



# **Impact Evaluation of SME Programs in Chile and Malaysia**

**Hong Tan**

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# Background on SME Impact Evaluation Studies

- 2010 World Bank book, “Impact Evaluation of SME Programs in Latin America”
  - Evaluations of SME programs in Chile, Colombia, Mexico, Peru in 2009
  - 4 country studies funded by the World Bank Research Committee
  - In collaboration with think tanks, SME agencies and National Statistics Offices
- 2010/2011 Malaysia SME Master Plan project
  - World Bank project for Government of Malaysia and SME Corp., Malaysia
  - Phase I technical study on SMEs and SME programs (unpublished)
  - World Bank team working with SME Corp, different SME agencies, and Department of Statistics, Malaysia
  - Phase II development of SME Master Plan 2011-2020
- Talk focuses on Impact Evaluation of SME Programs in Chile and Malaysia

# Outline of Presentation

## I. Motivation

- Importance of SMEs in developing countries
- SME support programs – common but poorly evaluated
- Recent Literature on evaluating SME programs

## II. Analytic Approach and Panel Data

- The evaluation challenge
- Non-experimental approach with treatment and control groups
- Propensity score matching combined with panel model estimation

## III. The Case of Chile

- 2004 Investment Climate Survey with SME module linked to 1992-2006 annual industrial survey (ENIA)

## IV. The Case of Malaysia

- Administrative data from SME Corp on beneficiaries of SME programs linked to 2000-2008 annual survey of manufacturing (ASM) from Department of Statistics, Malaysia

## V. Summary and Implications

# I. Motivation

## **SME Programs are a widely used policy instrument**

In both OECD and developing countries

Includes business development services (BDS) and finance

They address perceived constraints/market failures affecting SMEs more than larger enterprises

## **SME Programs are not often evaluated rigorously**

Most are qualitative, satisfaction surveys of program users which cannot show impacts

Non-experimental impact evaluations (treatment and control group comparisons) show mixed results

Recent randomized experiments of BDS firm-level interventions

## **Paucity of empirical evidence raises questions**

Do SME support programs work? Which ones are more effective?

Can such policies be justified on cost-benefit grounds?

Should governments be focusing just on reforming the business environment and improving SME access to finance?

# Six Steps to Heaven

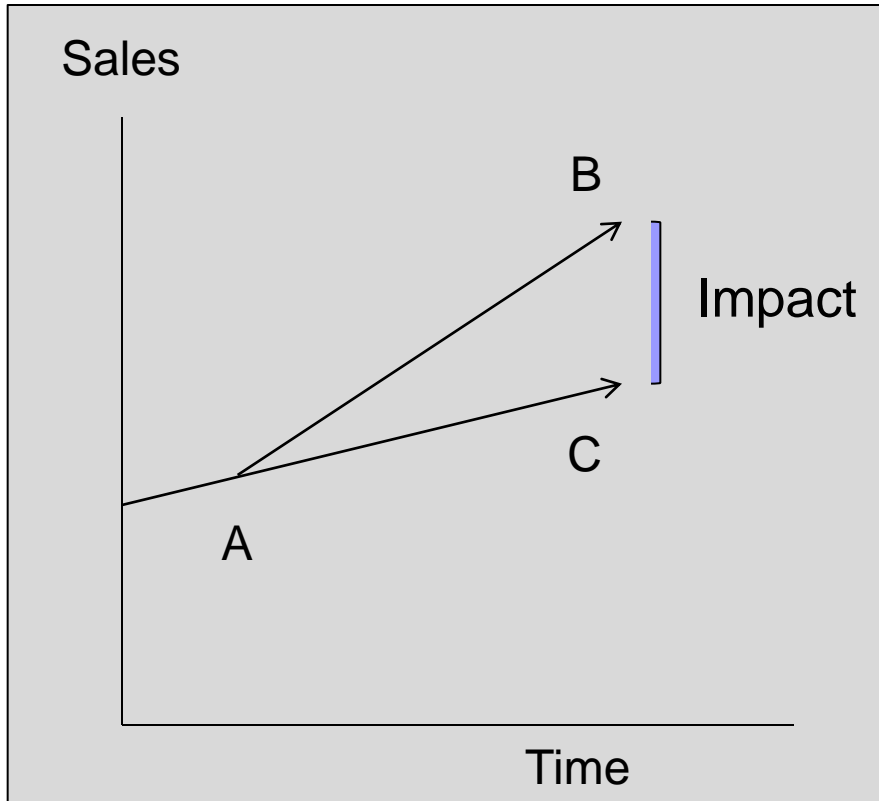
**David Storey's (1998) typology of SME programs evaluations in terms of analytic rigor and ability to yield results useful to policymakers**

1. Qualitative case studies
2. Program beneficiary satisfaction surveys
3. Studies asking program beneficiaries about program impacts
4. Simple comparisons of program beneficiaries to the average performance of other firms
5. Comparisons of beneficiaries to a control group of firms with broadly similar characteristics
6. Treatment-control group comparisons correcting for selection bias

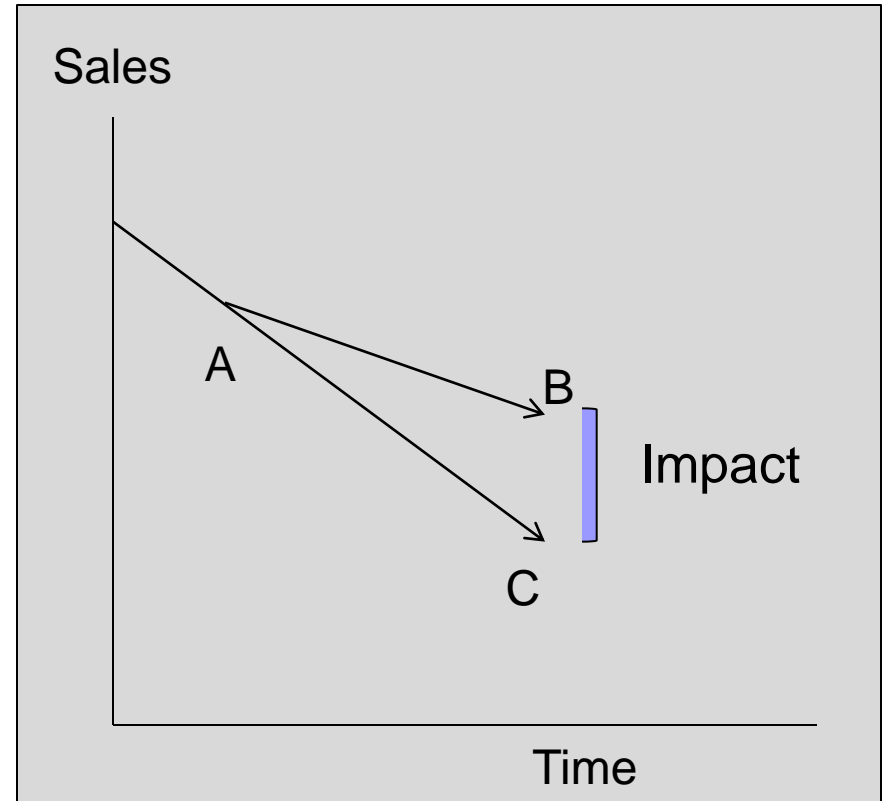
Steps 1 through 3 are useful for monitoring and improving program design and implementation

Steps 4, 5 and 6 – using a control group - are needed to rigorously estimate the impacts of participation in SME programs

# The Impact Evaluation Challenge: Should Firms be asked about impact?

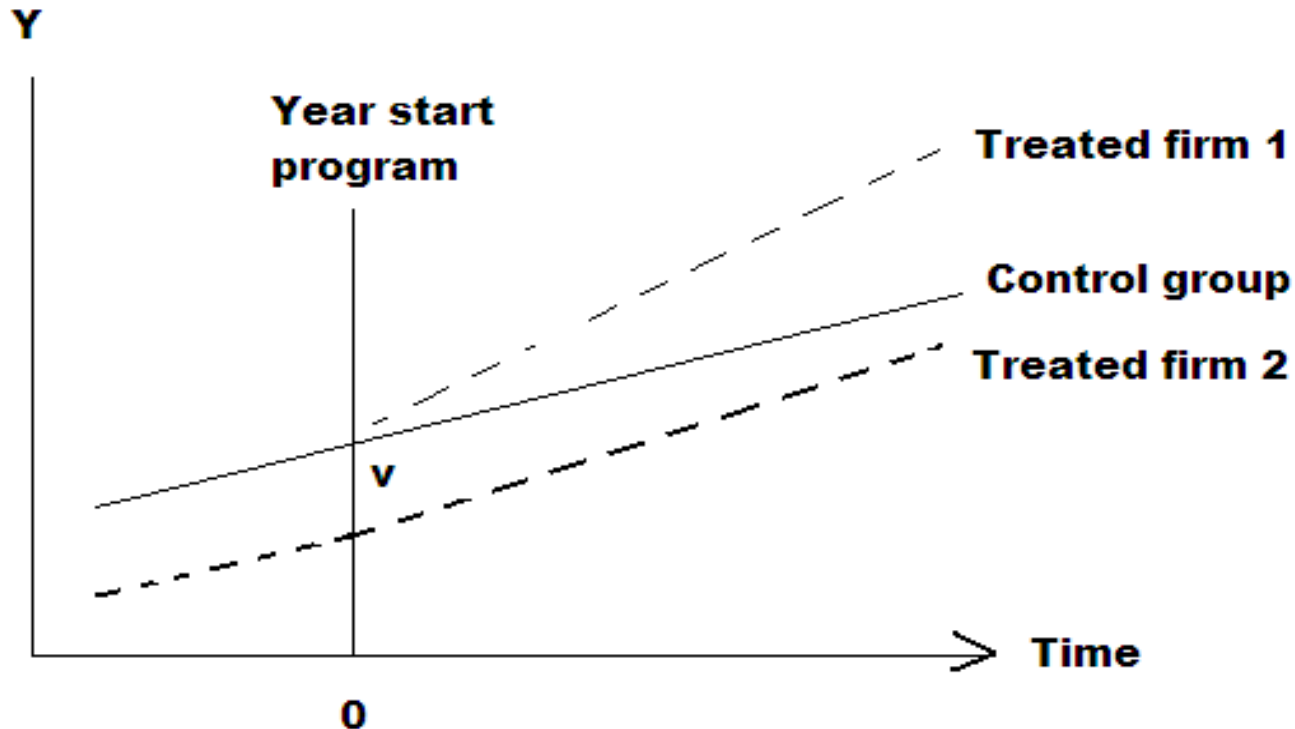


Growing economy



During recession

# The Impact Evaluation Challenge: Using control group & Addressing selection Bias



- (a) Using a control group (similar firms that did not use SME programs) to represent the counter-factual
- (b) Correcting bias in estimating impacts from self-selection of firms into SME Programs

# Recent SME Impact Evaluations

We reviewed 20 recent (steps 5 and 6) SME program evaluations in OECD and developing countries:

- Most studies (11) are in OECD countries – US, UK, Ireland, Belgium, Japan, Australia and New Zealand. They include:
  - **United States** – Manufacturing Extension Program (MEP) – subsidized technical assistance in technology upgrading
  - **United Kingdom** – Business Link (BL) – consulting services for SMEs
  - **New Zealand** – Growth Services Range (GSR) – grants and advisory services to high performing SMEs
  - **Japan** – CAL incentives to promote SME technology development
- Among developing countries, Latin American studies dominate (7); in other regions, 1 each in Turkey and in Bangladesh. They include:
  - **Chile** – PROFO – program of cluster development for SMEs
  - **Argentina** – FONTAR – matching grants for R&D and technology
  - **Mexico** – CIMO for training, COMPITE and CRECE for technology
  - **Turkey** – TTGV loans and TIDEB grants for R&D and technology

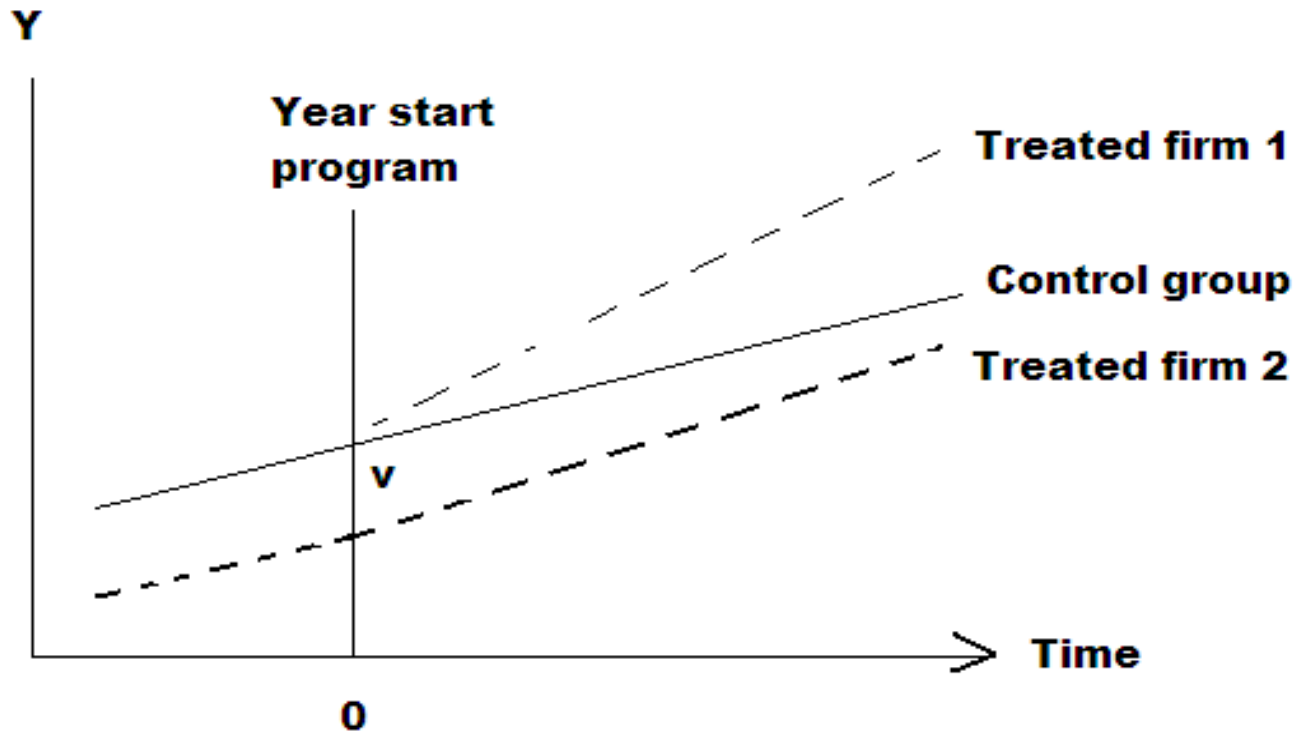


# Recent SME Evaluations

## Our review of non-experimental SME program impact evaluations globally revealed:

- Over the past decade, studies increasingly use propensity score matching (PSM) and difference in difference (DID) methods as program impact evaluation techniques improve
- Most studies track a single cohort of firms using 1 SME program and a control group, with OECD studies using longer panels (3 census in US case), and developing country studies tending to rely on shorter panels of 3-5 years
- Findings – most studies find positive impacts on intermediate outcomes like training, use of QC systems and R&D spending, but mixed impacts on final outcomes like exports, sales, employment and productivity growth.
- Most OECD studies find positive impacts on some final outcomes, only half of developing country studies find positive effects.
- We recommend (1) following treatment-control groups over longer horizon, and (2) care in choosing control group to exclude users of other SME programs.

## II. The Impact Evaluation Challenge



- (a) Identifying an appropriate control group with similar  $X$ s
- (b) Controlling for the effects of unobserved heterogeneity  $v$
- (c) Measuring impacts of use of multiple SME programs
- (d) When to measure impacts? Modeling time-path of program impacts

# The Non-Experimental Panel Data

## A. Chile and Malaysia Country Studies

- Multiple treatment groups, multiple treatment cohorts
- Linked to long panel data from annual surveys of manufacturing which distinguish between use / non-use of SME programs

## B. Chile - Firm survey with SME program module

- 600+ firms in the 2004 Investment Climate Survey
- About 200 firms report participation and date of participation in an open-ended list of BDS and finance programs
- Linked to 1992-2006 panel data of all firms developed from annual industrial surveys conducted by ENIA

## C. Malaysia – Administrative Data from SME Corp

- 2,000+ beneficiaries of SME programs from different Ministries
- Data on year of program participation, program(s) used and amount of fiscal support
- Linked to 2000-2008 panel data developed from 2000, 2003 and 2005 census and annual survey of manufacturing of DOSM

# Analytic Approach

## A. Analytic Issues

- Addressing selection bias in SME program participation using pre-treatment observable and un-observable variables
- Identifying the separate impacts of participation in multiple SME programs
- Estimating the time-paths of program impacts
- Do impacts vary by characteristics of beneficiaries (e.g. by employment size)

## B. Propensity score matching of Treatment-Control Groups

- Cox proportional hazards model or logit models to estimate the propensity score of SME program participation
- Correlates of PS are firm size, industry, age of firm, foreign ownership, location, pre-program participation lagged sales and sales growth
- Treatment and control groups matched on PS in the region of common support

# Estimating Program Impact $\alpha$

$$Y_{it} = \beta X_{it} + \alpha D + \varepsilon_{it}$$

## Specification of Program Use Variable D:

### Any Program Use

D = 0 in all year prior to using any program

D = 1 in year starting program and all subsequent years

### Time since Program Use

DT = 0 in all years prior to using program

DT = 1, 2, 3, 4 ..... T with years since using program

### Multiple Program Use

D1, D2 ... DN as in D

D1T, D2T .... DNT as in DT

# Panel Regression Model

## Outcome Variables

- Output, sales, employment, total factor productivity (TFP), value-added per worker, wages

## SME Program Variables

- Program Use indicator variable – 0 in all years prior to use, 1 in all years of use
- Time since Program Use – number of years since program use
- Both variables for ANY PROGRAM, or by PROGRAM type

## Explanatory Variables

- Regression models control for firm size, industry, location in state or province, time dummies
- Panel regression models on matched subsamples of treatment and control groups in the region of common support of PS
- Level and DID specifications to test for biases from unobserved firm heterogeneity
- Tests for differences in impacts across different SME programs, and for time effects of impacts from program use

### **III. SME Program Evaluation in Chile**

**The paper uses 2 firm-level surveys conducted by INE which provided the link between the 2 data files**

- **The 2004 Chile Investment Climate Survey (ICS):**
  - 603 firms in 6 manufacturing sectors
  - 207 firms participated in 1 or more programs
  - 396 firms never participated in any programs
- **ENIA panel (Annual Industrial Survey)**
  - Panel data from 1992 to 2002 with usual variables inputs, sales, outputs, fixed assets, employment, wages and exports
  - Panel data updated to 2006 using recent public-use ENIA panel.

# Overview of Chile Programs

Chile has a plethora of SME support programs run by different government agencies. CORFO, within Ministry of Economy, administers the main SME programs for the industrial sector

- **FAT** – Fondo de Asistencia Tecnica (73 obs) – Program to provide technical assistance and business development services (BDS)
- **PROFO** – Proyecto Asociativo de Formento (74 obs) – Cluster-based BDS for sectoral or regional groups of 4 or more enterprises
- **PDP** – Programa de Desarrollo de Proveedores (26 obs) – SME supplier development program for improving links to large firms
- **FONTEC** - Proyectos de Innovacion Tecnologica / Transferencia Tecnologica (93 obs) – R&D promotion and technology upgrading
- **FIN 1&2** – Lineas de Financiamiento / Reprogramacion de deuda (42 obs) – preferential financing and debt restructuring for SMEs
- **Other Programs** (24 obs) – administered by non-CORFO agencies



# Propensity Score Matching

## Cox proportional hazards model

- **Conditional Likelihood of Program Use**

Failure event (program entry) – pre-entry=0, entry & post-entry=1

- **Matching on Pre-Program Characteristics**

Establishment size – micro, small, medium and large

Industrial sector – 6 sectors

Location in the capital region – (1,0) indicator for Santiago

Foreign capital ownership

Establishment age – started operations in 1970s, 1980s or 1990s

1-year lag of log-sales (t-1)

Log-sales growth (t-1) minus (t-2)

# Correlates of Program Use

- **Firms more likely to participate in programs:**
  - Are larger - small and medium size
  - Located outside the Santiago capital region
  - Lower sales prior to participation
  - Higher sales growth prior to participation
  - Older firms - started operations in 1980s or 1990s
  - National firms
  - In machinery sectors
- **Define pscore and region of common support:**
  - Predict hazard rate by year-firm, compute mean firm pscore
  - Limit analysis to treatment/control group sub-samples in the region of common support (max & min of pscore)

# A. Impacts on Intermediate Outcomes

## PSM nearest neighbor estimates

A. Intermediate Outcomes	Treated	Controls	Difference	t-stat
<i>Innovation and Technology Inputs</i>				
Acquired new technology last 2 years	0.311	0.238	0.073	1.21
R&D in-house or via 3 <sup>rd</sup> party	0.570	0.311	0.258	3.88
Bought automatic & NC machinery	0.232	0.185	0.046	0.83
<i>Technology Outputs Last 2 years</i>				
Introduced new product line	0.530	0.384	0.146	2.15
Introduced new production process	0.755	0.536	0.219	3.44
<i>Quality Control</i>				
Got or getting ISO 9000 certification	1.033	0.404	0.629	4.62
<i>Providing worker training last 2 years</i>				
Training in-house	0.715	0.404	0.311	4.74
Training outside the firm	0.728	0.430	0.298	4.53
Training using SENCE tax incentive	0.722	0.457	0.265	4.01

Notes: Intermediate outcomes from 2004 Chile ICS

T-statistic – significance of differences in outcome means

## B. Impacts of Any Program Use Levels vs Fixed Effects in Panel Models

	Log Sales	Log Labor	Log Wage	Log Labor Productivity	Exports as % of Sales
<i>A. Levels Model</i>					
Any program	-0.387*	-0.022	-0.136	-0.372*	4.35
	(-2.25)	(-0.40)	(-1.60)	(-2.38)	(1.14)
<i>B. Fixed Effects Model</i>					
Any program	0.091***	0.024	0.082***	0.066**	2.202**
	(3.67)	(1.58)	(4.78)	(2.76)	(3.10)

Sign reversals of impacts from levels to DID indicative of negative self-selection of weaker firms into programs

Source: ICS-ENIA panel data 1994-2006

Note: \*\*\*, \*\* and \* significant at 1%, 5% and 10% levels

## **C. Impacts By Type of Program Used**

### **Fixed Effects Estimates in Panel Models**

Type of Program Used	Log Sales	Log Labor	Log Wage	Log Labor Productivity	Exports as % of Sales
Technical assistance (FAT, PDP)	<b>0.205***</b> (4.73)	<b>0.049</b> (1.82)	<b>0.085**</b> (2.82)	<b>0.156***</b> (3.72)	<b>-0.83</b> (-0.67)
Cluster programs (PROFO)	<b>0.074*</b> (2.05)	<b>0.016</b> (0.71)	<b>0.070**</b> (2.86)	<b>0.066</b> (1.89)	<b>0.221</b> (0.21)
Technology programs (FONTEC)	<b>0.061</b> (1.70)	<b>0.000</b> (0.02)	<b>0.050*</b> (2.05)	<b>0.048</b> (1.40)	<b>4.89***</b> (4.65)
Credit programs (FIN lines)	<b>-0.130*</b> (-2.02)	<b>-0.002</b> (-0.05)	<b>0.035</b> (0.79)	<b>-0.106</b> (-1.70)	<b>-1.210</b> (-0.67)

Source: ICS-ENIA panel data 1994-2006

Note: Programs clustered into 4 categories

\*\*\*, \*\* and \* significant at 1%, 5% and 10% levels

# D. Time Effects of Program Impacts

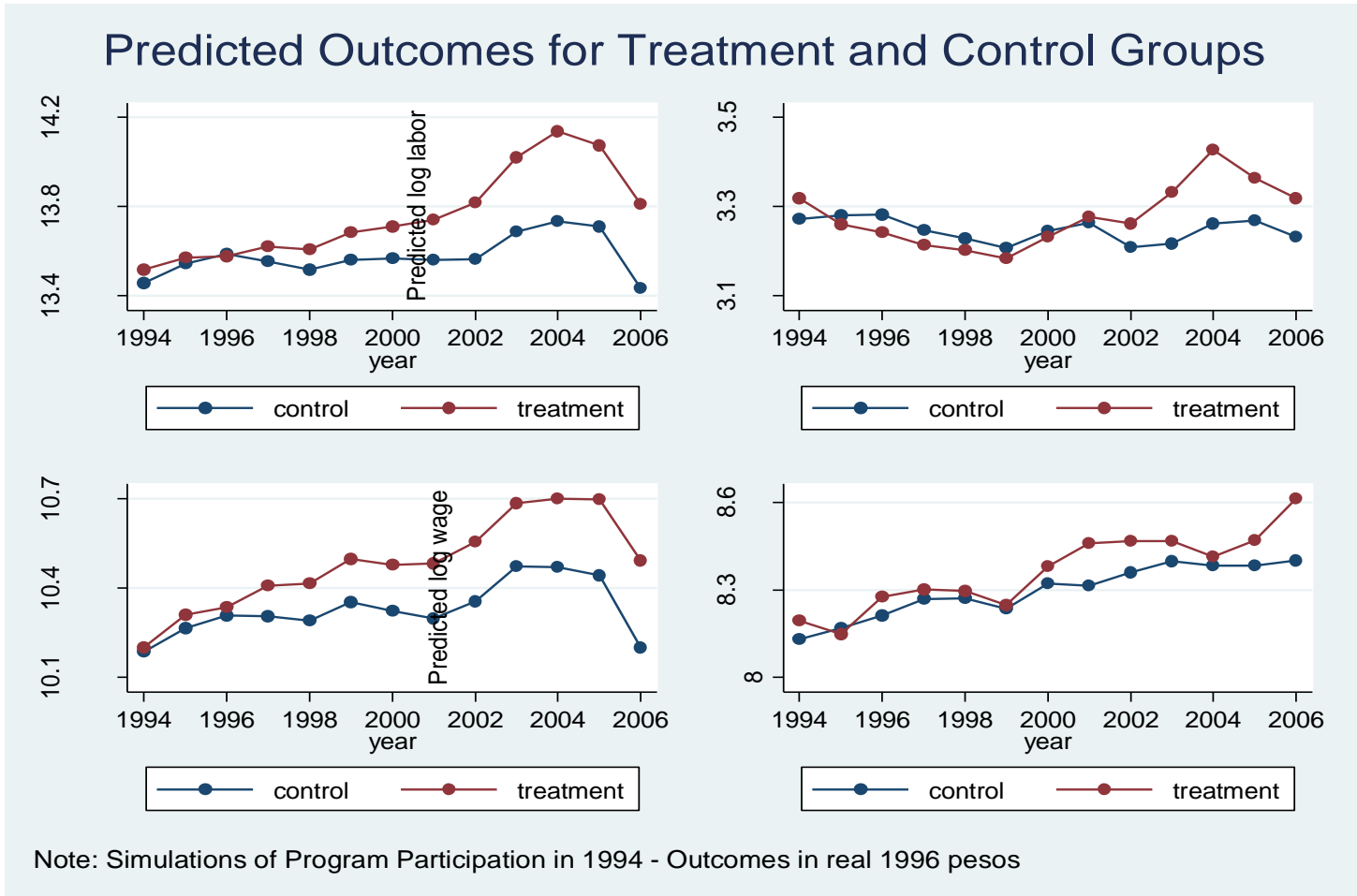
## Example of Log Labor Productivity

Any Program Use Time since start program	Log (Labor Productivity)	
	Coefficient (t-stat)	Time since start program Coefficient (t-stat)
Year started	0.014 (0.36)	4-5 years later 0.131** (2.64)
1 year later	0.045 (0.91)	6-7 years later 0.166** (2.63)
2 years later	0.028 (0.56)	8-10 years later 0.215** (2.72)
3 years later	0.102 (1.94)	11 + years later 0.279** (2.90)

Source: Linked ICS-ENIA panel data 1994-2006

Note: \*\*\*, \*\* and \* significant at 1%, 5% and 10% levels

# E. Time Paths of Impacts on Final Outcomes



Note: Final outcomes for treatment and control groups predicted from regression estimates reported in D. assuming treatment group enters SME program in 1994.

## **IV. SME Program Evaluation in Malaysia**

**Background: WB technical assistance to SME Corp of Malaysia on developing SME Master Plan, including assessment of its SME programs**

- **SME Corp's cross-ministry SME beneficiary file**
  - **By ministry, SME administrative records on beneficiaries, Establishment ID number, program used, date entered program, amounts of support**
  - **Administrative data covering period between 1998 and 2010.**
- **Establishment-level panel data**
  - **constructed from economic censuses, annual surveys (manufacturing) and periodic surveys of service sectors**
  - **Initial impact evaluation of SME programs in manufacturing over the 2000 to 2008 period**
  - **Linked to administrative data by Establishment ID numbers**



# SME Programs in Malaysia

## SME programs run by different government agencies.

- Ministry of Finance
  - MIDF: soft loans
- Ministry of Industry and Trade
  - MATRADE: export promotion, trade fairs, market development
- SME Corporation
  - Training and Quality Certification
  - Product and Process Improvement
  - E-Commerce and E-Design
- Other Ministries
  - Science and Technology (technology upgrading)
  - Ministry of Finance through TEKUN (micro-finance)
  - Ministry of Entrepreneur Development (halal foods)

# Logit Model of Program Use

Logit regression model used to identify correlates of SME program use for estimating propensity scores to match treated and control group firms. SME program use was:

- Lowest among microenterprises, highest for small firms and then falling as size increases, consistent with program targeting on SMEs
- Unlikely among foreign-owned firms with access to resources / technology from parent companies abroad as compared to locally-owned firms.
- Highest for younger companies (established in the 1990s) as compared to older ones with better capabilities, having survived to the present.
- Lower for companies with a higher share of skilled employees (managers, professionals and skilled technicians), but higher for firms with more educated employees
- Higher in peninsula Malaysia (more urban and industrialized) than in East Malaysia (more remote and rural)

# Impacts of Any Program use

Compared to the control group, the impacts of any program participation estimated using **random effects** models:

- Increased total output and employment 13-16 percent
- Raised the level of TFP (residual from production function estimated by Levinsohn-Petrin method) by over 25 percent
- BUT had no measurable impact on labor productivity (value added per worker) or real wages paid to full-time employees
- Some evidence of rising impacts over the first 4-6 years which diminish over time to 0 or negative range.

Using **fixed effects** models reduces estimated impacts to 2.5 percent for employment, 6 percent for TFP.

# Impacts of Program Use

- Programs measured by (0,1) indicator variable

	logOutput	logLabor	TFP	logVA/L	logWage
<b>A. ANY PROGRAM</b>					
Any program use	0.131***	0.163***	0.261***	-0.001	0.019
<b>B. PROGRAM TYPES</b>					
MATRADE market dev.	-0.004	0.018	0.047	0.008	0.012
MIDF soft loans	0.106**	0.101***	0.186***	0.022	0.041
SMECORP quality cert.	0.022	0.068***	0.143***	-0.051	-0.001
SMECORP prod/process	-0.014	0.032	0.051*	-0.039	0.027
SMECORP E-programs	0.236***	0.232***	0.337***	0.067*	0.061
Other programs	0.042*	0.076*	0.146**	-0.051	0.001

## Differences by Programs (0,1)

Types of impacts by program broadly resemble ANY program use (on output, employment and TFP), but variations in size of impacts across programs:

- SMECORP quality certification and E-programs had the largest relative impacts, followed by product and process improvement programs.
- MIDF (soft loans) had positive net impacts on several outcomes but not on labor productivity or wages.
- Use of MATRADE services (market development and export promotion) had no measurable impacts.

## Differences by Programs (Support)

Using cumulative fiscal support measure yields estimates of the elasticity of impact with amount of support. The results for ANY PROGRAM use the same, with slightly different results by programs:

- SMECORP E-programs and quality certification and product and process improvement had the largest relative impacts on output, value added and TFP.
- Use of MIDF (soft loans) and Other Programs had less strong positive impacts on employment and TFP
- MATRADE (export promotion) programs had no measurable impacts on outcomes

# Impacts of Fiscal Support

- Programs measured by cumulative fiscal support (log)

	logOutput	logLabor	TFP	logVA/L	logWage
<b>A. ANY PROGRAM</b>					
Any program use	0.011***	0.015***	0.024***	-0.001	0.002
<b>B. PROGRAM TYPES</b>					
MATRADE market dev.	0.001	0.003	0.005	-0.002	0.001
MIDF soft loans	0.006	0.005*	0.009*	0.003	0.003
SMECORP quality cert.	0.003	0.006***	0.014***	-0.004	-0.001
SMECORP prod/process	0.005	0.007**	0.010**	-0.001	0.001
SMECORP E-programs	0.024***	0.023***	0.032***	0.008*	0.003
Other programs	0.004	0.006	0.012*	-0.004	0.005

# Program Impacts by Firm Size

Large sample size allowed impacts of ANY PROGRAM use to be estimated separately by firm size of program beneficiaries:

- Two specifications: (A) Any Program Use - (0,1) indicator variable (B) Cumulative fiscal support from all programs used (in logarithms)
- Impacts on log of output, employment, TFP, value-added per worker, and wages (plus other outcomes)

The impacts of program participation were also largest for SMALL enterprises as compared to MICROENTERPRISES or MEDIUM size enterprises, with implications for targeting



# Program Impacts by Firm Size

- A. Programs measured by (0,1) indicator variable
- B. Programs measured by cumulated fiscal support

	logOutput	logLabor	TFP	logVA/L	logWage
<b>A. ANY PROGRAM USE</b>					
Microenterprise	0.410***	0.201***	0.467***	0.072	0.028
Small enterprise	0.874***	0.565***	1.037***	0.243***	0.107***
Medium enterprise	0.298***	0.198***	0.480***	-0.107***	0.043
Large enterprise	0.043	0.006	0.234***	-0.215***	0.006
<b>B. CUM. SUPPORT</b>					
Microenterprise	0.003	0.009	0.007	0.001	0.01
Small enterprise	0.033***	0.030***	0.047***	0.010***	0.003*
Medium enterprise	-0.015***	-0.005**	-0.004	-0.015***	0.001
Large enterprise	-0.025***	-0.014***	-0.019***	-0.018***	-0.002

# V. Concluding Remarks

- **Qualitative evaluations of SME programs are necessary but not sufficient**
  - Needed for monitoring and feedback
  - Important for program design and implementation
  - Periodic impact evaluations also key
- **Evidence of positive net impacts from programs**
  - On both intermediate and final outcomes
  - Impacts vary across programs
  - Many impacts only realized over time
- **Impact Evaluations of Programs**
  - Linked administrative and NSO data increasingly used in OECD and developing countries
  - Greater care needed in selection of control group
  - Longer panel data needed to measure full program impacts
  - Use DID methods to control for unobserved heterogeneity



**THANKS**

**Hope this helps in starting a discussion**