the export-led growth hypothesis for Thailand, alongside FDI-led growth and examine whether and to what extent this is effected by the threshold level of human capital. Thus, extending the Borensztein model in a time series context, we estimate an error correction model for the Thai economy over the period 1973-2006 to examine the impact of FDI as well as trade openness, conditional on domestic investment, human capital, and other factors including government expenditure.

Our main finding is that FDI per se does not have a positive and significant effect on economic growth as theory predicts, but FDI in conjunction with human capital does have a significant impact on growth, suggesting that a sufficient absorptive capability of human capital in the host country is important for FDI to matter for growth. In this sense, our finding accords with that of Borensztein et al. (1998) who argue that the minimum threshold level of human capital is necessary for FDI to have a positive impact on growth. Empirically, we also calculate a minimum threshold level of human capital from our estimated model indicating that Thailand satisfies this minimum. Comparing FDI and export-led growth hypotheses, however, we find support for the latter as the effect trade openness on growth has been more significant across most estimated variants of our empirical specification. After controlling for trade openness, support the FDI-led growth turns out to be relatively weak. Following Borensztein et al., we also are investigate whether FDI has crowded out or crowded in domestic investment in Thailand, our results being supportive of the latter in that FDI's effect on growth seem to have complemented that of domestic investment. However, we find more support for trade openness and domestic investment as major determinants of the recent growth of the Thai economy.

The remainder of this chapter is organised as follows: Section 5.2 presents the model linking human capital, FDI and growth. Section 5.3 presents a description of the data used in estimation and conduct unit root tests for stationarity. Section 5.4 introduces the concept of cointegration, and presents the empirical counterpart (i.e. the error correction model) to the theoretical model outlined in section 5.2. Section 5.4 presents the estimated results for variants of our empirical specification, allowing comparisons across short run and long run. Section 5.5 investigates whether, and to what extent, FDI (as well as trade openness) crowds out domestic investment. And finally, section 5.6 concludes.

5.2. The Model

As discussed in chapter 2 (section 2.5), Borensztein et al. (1998) develop a growth model in which technical progress, a determinant of growth, is represented through the variety of capital goods available. Technical progress is itself determined by FDI as foreign firms encourage adoption of new technologies and increase the production of capital goods, hence increasing variety. Thus, FDI leads to growth via technology spillovers, increasing factor productivity. However, certain host country conditions are necessary to ensure positive spillover effects. In particular, a minimum level of human capital (an educated labour force) is necessary for new technology and management skills to be absorbed. As noted in section 2.5, Borensztein et al. (1998) use, in a cross-country context, the following basic estimating equation:

$$g = c_0 + c_1 FDI + c_2 (FDI * H) + c_3 H + c_4 Y_0 \qquad (5.1)$$

where g is growth rate of real *GDP, FDI* is expressed as a proportion of *FDI* to *GDP, H* is a measure of schooling and Y_0 is initial *GDP*.

Using panel data for 69 developing countries, they estimate various specifications of (5.1) over two periods, 1970-1979 and 1980-1989. Across most specifications, they find that the coefficient on the interaction term (FDI*H) is positive and consistently significant but that of FDI is not (often negative when significant). This is interpreted as implying that FDI has a positive impact on growth only when H is above some critical level (estimated as 0.52); at low levels of H below 0.52, thus FDI has a negative impact on growth. Borensztein et al. (1998) results confirm the complementarity of FDI and human capital in the process of technology transfer as growth enhancing.

We have used the same basic estimating equation as (5.1) within an error correction framework, having obtained in the case of Thailand a sufficiently long and official time series data set extending back to the decade of the 1970s for both domestic investment and FDI flows. However, we have also used official data on GDP per capita, government consumption and export of goods and services for the period of estimation, 1973:2-2006:4. Our empirical specification therefore extends Borensztein et al. model (5.1) to include a dynamic version of the following model:

$$\begin{aligned} GDPPC_t = \beta_1 + \beta_2 H_t + \beta_3 I_t + \beta_4 FDI_t + \beta_5 FDI * H_t + \\ \beta_6 GX_t + \beta_7 EX_t + \beta_8 IM_t \end{aligned} \qquad (5.2)$$

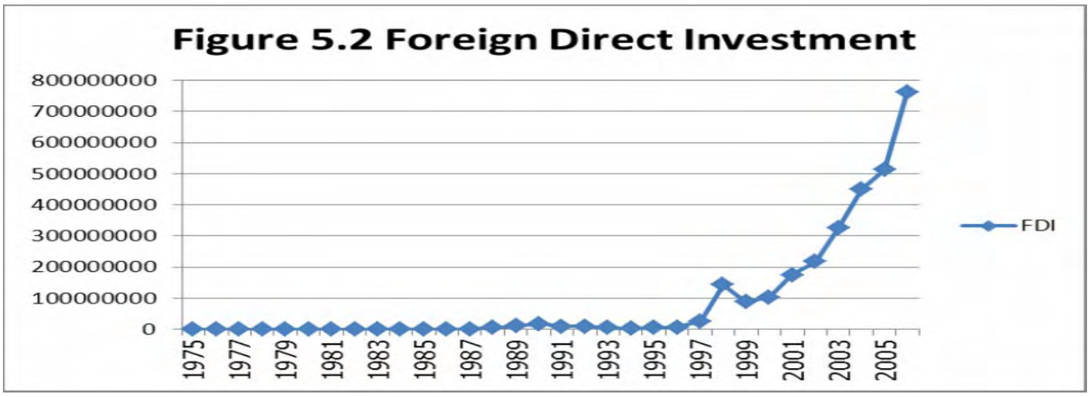
where *GDPPC* is GDP per capita, *FDI* denotes the level of foreign direct investment, *FDI*H* the foreign direct investment * year of schooling (secondary school), *GX* represent the level government expenditure, *EX* the level export of goods and services. IM denotes the level of imports of goods and services. We have basicically extended Borensztein's specification to test for export led growth as well as trade openness, thus allowing, at minimum, the inclusion of the additional terms EX and IM[2].

5.3. Data and Methodology

5.3.1. Data

The data set used is quarterly and covers the period 1973:2-2006:4. Most of the data are extracted from the International Financial Statistics published by IMF. They are GDP, domestic investment, foreign direct investment, export, import, population and the price index in the form of GDP deflator with 1995 as the base year.

To provide an illustration of trends the data depicted in Figures 5.2 and 5.3 are taken from World Development Indicators and not converted to the 1995 prices[3]. Figure 5.2 plots FDI in Thailand over the period 1975-2006. Notice that it increased significantly from the period 1999 to 2006.



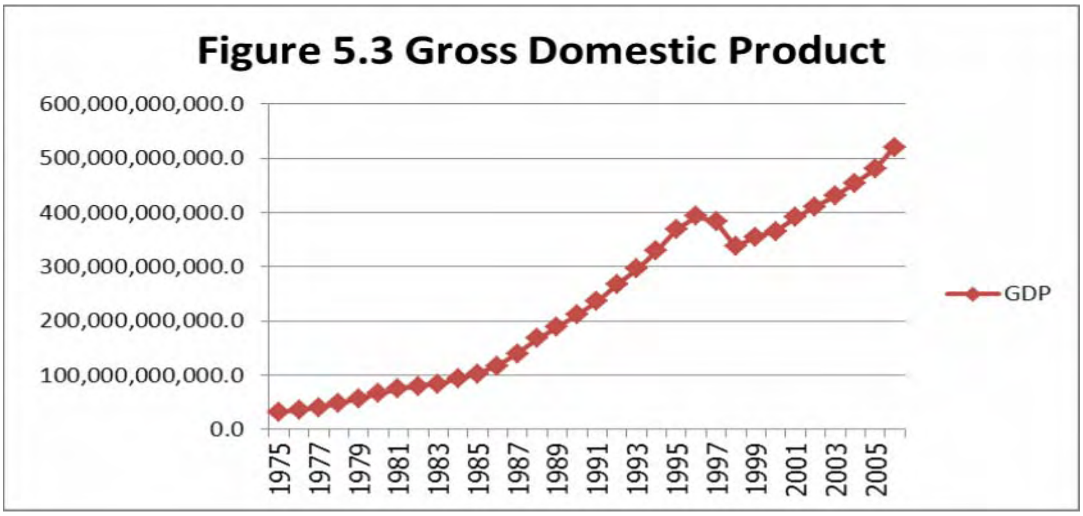
Source: Global Development Finance & World Development Indicators

Figure 5.3 presents the data for gross domestic investment over the same period, showing a strong correlation between the two variables. This massive increase in FDI in Thailand during an era of liberalisation raises important research questions about the

[2] Because ours is a time series model, the initial level of GDP per capita Y_0 is ignored in (5.2), this variable being only relevant in a cross-country context. Our empirical results include human capital and FDI variables separately.

[3] Deflated data at 1995 base value are presented in Figure 5.5 showing similar trends.

possible cause and effect relationship between FDI, domestic investment, and growth in Thailand, explored further below.



Source: Global Development Finance & World Development Indicators

For the data on human capital we have used the index prepared by Barro and Lee (2010). They published the annual indices for 129 countries including Thailand and we have used linear interpolation between two adjoining years to get our quarterly human capital index. This index for Thailand would measure the average number of school years attended by the population, both male and female aged 25 year and over, and aged 15 years and over. Since the use of one or the other index does not make any perceptible change in our results we have used the 25+version for our empirical testing.

Figure 5.4. human capital in Thailand (year of schooling attainment both male and female 25+)

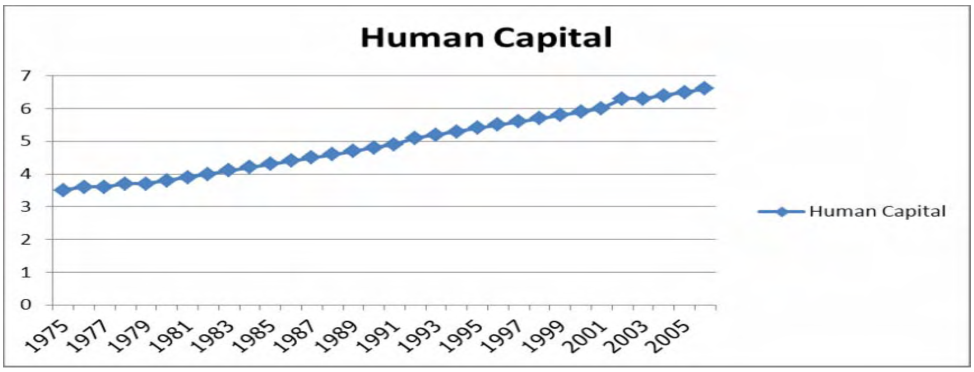


Figure 5.4 depicts the growth of education in Thailand, measured by the index described above. We can see, that human capital has been expanding rather slowly until early 1980's. But due to a massive government measure to expand general education by the Thai government of the time and also by subsequent governments there has been a big increase in the average skill-component of the population in general and of labour force in particular as measured by the Barro and Lee index. We should also note that Thailand started from a high value of 3.5 + of this index compared to other developing countries. It should be noted that This value is relatively high compared to the threshold value of 0.52 obtained by Borensztein et al. (1998)[4].

5.3.2. Correlation among the variables

Table 5.1 Correlation Matrix

	lnGDPPC	lnEX	lnEX*lnH	lnFDI	lnFDI*lnH	lnGX	lnH	lnI*lnH	lnIM	lnIM*lnH
lnGDPPC	1									
lnEX	0.9819	1								
lnEX*H	0.9859	0.9927	1							
lnFDI	0.8792	0.8836	0.9052	1						
lnFDI*lnH	0.9432	0.9461	0.9676	0.9803	1					
lnGX	0.9704	0.9894	0.982	0.8501	0.9228	1				
lnH	0.9622	0.9654	0.9862	0.8943	0.9617	0.9623	1			
lnI*lnH	0.9868	0.9854	0.9944	0.8889	0.9563	0.9815	0.9895	1		
lnIM	0.9857	0.9966	0.9887	0.8734	0.9383	0.9907	0.964	0.9886	1	
lnIm*lnH	0.9906	0.9925	0.9986	0.8995	0.9629	0.9841	0.9845	0.9972	0.9928	1
lnI	0.9802	0.986	0.9803	0.854	0.9242	0.9871	0.9656	0.9906	0.9942	0.9871

Note: H is an average of years of schooling attainment, EX is real export of goods and services, GX is real government consumption at 1995 prices, I is real domestic investment, FDI is real foreign direct investment, IM is real import of goods and services, and GDPPC is GDP per capita (all at 1995 prices), all in natural logarithms.

Table 5.1 presents correlations in level term between the variables. Broadly, the results suggest that there is high positive correlation of 96 per cent between GDP per capita and H. H is also positively correlated with FDI, EX, GX, I, and IM with the value of

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[4] It should be noted that (i) Borensztein et al. used schooling attainment (25+) for male population only as a measure of human capital while we have used the index for both male and female, and (ii) our threshold value calculated for Thailand is higher than the figure obtained by Borensztein et al. as this is model specific.

89%, 97%, 96%, 97% and 96%, respectively. Only FDI shows correlation values below 90% with other variables, except with FDI*H where the correlation is 0.98.

Table 5.2 Correlation Matrix (First Difference)

	ΔlnGDPPC	ΔlnFDI	Δ(lnFDI*lnH)	ΔlnEX	Δ(lnEX*lnH)	ΔlnGX	ΔlnH	ΔlnI	Δ(lnI*lnH)	ΔlnIM
ΔlnGDPPC	1									
ΔlnFDI	0.08109	1								
Δln(FDI*lnH)	0.06734	0.98913	1							
ΔlnEX	0.25947	0.16948	0.16723	1						
Δ(lnEX*lnH)	0.23808	0.18092	0.19882	0.96271	1					
ΔlnGX	-0.25899	0.07353	0.07589	-0.09729	-0.08445	1				
ΔlnH	-0.003	0.054	0.11898	0.0447	0.26995	-0.0202	1			
ΔlnI	-0.34813	0.135	0.13393	0.25276	0.26859	0.35268	0.12484	1		
Δ(lnI*lnH)	-0.32274	0.12858	0.14431	0.23123	0.30582	0.33198	0.33973	0.96524	1	
ΔlnIM	0.37706	0.27463	0.27616	0.62497	0.59357	-0.04171	0.05514	0.48705	0.45284	1
Δ(lnIM*lnH)	0.37401	0.2756	0.29689	0.56685	0.60497	-0.03923	0.27646	0.49013	0.52021	0.96202

Table 5.2 presents sample correlations between the corresponding growth rates. This yields a negative correlation between domestic investment growth and GDP growth per capita. However, it should of interest to note that FDI and FDI*H are also highly correlated even in first differences (with a value of 0.99).

5.3.3. Unit Root Tests for Stationarity

It is well established that macro time series data such as the ones used in this study tend to exhibit either deterministic and stochastic trends and are therefore in a sense non-stationary; that is the variables in question have means, variances, and covariances that are not time invariant. According to Engle and Granger (1987), the direct application of OLS to non-stationary data produces regressions that are misspecified or spurious in nature. These regressions tend to produce performance statistics that are inflated in nature, such as high R^2s and t-statistics, which often lead investigators to commit a high frequency of Type I errors (rejecting the true hypothesis) (Granger and Newbold, 1974). As is common, we therefore tested each of the variables in question for a unit root (non-stationarity) using an Augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1981) based on estimation of the following equation:

$$\Delta Y_t = a_0 + (\rho - 1)Y_{t-1} + \sum_{i=1}^{p} \theta \Delta Y_{t-1} + bT + \varepsilon_t \qquad (5.3)$$

where Y_t is the variable under consideration, Δ is the first-difference operator, α_0 is a constant and T is the time trend, *p* being the number of lags set to a maximum lag order of √N so N being the sample size. Failure to reject the null hypothesis of the unit root *(ρ = 1)* signifies the presence of a non-stationary process. The null hypothesis of non-stationary (i.e. the given series is I(1)) is not rejected if ρ is not significantly different from unity.

Table 5.2 Unit root results

Table 5.2.1. THAILAND: Unit root test for stationarity with constant only.

Level form.		rst Difference form.	
t-adf		t-adf	
lnH	-0.15287	lnGDPPC	-10.658**
lnEX	3.1343	lnH	-5.7012**
lnIM	-1.6495	lnEX	-8.4263**
lnGX	0.136	lnIM	-9.4802**
lnI	-0.8541	lnGX	-16.362**
lnFDI	-2.5671	lnI	-12.850**
lnFDI*lnH	-0.0042	lnFDI	-13.611**
lnEX*lnH	-0.0796	lnFDI*lnH	-10.3611**
lnIM*lnH	-0.5986	lnEX*lnH	-10.8637**
lnI*lnH	-1.4963	lnIM*lnH	-9.9286**
lnGDPPC	-0.28881	lnI*lnH	-12.852**
lnOPEN	-0.598575	lnOPEN	-9.928614**

Note: I ** denotes significance at 1 per cent level, respectively.

ii) MacKinnon critical values for rejection of hypothesis of a unit root.

Note: Author's calculations on the PC Give 9.0.

Table 5.2 presents the results obtained applying the unit root test for lnGDPPC, lnFDI, lnI, lnFDI*H, lnEX, lnH, lnEX*H, lnI*H, lnIM*H and lnGX. The test is performed both on levels and on first differences of the variables. The degree of integration of each series is determined first. This is important because cointegration tests cannot be carried out if the variables are not of the same order of integration.

Table 5.2.1 above present the results of the ADF test (with one lag) on all variables (expressed in logs) in levels and differenced form under the assumption of no trend, that is equation (5.3) above is run with a constant term but no time trend. It can be seen that all the variables in level form are non-stationary; that is, they appear to follow a random walk with (positive) drift [Nelson and Plosser 1982]. After first differencing, however, all the variables reject the null hypothesis of non-stationarity. Thus, the evidence presented above suggests that the variables in question are I (1)

Table 5.2.2. THAILAND: Unit root test for stationarity with constant and time trend.

Level form.		First Difference form.	
t-adf		t-adf	
lnH	-0.88256	lnGDPPC	-10.658**
lnEX	0.80004	lnH	-5.7012**
lnIM	-2.3245	lnEX	-8.4263**
lnGX	-2.1101	lnIM	-9.9598**
lnI	-1.6923	lnGX	-16.362**
lnFDI	-3.9124	lnI	-12.850**
lnFDI*lnH	-2.931	lnFDI	-13.611**
lnEX*lnH	-3.383	lnFDI*lnH	-10.3761**
lnIM*lnH	-2.0878	lnEX*lnH	-10.8213**
lnI*lnH	-0.3407	lnIM*lnH	-10.0032**
lnGDPPC	-2.2061	lnI*lnH	-13.0280**
lnOPEN	-2.08778	lnOPEN	-10.00317**

Note: i) ** denotes significance at 1 per cent level, respectively.

ii) MacKinnon critical values for rejection of hypothesis of a unit root.

Note: Author's calculations on PC Give 9.0.

Table 5.2.2 also presents the results of ADF test (one lag) on all the variables (in logarithmic form) with a deterministic time trend. The results indicate that the null hypothesis of non-stationary cannot be rejected for any of the variables in level form, suggesting that the variables in question do not exhibit a deterministic time trend but are I(1) throughout the period under consideration. In other words, the common practice of detrending the data by a single trend line will not render the data in question stationary because the trend line itself may be shifting over time [Charemza and Deadman, 1997]. When the ADF test is applied to these variables in first differences under the assumption of a constant and deterministic time trend, all of the variables become stationary even at the one percent level of significance. Thus we conclude from unit root tests that all variables are I(1) in levels form, rendering their growth rates as I(1).

5.4. The Concept of Cointegration

The concept of cointegration was introduced in the econometric literature by Granger (1981) and further extended and formalised by Engle and Granger (1987). This concept is based on the idea that, although economic time series exhibit nonstationary behaviour, an appropriate linear combination between trending variables could remove the common trend component. The resulting linear combination of the time series variables will thus be stationary, which means the relevant time series are cointegrated.

According to Engle and Granger (1987) a set of variables is said to be cointegrated or "to move together in the long-run" if a linear combination of their individual integrated series I(d) is stationary where d is the order of integrated. From an economist's perspective, cointegration is of interest because of the possible existence of a long run or a steady state equilibrium relationship. The research on cointegration tests has developed in two main directions: (i) tests based on the residuals from a cointegrating regression suggested by Engle and Granger (1987); and (ii) tests based on the system of equations utilising vector autoregressive models, suggested by Johansen (1988, 1991) and Johansen and Juselius (1990).

The Engle-Granger (E-G) residual based test is one of the most commonly used cointegration tests. For models of cointegrated variables, this test involves the following two steps: (a) estimation of a cointegrating regression by applying OLS on the levels of the variables included; and (b) testing for stationarity of the residuals by using augmented Dickey-Fuller tests.

While the E-G single equation based cointegration tests have been used frequently in the literature, it has several limitations. First if there are more than two variables in the model, there can be more than one cointegrating combination. That is, the variables in a model may feature as part of several equilibrium relationships governing the joint evolution of the variables. Second, even if there is only one cointegration relationship, estimating a single equation is potentially inefficient because of the loss of information that results from inability of the model to treat all variables as potentially endogenous. Given that the number of cointegration vectors in a model is unknown, and given the need to allow all variables to be potential endogenous, the E-G single equation approach to testing for cointegration can give rise to misleading results.

The approach developed by Johansen (1988, 1991) and extended by Johansen and Juselius (1990) (explained briefly below) is considered superior to the E-G method, as it provides testing within a multivariate framework and allows for more than one cointegration vector in the estimated model thereby preventing loss of efficiency.

For the Johansen and Juselius method, two tests are commonly used to determine the number of cointegrating vectors. These are namely the trace test and the maximum-eigenvalue test statistics, stated as follows:

$$Trace = -T\sum_{i=r+1}^{n}\ln(1-\lambda_i) \qquad r = 0,1,2,\ldots,n-2,n-1 \qquad (5.4)$$

$$\lambda_{\max} = -T\ln(1-\lambda_{r+1}) \qquad r = 0,1,2,\ldots,n-2,n-1 \qquad (5.5)$$

where λ_i are the eigenvalues corresponding to the decomposition of the matrix of long run multipliers in the multivariate system[5]. In each case, the null hypothesis that there are at most r cointegrating combinations amounts to:

[5] The derivation of the eigenvalues and the corresponding eigenvectors are not of interest here, see for example Harris (1995), Chapter 5 for more details. Chapter 6 briefly covers the representation of the multivariate system.

$$H_0 : \lambda_i = 0 \quad i = r + 1, \ldots, n$$

where only the first r eigenvalues are non-zero. Thus, the alternative for r = 0 is that r = 1; r = 1 is tested against the alternative of r = 2; and so on. If there is any divergence of results between these two tests, it is recommended that one should rely on the evidence based on the trace test, since the results of the latter test, as indicated by Banerjee et al. (1986, 1993).

5.4.1 Cointegration analysis

Table 5.3 Results of Johansen cointegration test

Sample(adjusted): 1974:3 2006:4

Included observations: 106 after adjusting endpoints

Trend assumption: Linear deterministic trend

Series: GDPPC FDI FDIH EX I GX IM

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.402302	152.4392	124.24	133.57
At most 1 *	0.252837	97.88434	94.15	103.18
At most 2	0.219180	66.98828	68.52	76.07
At most 3	0.161774	40.76269	47.21	54.46
At most 4	0.097613	22.05715	29.68	35.65
At most 5	0.090663	11.16973	15.41	20.04
At most 6	0.010282	1.095535	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates 2 cointegrating equation(s) at the 5% level

Trace test indicates 1 cointegrating equation(s) at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.402302	54.55490	45.28	51.57
At most 1	0.252837	30.89606	39.37	45.10
At most 2	0.219180	26.22559	33.46	38.77
At most 3	0.161774	18.70555	27.07	32.24
At most 4	0.097613	10.88741	20.97	25.52
At most 5	0.090663	10.07420	14.07	18.63
At most 6	0.010282	1.095535	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Note:

GDPPC is GDP per capita;

FDI is Foreign Direct Investment;

I is domestic investment;

EX is exports of goods and services;

GX is government expenditure;

H is year of schooling attainment;

FDI*H is FDI*schooling attainment;

and IM is imports;

***, ** Indicates that the test of statistic is significant at 5%, and 1% level, respectively.**

Table 5.3 shows results obtained from applying the Johansen approach discussed above. The eigenvalues associated with the combinations of the I(1) variables are ordered from the highest to lowest. Thus, a test of the significance of no cointegration (r = 0) is performed against the incremental alternative that r = 1, and so on .

According to both the trace and the eigenvalue tests, the results suggest that there exist, for the Thai data set over the period 1973:2 to 2006:4, at most two cointegration relationships among the variables lnFDI, lnGDPPC, lnH, lnI, lnIM, lnEX, lnGX, and lnFDI*H

5.4.2. Error Correction Models

Given cointegration among the variables, it is appropriate to use an error correction model.

Consider the equation:

$$\Delta Y_t = \beta_0 + \sum_{j=1}^{k} \beta_j \Delta X_{t-j} + \sum_{j=1}^{h} \alpha_j \Delta Y_{t-j} + e_t \qquad (5.6)$$

where e_t has zero mean random variable, given $\Delta Y_{t-1},..., \Delta Y_{t-h}, \Delta X_t, \Delta X_{t-1},..., \Delta X_{t-k}$. If we view this as a rational distributed lag model, we can find the impact propensity, long run propensity, and lag distribution for ΔY for changes in ΔX. In our case, given *Y* and *X* are cointegrated, an error correction model is obtained by adding a lagged estimated error term:

$$\Delta Y_t = \beta_0 + \sum_{j=1}^{k} \beta_j \Delta X_{t-j} + \sum_{j=1}^{h} \alpha_j \Delta Y_{t-j} + \delta Z_{t-1} + e_t \qquad (5.7)$$

where $Z_t = \hat{e}_t = Y_t - \hat{\varphi}_0 - \sum_{j=1}^{k} \hat{\gamma}_j \Delta X_{t-j} - \sum_{j=1}^{h} \hat{\theta}_j \Delta Y_{t-j}$ is the one period lagged value of the estimated error of the contegrating regression obtained for OLS estimation, This term is I(1)called the error correction term. The principle behind this model is that there often exists a long run equilibrium relationship between economic variables. In the short run however there may be disequilibrium. With an error correction mechanism, a proportion of the disequilibrium is corrected in the next period. The error correction process is thus a means to reconcile short-run and long run behaviour. Therefore, in the error correction model, the right hand side contains the short run dynamic coefficients (i.e. α_1, β_1) as well as the feedback coefficient (i.e. δ). The absolute value of δ decides how quickly the equilibrium is restored.

In light of the above, our empirical error correction formulation of the growth of per capita GDP is

$$\Delta \ln GDPPC_t = \beta_1 + \beta_2 \Delta \ln H_t + \beta_3 \Delta \ln I_t + \beta_4 \Delta \ln FDI_t + \beta_5 \Delta \ln FDI * H_t + \beta_6$$
$$\Delta \ln GX_t + \beta_7 \Delta \ln EX_t + \beta_8 \Delta \ln IM + EC_{t-1} + \varepsilon_t$$

(5.8a)

where

$$EC_t = \ln GDPPC_t - \hat{\gamma}_1 \ln H_t - \hat{\gamma}_2 \ln i_t - \hat{\gamma}_3 \ln FDI_t - \hat{\gamma}_4 \ln FDI * \ln H_t - \hat{\gamma}_5 \ln GX_t$$
$$- \hat{\gamma}_6 \ln EX_t - \hat{\gamma}_7 \ln IM_t$$

(5.8b)

and Δ is the difference operator, *GDPPC* is GDP per capita, *FDI* denotes foreign direct investment, *FDI*H* represents foreign direct investment * year of schooling attainment (secondary school), *GX* is government expenditure, *IM* is imports of goods and services, EX is exports of goods and services, and *EC* is error correction term, and ε is the error term[6].

The economic rationale for the inclusion of right hand side variables in equation (5.8) and the interpretation of their respective coefficients is given below. The coefficient of *H*(β_2) is expected to be positive in the GDP growth rate formulation, in the simplest term this means that an increase in the number of attainment students in the secondary school of education will result in an increase in GDP. The coefficient of *I* (β_3) is expected to be positive as it is generally accepted that investment is a key variable determining economic growth, and thus when evaluating the impact of FDI on economic development in a host country a key question arises whether foreign investment crowds in domestic investment or whether it has the opposite effects of displacing domestic producers. This means that the sign coefficient of *FDI* ($\beta 4$) can be positive or negative depending on whether increase in foreign capital stock complement or substitute for domestic investment, where as the coefficient of *FDI*H* (β_5) is expected to have a positive sign because a higher level of human capital, is often associated with a greater transfer of technology which is growth enhancing. Government consumption is added as an additional regressor to the model with its effect expected to be negative because

[6]The empirical specification would alternatively be represented with regressors I, FDI, FDI*H, EX and IM expressed as a proportion of GDP. Estimation carried out with transformations of this type has not effected significant differences from the results presented in Table 5.4 and 5.5 below – see corresponding tables in the appendix to this chapter Table A.5.1 and A.5.2.

collective consumption goods such as housing and salaries of public employees may directly or indirectly (via output taxes and subsidies) crowd out private consumption expenditures and thus affect output in a negative fashion (Aschauer (1990) and Sala-i-Martin (1995)). However, it may also be the case that part of these expenditures goes to financing primary and secondary education (as they do in several developed and developing countries, including Thailand). To the extent that they do, they may generate in the long run a positive spillover effect to the domestic investment in the form of a better educated workforce that can efficiently seize the market opportunities offered by the transfer of technology and managerial know-how with FDI, thus affecting output in a positive manner to support a positive sign in coefficient *FDI*H* (β_5) above. The coefficient of *EX* (β_7) is expected to have a positive sign because increased exports, an proxy for a higher degree of openness is often associated with a greater technology transfer, learning by doing, greater market discipline, and an additional outlet for the goods and services produced by domestic firms (Tyler 1981; Feder 1983; Ram 1987; Moschos 1989). The inclusion of imports explicitly in the specification allows for control of import growth in the investigation of export-growth or FDI-growth relationship. Apart from theory which suggests that imports may play a control role in explaining export-led growth, omitting imports from the analysis may overstate the effects of exports or FDI on growth (as we find below, se also Riezman et al. (1996). The coefficient of *IM* (β_8) can be either negative or positive depending on the composition of imports. If imports are mainly capital goods, this may have a positive long run effect on growth mainly through domestic investment.

5.4.3. Results

Table 5.4 THAILAND: OLS Regressions: Dependent variable is lnGDPPC, 1973:2-2006:4.

Regressor	5.4.1	5.4.2	5.4.3	5.4.4	5.4.5	5.4.6	5.4.7	5.4.8	5.4.9	5.4.10	5.4.11	5.4.12	5.4.13	5.4.14	5.4.15
Coefficient															
(t-statistic)															
Constant	6.14	9.38	6.4	7.15	6.38	6.56	7.04	7.07	9.03	9.11	9.23	10.72	10.9	9.91	9.23
	(90.04)	(22.09)	(78.51)	(36.5)	(76.88)	(55.32)	(45.14)	(49.35)	(21.07)	(19.48)	(20.31)	(32.25)	(37.36)	(29.75)	(35.32)
*ln*H	0.21	-1.67	0.33	0.53	0.26	0.07	0.48	0.35	-1.06	-1.45	-1.04	-2.68	-2.22	-2.14	-1.21
	(1.15)	(-5.88)	(2.25)	(3.67)	(1.57)	(0.33)	(2.99)	(1.70)	(-3.06)	(-4.47)	(-3.02)	(-11.41)	(-10.13)	(-9.13)	(-5.73)
*ln*I	0.2	0.24	0.14	-0.03	0.15	0.16	-0.01	0.01	0.13	0.22	0.09	-0.34	-0.51	0.21	0.06
	(6.33)	(9.28)	(4.60)	(-0.66)	(4.68)	(5.00)	(-0.19)	(0.27)	(2.63)	(7.33)	(1.71)	(-6.67)	(-9.55)	(10.21)	(1.90)
*ln*IM				0.37							0.25		0.29		
				(4.16)							(2.85)		(5.76)		
*ln*EX			0.18	-0.04	0.16	0.14				0.05	-0.07	0.10	-0.04	-0.38	
			(5.73)	(-0.74)	(4.50)	(3.64)				(1.36)	(-1.31)	(4.17)	(-1.33)	(-7.96)	
*ln*OPEN							0.31	0.28	0.16						-0.25
							(6.25)	(5.35)	(2.88)						(-5.59)
*ln*GX	0.01	-0.05	-0.11	-0.12	-0.10	-0.09	-0.12	-0.11	-0.10	-0.08	-0.09	-0.02	-0.03	-0.06	-0.06
	(0.38)	(-1.90)	(-3.06)	(-3.32)	(-2.57)	(-2.22)	(-3.41)	(-3.1)	(-3.23)	(-2.34)	(-2.71)	(-0.68)	(-1.30)	(-2.68)	(-3.17)
*ln*FDI	0.04	-0.38			0.01		0.00		-0.29	-0.34	-0.30	0.07	0.13	0.11	0.16
	(3.35)	(-6.79)			(0.87)		(0.07)		(-4.8)	(-5.59)	(-4.90)	(1.25)	(2.72)	(1.87)	(3.17)
*ln*FDI**ln*H		0.26				0.02		0.01	0.19	0.23	0.20	-0.06	-0.10	-0.09	-0.13
		(7.70)				(1.88)		(0.92)	(4.91)	(5.90)	(5.02)	(-1.60)	(-3.24)	(-2.25)	(-3.76)
*ln*I**ln*H												0.32	0.33		
												(11.96)	(14.05)		
*ln*EX**ln*H														0.31	
														(10.62)	
*ln*OPEN**ln*H															0.32
															(13.32)
Adjust R2	0.97	0.98	0.97	0.98	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99
S.E.	0.08	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.04	0.04	0.04	0.04
Ed. Threshold (FDI)		4.31							4.62	4.39	4.48				3.42
Ed. Threshold(Domestic Investment)												2.89	4.71		
Ed. Threshold(Exports)														3.42	
Ed. Threshold(Openness)															2.18

Note: Following Borensztein et al. ((1998), the threshold values are calculated as follows. Consider ln *X* and ln *X* * ln *H* as the two regressors with estimates $\hat{\alpha}$ and $\hat{\beta}$, where one is positive and the other negative. To calculate the minimum level at which the overall effect is positive, put $\hat{\alpha}\ln X + \hat{\beta}\ln X * \ln H = 0$, so that ln *H* = $-\hat{\alpha} / \hat{\beta}$, or *H* = antilog $(-\hat{\alpha} / \hat{\beta})$. Note that it does not matter where the signs of coefficients are reversed, as long as one estimate is positive, and the other negative, as we find in all cases.

Table 5.5 THAILAND: OLS Regressions: Dependent variable is Δ$lnGDPPC$, 1973:3-2006:4.

Regressor	5.5.1	5.5.2	5.5.3	5.5.4	5.5.5	5.5.6	5.5.7	5.5.8	5.5.9	5.5.10	5.5.11	5.5.12	5.5.13	5.5.14	5.5.15
Coefficient															
(t-statistic)															
Constant	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00
	(3.94)	(3.13)	(2.60)	(1.94)	(2.66)	(2.65)	(1.85)	(1.83)	(1.45)	(2.20)	(1.51)	(1.07)	(0.79)	(1.10)	(0.55)
Δ*ln*H	-1.52	-0.09	-0.8	-0.63	-0.88	-0.95	-0.55	-0.52	0.47	-0.04	0.39	-1.15	-1.05	0.56	-0.96
	(-1.57)	(-0.09)	(-0.94)	(-0.89)	(-1.02)	(-1.10)	(-0.78)	(-0.73)	(0.64)	(-0.04)	(0.53)	(-0.82)	(-0.94)	(0.41)	(-0.95)
Δ*ln*I	-0.05	-0.05	-0.11	-0.22	-0.11	-0.1	-0.22	-0.21	-0.2	-0.09	-0.21	-0.36	-0.52	-0.02	-0.18
	(-1.65)	(-1.51)	(-3.57)	(-8.34)	(-3.55)	(-3.41)	(-8.25)	(-8.16)	(-7.63)	(-2.85)	(-7.74)	(-2.22)	(-3.97)	(-0.66)	(-6.90)
Δ*ln*IM				0.29							0.3		0.32		
				(8.29)							(8.38)		(9.48)		
Δ*ln*EX			0.13	-0.00	0.13	0.13				0.12	-0.01	0.13	-0.01	0.05	
			(4.82)	(-0.02)	(4.63)	(4.64)				(4.41)	(-0.24)	(5.21)	(-0.44)	(0.33)	
Δ*ln*OPEN							0.29	0.29	0.29						-0.11
							(9.67)	(9.73)	(9.85)						(-0.77)
Δ*ln*GX	-0.06	-0.07	-0.17	-0.01	-0.04	-0.04	-0.01	-0.01	-0.01	-0.05	-0.01	-0.07	-0.01	-0.08	-0.03
	-2.2	(-2.36)	(-1.54)	(-0.26)	(-1.57)	(-1.57)	(-0.26)	(-0.23)	(-0.34)	(-1.69)	(-0.27)	(-2.54)	(-0.68)	(-2.79)	(-1.16)
Δ*ln*FDI	0.02	0.04			0.01		-0.00		0.08	0.04	0.08	0.08	0.13	0.08	0.16
	(1.93)	(0.54)			(0.99)		(-0.40)		(1.41)	(0.57)	(1.38)	(1.14)	(2.48)	(1.21)	(2.92)
Δ(*ln*FDIln*H)**		-0.02				0.01		-0.00	-0.06	-0.02	-0.06	-0.05	-0.09	-0.06	-0.12
		(-0.36)				(0.97)		(-0.58)	(-1.51)	(-0.47)	(-1.47)	(-1.08)	(-2.60)	(-1.16)	(-3.08)
Δ(*ln*Iln*H)**												0.22	0.22		
												(2.01)	(2.56)		
Δ(*ln*EXln*H)**														0.05	
														(0.43)	
Δ(*ln*OPENln*H)**															0.29
															(2.95)
ECM_{t-1}	-0.19	-0.19	-0.17	-0.16	-0.17	-0.18	-0.15	-0.15	-0.17	-0.2	-0.17	-0.51	-0.39	-0.48	-0.39
	(-3.53)	(-2.95)	(-3.24)	(-3.45)	(-3.26)	(-3.35)	(-3.38)	(-3.41)	(-3.48)	(-3.30)	(-3.56)	(-5.13)	(-4.85)	(-4.79)	(-4.81)
Adjust R^2	0.21	0.19	0.29	0.54	0.29	0.29	0.54	0.54	0.56	0.3	0.56	0.39	0.61	0.36	0.61
S.E.	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02

Note: *ECM* is the one period lagged residual of the corresponding levels regression in Table 5.4 taking account of all the variables included in the appropriate specification, hence reducing the sample size in the error correction model by 1.

Table 5.4 above presents the results of various estimated versions of the long run counterpart to the empirical formulation in equation (5.8). The results of this static long run regression are then used to estimate the appropriate error correction model, whose results are provided in Table 5.5[7].

The long run estimates of the static regression allow calculation of the threshold value of human capital, while that of the error correction model distinguish the short run estimates from the long run.

Another way of distinguishing between the results of Table 5.4 and 5.5 is that former indicates the relationship in levels while the latter is interpreted in terms of growth rates. Thus the error correction form facilities testing of the export-led and FDI-led hypotheses in term of growth rates, while observing the constraints imposed in the long run through cointegration among the variables.

The main conclusions from the results in Tables 5.4 and 5.5 may be summarised as follows.

1. The effect of government expenditure on income and growth is negative and almost always significant, as expected, across all estimated specifications.
2. The effect of FDI on growth is not robustly significant, although remains positive in the short run but over the longer term turns mostly negative. This perverse result, however, may be the result of multicollinearity caused the inclusion of both FDI and FDI*H which are highly correlated in both levels and growth rates (see Table 5.1 and 5.2). However, the inclusion of both these terms in the regression is necessary to determine the education threshold, found to be approximately 4.5 years average attainment level of secondary education, beyond which the negative effect of FDI is offset by the positive effect of FDI*H. This seems to suggest that although FDI has a positive influence on growth in the short run, the

[7] In the estimated variants of the equation (see Tables 5.4 and 5.5) we also include additional terms, in particular, we allow for the joint influence of exports and imports through a variable constructed as OPEN=(EX+IM)/GDP signify trade openness, to replace the individual variables EX and IM. In addition, we also allow influences of domestic investment, exports and imports, interacting with human capital. Thus, we include additional terms in (logs of) I*H, EX*H, and OPEN*H which allows us to check for the robustness of the specification.

long run effect is only positive above education threshold levels of 4.7 and 2.18 when other interaction terms are also present, namely I*H and OPEN*H, respectively (regressions 5.4.13 and 5.4.15).

3. The effect of domestic investment is generally positive and significant but appears to turn negative or insignificant when the interaction term I*H is also included (regressions 5.4.12 – 5.4.13), suggesting possible multicollinearity. However, the inclusion of the imports variable in the regression also renders the effect of domestic investment on income and growth negative, which is puzzling (see further remarks 4 and 5 below).

4. Exports generally have a positive effect on both income and growth, except when controlling for imports growth, as the effect of exports is insignificant when the imports variable is also included in the regression.

5. Imports have a positive and significant effect on income and growth, the effect of this variable being persistent in both the short run and long run specifications. The inclusion of imports improves the explanatory power of the regression but at the same time renders the effect of exports and as well as domestic investment negative or insignificant. This might be a perverse result, but may suggest a case for imports led growth in Thailand, with exports growth mainly facilitating the demand for imports growth.

6. To overcome the puzzling effect of imports, regressions 5.4.7-5.4.9 and 5.5.7-5.5.9 are estimated with the variable OPEN replacing both EX and IM variables, thus estimating the overall effect of trade openness and comparing with the effect of FDI[8]. The results clearly suggest that trade openness has significantly influenced both income and growth while the effect of FDI is largely insignificant. As regression 5.4.9 suggests, the effect of domestic investment on growth under

[8] It has been checked that the variable OPEN (replacing the individual components GX and IM) is I(1) by the ADF test, see Table 5.2.1 and 5.2.2 and is cointegration with the other variables used in the estimated equation.

trade openness is positive in the long run, although negative in the short run (regression 5.5.9).

7. The effect of human capital on income and growth is ambiguous but clearly positive in the absence of the inclusion of the interaction terms (FDI*H, I*H), and negative otherwise. In regression 5.4.9 and 5.5.9, which shows a positive effect of trade openness, the effect of human capital on income is clearly positive in the short run but negative in the long run. However, the negative coefficient on human capital is not unusual, owing to the possibility of high fixed costs in the initial production of human capital, high opportunity cost in terms of output of educating child workers, and cost involved in the interaction of educated and non-educated workers (Evans, Green and Murinde (2002)).

8. Finally, regressions 5.4.15 and 5.5.15 are estimated with the inclusion of the interaction terms FDI*H and OPEN*H alongside FDI and OPEN, resulting in a marginal improvement of overall fit over other regressions. The outcome is a positive effect of trade openness above the education threshold of 2.18, and a positive effect of FDI above the threshold level of 3.42 in the long run. In this case, the effect of domestic investment is also positive in the long run although negative in the short run, and that of human capital is negative in both short run and long run.

5.5. Foreign Direct Investment in Thailand: Does it Crowd out Domestic Investment?

A crucial question as regards the development impact of FDI is the extent to which it affects investment by domestic firms in Thailand. If it has no effect whatsoever, any increase in FDI ought to be reflected in a Baht for Baht increase in total investment. If FDI crowds out investment by domestic firms, the increase in domestic investment ought to be smaller than the increase in FDI. Finally, if there is crowding in, domestic investment ought to increase by more than the increase in FDI.

This precisely the spirit of Romer's (1993) important paper on the contribution of FDI to development. Romer uses an endogenous growth model, whose driving force is the introduction of new goods together with the technologies and human capital that accompany such goods into economies that do not have the know-how or human resources to produce them. If FDI enters the economy in sectors where there are competing domestic firms (or firms already producing for export markets), the very act of foreign investment may take away investment opportunities that were open to domestic entrepreneurs prior to the foreign investments.

In other words, such FDI is likely to reduce domestic investments that would have been undertaken, if not immediately at least in the future, by domestic producers[9]. The contribution to total capital formation of such FDI is likely to be less than the FDI flow itself. In other words, the relationship between FDI and domestic investment is likely to be complementary when investment is in an undeveloped sector of the economy (owing to technological sectors or to the lack of knowledge of foreign markets).

On the other hand, FDI is more likely to substitute for domestic investment when it takes place in sectors where there exist plenty of domestic firms. The same may occur where domestic firms already have access to the technology that the MNE brings into the country.

Also, it could be argued that the entry of an MNE into a sector where there exist several domestic firms lead to investments by incumbent domestic firms in order to become more competitive. However, give the vast technological superiority of MNEs, their investments are more likely to displace domestic firms, and even cause their bankruptcy, than to induce domestic firms to invest. Even where FDI does not displace domestic investment, foreign investments may not stimulate new downstream or upstream production, and therefore, may fail to exert strong crowd in effects on domestic

[9] Of course, such foreign investments may be desirable for other reasons, such as introducing competition into stagnant or backward sectors. However, what we are concerned about here is the impact on domestic investment and entrepreneurship. Given the enormous superiority of MNEs over domestic firms in most developing countries, the competition is likely to be one-sided.

investment. Thus, the existence of backward or forward linkages from the establishment of foreign investors is a key consideration for determining the total impact of FDI on capital formation. It should be stressed, though, that linkages are a necessary but not sufficient factor for crowd in. In cases where foreign firms simply displace existing ones, the existence of linkages cannot prevent crowd out.

Table 5.6 THAILAND: OLS Regressions: Dependent variable is lnI/GDP, 1973:2-2006:4.

Regressor	5.6.1	5.6.2	5.6.3	5.6.4	5.6.5	5.6.6
Coefficient						
(t-statistic)						
Constant	-11.46	-15.1	-7.07	-12.9	-14.64	-14.8
	(-5.74)	(-12.5)	(-26.88)	(-15.16)	(-17.97)	(-18.20)
ln H	6.41	4.03	0.75	4.02	4.81	5
	-4.95	-5.17	-2.46	-7.66	-9.03	-9.23
ln EX			-0.66	-0.4		
			(-6.42)	(-4.34)		
ln IM			1.09	0.97		
			-10.4	-10.95		
ln OPEN					0.67	0.86
					-11.23	-6.48
ln GX		0.66	0.17	0.09	0.01	-0.01
		-14.26	-2.23	-1.46	-0.13	(-0.15)
ln FDI	0.09	0.68	-0.06	0.68	0.83	0.67
	-0.35	-4.28	(-2.23)	-6.4	-7.63	-4.52
ln FDI**ln* H	-0.1	-0.44		-0.47	-0.59	-0.47
	(-0.65)	(-4.62)		(-7.10)	(-8.88)	(-4.89)
ln OPEN**ln* H						-0.13
						(-1.61)
Adjust R2	0.91	0.97	0.98	0.99	0.99	0.99
S.E.	0.3	0.2	0.1	0.1	0.1	0.1
Ed. Threshold (FDI)				4.26	4.1	4.18

Empirically, using data for Thailand, we can test whether FDI crowds out or crowds in domestic investment by running a regression with the dependent variable (log of) I/GDP, and test the effect of FDI, after controlling for other variables (human capital, exports, imports, government expenditure, and FDI*H in our case). Table 5.6 and 5.7 presents the results of estimated variant of the error correction model with lnI/GDP as the dependent variable[10].

Regressions 5.6.1 and 5.7.1 show that the effect of FDI on domestic investment is not significant, but after controlling for other variables (GX, EX, IM (and OPEN to replace EX and IM)), the effect is both positive and significant, in the short run as well as the long run, provided the interaction term FDI*H is also included in the regressions. The implication of the latter term means that the efficiency of FDI spills over into domestic investment, and suggests that the net effect of FDI, above a minimum threshold level of 4.1, is still positive.

Table 5.7 THAILAND: OLS Regressions: Dependent variable is ΔlnI/GDP, 1973:2-2006:4.

Regressor	5.7.1	5.7.2	5.7.3	5.7.4	5.7.5	5.7.6
Coefficient						
(t-statistic)						
Constant	0	0	-0.03	0.01	0	0
	(-0.10)	(-0.03)	(-1.85)	-0.41	(-0.10)	-0.3
Δ*ln* H	7.48	2.77	5.38	1.8	3.05	2.26
	-1.98	-0.81	-2.15	-0.76	-1.23	-0.59
Δ*ln* EX			-0.25	-0.23		
			(-2.40)	(-2.67)		
Δ*ln* IM			0.56	0.49		
			-4.46	-4.65		
Δ*ln* OPEN					0.32	0.46
					-3.62	-0.86
Δ*ln* GX		0.55	0.49	0.48	0.45	0.44
		-5.33	-6.06	-7	-6.26	-6.27
Δ*ln* FDI	0.16	0.24	-0.12	0.53	0.53	0.47
	-0.55	-0.87	(-0.58)	-2.71	-2.6	-2.28
Δ(*ln* FDI**ln* H)	-0.09	-0.16		-0.37	-0.39	-0.35
	(-0.45)	(-0.80)		(-2.72)	(-2.68)	(-2.36)
Δ (*ln* OPEN**ln* H						-0.09
						(-0.25)
ECM_{t-1}	-0.15	-0.26	-0.54	-0.85	-0.73	-0.75
	(-3.34)	(-3.51)	(-6.79)	(-10.29)	(-9.26)	(-9.57)
Adjust R^2	0.08	0.21	0.47	0.62	0.58	0.59
S.E.	0.1	0.1	0.1	0.1	0.1	0.1

[10] In line with the growth regressions of Table 5.4 and 5.5, the right hand side variables, in Table 5.6 and 5.7, are not expressed as proportions of GDP, but the Appendix (Table A.5.3 and A.5.4) show results conducted with I, EX, IM, and OPEN, all expressed as proportions of GDP, which are qualitatively similar.

The complementarity between domestic and foreign investment, however, is not robust without the inclusion of FDI*H when other controlling variables, in particular EX and IM, are included (regressions 5.6.3 and 5.7.3). While multicollinearity may account for some of the perverse results of FDI on income and growth in Tables 5.4 and 5.5, the results of Table 5.6 and 5.7 clearly suggests that most of the effect of FDI on growth probably derives from efficiency gains and spillover effects into domestic investment. Regressions 5.6.6 and 5.7.6 also suggest complementarity between trade openness and domestic investment, implying a similar positive effect on growth as FDI.

5.6. Conclusion

This chapter has analysed the effects of FDI inflows and trade openness flows on economic growth in Thailand, following the lead of the endogenous growth literature which emphasises the importance of taking account of human capital in the growth process. This is incorporated by studying the interactions between these variables (i.e FDI and trade) and human capital, proxied by educational attainment in secondary schooling. Using time series data for Thailand over the period 1973:2 – 2006:4, we estimated an error-correction model allowing for cointegration of variables to be incorporated as long run constraints in the model, thus illustrating both short run and long run effects of FDI and trade openness on growth, conditional of domestic investment, human capital, and government expenditure. Several major findings are reported. Firstly, following Borensztien et al. (1998), we estimate the minimum education threshold levels for human capital for FDI to yield positive and significant effects on economic growth, and calculate similar threshold level for assessing the effects of trade openness on growth too. The results indicate that FDI has had a positive influence on growth above education threshold levels of 4.5, although trade openness has yielded a more significant and dominant influence on Thai economic growth than FDI. Secondly, a somewhat perverse result obtained in our regressions, when separating the effects of trade openness through exports and imports alongside FDI, is that imports growth has yielded a positive and significant impact on growth, dominating export-led and FDI-led growth. An interpretation of this outcome is that technology embedded in imported goods may have had an FDI-type effect on growth, facilitating technology transfer and complementing the growth of domestic investment. In this context, exports and FDI may simply be facilitating and complementing imports led growth. However, it seems sensible to suggest that trade openness has yielded more beneficial impact on growth, and this effect is stronger than that of FDI in the case of Thailand. Finally, both trade openness and FDI has complemented domestic investment yielding positive effects on economic growth mainly through efficiency gains, suggesting that domestic investment has not been crowded out by foreign investment to Thailand.

Chapter 6

FDI, Trade and Economic Growth in Thailand: A Multivariate VAR Analysis.

6.1. Introduction

In contrast to chapter 5, which estimated an error correction model and looked mainly at the effects of FDI, trade openness and human capital within a single equation framework, this chapter formally investigates causal links between the variables using Granger causality tests within a multi-equation framework.

The theoretical foundation for empirical studies on FDI and growth derives from the neoclassical model endogenous growth. In traditional neoclassical models of growth, FDI increases the volume of investment and its efficiency, and leads to long-term level effects and medium-term, transitional increases in growth. The new or endogenous growth models consider long run growth as a function of technological progress, and provide a framework in which FDI can permanently increase the rate of growth in the host economy through technology transfer, diffusion, and spillover effects. Evidence in the existing empirical literature on the causal relationship between FDI and economic growth is rather inconclusive. Most of these studies conduct traditional causality tests, using single time series or panel data.

Many empirical studies have investigated the effect of FDI on host countries (noted in chapter 2, 5), although the question of whether inward FDI is responsible for host economic growth or whether it is caused by the growth of the host country remains open. Most studies implicitly assume either that FDI is causally prior to economic growth, or that FDI results from the host countries' economic growth. Although such an approach may be useful in revealing the presence of a statistical association between FDI and host economic growth, they clearly do not reveal a monotonic relationship.

Some studies have addressed the issue in terms of short-run dynamics and long-run relationship between FDI and income growth. Bende-Nabende and Ford (1998), for example, investigate the simultaneity between FDI and economic growth in a small, pilot, dynamic model of Taiwan.

In this chapter we attempt to shed further light on the long-run relationship and the direction of causality between FDI, trade openness and economic growth, using the framework of cointegration and error correction modelling with the Thai data set for the period 1973:2 – 2006:4. Thailand has experienced an unprecedented boom in FDI inflows over the past decades, with flows reaching 23 billion of Baht in 1997. During the same period, Thai economy grew at an average rate of 8.7 per cent. Establishment of the causal link between FDI and economic growth has important implications for development strategies. If there is a causality from FDI to growth, then it would lend credence to the FDI-led growth hypothesis: that FDI not only leads to structural transformation and industrial upgrading, but also promotes the growth of national income in host economies. If the causal process is in the opposite direction, then it would imply that growth may be a prerequisite for developing countries to attract FDI, and the amount of FDI flows into a country depends on the country's absorptive capacity. If the causal process is bi-directional, then FDI and growth have a reciprocal causal relationship, and thereby a virtuous cycle is expected. Therefore, we can expect between FDI and growth three hypotheses: (1) the FDI-led growth hypothesis; (2) the growth-driven FDI hypothesis; and (3) the two-way causal hypothesis, combining of (1) and (2).

However, we also examine the relationship between openness (and specifically exports) and economic growth for Thailand and focus specifically on the comparison between FDI-led growth and export-led growth. In investigating these issues, we employ a multivariate VAR model in which other relevant factors (domestic investment, exports and imports) are also allowed to exert their influence apart from the two basic variables (FDI and FDI * H). In particular, we attempt to test the causal relationship between trade openness, FDI and growth, and also examine whether Thailand's trade expansion is caused by higher rapid economic growth or that higher external trade has led to higher economic growth.

The main contribution of this chapter, therefore, is to examine the causal relationship between FDI and economic growth, as well as trade and economic growth using multivariate Granger causality tests conducted within a VAR or VECM cointegration framework. In doing so, we first test the integration properties of the data, then employ the Johansen procedure to detect the number of cointegrating vectors, and then test for causality using the appropriate form of VAR (restricted VECM or unrestricted VAR) depending on whether the variables under consideration are cointegrated or not (Sims et al. (1990)). We also conduct Wald tests of the hypothesis that all higher-order lagged coefficients in the ECM, on each variable in turn are zero that is, the second set of restrictions implied by Granger non causality.

The remainder of the chapter is organised as follows. Section 6.2 reviews the empirical evidence on FDI, trade and growth focussing on causality issues. Section 6.3 describes the econometric methodology for Granger causality testing in the context of both the VAR and VECM frameworks. Section 6.4 reports the data characteristics, including the results for ADF tests and the Johansen cointegration test results for a variety of VECM specifications. Section 6.5 presents and discusses the empirical results on causality testing, conducted in both bivariate and multivariate settings, the main empirical contribution here being the extensive investigation of causal links among the variables. Finally, section 6.6 concludes.

6.2. FDI, Human capital, Trade and Growth: A Discussion of the Empirical Evidence

In this section, we briefly review selected papers that have investigated the causal relationship between FDI and growth and note several drawbacks of these traditional approaches. Regarding studies on FDI-led growth, some scholars have applied time series data analysis and directed their FDI-led growth studies towards the use of the Granger no-causality test procedure. See, inter-alia, Karikari (1992), Saltz (1992), de Mello (1999), Kasibhatla and Sawhney (1996), Kholdy (1995), Pfaffermayr (1994), United Nations (1993). Some empirical studies on the FDI-led growth hypothesis have been directed towards the Chinese economy. Recent attempts are that by Chen, Chang, and Zhang (1995), Zhang (1995), Chen (1996), Pomfret (1994), Sun (1996), and Wang & Swain (1995). However, none of these studies have tested for the direction of causality between GDP growth and FDI inflow, they have implicitly assumed and tested one-way causality running from FDI to GDP growth. Second, most these studies have used cross-section data, which is also subject to debate.

The main arguments against cross section data analysis, and in favour of time series analysis, have been that cross-country studies implicitly impose or assume a common economic structure and similar production technology across different countries which is most likely not true and further, economic growth of a country is influenced not only by FDI and other factors inputs, but also by a host of domestic policies. Despite recent developments in the panel data analysis, including the use of random coefficients to improve the power of the test based on cross section data, the significance of the conclusion drawn from cross section data is still subject to some debate in finding a long run causal relationship in the data (Enders (1995) and Marin (1992)). Some studies have tried to overcome the problems with cross-section data analysis and the simultaneity bias by using a simultaneous equation model (Gupta and Islam (1983), Lee and Rana (1986) and Synder (1990)). However, these studies, as pointed out by White (1992), suffer from the problems of inadequate theoretical foundations and poor econometric methodology (i.e. their estimation methods).

As far as the model specification is concerned, most of these studies have used a simple two-variable relationship. It should be pointed out that the approach of using a simple two-variable framework in the causality test without considering the effect of other variables such as export, import and domestic investment are subject to a possible specification bias. It is established in the econometric literature that causality tests are sensitive to model selection and function form (Gujarati (2003)). Riezman, Whiteman and Summer (1996) conduct a comprehensive time series study of export-led growth and argue that omitting the imports variable in the VAR estimation process can result in both type I and type II errors, that is spurious rejection of one causality as well as spurious detection of it.

An additional issue is the endogenous nature of a production function, implying that studies which ignore the endogenous nature of the growth process are subject to a simultaneity bias. The use of a VAR model has proved to generate more reliable estimates in an endogenous context (Gujarati (2003)).

Although the choice of the optimal lag in the causality test has been noted in some studies, very few studies have considered the problem of the sensitivity of the causality test results under different lag structures. It is vital to obtain consistent causality results for at least some consecutive lag structures along with the optimal choice of the lag using some conventional criterion such as AIC or SC. We attempt to address this issue by considering the robustness of the results based on such criteria.

Theoretically, the causality between FDI and GDP growth could run either direction, FDI could promote further GDP growth, as emphasised by Dunning (1970), the World Bank (1993) and Krueger (1987). Recently, economists, in line with new growth theory argued that through the capital accumulation in the recipient economy, FDI inflows generate non-convex growth by encouraging the development of new inputs and foreign technologies in the production function of the recipient economy. Further, through knowledge transfers, FDI is expected to augment the existing stock of knowledge in the recipient economy through labour training and skill acquisition. On the other hand, foreign investors may increase productivity in the recipient economy of FDI can be deemed to be a catalyst for domestic investment and technological progress.

However, FDI achieved through the technology transfer channel accrue only to economies that possess a sufficient level of human capital base to absorb the advanced technology. In fact, Borensztein, De Gregorio and Lee (1998) find that below a certain threshold of human capital, FDI has a negative effect on growth. These findings seem to support the growth literature that stresses the necessity of high levels of human capital in order to affect growth through technological change. Benhabib and Spiegel (1994) suggest that given FDI's role as a vehicle for the adoption of new technologies, it should positively affect the rate of human capital accumulation.

However, the causality could also run the opposite way, rapid GDP growth could induce the inflow of FDI (Dowling and Hiemenz (1982), Lee and Rana (1986)). This is because rapid GDP growth will usually create a high level of capital requirement and the resource gap in the host country and hence the host country will demand more FDI by offering concession terms for FDI to attract overseas investors. Further, rapid economic growth in the host country like Thailand will build the confidence for overseas investors investing in the host country. More importantly, rapid economic growth, accompanied by an increased higher per capita income, will create huge opportunities for FDI in investment in industrial sectors, consumer durable goods and infrastructure sectors in the host country. This is the hypothesis of growth led FDI, discussed in chapter 5.

Among studies, examining the effects of trade and FDI on growth in China. Wei (1995) and Wei et al. (2001) find support for both exports and FDI influence economic growth. Dees (1998) finds that FDI has a positive effect on economic growth through its influence on technical change, Woo (1995) argues that FDI does not have a significant impact on growth and claims that Wei's (1995) estimates overstate the contribution of FDI to growth because FDI is correlated with total factor productivity growth. Although both these papers investigate possible directions of causality, none of them test explicitly for bi-directional links.

However, it should be pointed out that the direction of the causality between FDI and GDP growth depends on many economic as well as political and cultural factors, such as the level of economic development, the productivity of FDI and the policies shaping FDI inflows. Thailand is quite in line with this context. Since the adoption of the export promotion (EP), BOI promotion policy in 1972 and FDI promotion in 1997, Thailand has achieved a high level of economic growth. However, investment in public infrastructure has deteriorated, and this has become a serious bottleneck to further economic development. It is anticipated that public investment by be fuelled with the availability of foreign capital. During the 1980-2000 (see chapter 3), Thailand's rapid economic growth increasingly hedged on the huge FDI inflow, while its rapid economic growth also attracted more foreign capital from overseas.

6.3. Econometric Methodology for Causality Testing

Many tests of causality have been derived and implemented, including Granger (1969), Sims (1972) and Geweke et al. (1983), to test the direction of causality (see

Hamulton (1997). Although it is quite common to test for the direction of causality, the conclusions drawn in some studies are delicate for two important reasons. Firstly, the choice of lag lengths in the autoregressive or VAR models is often ad hoc, (see for example, Jung and Marshall (1985), Chow (1987), and Hsiao (1987)), although the length of lag chosen will critically affect results. Secondly, in the absence of evidence on cointegration, spurious causality may be identified. In our case we will attempt to overcome these shortcomings via the adoption of a three-stage procedure: (i) unit root test (ii) checking cointegration among variables (iii) Vector Autoregression (VAR or cointegration VECM) taking account of lag length using AIC criteria.

Engle and Granger (1987) show that if two series are individually I(1), and cointegrated, a causal relationship will exist in at least one direction. Furthermore, the Granger Representation Theorem demonstrates how to model cointegrated I(1) series in the form of a VAR model. In particular, the VAR can be constructed either in terms of the levels of the data, the I(1) variables; or in terms of their first differences, the I(0) variables, with the addition of a error correction model (ECM) to capture the short-run dynamics. If the data are I(1) but not cointegrated, causality tests cannot validly be derived unless the data are transformed to induce stationarity which will typically involve tests of hypotheses relating to the growth of variables; assuming that, in our case they defined in logarithms.

6.3.1. Definition of Causality

Consider, for instance, that we are going to analyse the empirical relationship between two variables *X* and *Y*, by means of Granger-causality tests. As it is well known, the results from these tests are highly sensitive to the order of lags in the autoregressive process. An inadequate choice of the lag length would lead to inconsistent model estimates, so that the inference drawn from them is likely to be misleading. In this study, we will identify the order of lags for each variable, which is based on Granger's concept of causality, and Akaike's final prediction error criterion, to avoid imposing false or spurious restrictions on the model.

In principle, with two stationary variables, X_t and Y_t, where the interest lies in testing Ganger-causality from *Y* to *X*, we consider the following representations:

$$X_t = \alpha + \sum_{i=1}^{p} \beta_i X_{t-i} + u_t \tag{6.1}$$

$$X_t = \alpha + \sum_{i=1}^{p} \beta_i X_{t-i} + \sum_{j=1}^{q} \gamma_j Y_{t-j} + v_t \tag{6.2}$$

and apply the following steps to establish Granger causality (see Granger (1969), Hsiao (1981)):

1. Take X_t to be a univariate autoregressive process as in (6.1), and compute its final prediction error criterion (FPE hereafter) with the order of lags *i* varying from 1 to *p.* Choose the lag that yields the smallest FPE, say *p*, and denote the corresponding FPE as FPE_x (*p*,0).

2. Treating X_t as a controlled variable with *p* lags, add lags of Y_t as in (6.2), and compute the FPE_x with the order of lags *j* of *Y* varying from 1 to *Q*. Choose the lag that yields the smallest FPE, say *q,* and denote the corresponding FPE as FPE_x (*p,q*).

3. Compare FPE_x *(p,0)* with FPE_x *(p,q)*. If FPE_x *(p,0)* > FPE_x *(p,q)*, then Y_t is said to Granger-cause X_t, whereas if FPE_x *(p,0)* < FPE_x *(p,q)*, then Y_t does not Granger-caused by X_t.

Conversely, Granger-Causality from X_t to Y_t can be established from steps 1 to 3 with Y_t as the dependent variable, and X_t as the causal variable.

In practice, most software programs simply test the joint significant of the null hypothesis H_0: $\gamma_i = 0$ using an F-test, particularly in the bivariate case above. As we are also empirically investigating causality within a multivariate VAR or VECM framework, the alternative is also to use the X^2 (Wald) test statistic to test the joint significance of more than one endogenous variable, by considering the unrestricted and restricted models (Toda and Phillips (1993)).

6.3.2. Granger Causality in a Multivariate context

Consider the unrestricted VAR,

$$z_t = c + A_1 z_{t-1} + \ldots + A_k z_{t-k} + u_t \qquad u_t \sim IN(0,\Sigma) \qquad (6.3)$$

where z_t is $(n \times 1)$ and each of the A_i is an $(n \times n)$ matrix of parameters. To illustrate a procedure for testing causality, we need to represent this system for one subset of z variables conditional on the other. Thus, consider $z_t = (y_t\ , x_t)'$, then (6.3) can be written as

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} A_{11}^1 & A_{12}^1 \\ A_{21}^1 & A_{22}^1 \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} A_{11}^k & A_{12}^k \\ A_{21}^k & A_{22}^k \end{bmatrix} \begin{bmatrix} y_{t-k} \\ x_{t-k} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \qquad (6.4)$$

where y_t is $(n_1 - 1)$ and x_t is $(n_2 \times 1)$ where $n_1 + n_2 = n$, and A_{ij}^h are the sub-matrices of parameters associated to the VAR, with superscripts denoting the order of the lags of the

VAR, h = 1,…,k and c_1 and c_2 are vectors of constants. In this representation, the absence of causality from past values of x to y corresponds to the elements of the sub-matrices A_{12}^{h} = 0 for h = 1,…k

In a bivariate case, where y_t and x_t are individual variables, we can represent the 2 variable VAR system by the following equations:

$$y_t = c_1 + \sum_{i=1}^{k} \alpha_{11}^{i} y_{t-i} + \sum_{j=1}^{k} \alpha_{12}^{j} x_{t-i} + \varepsilon_{1t}$$

and (6.5)

$$x_t = c_2 + \sum_{i=1}^{k} a_{21}^{i} x_{t-i} + \sum_{j=1}^{k} a_{22}^{j} y_{t-j} + \varepsilon_{2t}$$

In this case, testing Granger causality from x and y implies that testing the joint significance of a_{12}^{i} coefficients. More precisely, x does not Granger-cause y if the vector of past values of x (x_{t-1}, x_{t-2},…, x_{t-k}) has no power in forecasting y_t, or the hypotheses H_0 : a_{12}^{i} = 0 is not rejected. Conversely, y does not Granger-cause x if the hypothesis H_0 : a_{22}^{j} = 0 is not rejected.

6.3.3. Vector Error Correction Models for Multivariate Causality Tests

As argued by Granger (1988), standard Granger-causality tests are invalid if the time series are nonstationary. Further, if cointegration is established, then a vector ECM should be used to investigate causality, sometimes called restricted VAR regression. The advantage of VECM as opposed to the unrestricted VAR is that the information in about the long run is retained in the cointegrating combinations, and the stationarity properties of the variables involved in the system are properly taken into consideration (Johansen (1991); Johansen and Juselius (1992)). In our case, the system of ECM may be generated as follows, from the unrestricted VAR, (ignoring the constant term for simplicity):

$$z_t = A_1 z_{t-1} + ... + A_k z_{t-k} + u_t \qquad u_t \sim IN(0,\Sigma) \qquad (6.6)$$

where z_t is $(n \times 1)$ and each of the A_i is an $(n \times n)$ matrix of parameters. Equation (6.6) can be reformulated into a vector error-correction (VECM) form:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + ... + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-k} + u_t \qquad (6.7)$$

where $\Gamma_i = -(I - A_i - ... - A_i), (i = 1,..., k-1),$ and $\Pi = -(I - A_1 - ... - A_k)$. This way of specifying the system contains information on both the short run and long run adjustment to changes in z_t, via the estimates of $\hat{\Gamma}_i$ and $\hat{\Pi}$ respectively. If z_t is I(1), then Δz_t is I(0), but stationarity of the system must also depend on Πz_{t-k} to be I(0). This implies that there must exist up to $(n - 1)$ cointegrating relationships for the system to be stationary. Assuming that there are $r \leq (n - 1)$ cointegrating vectors in the system, then Π can be factorised as $\Pi = \alpha\beta'$, where α and β are $(n \times r)$ matrices, the elements of α represents the speeds of adjustment (or feedback parameters in the error correction form) and β being a matrix of long run coefficients such that the term $\beta' z_{t-k}$ represents the cointegrating relationships in the system (i.e. r columns of β form r linearly independent combinations of the variables in z_t, each of which is stationary) to ensure that $\beta' z_{t-k} \sim$ I(0).

Furthermore, for the system (6.7) to be stationary, the remaining $n - r$ column of β (comprising the I(1) common trends) would not represented in the system, implying that the last $(n - r)$ columns of α are insignificantly small (i.e., effectively zero), so that Πz_{t-k}

is also I(0) in (6.7) and z_t will converge to its long run steady state solution. Thus, determining how many $r \leq (n-1)$ cointegration vectors exist in β amounts to equivalently testing which columns of the matrix α are zero. Consequently, testing for cointegration amounts to checking the rank of Π, that is, finding the number of r linearly independent columns in Π. Actual tests of cointegration (namely the trace and the maximum eigenvalue tests stated in Chapter 5) amount to determining the rank of Π. Johansen (1988) derives these tests and estimates of α and β using a procedure known as reduced rank regressions (see Harris (1995), Chapter 5, for clear exposition).

Now, in a bivariate system, let $z_t = [y_t, x_t]'$, and for ease of exposition suppose k = 2, then the system with $\Pi = \alpha\beta'$ can be written as:

$$\begin{bmatrix} \Delta y_t \\ \Delta x_t \end{bmatrix} = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} \Delta y_{t-1} \\ \Delta x_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{21} \\ \beta_{12} & \beta_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} \tag{6.8}$$

The absence of cointegration in the above system means that in principle the elements of α matrix are all zero. With one cointegrating vector (r=1) we expect the second column of the α matrix to be zero (i.e. α_{12} = α_{22} = 0). In this case, α_{11} represents the speed of adjustment at which Δy_t adjusts towards the single long run cointegration relationship (β_{11} y_{t-1} +β_{21} x_{t-1}), while α_{21} represents the speed at which Δx_t responds to the disequilibrium changes represented by the cointegration vector. However, if α_{21} = α_{22} = 0 (i.e. zero second row of the α matrix), then the equation for Δx_t contains no information about the long run β since the cointegration relationships do not enter into this equation, and it is therefore valid to condition on the weakly exogenous variable x_t and proceed with the following conditional VECM model:

$$\Delta y_t = \tilde{\phi}_0 \Delta x_t + \tilde{\phi}_1 \Delta z_{t-1} + \tilde{\alpha}\beta' z_{t-1} + \tilde{u}_t \qquad (6.9)$$

where α is equal to α with α_{21} = α_{22} = 0[1]. Note, the weakly exogenous variable, x_t, remains in the long-run model (i.e., the cointegration vectors) although its short run behaviour is not modelled because of the exclusion from the vector on the left hand side of the equation. Thus, weak exogeneity of a variable in the VECM can be tested by checking for the presence of all zeros in the appropriate row of the α matrix.

Causality inferences in the multivariate VECM model are made by estimating the parameters of the model, subject to the predetermined number of cointegrating vectors in the system, as determined by the Johansen likelihood ratio tests. Then, absence of causality in the short run implies that the lagged coefficient values of the first difference terms of the relevant causal variable in the VECM are jointly insignificant. Toda and Phillips (1993) show that non-causality in VECM also involves, in addition, some nonlinear restrictions, comprising elements of the α and β matrices. To illustrate in the case of the bivariate system (6.8), for example, non-causality from *x* to *y* implies not only ϕ_{12} = 0 but also $\alpha_{11}\beta_{11} + \alpha_{12}\beta_{22}$ = 0. However, Hall and Milne (1994) introduce the notion of the absence of weak causality to denote the situation in which the long run level of one or more variables is unaffected by the levels of others. In (6.8), this is testable via zero restriction on the appropriate row of the α matrix, which is equivalent to weak exogeneity.

[1] The parameterisation in (6.9) is somewhat altered form the unconditional VAR, as it is assumed that the latter is decomposed into a conditional model for y_t given x_t, and a marginal model for x_t (not shown). In a sense, (6.9) is an error-correction model.

Following Hall and Milne, it is noted that if weak non-causality is rejected, then Granger non-causality, which in addition involves the remaining higher-order short run dynamics, also is rejected. Thus, estimating the full VECM model, and testing restrictions on the appropriate long run and short-run adjustment coefficients allows investigation of bi-directional causality between two variables.

In what follows, we first test for Granger Causality between pairs of variables before allowing for the presence of conditioning variables in the VAR/VECM specification. Of course, before estimating a VAR or VECM model, we test for unit roots and check for cointegration in the data.

6.4 Unit Root and Cointegation Testing

The empirical analysis reported in this section involves subsets or combinations of the following variables: GDP per capita (GDPPC), domestic investment (I), human capital (H), government expenditure (GX), exports (EX), imports (IM), Foreign Direct Investment (FDI), as well its interaction with human capital (FDI*H). Additionally, we also consider trade openness (OPEN) as a substitute for exports and imports entering separately. As in the estimation of the single equation error correction model (Section 5.4), variants of the multivariate model as well as the presence of other interaction terms (notably I*H) are entertained particularly in checking for the robustness of the results. The results of single equation estimation (Table 5.4) have influenced the choice of appropriate sub-set of the variables in determining the outcome of causality.

6.4.1 Data

As noted in Chapter 5, data are quarterly covering the period 1973:2-2000:4. Table 6.1a presents the descriptive statistics for the seven series (the minimal set of variables in the system). Table 6.1b presents the correlation matrix indicating high positive correlation among all the variables although it may be noted that correlations of FDI with other variables are lower by at least 10 per cent.

Table 6.1a Descriptive statistics

	lnGDPPC	**lnGX**	**lnH**	**lnI**	**lnIM**	**lnEX**	**lnFDI**
Mean	9.141	10.28	1.53	10.87	8.641	10.62	8.434
Median	9.0312	10.33	1.576	10.75	8.344	10.41	8.114
Maximum	9.8401	12.58	1.799	13.15	11.07	13.54	11.12
Minimum	8.4239	7.318	1.264	7.668	5.226	7.043	5.753
Std. Dev.	0.4378	1.454	0.193	1.584	1.688	1.746	1.341
Skewness	0.1527	-0.251	-0.167	-0.239	-0.165	-0.104	0.077
Kurtosis	1.6612	2.08	1.424	1.888	1.918	1.968	2.148

Table 6.1b Data Correlations

	lnGDPPC	**LnGX**	**lnH**	**lnI**	**lnIM**	**lnEX**	**lnFDI**
lnGDPPC	1						
lnGX	0.971	1					
lnH	0.963	0.961	1				
lnI	0.982	0.987	0.965	1			
lnIM	0.987	0.99	0.964	0.994	1		
lnEX	0.983	0.989	0.965	0.986	0.996	1	
lnFDI	0.88	0.854	0.896	0.858	0.877	0.887	1

6.4.2. Unit Root Tests for Stationarity

Table 6.2 gives the results of ADF unit root tests with lag lengths chosen by downward search using the AIC t-test on the longest lag[2]. The null hypothesis of a unit root is not rejected for any of the level variables. However, each of the logged series is stationary in first differences, so all the variables are integrated of order one[3].

Table 6.2 ADF test for Unit Root

Null Hypothesis: each series contains a unit root		
Variables	**ADF(include trend) Level**	**ADF(intercept only) 1st Difference.**
lnGDPPC	-1.98 (4)	-3.46* (3)
lnGX	-1.48(4)	-3.23**(4)
lnFDI	-3.28 (0)	-6.65** (3)
lnFDI*lnH	-3.26(0)	-6.63**(3)
lnI	-1.04(4)	-2.15*(4)
lnI*lnH	-0.84(3)	-2.04*(4)
lnEX	-3.92(4)	-4.81**(4)
lnIM	-2.53(4)	-3.46**(3)
lnH	-3.80(4)	-5.35**(3)
lnOPEN	-2.13(4)	-10.44

Note: 1. ** and * denote significance at the 1% and 5% levels, respectively.

2. **Figures in parentheses are the number of lags used.**
3. **The results of ADF tests here are slightly different from the results of ADF tests in Chapter 5 owing to different lag length used, making a difference to the sample size.**

[2] As noted earlier in section 6.2, it is vital to ensure that unit root test results are consistent across different lag structures. We here only reported the results in Table 6.2 for the lag length chosen by the AIC test, although the results are unaffected for other lag lengths (especially the lag length chosen by the SC criterion).

[3] The results of ADF tests reported in this table here are slightly different as in Table 5.2 because of different lag lengths. Nevertheless, unit roots tests are reported here to reinforce that all series are I(1).

6.4.3. Testing for Cointegration

It is now possible to implement tests of cointegration among various combinations of the I(1) variables to check the existence of a stable long run relationship. If the variables are cointegrated, then we use a vector error correction model (VECM) to test for causality between the variables of interest, since cointegration implies the existence of a long-run constraint that needs to be accounted for. In the absence of cointegration, given that all series are I(1), then we test for causality based on first difference VAR, since this takes into account the implicit constraint that there is no cointegration. (Toda and Phillips (1993)).

6.4.3.1 Pairwise Combinations

Table 6.3 reports the results of Johansen tests for given pairs of variables to be used for bivariate causality testing, so that for each pair of variables there could be at most one conitegrating relationship if it exists. The order of the VAR or the lag length is set to 4 (following the AIC criterion for unit root tests), although (unreported) results for other lag lengths (particularly orders 2, 3, and 5) have not affected the conclusions. The null hypothesis of no cointegration is not rejected for most pairs, except for GDPPC and schooling (H), and GDPPC and government expenditure (GX). It turns out that the following pairs of variables are not cointegrated: GDPPC and exports (EX), GDPPC and imports (IM), GDPPC and trade openness (OPEN), GDPPC and domestic investment (I), GDPPC and FDI, and GDPPC and FDI*H.

One reason for lack of cointegration among pairs of variables is the omission of the relevant conditioning variables, whose inclusion makes cointegration otherwise possible, as noted from the results of Table 6.4 below. Although this may seriously bias the outcome of causality tests based on pairs of variables, it seems sensible to proceed by checking for cointegration and causality among the minimal set of variables first, and then progressively increase the number of variables to ensure that causality inferences drawn from the empirical analysis are not model specific.

Table 6.3. Results of Johansen cointegration tests, Pairwise Cointegration

Unrestricted Cointegration Rank Test (lag length of VAR = 4)						
Pair 1	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.088	7.16	15.41	7.14	14.07
lnFDI*H	At most 1	0.083	0.62	3.76	0.02	3.73
Pair 2	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.08	8.73	15.41	8.44	14.07
lnFDI	At most 1	0.083	0.3	3.76	0.3	3.73
Pair 3	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.08	18.18	15.41	15.63	14.07
lnH	At most 1	0.083	2.55	3.76	2.55	3.73
Pair 4	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.08	17.91	15.41	16.73	14.07
lnGX	At most 1	0.02	1.18	3.76	1.18	3.73
Pair 5	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.11	14.02	15.41	12.79	14.07
lnI	At most 1	0.01	1.23	3.76	1.23	3.73
Pair 6	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.08	10.38	15.41	8.81	14.07
lnIM	At most 1	0.01	1.57	3.76	1.57	3.73

Pair 7	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.05	10.41	15.41	8.86	14.07
lnEX	At most 1	0	3.76	3.76	2.09	3.73
Pair 8	Hypothesized No.	Eigenvalue	Trace	5%	Max-Eigen	5%
	of CE(s)		Statistic	Critical value	Statistic	Critical value
lnGDPPC	None	0.05	5.96	15.41	5.76	14.07
lnOPEN	At most 1	0	0.2	3.76	0.2	3.73

Note: Author's calculations on the E Views 4.1.

6.4.4. Cointegration among more than two variables

Because H and GX individually appear to be cointegrated with GDPPC, it is sought to extend the span of variables combining these three variables with other sets of variables, and check for cointegrating combinations. Table 6.4 reports the number of cointegrating vectors determined by the Johanson tests[4] for various combinations of variables that commonly include (logs of) GDPPC (as the dependent variable) and H, I and GX (as the minimal set of conditioning variables). As explained earlier, causality tests are to be carried out on various VAR/VECM specifications in order to check for the robustness of the results. The choice about the inclusion of the additional variables in the VAR specifications is partly based on the single equation estimation results reported in Table 5.6.

It can be seen that cointegrating combinations exist between GDPPC, FDI and EX with the addition of H, GX and I as conditioning variables. Although the results of Trace and λ-max statistics differ in terms of the number of cointegrating combinations, the

[4] It would be tedious to report in detail the Johanson test results for all the VAR specifications. Instead, what is reported is the number of cointegrating vectors, as determined by the Trace and Max Eigenvalue tests, for each set of variables chosen in the VAR estimation conducted with lag length 4.

addition of imports (IM) to the VAR specification clearly increases the span of the cointegration space, as can be seen from the comparison of results between the successive rows 3 & 4, 9 &10, and 11 & 12. This result is noteworthy, as the results of single equation estimation (see Table 5.4) revealed that imports is a significant determinant of per capita GDP growth in Thailand and therefore its omission from the analysis may seriously bias the outcome of causality tests.

Table 6.4. Cointegrating Vectors

VAR Specification (all variables in logs)	No. of Coingetrating vectors significant at 5 % (at 1 per cent level in parenthesis)		
	Trace	λ_{Max}	No. used in VECM
VAR Model 1: GDPPC, H, I, GX, and FDI	2(1)	1(0)	1
VAR Model 2: GDPPC, H, I, GX, FDI, and FDI*InH	2(1)	1(1)	1
VAR Model 3: GDPPC, H, I, IGX, and EX	3(2)	1(0)	2
VAR Model 4: GDPPC, H, I, GX , IM, and EX	3(3)	3(0)	3
VAR Model 5: GDPPC, H, I, GX, EX, and FDI	2(1)	0(0)	1
VAR Model 6: GDPPC, H, I, GX, OPEN, and FDI	2(1)	1(1)	1
VAR Model 7: GDPPC, H, I, GX, OPEN, and FDI*H	2(1)	1(1)	1
VAR Model 8: GDPPC, H, I, GX, OPEN, FDI and FDI*H	2(2)	2(2)	2
VAR Model 9: GDPPC, H, I, GX, EX, FDI, and FDI*H	3(2)	2(2)	2
VAR Model 10: GDPPC, H, I, GX, EX, IM, FDI, and FDI*H	4(3)	2(2)	3
VAR Model 11: GDPPC, H, I, GX, EX, FDI, FDI*H, and I*H	4(3)	3(3)	3
VAR Model 12: GDPPC, H, I, GX, EX, IM, FDI, FDI*H, and I*H	6(5)	3(3)	5
Note: calculation on the E Views 4.1.			

Thus, we consider causality tests for numerous sets of variables, both with and without the imports variable and check for potential biases . The final column of Table 6.4 states the number of cointegrating vectors to be chosen for VECM estimation, largely based on the results of the Trace statistic (at 1% level), although it could be argued that our choice more appropriately represents a half way compromise given the outcome of the two test results.

6.5. Empirical Analysis on Granger Causality

6.5.1. Pairwise Granger Causality Tests

Table 6.5 summaries the results of bivariate Granger causality tests to establish causal links, if any, between pair of variables. The results reported are for the VAR lag lengths 2,3,4 and 5. Given the absence of cointegration between the pairs considered, the VAR specification is in first differenced form. The causality evidence in this context may be interpreted as occurring between growth rates. The results (summarised in the last column of Table 6.5) reveal bi-direction causality between per capita GDP and investment. There is also evidence of causality from GDP growth to exports and to imports (and so also trade openness), and some evidence of causal link in the opposite direction but this is not highly significant and is not persistent at all lag lengths. Most notable is the absence of any causal connection between FDI (and FDI*H) and per capita GDP growth.

Table 6.5. Granger Causality Tests Based on Unrestricted VAR

VAR Lag Length	2	3	4	5	Summary
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnI)	21.09462***	55.23919***	25.91026***	24.27982***	
Dependent variable: Δ (lnI)					Bi-directional causality
Causal variable	χ^2	χ^2	χ^2	χ^2	ΔlnGDPPC ⇔ΔlnI
Δ (lnGDPPC)	43.33821***	50.39543***	17.4204***	14.55448***	
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnEX)	3.627551	3.47593	6.86466	10.08539*	
Dependent variable: Δ (lnEX)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnGDPPC)	10.55873***	10.83095***	8.981049*	9.093709*	ΔlnGDPPC ⇒ΔlnEX
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnIM)	0.892186	8.98648**	5.01005	6.330115	
Dependent variable: Δ (lnIM)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnGDPPC)	35.39696***	32.58719***	13.32635***	12.87193**	ΔlnGDPPC ⇒ΔlnIM
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnOPEN)	0.892114	8.986407**	5.00993	6.329988	
Dependent variable: Δ (lnOPEN)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnGDPPC)	35.39696***	32.58713***	13.32645***	12.87208**	ΔlnGDPPC ⇒ΔlnOPEN
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnFDI)	1.328054	1.63013	1.59702	2.686887	No causal link
Dependent variable: Δ (lnFDI)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnGDPPC)	1.391887	1.87755	3.36202	4.06104	No causal link
Dependent variable: Δ (lnGDPPC)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (lnFDI*lnH)	2.326024	3.05414	2.61167	3.781528	No causal link
Dependent variable: Δ (lnFDI*lnH)					
Causal variable	χ^2	χ^2	χ^2	χ^2	
Δ (GDPPC)	1.860343	2.42063	3.67323	4.439437	No causal link

Note: * , ** and * denote significance at the 10% , 5% and 1% levels, respectively.**

6.5.2 Weak Exogeneity Tests

Table 6.6 reports the outcome of weak exogeneity tests conducted for all specifications entertained in Table 6.4. This is conducted within a VECM formulation given the presence of cointegration among the variables considered. As noted earlier, weak exogeneity of a variable with respect to the cointegrating parameters in the VECM model can also be interpreted as evidence of the absence of weak causality, implying that the short run behaviour of the variable in question is not affected by co-movement of other variables in the system. This is a sufficient (but not necessary) condition for non-causality in VECM models (Toda and Phillips, 1993). Thus, in our context, we need to establish evidence of weak non-causality (equivalent to weak exogeneity in VECM models) for the outcome of Granger Causality tests (reported in Table 6.7 below) to be strictly valid. Failure to reject weak exogeneity in VECM models therefore implies, in turn, that there is evidence of bi-directional Granger causality between the given set of cointegrating variables. As can be noted in Table 6.6, the null hypothesis of weak exogeneity cannot be rejected for most of the variables, specifically for models 8, 9 and 10. The only variable for which the rejection frequency is high across most models is government expenditure (GX), although this is also accepted in models 8-10. Most other variables, in particular FDI, FDI*H, EX, IM, H and I are also acceptable candidates for weak exogeneity, implying that it is valid to condition on these variables in single equation ECM models, as was done in the regressions reported in Chapter 5 (Table 5.5). Note that the null hypothesis for weak exogeneity is not rejected for GDPPC, except for models 1, 11 and 12, suggesting that it would not be appropriate to base inferences about non-causality from other variables to GDPPC on these models.

VECM models 11 and 12, which add I*H to the variable set, also appear to reject weak exogeneity of other variables, an outcome that may associated with the increased number of variables and therefore the increased number of cointegrating vectors. Increasing the VAR lag length in this case does not substantially alter the outcome of exogeneity tests. However, inclusion of I*H is subsidiary to our main analysis and, therefore, VECM models 11 and 12 are not of major interest to our investigation. Nevertheless, they are represented here mainly to highlight cases where our conclusions might not be robust.

Table 6.6 Weak Exogeneity Tests

(H_0: variable is weakly exogenous to cointegrating system)

VECM Model 1.			**VECM Model 2.**			
Lag length (4)	p-value	Decision (H_0)	Lag length (4)	LR Test	p-value	Decision (H_0)
GDPPC	0.05	R	GDPPC	0.06	0.8	A
H	0.56	A	H	0.63	0.43	A
I	0.95	A	I	0.77	0.68	A
GX	0	R	GX	17.45	0	R
FDI	0.99	A	FDI	2.16	0.14	A
			FDI*H	1.42	0.23	A
VECM Model 3.			**VECM Model 4.**			
Lag length (4)	p-value		Lag length (4)	LR Test	p-value	
GDPPC	0.23	A	GDPPC	1.32	0.25	A
H	0.07	R	H	1	0.32	A
I	0.54	A	I	0.05	0.82	A
GX	0.01	R	GX	3.59	0.06	R
EX	0.83	A	IM	2.21	0.14	A
			EX	0.45	0.5	A

VECM Model 5.			**VECM Model 6.**			
Lag length (4)	p-value		Lag length (4)	LR Test	p-value	
GDPPC	0.66	A	GDPPC	1.35	0.25	A
H	0.8	A	H	0.37	0.55	A
I	0.44	A	I	0.5	0.48	A
GX	0.01	R	GX	14	0	R
EX	0.15	A	OPEN	3.01	0.08	R
FDI	0.91	A	FDI	0.49	0.48	A
VECM Model 7.			**VECM Model 8.**			
Lag length (4)	p-value		Lag length (4)	LR Test	p-value	
GDPPC	0.21	A	GDPPC	0.01	0.91	A
H	0.53	A	H	2.35	0.13	A
I	0.55	A	I	0.05	0.83	A
GX	0	R	GX	4.2	0.04	R
OPEN	0.07	R	OPEN	1.83	0.18	A
FDI*H	0.55	A	FDI	1.36	0.24	A
			FDI*H	0.91	0.34	A
VECM Model 9.			**VECM Model 10.**			
Lag length (4)	p-value		Lag length (4)	LR Test	p-value	
GDPPC	0.44	A	GDPPC	1.67	0.2	A
H	0.49	A	H	1.96	0.16	A
I	0.89	A	I	1.18	0.28	A
GX	0.12	A	GX	0.37	0.54	A
EX	0.63	A	EX	1.96	0.16	A
FDI	0.17	A	IM	0.94	0.33	A
FDI*H	0.28	A	FDI	1.09	0.3	A
			FDI*H	0.99	0.32	A
VECM Model 11.			**VECM Model 12.**			
Lag length (4)	p-value		Lag length (4)	LR Test	p-value	
GDPPC	0.09	R	GDPPC	3.91	0.05	R
H	0.66	A	H	5.13	0.02	R
I	0	R	I	2.76	0.1	R
GX	0.77	A	GX	7.17	0.01	R
EX	0.01	R	EX	2.51	0.11	A
FDI	0.65	A	IM	5.7	0.02	R
FDI*H	0.56	A	FDI	1.61	0.21	A
I*H	0	R	FDI*H	1.91	0.17	A
			I*H	1.25	0.26	A

Note: R denotes rejection and A denotes acceptance of the null.

6.5.3 Multivariate Granger Causality Tests

Table 6.7 reports the results of Wald tests for the null hypothesis that all higher order lagged coefficients of the relevant causal variable in the VECM are jointly zero[5]. These are conducted pairwise, so that for each dependent variable the results reported are the Chi-square values for the relevant causality test taking each causal variable in succession. The values down the columns are the results for a given VECM model, while the values along the rows are the results of a given causality test conducted across all the models. This way of presenting the results makes comparisons across models easier.

Evidence of bi-directional causality between domestic investment and per capita GDP growth found in the bivariate case (Table 6.5) is confirmed here in the multivariate case, as shown by the results of the Granger causality tests on GDPPC and I (see the first and the third blocks of Table 6.7). Of particular interest are the results of the Granger causality tests on GDPPC, which reveal that domestic investment (I) and exports (EX) are the main causal effects on growth across most VECM specifications. Notice that imports do not affect growth directly, implying that the direct significance of trade openness on growth comes mainly through exports. This may lend credence to the export-led growth hypothesis for Thailand, although causality tests on what causes investment growth reveal that imports might have an indirect effect on growth through its impact on domestic investment. The same goes for human capital, which does not directly affect growth but

[5] Note that these comprise the second set of restrictions implied by Granger non-causality, as the test procedure is sequential to the establishment of weak non-causality from the cointegrating vector to the dependent variable, or equivalently weak exogeneity in the VECM model, as a sufficient condition. Simultaneous testing of the joint restrictions is not possible, as the asymptotic distribution of the Wald test statistic under the null is non-standard Chi-Square involving nuisance parameters, and therefore standard critical values are not applicable (see Toda and Phillips, 1993).

may be having an indirect effect given evidence of its bi-directional causality with domestic investment (across most specifications). Most noteworthy is lack of evidence for FDI-led growth, directly or indirectly through domestic investment. Whatever impact FDI is having on growth appears to come through it impact on human capital (and also apparently through government consumption), although evidence for this is not quite robust.

Direct support for growth led-FDI hypothesis is also weak, although indirect effect may be coming through the causal links from domestic investment and exports to FDI, reinforced by bi-directional causality between GDP growth and domestic investment. Causality tests, however, have revealed a significant impact of growth and FDI on government expenditure, a finding possibly explained by recent investments in public infrastructure (including education) fuelled by the availability of foreign capital and joint ventures with foreign multinationals. However, there is little in the data to suggest that this has affected economic growth directly, although according to the causality tests government expenditure has significantly influenced the development of human capital in Thailand. This possible explains the apparently significant, albeit negative, effect of government expenditure on per capita GDP growth found in the single equation regression results of Chapter 5.

Table 6.7 Multivariate Granger Causality Tests

Granger causality tests: Dependent variable ΔlnGDPPC											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnH	0.51	3.19	3.08	1.73	3.37	3.45	0.39	0.39	0.76	5.72	6.08
ΔlnI	10.80**	21.04***	19.58***	16.91***	24.97***	24.56***	19.95***	14.08***	13.29***	5.94	6.7
ΔlnGX	3.37	2.77	3.41	3.45	3.6	3.64	4.62	6.09	5.92	3.5	2.84
ΔlnIM			1.64						1.39		0.93
ΔlnEX		13.41***	7.04	8.09*				11.55**	5.78	11.68**	6.59
ΔlnOPEN					8.15*	7.78*	10.90**				
ΔlnFDI	2.47			0.74	2.96		2.11	4.52	4.67	3.23	3
ΔlnFDI*lnH						3.43	2.47	4.89	5	3.77	3.59
ΔlnI*lnH										6.83	7.61*
Granger causality tests: Dependent variable ΔlnH											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC	1.61	3.71	6.42	4.01	6.65	6.14	5.04	1.92	6.28	0.42	1.94
ΔlnI	2.74	7.94*	12.05**	3.14	10.27**	10.09**	1276***	3.08	6.3	2.02	10.94**
ΔlnGX	14.43***	16.82***	13.27***	14.40***	13.43***	14.00***	14.44***	13.80***	12.14**	11.61**	7.93*
ΔlnIM			6.83						13.30***		14.05***
ΔlnEX		2.45	1.19	2.03				1.93	1.8	1.78	2.78
ΔlnOPEN					9.12*	8.60*	12.16**				
ΔlnFDI	0.91			10.42**	0.04		1.98	0.46	2.8	0.58	1.6
ΔlnFDI*lnH	0.87					9.72**	1.84	0.53	3.79	0.4	0.96
ΔlnI*lnH										2	9.83**
Granger causality tests: Dependent variable ΔlnI											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC	4.59	7.89*	8.13*	7.49	4.97	4.96	4.58	7.13	7.80*	4.8	4.6
ΔlnH	6.19	4.31	8.73*	5.8	9.81**	9.81**	9.68**	6.01	9.90**	22.29***	7.85*
ΔlnGX	2.73	1.25	1.32	1.6	1.46	1.49	1.72	3.14	2.42	0.73	3.71
ΔlnIM			13.57***						11.63**		14.92***
ΔlnEX		2	4.1	2.97				2.93	3.19	4.96	5.17
ΔlnOPEN					8.44*	8.78*	10.55**				
ΔlnFDI	5.96			2.34	1.07		5.41	4.9	3.24	2.36	3.34
ΔlnFDI*lnH	6.78					1.69	6.34	5.58	3.35	1.95	4.18
ΔlnI*lnH										20.56***	4.65
Granger causality tests: Dependent variable ΔlnGX											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC	15.20***	6.12	8.23*	7.05	26.81***	26.32***	21.97***	11.00**	8.84*	2.2	5.14
ΔlnH	17.65***	2.76	4.22	4.89	8.44*	6.98	16.02***	11.10**	6.07	2.77	17.87***
ΔlnI	9.25*	3.85	2.59	5.188	2.17	2.17	2.36	12.46***	5.28	3.3	18.53***
ΔlnIM			10.81**						10.38**		17.35***
ΔlnEX		4.27	7.47	9.64				10.75**	6.34	3.48	13.50***
ΔlnOPEN					15.00***	14.64***	9.54**				
ΔlnFDI	24.54***			5.02	5.75		23.84***	18.34***	4.1	5.27	12.20***
ΔlnFDI*lnH	23.38***					3.08	22.69***	18.55***	3.72	5.61	10.76**
ΔlnI*lnH										2.27	16.49***

Granger causality tests: Dependent variable ΔlnIM											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC			3.8						1.53		2.87
ΔlnH			11.84**						7.76*		7.46
ΔlnI			20.18***						21.44***		5.32
ΔlnGX			2.83						5.78		4.99
ΔlnEX			2.28						5.67		1.49
ΔlnOPEN											
ΔlnFDI									2.79		1.44
ΔlnFDI*lnH									3.19		1.14
ΔlnI*lnH											4.51
Granger causality tests: Dependent variable ΔlnEX											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC		3	2.95	4.34				0.86	2.12	10.00**	5.53
ΔlnH		3.57	1.67	7.28				2.63	5.12	18.85***	11.13**
ΔlnI		2.64	4.64	5.44				5.55	8.01*	29.02***	19.04***
ΔlnGX		6.78	4.87	8.45				4.9	3.19	6.25	2.45
ΔlnIM			2.59						9.67**		1.48
ΔlnOPEN											
ΔlnFDI				7.23				3.78	6.62	6.03	3.3
ΔlnFDI*lnH								3.29	6.04	5.06	2.52
ΔlnI*lnH										27.08***	17.21***
Granger causality tests: Dependent variable ΔlnOPEN											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC					3.49	3.65	267				
ΔlnH					9.63**	9.54**	6.7				
ΔlnI					14.10***	14.40***	11.44**				
ΔlnGX					2.55	2.94	2.13				
ΔlnIM											
ΔlnEX											
ΔlnFDI					7.47		0.45				
ΔlnFDI*lnH						7.89*	0.38				
ΔlnI*lnH											
Granger causality tests: Dependent variable ΔlnFDI											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC	0.64			0.63	1.43		1.06	0.09	0.72	0.19	0.91
ΔlnH	2.51			3.32	2.64		3.73	5.72	5.41	7.96*	9.67**
ΔlnI	6.01			9.93**	5.61		6.35	9.96**	10.39**	8.25*	10.83**
ΔlnGX	1.32			7.19	2.72		1.92	6.28	7.88*	8.39*	6.37
ΔlnIM									3.88		3.67
ΔlnEX				13.68***				19.98***	15.06***	24.15***	23.51***
ΔlnOPEN					2.62		3.35				
ΔlnFDI*lnH	3.34						3.69	3.91	4.78	3.5	3.08
lnI*lnH										6.93	8.58*

Granger causality tests: Dependent variable ΔlnFDI*lnH											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC	0.72					1.52	1.17	0.14	0.6	0.25	0.99
ΔlnH	2.02					2.54	3.19	4.92	4.82	6.97	9.11*
ΔlnI	6.18					6.18	6.93	10.30**	10.96**	6.33	9.29**
ΔlnGX	2.2					3.76	2.88	8.09*	9.42**	9.98**	8.02*
ΔlnIM									3.65		4.05
ΔlnEX								19.16***	14.65***	22.78***	22.71***
ΔlnOPEN						2.57	3.52				
ΔlnFDI	4.09						4.44	4.7	5.9	3.95	3.35
ΔlnI*lnH										5.37	7.48
Granger causality tests: Dependent variable ΔlnI*lnH											
VAR lag length = 4											
Model	2	3	4	5	6	7	8	9	10	11	12
ΔlnGDPPC										4.21	4.77
ΔlnH										21.73***	8.76*
ΔlnI										20.13***	2.5
ΔlnGX										0.67	3.11
ΔlnIM											14.05***
ΔlnEX										8.95*	7.95*
ΔlnOPEN											
ΔlnFDI										2.72	4.66
ΔlnFDI*lnH										2.48	5.37

Note: *, ** and * denote significance at the 10%, 5% and 1% levels, respectively.**

6.6 Conclusion

Extending the empirical analysis of Chapter 5 to a multivariate context, this Chapter has conducted Granger causality tests across a variety of specifications within a VAR/VECM framework. The main contribution of the chapter has been identify causal links among factors affecting and affected by economic growth in Thailand, including the formal investigation of the export-led and FDI-led growth hypotheses, using quarterly data over the period 1973:2-2006:4.

The empirical analysis has involved, after testing the integration and cointegration properties of the data, investigation of causality between pairs of variables in a bivariate setting, and this was further extended to a multivariate context to examine causality links among several sub-set of variables. The main issue here has been to ensure that causality inferences drawn for the empirical analysis are robust with respect to changes in the VAR/VECM specifications

Taken together, the results have revealed strong support for the claim that economic growth in Thailand has been driven largely by domestic investment growth, as would be expected, but also that domestic investment has been fuelled by economic growth. Controlling for domestic investment growth as well as other factors, causality tests in a multivariate framework also show support for the export-led growth hypothesis, but not for FDI-led growth in Thailand. Support for this claim is also shown in the bivariate causality tests, although in a multivariate context it has been possible to identify other possible linkages. For example, multivariate tests results have shown that imports have not contributed to growth directly, but its effect is coming indirectly through domestic investment. In this way, trade openness has complemented domestic investment in fuelling economic growth in Thailand.

Chapter 7

Exploring Human Capital Theory in Northern Region Industrial Estate of Thailand

7.1 Introduction

The decisions of management teams impact firm outcomes is central to the literatures of strategic management. Strategic man who can accurately predict and adapt to changes in the external environment can better position their companies for success.

To capture the decision making processes of management teams is to use the demographic characteristics of the team members as a proxy. Two key demographic characteristics, education and experience, underlie the concept of human capital. A key component of human capital is the possession of knowledge that is specific and not early appropriable, and which yields competitive advantage. Numerous studies have established that human capital is a key factor in explaining organizational performance (Bruderl, Preisemdorfe, and Ziegler (1992); Gimeno, Folta, Cooper, and Woo (1997); Pennings et al. (1998).

However, studies to date have focused on the quantitative method of human capital, i.e., the idea that more is better, and have accordingly used measure such as years or level of education or experience (Bruderl et al. (1992); Evans and Leighton (1989). When it comes to understanding knowledge as a key resources of the firms, it is also important to consider the qualitative aspects of human capital. In contexts where firms possess large quantities of human capital, differences in quantity may matter less than differences in quality. By distinguishing between types of education and experiences, we have the opportunity to better understand which aspects of human capital are associated with higher performance. Therefore, in this article, we investigate the relationship between human capital the type of education and industry experience represented by management teams and two dimensions of investment performance.

This chapter makes a number of contributions. First, we use a more fine-grained approach to human capital by investigating the performance effects of the different types of education and experience represented by management team. Second, we acknowledge two dimensions of performance and investigate how types of human capital are differentially associated with these performance dimensions. Finally, we offer a number of important topics for future research.

7.2 Human capital and differences in performance

Having identified the perceptions of risk, return, opportunities, and threats as underlying decisions and thus contributing to performance, we now need to understand what make these perception vary across business. One key factor contributing to risk perception is problem domain familiarity: there is less perceived risk in familiar domains than in unfamiliar ones (Sitkin and Pablo (1992)). Similarly, in perceiving returns it would be guided by their knowledge and understanding of the value that can be added and extracted from the company. In recognizing opportunities and threats, it is guided by their perception of looming gains or losses, by their feeling of having discretion over the situation at hand, and by whether they posses key resources (Jackson and Dutton (1988)). What there brief arguments suggest is that a key ingredient to having accurate perceptions of risk, return, opportunities, and threats is having relevant knowledge.

Furthermore, investments are often in emerging industries, the above perceptions are also influenced by the ability to accumulate new knowledge, which is, in turn, dependent upon the existing stock of knowledge (Cohen and Levinthal (1990)). This stock of knowledge includes both explicit knowledge, formally acquired in educational institutions, and implicit knowledge acquired during one's experience in a particular domain. As these aspects of knowledge underlie the concept of human capital, we will elaborate in more detail on the contribution of human capital.

The link between organizational human capital and performance can be understood in the context of the resource-based view of the firm, which associates superior performance with the possession of resources that are valuable, rare, inimitable, and nonsubstitutable (Barney (1991)). Knowledge is a resource that readily meets these conditions, is heterogeneously distributed across firms, and is thus central to understanding differences in performance (Spender (1996)). Not all knowledge, however, renders a firm unique, it is tts tacit component, embedded in the firm's social context, that makes the yielded advantages long lasting (Spender (1996)).

Although all knowledge has an explicit component, personal knowledge is often tacit in nature, reflecting a person's unique social environment and past experience (Polanyi (1967)). While explicit knowledge can be articulated, codified, and more easily transmitted across people and organizations, tacit knowledge tends to stick to particular individuals or firms in ways that make their actions and decisions difficult to replicate. Human capital represents the knowledge and skills that individuals bring to an organization. As it is developed through both education and personal experience, it contributions to both the explicit and tacit knowledge of the firm.

The contribution to tacit knowledge is particularly strong in the big company context that consist of a small number of employee with great deal making and value-adding skills. These people have typically entered the big company after extensive experience in other industries (Bygrave and Timmons (1992)). The nature of their tacit knowledge may be distinguished less by the amount of human capital they have than by the domain components of their human capital. Although the basic tenet of human capital theory is that the greater the human capital, the better the performance at a particular task, the nature of this proposition changes at the firm level and in the context of firms with significant amounts of human capital. Specifically, as it is the collective organizational tacit knowledge that makes the organizational distinct, we need to examine the extent to which individual tacit knowledge is developed into a collective one. Key to this process of collectivization of knowledge is the sustained interaction among the individuals in the firm, in the context of a particular organizational activity. Thus, because individual company enter the firm with knowledge and experience from multiple domains, the extent to which their knowledge and experience in particular domains would contribute the firm's tacit knowledge will be dependent on the extent to which other members of the firm also have experience in that domain. It is the shared knowledge and experience of several companies that make for a distinct firm-level tacit knowledge in regard to their pre and post investment activities. Therefore, to understand the nature of tacit knowledge, it is essential that we examine the domain components of their human capital rather than just their total human capital.

In assessing the contributions of the various domain components of human capital to the performance of the company, it is useful to distinguish between general and specific human capital with regard to the domains of pre and post investment activities identified above. General human capital refers to overall education and practical experience, while specific human capital refers to education and experience with a scope of application limited to a particular activity or context. We distinguish between general and specific human capital on the basis of whether education and experience in a particular domain provide skills that are directly used in carrying out the activities of investment selection and management. While all education may make some contribution to general human capital, some of it contributions more to specific human capital. Education and experience specific to the pre and post investment activities of company include business, law, and consulting. Business education and experience provide expertise in screening potential of the companies, in conducting the more detailed assessment required as part of due diligence, and in advising the company's management team on operational and strategic issue.

Education that is not directly related to the tasks of the company can be considered more general in its contribution to human capital. For example, education in humanities is designed to be broad in its application. In addition, education in science, although more specialized, is not directly related to the pre and post investment activities of a company. Therefore, we may regard these types of education as contributing to general human capital. Experience running an entrepreneurial firm provided considerable expertise, but not necessarily directly related to the more formal and bureaucratic activities required of a company. For this reason, entrepreneurial experience likely contributes more to general, rather than specific, human capital. Based on the performance proposition outlined above, we offer the following:

Hypothesis 1: Company with greater proportions of their management teams with specific human capital in terms of education and as well as industry experience will have higher significant in the result.

Hypothesis 2: Company with greater proportions of their management teams with specific human capital in terms of education and as well as industry experience will have lower significant in the result.

Hypothesis 3: Company with greater proportions of their management teams with specific human capital in terms of education in humanities and science as well as staff experience, will have higher proportions of company.

Hypothesis 4: Company with greater proportions of their management teams with specific human capital in terms of education in humanities and science as well as staff experience, will have lower proportions of company.

As these hypotheses refer to only positive effects of human capital on performance, they may appear inconsistent with argument about an inversed-U-shaped relationship between human capital and performance, particularly firm survival. This relationship is usually explained by the effect of ageing. While this effect may be relevant in the context of conceptualizing human capital as the member of years of experience, it holds no concrete implications for the more detailed, qualitative nature of human capital that we explore.

7.3 Exploring an alternative perspective

Although much of the research on human capital theory has operationalzed general human capital in terms of year of schooling, the empirical support for a positive relationship between education and performance at a particular task is mixed. For example, while there is a positive relationship between education and productivity and between education and firm survival, there is no clear effect of education on other indicators of performance, namely, career progress and job attainment. Similarly, in the entrepreneurship literature, the findings for a positive association between education and business start-ups and between education and the discovery and exploitation of opportunities have been mixed. A possible explanation for this is that broad brush measures have insufficient sensitivity for the different impact that general and specific human capital can have on performance, especially when considering different dimensions of performance.

Although the above argument appear reasonable, there is little human capital theory upon which to hypothesize the nature of this finer grained distinction between types of education and experiences and dimensions of performance. The following, therefore, are exploratory propositions and offer and alternative perspective to that offered by human capital theory as represented in Hypotheses 1 through 4 above.

7.4 Research design and sample

Two factors were instrumental in designing the study. We needed a sample of company that had made a sufficient number of investments in multinational companies, had sufficient time for those investments to have reached an outcome, and had invested in similar industries, to alleviate possible confounding effects. Therefore, from the data, we drew a list of companies – 274 firms in total. It must be noted that given the focus of this research and the sample selected, our results may not be highly generalizable to those companies in Northern Region Industrial Estate of Thailand.

7.4.1 Measures

7.4.1.1 Dependent variables

We investigated one dependent variable: income, perationalized as the proportion of companies. We obtained information on the status of each company as of 2009 from the research data. We gathered the data on the human capital of management from field work.

7.4.1.2 Education

We used this information to measure our education-related human capital variables. We calculated a score for each of these degrees to represent the proportion of management team members that had attained this type of education. Thus, these measures based on determining one dominant specialization for each management team member or for the top management team as a whole, this measure captures the prevalence of particular educational specializations as it allows for more than one degree to be recorded per individual.

7.4.1.3 Industry experience

We used this information to measure our industry-related human capital variables. We coded each staff for whether he or she had worked in the industries. Industry experience included commercial, investment and technical as well as investment management in the industry.

7.5 Analyses and results

The correlations and descriptive statistic for the variables are presented in Table 7.1. Our collinearity diagnostics showed that all variance inflation factor values were below 3.0, suggesting that multicollinearity was not an issue. We used hierarchical regression analysis to test Hypotheses.

Hierarchical regression analysis and results

We conducted several diagnostic tests to ensure the data did not violate the assumptions of normality, linearity, and homoscedasticity necessary for OLS regression estimation. To especially guard against possible curvilinear relationships, we plotted each independent – dependent variable relationship and conducted one-way ANOVA to test for this relationship.

The results of the hierarchical regression analysis are reported in Table 7.2 and 7.3. This based model was statistically significant (R2=0.131, P<0.01). The addition of the predictor variables made a significant coefficients for education and experience. These results support Hypothesis 1 and 3, respectively. Conversely, with higher prevalence of consulting industry experience have lower proportions of success companies. The effects of the remaining types of education and industry experience were significant and therefore, Hypotheses 2 and 4 were not supported.

Table 7.1. Descriptive statistics and correlations

		SEX	STATUS	EDYEAR	YEAR	AGE	INCOME
SEX	Pearson Correlation	1	-.052	-.174(**)	-.008	-.097	-.070
	Sig. (2-tailed)	.	.394	.004	.891	.110	.246
	N	274	274	274	274	274	274
STATUS	Pearson Correlation	-.052	1	-.086	.321(**)	.401(**)	.125(*)
	Sig. (2-tailed)	.394	.	.154	.000	.000	.038
	N	274	274	274	274	274	274
EDYEAR	Pearson Correlation	-.174(**)	-.086	1	-.159(**)	-.230(**)	.107
	Sig. (2-tailed)	.004	.154	.	.008	.000	.076
	N	274	274	274	274	274	274
YEAR	Pearson Correlation	-.008	.321(**)	-.159(**)	1	.599(**)	.312(**)
	Sig. (2-tailed)	.891	.000	.008	.	.000	.000
	N	274	274	274	274	274	274
AGE	Pearson Correlation	-.097	.401(**)	-.230(**)	.599(**)	1	.233(**)
	Sig. (2-tailed)	.110	.000	.000	.000	.	.000
	N	274	274	274	274	274	274
INCOME	Pearson Correlation	-.070	.125(*)	.107	.312(**)	.233(**)	1
	Sig. (2-tailed)	.246	.038	.076	.000	.000	.
	N	274	274	274	274	274	274

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 1.2. Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3347.357	1315.718		2.544	.012		
	SEX	-122.688	253.720	-.028	-.484	.629	.947	1.057
	AGE	43.125	32.591	.100	1.323	.187	.565	1.769
	STATUS	35.985	235.455	.010	.153	.879	.829	1.207
	EDYEAR	155.920	54.729	.170	2.849	.005	.908	1.101
	YEAR	132.770	34.493	.276	3.849	.000	.631	1.586

a Dependent Variable: INCOME

There were also significant coefficients for industry experience and education. The positive coefficient for industry experience indicates that it has higher proportions of success companies, a result in the opposite direction to that proposed by Hypothesis 2. The negative coefficient for gender with greater of such experience have lower proportions of companies, a result supporting Hypothesis 4. The effect for industry experience was not significant and therefore, Hypothesis 4 is not supported.

Table 7.2 Model 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.362(a)	.131	.115	1896.25438

a Predictors: (Constant), YEAR, SEX, ED, STATUS, AGE

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	145163046.819	5	29032609.364	8.074	.000(a)
	Residual	963669225.614	268	3595780.693		
	Total	1108832272.433	273			

a Predictors: (Constant), YEAR, SEX, ED, STATUS, AGE

b Dependent Variable: INCOME

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3998.846	1167.751		3.424	.001
	SEX	-97.813	255.657	-.023	-.383	.702
	AGE	41.980	32.521	.098	1.291	.198
	STATUS	37.700	235.466	.010	.160	.873
	ED	262.757	92.407	.171	2.843	.005
	YEAR	132.990	34.496	.276	3.855	.000

a Dependent Variable: INCOME

Table 7.3 Model 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.362(a)	.131	.115	1896.14697

a Predictors: (Constant), YEAR, SEX, EDYEAR, STATUS, AGE

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	145272221.455	5	29054444.291	8.081	.000(a)
	Residual	963560050.978	268	3595373.325		
	Total	1108832272.433	273			

a Predictors: (Constant), YEAR, SEX, EDYEAR, STATUS, AGE

b Dependent Variable: INCOME

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3347.357	1315.718		2.544	.012
	SEX	-122.688	253.720	-.028	-.484	.629
	AGE	43.125	32.591	.100	1.323	.187
	STATUS	35.985	235.455	.010	.153	.879
	EDYEAR	155.920	54.729	.170	2.849	.005
	YEAR	132.770	34.493	.276	3.849	.000

a Dependent Variable: INCOME

7.6 Discussion

In a broad sense, our finding suggest that human capital provides a significant explanation of variations in the examined dimensions of performance, over the effects accounted for by firm characteristics. We have shown that for particular knowledge areas, the higher the overlap among the partners, the higher the performance of the companies. This provides support to the management matters and to the presented conceptual argument that firm knowledge developed in particular areas yields competitive advantage. However, since not all knowledge areas had significant or positive effects, we need to subject the relationships between the particular knowledge areas examined and the two dimensions of performance to a closer analytical scrutiny.

7.6.1 Specific human capital

As expected, we found that those companies with greater proportions of staff management teams with higher education and experience had lower proportions of bankruptcies in their industry. This is consistent with findings suggesting a positive link between specific human capital and venture survival. This is also consistent with the findings of industry-specific human capital is negatively related to firm dissolution. Although it regard industry-specific experience as general human capital, this different classification is largely due to their studying a single, more homogeneous industry.

Interestingly, we found that those companies with greater proportions of their management teams with high experience has higher proportions of success in their industries. This result was surprising at first because it appeared inconsistent with human capital theory, but upon further reflection, it might offer an interesting insight into the post-deal management of companies. For companies that are not performing well and have the prospect of further deteriorating performance, declaring bad investment for the company is possible the only way for companies to get something back from such company.

7.6.2 General human capital

As expected, we found that those companies with greater proportions of their management team with higher education it had higher proportions of success in their industry. This is broadly consistent with the findings of a positive relationship between education as a proxy for general human capital and various aspects of performance, namely, firm growth and opportunity discovery. In regard to why the particular educational specializations of technical science has a positive association with success companies, the current finding are also consistent with the nation of general human capital facilitating access to a wider opportunity set. Perhaps, the firm knowledge built around the shared education in these areas enables to companies to successfully respond to and integrate new technological advances, and to successfully anticipate the market acceptance of the commercial products based on such technological advances.

7.6.3 Potential limitations and future research

This study, as all studies, has a number of limitations and possibilities for future research. First, we captured aspects of companies human capital by measuring the education and experience of its management term to explain firm level outcomes. Although the top management team makes important strategic decisions for a firm, capturing the human capital of all individual within the organisation, might explain greater variance in company performance. However, such an approach does introduce a number of new challenges. It is probably difficult for researchers to access biographical information on all employees that work in companies. Furthermore, how should the human capital of all these individuals be combines to provide an organizational level variable. A simple proportion of education and experience as used in this study does not take into sufficiency consideration the different roles and responsibilities of these individuals. For example, a company might has more administrative staff, such as receptionists and data entry personnel, who add to the general efficiency of the firm but who have little to do with the pre and post investment activities of the venture capital process. In this case, a proportion measure across the whole firm would appear to understate the human capital of the firm to maximize success companies.

Second, the present study did not control for the quality or size of companies deal flow. The attributes of the deal flow could influence the proportions of success companies. While this is a limitation of the study, it reflects the need for a more focused approach. To increase the size and quality of a company's deal flow is a pre investment activity and based on the human capital literature discussed above, we would expect that those with more human capital would be able to generate a better deal flow, which is then reflected in superior performance. This limitation does highlight the need for future research to offer fine-grained analysis of the pre and post investment activities and more closely match types of human capital to these task but be of little benefit to the performance of a different , post investment task.

Finally, the present study did not control for the companies possible syndication of the deals in which they have invested. A significant proportion of venture capital deals are syndicated, and the connectedness of companies within certain regions or industry sectors ranges between 22% and 69%. Accounting for the co-investment partners of a company could either enhance or weaken the human capital effects reported in this paper because the base for human capital influence may expand or shift. This limitation also points to an important area for future research, namely, consideration of the human capital of syndicate partners when trying to gain a deeper understanding of company outcomes.

7.7 Conclusion

The general implication of human capital theory is that more is better. Empirical support for this claim has been predominantly based on using yeas of education or experience as proxy for human capital. From a methodological point of view, the empirical studies in this stream essentially compare contexts where human capital abounds to contexts where it is lacking. There is thus less theoretical and empirical precision in contexts where there are no apparent or sizeable differences in the amount of human capital. The current study explores the qualitative nature of human capital by examining the specific domains of which it compared. We show that particular aspects of human capital contribute to some but not all dimension of performance. Understanding the qualitative nature of human capital, as well as its links to the various facts of performance, makes an important extension of the theory.

In addition, the results of this study have some important implications for practitioners. Companies may build their investment terms with a human capital consideration in mind. Understanding the human capital factors contributing to achieving more that can help build teams that increase firms performance. But they must acknowledge the aspects of human capital differ in their impact on each performance dimension. Similarly, entrepreneurs seeking venture capital fiancé may increase their awareness of the value that a company could bring to their start-up company. By preexamining the backgrounds of the management team, entrepreneurs can target those companies that could make the greatest contribution to their success.

Chapter 8

Conclusion and Policy Implications

8.1. Introduction

It is well understood that economic growth results either from accumulation of factors of production or from improvements in technology or both. Traditional growth theory sought the explanation of economic growth under sufficiency economy in terms of accumulation of resources. Factor accumulation was seen as the major determinant of economic growth and the standard neoclassical conclusion is that, unless the return to labour and capital accumulation could stay bounded away from zero, growth would peter out in the long run. At a fundamental level, one can draw a distinction between international trade in technology and other indirect channels of international technology transfer, such as trade openness in goods and international movement of factors of production. This research explores the role of trade openness and FDI as channels of technology transfer, although empirically assesses their relative contribution to economic growth in Thailand. As channels of technology transfer, the impact of trade and FDI depends on the geographical scope of knowledge spillovers, national versus international, although for developing countries spillovers are more likely to be national in scope (Sagii 1999, 2000). However, regardless of the channel through which knowledge spillovers occur, several studies (both theoretical and empirical) indicate that absorptive capacity in the host country is crucial for obtaining significant benefits from trade and FDI (Borensztein et al., 1998, Keller, 1996). Thus, it may be argued lead liberalisation of trade openness and FDI policies may need to be complemented by appropriate policy changes with respect to education, R&D, and human capital accumulation, if developing countries are to take full advantage of increased trade openness and FDI.

On the other hand, as Xu (1999) notes, FDI may contribute to productivity growth due to reasons other than FDI. Thus, a statistically significant coefficient on some measure of FDI in a productivity growth equation does not necessarily imply that technology transfer is the mechanism through which FDI contributes to productivity growth. One would expect the same applies to trade, in that a statistically significant effect of trade openness on growth may be the result of a deliberate policy of export promotion affecting the allocation of resources rather than signifying a channel of technology transfer.

There is no doubt that MNEs play a positive role in the development process, and many developing countries have designed policies to attract foreign investment from industrialised countries. But curiously, as noted by de Mello (1997) in his survey about FDI and growth in developing countries, “whether FDI can be deemed to be a catalyst for output growth, capital accumulation and technological progress is a less controversial hypothesis in theory than in practice...”. The available empirical literature on the impact of FDI on growth provides contrasting results not only about the existence of a significant link between FDI and growth (of the recipient economy), but also about the sign of such relationship. For example, Blömstrom et al. (1992) finds a significant positive impact of FDI inflows on growth, while Hein (1992) finds no evidence in support. Balasubramanyan et al. (1996) find that, in countries with export promoting trade regimes, FDI has a stronger effect on growth, a finding that accords with the view that FDI results in technology transfer (as in Borensztein et al., 1998, and de Mello, 1999).

However, there may be other factors that can discriminate between positive and negative effects of FDI on growth. As Balasubramanyan et al. (1996) note, the impact of FDI on growth is significantly positive in economies which pursue an export promotion (EP) strategy and not significant in countries which are characterised by an import substitution (IS) policy. This idea that trade policy choices may determine the impact of

FDI dates back to the work of Bhagwati (1973), and the empirical results of Balasubramanyan et al. (1996) are indeed coherent with that suggested by Bhagwati's analysis. Economies that may be qualified as relatively open attract a larger amount of foreign capital than closed economies. But this is not inconsistent with the view that higher growth may be a factor influencing FDI, since empirical evidence by the World Bank (1993) and others (e.g. Riezman et al., 1996) have shown countries that have pursued outward orientated trade policies have growth faster than countries that have adopted restricted trade regimes.

In the case of Thailand, which has pursued a deliberate policy of the export promotion (EP) since 1972 and FDI promotion since 1997, it is perhaps not surprising to note that the evidence for export-led growth is strong while that for FDI-led growth is weak, as the upsurge in FDI flows is rather recent. However, without further investigation of the evidence about knowledge spillovers it is premature to draw any inference about whether Thai growth has been influenced by technology transfer or productivity through efficient allocation of resources. Nevertheless, in the light of the discussion above it is appropriate to draw some very broad policy implications on Thailand.

8.2. Policy Implications

8.2.1. Productivity and Human Capital Development

The key factors contributing to Thailand's robust economic growth in the past have been abundant natural resources and cheap but high quality labour. The country, however, is rapidly losing its comparative advantage in this regard, as steady population growth has put pressure on available land and other natural resources, and as wages have risen without commensurate increases in labour productivity. Moreover, the countries with which Thailand competes (e.g. India, Malaysia, China) have moved steadily into areas and modes of production that are more and more technology-intensive. Recent growth performances of above 4% (in 1999 and 2000) have been encouraging, although this rate is still less than half that enjoyed in the decade before the 1997 crisis, and is below that achieved by India and China. In order to ensure sustainable growth in the future, Thailand will need to advance its development and adaptation of new technologies, and to implement other policies directed at increasing the productivity of its labour force. Special efforts need to be made to raise productivity in agriculture, as this sector still employs about half of all workers and has the potential to contribute more to Thailand’s economy. This is not to undermine the importance of FDI in industrial and services sectors, though, as investment is required to prepare workers with the appropriate skills needed to compete in the knowledge-based global economy. The key to success in these areas will be the outputs of the education and training system. With education reforms now underway, it is anticipated that production in Thailand should move up the value-added ladder and compete more successfully in the global economy.

8.2.2. FDI and Sustainable Economic Development

FDI is taking a greater role in building the Thai economy but further assessment of the factors which influence and are influenced by FDI flows is necessary given weak evidence in support of either FDI led growth or growth led FDI. Further, evidence whether FDI generating knowledge spillovers into domestic industries can only be ascertained through plant level studies of the kind that has been undertaken for other countries (see Sagii, 2000, for a critical survey). Foreign companies are thought to be attracted to recipient countries for a whole range of factors, e.g. political, market potential and accessibility, repatriation of profits, ease of currency conversion, although it is now accepted that privatisation and deregulation of markets are seen as central means to attract FDI. While Thailand is more successful recently in attracting FDI, it needs to ensure that it can adapt to rapid and large inflows of FDI, and that these flows positively benefit Thailand’s growth. This means adopting appropriate complementary pro-trade policy that encourage greater and longer-term domestic investment, as well as higher returns on investment capital.

Thai policy makers recognise that the challenge facing the global economy of today is to build knowledge, not just buildings and machines. Most incentives and in particular investment incentives, that are in place continue to primarily support capital investments of one kind or another. While there has been much discussion of the knowledge economy and the value of information, innovative FDI policies to support the domestic acquisition, utilisation and development of such assets remain to be developed and implemented. A common perception in Thailand is that large or foreign firms are capable of helping themselves and do not require assistance from the government. The weight of international evidence indicates that the use of public sector incentives to encourage good firms to do good things better and with more technology that can be good investments if the true externalities are correctly evaluated and the programmes are implemented fairly and efficiently. The critical lesson for Thai policy makers is to create an environment that stimulates the private sector to devote greater resources to technological development activities. One element of the enabling environment that could be strengthened to facilitate FDI participation in Thailand is a more positive awareness of the potential contributions of foreign investors. This could involve better dissemination of information on the benefit of foreign involvement and the fact that most foreign investors make a long-term commitment to Thailand and are willing to go much further in supporting social and community development efforts.

Appendix

Appendix A.3.1 Thailand overview

THAILAND - NATIONAL STATISTICAL DATA

	Latest Value	Scale	Units
Thailand Balance of Trade	1309.00	Million	USD
Thailand Business Confidence	67.90		
Thailand Consumer Confidence	72.60		
Thailand Current Account	1750.00	Million	USD
USDTHB Exchange Rate	30.63		
Thailand Exports	17220.00	Million	USD
Thailand Gross Domestic Product (GDP)	263.86	Billion	USD
Thailand GDP Annual Growth Rate	3.80	%	
Thailand GDP Growth Rate	1.20	%	
Thailand GDP per capita (Constant Prices Since 2000)	2640.00		USD
Thailand GDP per capita (Purchasing Power Parity PPP)	8086.00		USD
Thailand Government Bond 10 Year Yield	3.89		
Thailand Government Budget	-4.10	%	
Thailand Imports	15910.00	Million	USD
Thailand Industrial Production	-2.50	%	
Thailand Inflation Rate	3.03	%	
Thailand Interest Rate	2.25	%	THB
Thailand Stock Market Index	985.91		THB
Thailand Unemployment Rate	1.01	%	

THAILAND - IMF DATA & FORECASTS

	2010	2015	Scale	Units
Thailand GDP at constant prices	4497.40	5815.49	Billions	Thai Baht
Thailand percent change in GDP at constant prices	5.52	5.00		Percent change
Thailand GDP at current prices	9799.36	13967.77	Billions	Thai Baht
Thailand GDP at current prices in US dollars	297.85	427.80	Billions	U.S. dollars
Thailand GDP deflator	217.89	240.18		Index
Thailand GDP per Capita at constant prices	66477.45	81788.47	Units	Thai Baht
Thailand GDP per Capita at current prices	144847.38	196441.41	Units	Thai Baht

Thailand GDP per Capita at current prices in US dollars	4402.63	6016.57	Units	U.S. dollars
Thailand GDP based on Purchasing Power Parity (PPP) valuation of country GDP	573.61	810.48	Billions	Current international dollar
Thailand GDP based on Purchasing Power Parity (PPP) per capita GDP	8478.66	11398.55	Units	Current international dollar
Thailand GDP based on Purchasing Power Parity (PPP) share of world total	0.77	0.81		Percent
Thailand Implied Purchasing Power Parity (PPP) conversion rate	17.08	17.23		National currency per current international dollar
Thailand Consumer Prices Index average	129.28	139.66		Index; 2000=100
Thailand Inflation average	3.25	1.38		Percent change
Thailand Consumer Prices Index end-of-period	129.43	139.61		Index; 2000=100
Thailand Inflation end-of-period	2.74	1.45		Percent change
Thailand Population	67.65	71.10	Millions	Persons
Thailand Current account balance in US dollars	7.44	0.73	Billions	U.S. dollars
Thailand Current account balance in percent of GDP	2.50	0.17		Percent of GDP

Source: IMF

Table A.3.2. Capital Stock (1995 prices) Growth Structure 1972-2006

Capital Stock Growth (%)	**1972-1985**	**1986-1996**	**1997-2006**
Agriculture	1.2	5.6	-2.3
Industry	6.4	11.7	7.7
Manufacturing	6.7	14.0	11.6
Services	5.6	9.9	0.2
Total	5.3	10.3	3.6
Capital Stock Share (%)			
Agriculture	14.1	8.2	5.8
Industry	37.6	41.9	49.6
Manufacturing	11	14.6	19.7
Services	48.3	50.0	44.6
Total	100	100	100
Contribution to Growth (%)			
Agriculture	0.2	0.4	-0.1
Industry	2.4	4.9	3.8
Manufacturing	0.7	2.1	2.2
Services	2.7	4.9	0.1
Total	5.3	10.3	3.6

Source: National Development and Social Board, Thailand.

Note: Capital Stock are measured as weighted average of gross capital stocks (75%) and net capital stocks (25%).

Table A.3.3 Sources of Growth by Sectors, 1981-1995 (percentages)

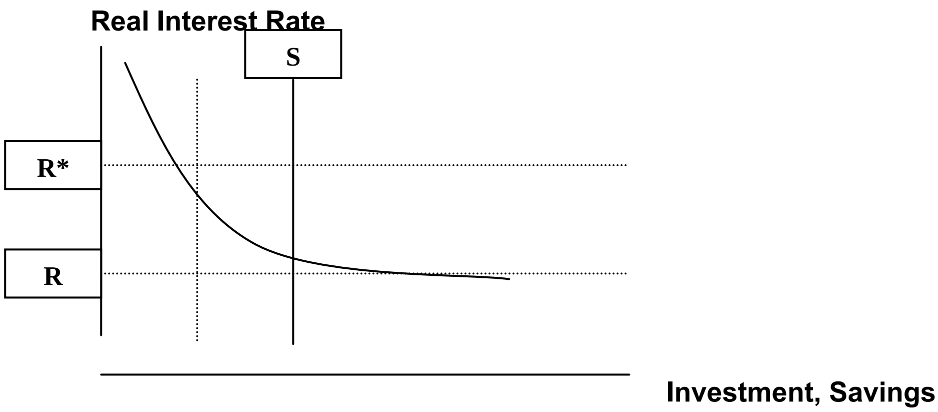
			Labour	**Labour**	**TFP**	**TFP**
	Land	**Capital**	**Unadjusted**	**Quality adjusted**	**Unadjusted**	**Quality adjusted**
1981-1985	2.9	62.2	20.7	25.1	14.1	9.7
Agriculture	4.0	11.7	21.6	41.8	62.7	42.5
Industry		86.2	28.0	42.7	-14.2	-28.9
Manufacturing		68.3	31.9	57.1	-0.2	-25.5
Services		74.9	34.0	52.3	-8.8	-27.2
1986-1995	-0.3	61.6	9.3	21.4	29.4	17.3
Agriculture	-0.9	90.6	-7.1	-4.2	17.4	14.5
Industry		64.1	27.3	36.5	8.6	-0.5
Manufacturing		59.4	28.1	37.1	12.5	3.5
Services		65.7	24.6	33.0	9.7	1.3
Of which: 1986-1990	-0.2	47.6	13.1	21.3	39.6	31.3
Agriculture	-0.9	59.3	23.3	35.6	18.3	6.0
Industry		49.0	24.3	26.6	26.7	24.4
Manufacturing		47.6	27.0	26.0	25.4	26.4
Services		52.1	18.9	32.6	29.0	15.3
Of which: 1991-1995	-0.5	78.6	4.8	21.5	17.1	0.4
Agriculture	-0.8	117.3	-33.2	-38.3	16.7	21.8
Industry		84.5	31.5	49.9	-15.9	-34.4
Manufacturing		75.6	29.7	52.4	-5.3	-28.0
Services		823.3	31.7	33.5	-14.0	-15.8

Source: Tinakorn and Sussangkarn (1998)

A.3.4 Currency Crisis in Thailand

Preceding the financial crisis, Thailand's economic growth rate soared. During its period of development, Thailand experienced strong economic growth that averaged almost 10% per year from 1987-1995 (Fischer (1998)). Similar to other South East Asian countries, Thailand has a low wage labour force; thus it successfully attracted significant foreign direct investment (FDI) to build production plants for export to developed economies (Ciminero (1997)). Thailand ran a trade surplus, which attracted large capital inflows (see figure A.3.4.1).

Figure A.3.4.1 The Effects of the World Interest Rate



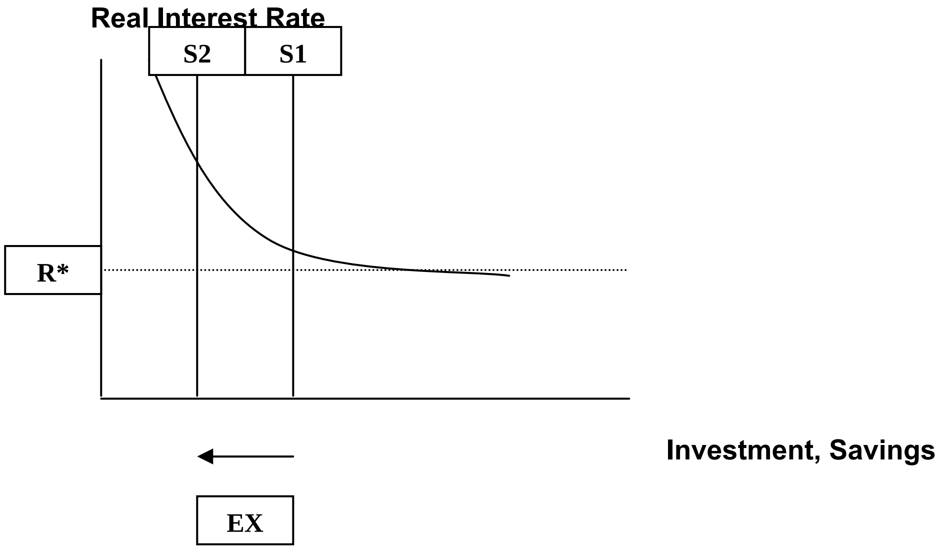
Note: R denote Thailand's interest rate, R* denote the world interest rate

Additional, the Thai currency (the baht) was pegged to the US dollar, meaning that if the US dollar appreciated in value so did the baht, and if the dollar depreciated, the baht also depreciated. This brought in more capital inflow "as so long as the baht was pegged to the US (dollar), Thailand was viewed as even more attractive for FDI and foreign portfolio investment in its securities market" (Ciminero (1997)).

Thailand enjoyed its rapid annual real GDP growth. It became overconfident of its economic state because of its quick growth and the US dollar baht peg. The Thai government embarked on excessive official spending and encouraged the country's banks to lend generous amounts of money for private real estate and other spending (Ciminero

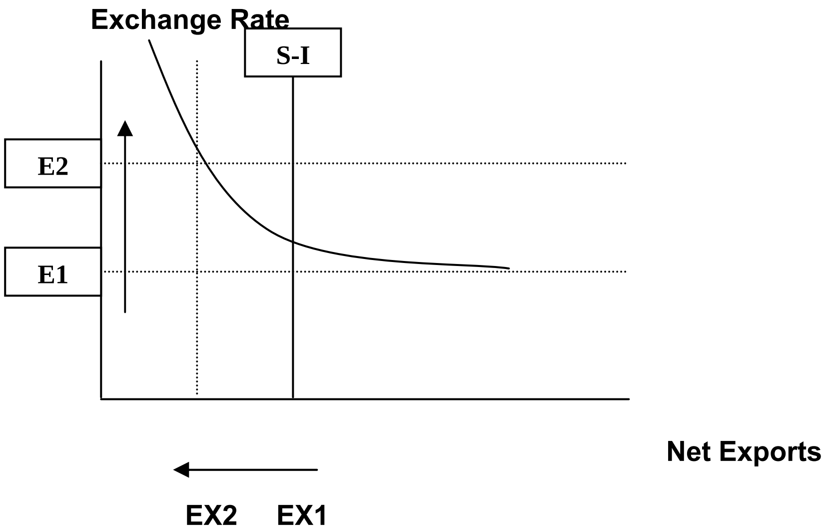
(1997)). Inclusively, liberalisation of the financial sector encouraged domestic companies to borrow extensively from foreign countries. Companies in Thailand borrowed large sums of money as the economy boomed (see figure A.3.4.2).

<u>Figure A.3.4.2 The Effects of Decreased National Saving</u>



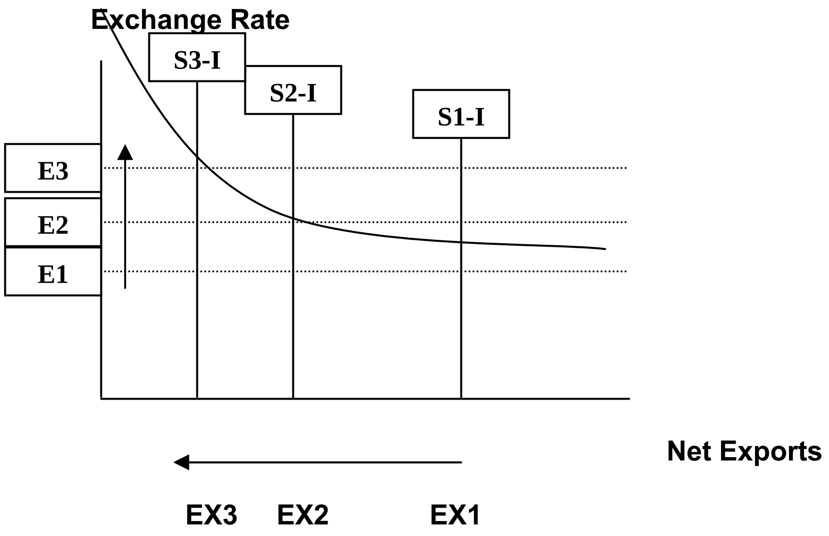
Most of the loans were made in US dollars because interest rates were much lower than the Thai currency. By borrowing money from a country where the interest rate is lower, Thailand assumed it would profit from the low interest rate. Since the exchange rate was pegged against the US dollar, companies were not concerned with having to earn domestic currency to repay the loans in dollars. Unfortunately, the weakness of the US dollar at the time masked the weaknesses in the Thai economy. As the US dollar appreciated, Thailand became less competitive in the world's market and its net export declined (see figure A.3.4.3).

__Figure A.3.4.3 The Formation of the Trade Deficit__



Thailand's total exports declined by 0.2% (compared to increases exceeding 20% per year in prior years) when it lost competitiveness in labour intensive products (Sussangkarn (1998)). The slowdown in export growth caused Thailand to abandon the dollar peg and devalue its currency in order to promote exports. Losses in revenue gave rise to a crisis as debts became heavier and heavier. The large amount of capital inflows Thailand received led to rapid growth in outstanding external debt. "The total outstanding external debt rose from 28.8 billion US (dollars) (33.8% of GDP) in 1990 to 94.3 billion US (dollars) (50.9% of GDP) at the end of 1996" (Sussangkarn (1998) (see figure A.3.4.4).

Figure A.3.4.4 The Effect of Reduced National Savings on the Trade Deficit



Appendix 4

A.4.1 Capital Stock Calculation

The capital stock (K) was estimated using investment data at constant price starting in 1959. The series was estimated using the perpetual inventory method,

$$K_t = (1-h)K_{t-1} + I_t \qquad \text{(A.4.1)}$$

where K_t is the capital stock at the end of each period; I_t is investment in each period; and h is the depreciation rate.

An initial value of the capital stock is required for the estimation of equation (A.4.1). Following Martin and Warr (1990), the logarithm of investment was first regressed against at time trend to obtain its average growth rate and a trend value of investment at the beginning of the sample, I_0. Making the conventional assumption that the capital stock was in a steady state at time t_0, K_0 can then be estimated as,

$$K_0 = \frac{I_0}{(g+h)} \qquad \text{(A. 4.2)}$$

where K_0 is the initial capital stock; g is the estimated growth rate of investment; and h is the depreciation rate.

Appendix 5

A. 5.1 THAILAND: OLS Regressions: Dependent variable is lnGDPPC, 1973:2-2006:4.															
Regressor	**5.4.1**	**5.4.2**	**5.4.3**	**5.4.4**	**5.4.5**	**5.4.6**	**5.4.7**	**5.4.8**	**5.4.9**	**5.4.10**	**5.4.11**	**5.4.12**	**5.4.13**	**5.4.14**	**5.4.15**
Coefficient															
(t-statistic)															
Constant	8.02	9.96	8.30	9.01	8.02	8.39	4.10	4.08	5.77	9.88	9.96	11.68	11.83	11.13	9.23
	(18.66)	(31.51)	(26.68)	(28.64)	(21.37)	(20.35)	(12.49)	(10.26)	(10.05)	(29.25)	(30.41)	(42.03)	(48.48)	(39.67)	(10.86)
***ln*H**	1.07	-1.96	0.82	1.01	0.92	0.77	0.56	0.65	-0.38	-1.85	-1.39	-2.95	-2.43	-2.45	-0.71
	(5.35)	(-7.12)	(5.14)	(6.74)	(5.22)	(3.33)	(5.09)	(4.66)	(-1.31)	(-5.82)	(-4.02)	(-12.52)	(-10.81)	(-10.10)	(-2.63)
***ln*I/GDP**	0.22	0.24	0.15	-0.09	0.14	0.16	-0.13	-0.14	-0.04	0.23	0.09	-0.34	-0.52	0.23	-0.03
	(5.11)	(8.46)	(3.95)	(-1.51)	(3.45)	(3.83)	(-4.23)	(-4.10)	(-0.97)	(7.28)	(1.65)	(-6.22)	(-9.13)	(10.13)	(-0.95)
***ln*IM/GDP**				0.51							0.26		0.31		
				(5.02)							(2.96)		(5.76)		
***ln*EX/GDP**			0.22	-0.09	0.24	0.21				0.02	-0.10	0.09	-0.06	-0.38	
			(5.79)	(-1.33)	(5.83)	(4.70)				(0.64)	(-1.78)	(3.51)	(-1.63)	(-7.55)	
***ln*OPEN/GDP**							0.38	0.38	0.28						0.05
							(10.55)	(15.36)	(8.09)						(0.92)
***ln*GX/GDP**	-0.02	-0.09	-0.16	-0.16	-0.18	-0.16	-0.18	-0.18	-0.17	-0.11	-0.12	-0.03	-0.04	-0.08	-0.15
	(-0.44)	(-3.31)	(-3.64)	(-3.84)	(-3.87)	(-3.29)	(-7.27)	(-7.08)	(-6.93)	(-3.03)	(-3.38)	(-1.19)	(-1.74)	(-3.20)	(-6.82)
***ln*FDI/GDP**	0.02	-0.52			-0.02		-0.03		-0.21	-0.50	-0.44	-0.02	0.07	0.00	0.01
	(1.05)	(-11.65)			(-1.30)		(-2.99)		(-3.95	(-9.68)	(-8.22)	(-0.37)	(1.31)	(0.04)	(0.11)
ln*FDI*ln*H/GDP**		0.34				0.00		-0.01	0.12	0.32	0.28	-0.01	-0.07	-0.03	-0.04
		(2.42)				(0.35)		(-2.35)	(3.47)	(9.53)	(7.88)	(-0.16)	(-1.97)	(-0.61)	(-0.82)
ln*I*ln*H/GDP**												0.33	0.34		
												(11.24)	(13.27)		
ln*EX*ln*H/GDP**														0.31	
														(9.49)	
ln*OPEN*ln*H/GDP**															0.21
															(5.12)
Adjust R^2	0.95	0.98	0.96	0.97	0.96	0.96	0.98	0.98	0.99	0.98	0.98	0.99	0.99	0.99	0.99
S.E.	0.1	0.07	0.09	0.08	0.09	0.09	0.05	0.06	0.05	0.07	0.06	0.04	0.04	0.05	0.05
Ed. Threshold(FDI)		4.81							5.75	4.76	4.8				1.28
Ed. Threshold(Domestic Investment)												2.8	4.62		
Ed. Threshold(Exports)														3.42	
Ed. Threshold(Openness)															1.26

A. 5.2 THAILAND: OLS Regressions: Dependent variable is Δ***lnGDPPC, 1973:3-2006:4.***

Regressor	5.5.1	5.5.2	5.5.3	5.5.4	5.5.5	5.5.6	5.5.7	5.5.8	5.5.9	5.5.10	5.5.11	5.5.12	5.5.13	5.5.14	5.5.15
Coefficient															
(t-statistic)															
Constant	0.02	0.01	0.02	0.01	0.02	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
	(3.85)	(2.81)	(3.24)	(2.73)	(3.24)	(3.25)	(1.24)	(1.28)	(1.02)	(2.47)	(2.04)	(1.19)	(1.25)	(0.64)	(0.06)
Δ***ln*H**	-0.44	-0.12	-0.10	-0.13	-0.09	-0.17	0.15	0.17	0.49	-0.07	0.33	-4.39	-3.77	-3.00	3.53
	(-0.56)	(-0.15)	(-0.14)	(-0.18)	(-0.12)	(-0.22)	(0.28)	(0.31	(0.84)	(-0.08)	(0.45)	(-4.19)	(-3.97)	(-2.54)	(5.50)
Δ***ln*I/GDP**	-0.10	-0.09	-0.12	-0.21	-0.12	-0.12	-0.21	-0.21	-0.21	-0.10	-0.20	-0.78	-0.83	-0.04	-0.12
	(-4.01)	(-3.18)	(-4.77)	(-7.94)	(-4.85)	(-4.77)	(-11.09)	(-11.13)	(-10.61)	(-3.63)	(-7.00)	(-7.10)	(-8.40)	(-1.42)	(-5.89)
Δ***ln*IM/GDP**				0.23							0.23		0.23		
				(5.71)							(5.58)		(6.34)		
Δ***ln*EX/GDP**			0.05	-0.03	0.05	0.05				0.04	-0.03	0.06	-0.02	-0.50	
			(1.95)	(-1.04)	(1.86)	(1.83)				(1.61)	(-1.19)	(2.68)	(-1.01)	(-3.71)	
Δ***ln*OPEN/GDP**							0.24	0.25	0.25						-0.02
							(10.42)	(10.40)	(0.40)						(-1.05)
Δ***ln*GX/GDP**	-0.09	-0.09	-0.08	-0.05	-0.08	-0.08	-0.02	-0.12	-0.02	-0.09	-0.05	-0.08	-0.04	-0.11	0.71
	(-3.67)	(-1.34)	(-3.39)	(-2.11)	(-3.42)	(-3.41)	(-1.02)	(-0.98)	(-1.08)	(-3.66)	(-2.28)	(-3.96)	(-2.24)	(-4.44)	(9.93)
Δ***ln*FDI/GDP**	0.01	-0.09			0.01		-0.01		0.02	-0.09	-0.03	-0.01	0.05	0.01	-0.05
	(1.06)	(-1.34)			(0.58)		(-1.17)		(0.35)	(-1.29)	(-0.43)	(-0.23)	(1.05)	(0.13)	(-1.15)
Δ**(*ln*FDI**ln*H)/GDP**		0.07				0.01		-0.01	-0.02	0.06	0.02	0.01	-0.04	-0.01	0.03
		(1.44)				(0.82)		(-1.21)	(-0.53)	(1.36)	(0.36)	(0.28)	(-1.12)	(-0.15)	(1.03)
Δ**(*ln*I**ln*H)/GDP**												0.49	0.44		
												(6.63)	(6.63)		
Δ**(*ln*EX**ln*H)/GDP**														0.40	
														(4.14)	
Δ**(*ln*OPEN**ln*H)/GDP**															-0.39
															(-6.63)
ECM_{t-1}	-0.08	-0.14	-0.08	-0.10	-0.08	-0.08	-0.11	-0.11	-0.12	-0.14	-0.14	-0.31	-0.26	-0.30	-0.11
	(-2.53)	(-2.55)	(-2.19)	(-2.54)	(-2.18)	(-2.18)	(-2.54)	(-2.49)	(-2.71)	(-2.66)	(-3.01)	(-3.84)	(-3.62)	(-3.49)	(-2.29)
Adjust R^2	0.41	0.41	0.41	0.53	0.41	0.41	0.69	0.69	0.69	0.42	0.53	0.60	0.68	0.51	0.79
S.E.	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.02

Note: *ECM* is the one period lagged residual of the corresponding levels regression in Table A 5.2 taking account of all the variables included in the appropriate specification, hence reducing the sample size in the error correction model by 1.

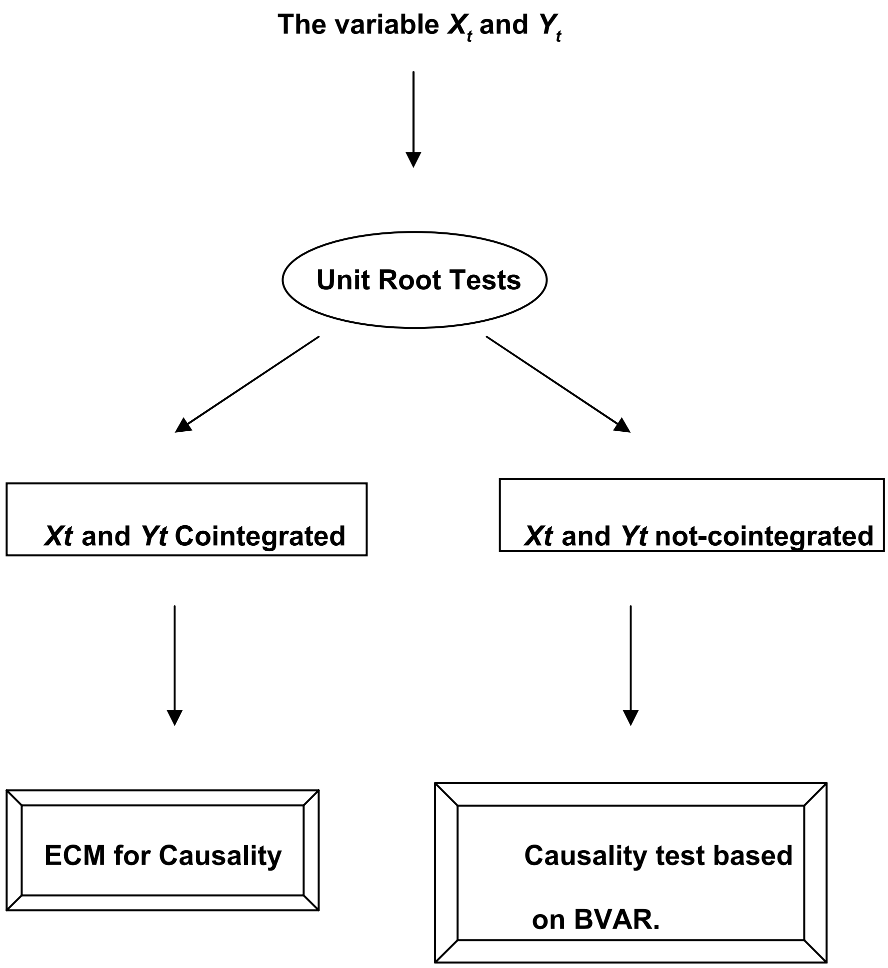
A. 5.3 THAILAND: OLS Regressions: Dependent variable is lnI/GDP, 1973:2-2006:4.						
Regressor	**5.6.1**	**5.6.2**	**5.6.3**	**5.6.4**	**5.6.5**	**5.6.6**
Coefficient						
(t-statistic)						
Constant	-10.15	-4.45	0.32	-1.17	-12.07	-12.53
	(-9.40)	(-4.38)	(0.57)	(-2.06)	(-16.48)	(-6.45)
***ln*H**	3.84	2.68	1.20	3.71	4.84	4.88
	(3.13)	(2.91)	(5.17)	(7.53)	(9.28)	(8.91)
***ln*EX/GDP**			-0.67	-0.49		
			(-7.33)	(-5.63)		
***ln*IM/GDP**			1.34	1.33		
			(13.97)	(15.80)		
***ln*OPEN/GDP**					0.72	0.75
					(15.87)	(5.86)
***ln*GX/GDP**		0.68	0.13	0.03	0.01	0.01
		(9.26)	(1.93)	(0.44)	(0.21)	(0.16)
***ln*FDI/GDP**	-0.44	-0.00	-0.06	0.41	0.80	0.77
	(-2.20)	(-0.01)	(-2.52)	(4.79)	(8.13)	(5.10)
Ln*FDI*ln*H/GDP**	0.18	-0.04		-0.31	-0.57	-0.55
	(1.48)	(-0.40)		(-5.60)	(-9.28)	(-5.31)
ln*OPEN*ln*H/GDP**						-0.03
						(-0.25)
Adjust R2	0.91	0.95	0.99	0.99	0.99	0.99
S.E.	0.3	0.2	0.1	0.1	0.1	0.1

A. 5.4 THAILAND: OLS Regressions: Dependent variable is ΔlnI/GDP, 1973:3-2006:4.						
Regressor	**5.7.1**	**5.7.2**	**5.7.3**	**5.7.4**	**5.7.5**	**5.7.6**
Coefficient						
(t-statistic)						
Constant	-0.00	0.00	-0.02	0.01	0.00	0.01
	(-0.11)	(0.05)	(-1.51)	(0.51)	(0.20)	(0.62)
Δ*ln*H	10.76	5.86	2.62	1.58	3.32	-5.21
	(2.89)	(1.84)	(1.28)	(0.75)	(1.46)	(-1.92)
Δ*ln*EX/GDP			-0.14	-0.15		
			(-1.62)	(-1.98)		
Δ*ln*IM/GDP			0.84	0.85		
			(7.75)	(8.85)		
Δ*ln*OPEN/GDP					0.46	-0.93
					(5.64)	(-3.08)
Δ*ln*GX/GDP		0.54	0.47	0.41	0.47	0.35
		(6.29)	(7.90)	(7.85)	(7.80)	(6.00)
Δ*ln*FDI/GDP	0.56	0.44	-0.02	0.52	0.66	0.70
	(1.97)	(1.71)	(-0.74)	(3.16)	(3.62)	(4.23)
Δ(*ln*FDIln*H)/GDP**	-0.37	-0.26		-0.38	-0.48	-0.51
	(-1.83)	(-1.59)		(-3.26)	(-3.69)	(-4.33)
Δ (*ln*OPENln*H)/GDP**						1.09
						(4.74)
ECM_{t-1}	-0.17	-0.13	-0.41	-0.58	-0.61	-0.42
	(-3.57)	(-2.39)	(-5.36)	(-7.51)	(-8.35)	(-5.48)
Adjust R^2	0.13	0.29	0.64	0.72	0.65	0.71
S.E.	0.1	0.1	0.09	0.08	0.09	0.08

Note: *ECM* is the one period lagged residual of the corresponding levels regression in A 5.4 taking account of all the variables included in the appropriate specification, hence reducing the sample size in the error correction model by 1.

Appendix 6

A.6.1 Methodology of the Causality Test



Source: Toda and Phillops (1993), Sims et al. (1999)

A.7 Forecast Evaluation

Suppose the forecast sample is j=T+1, T+2,…,T+h, and denote the actual and forecasted value in period as and , respectively. The reported forecast error statistics are computed as follows:

Root Mean Squared Error $\sqrt{\sum_{t=T+1}^{T+h}(\hat{y}_t - y_t)^2/(h+1)}$ (A.7.1)

Mean Absolute Error $\sum_{t=T+1}^{T+h}\left|\hat{y}_t - y_t\right|/(h+1)$ (A.7.2)

Mean Absolute Percentage Error $\sum_{t=T+1}^{T+h}\left|\hat{y}_t - y_t\right|/(h+1)$ (A.7.3)

Theil Inequality Coefficient $\dfrac{\sqrt{\sum_{t=T+h}^{T+h}(\hat{y}_t - y_t)^2/(h+1)}}{\sqrt{\sum_{t=T+1}^{T+h}\hat{y}_t^2/(h+1)}+\sqrt{\sum_{t=T+1}^{T+h}y_t^2/(h+1)}}$ (A.7.4)

The first two forecast error statistics depend on the scale of the dependent variable. These should be used as relative measures to compare forecasts for the same series across different models; the smaller the error, the better the forecasting ability of that model according to that criterion. The remaining two statistics are scale invariant. The Theil inequality coefficient always lies between zero and one, where zero indicates a perfect fit.

The mean squared forecast error can be decomposed as

$$\sum(\hat{y}_t - y_t)^2/h = ((\sum\hat{y}_t/h) - \bar{y})^2 + (s_{\hat{y}} - s_y)^2 + 2(1-r)s_{\hat{y}}s_y \qquad \text{(A.7.5)}$$

where $\sum \hat{y}_t / h, \bar{y}, s_{\hat{y}}, s_y$ are the means and (biased) standard deviations of $\hat{y}_t$ and y, and r is the correlation between $\hat{y}_t$ and y. The proportions are defined as:

Bias Proportion $\dfrac{((\sum \hat{y}_t / h) - \bar{y})^2}{\sum (\hat{y}_t - y_t)^2 / h}$ (A.7.6)

Variance Proportion $\dfrac{(s_{\bar{y}} - s_y)^2}{\sum (\hat{y}_t - y_t)^2 / h}$ (A.7.7)

Covariance Proportion $\dfrac{2(1-r) s_{\bar{y}} s_y}{\sum (\hat{y}_t - y_t)^2 / h}$ (A.7.8)

- The bias proportion tells us how far the mean of the forecast is from the mean of the actual series.
- The variance proportion tells us how far the variation of the forecast is from the variation of the actual series.
- The covariance proportion measures the remaining unsystematic forecasting errors.

Note that the bias, variance, and covariance proportions add up to one. If your forecast is "good", the bias and variance proportions should be small so that most of the bias should be concentrated on the covariance proportions. For additional discussion of forecast evaluation, (see Pindyck and Rubinfeld (1991), Chapter 12).

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