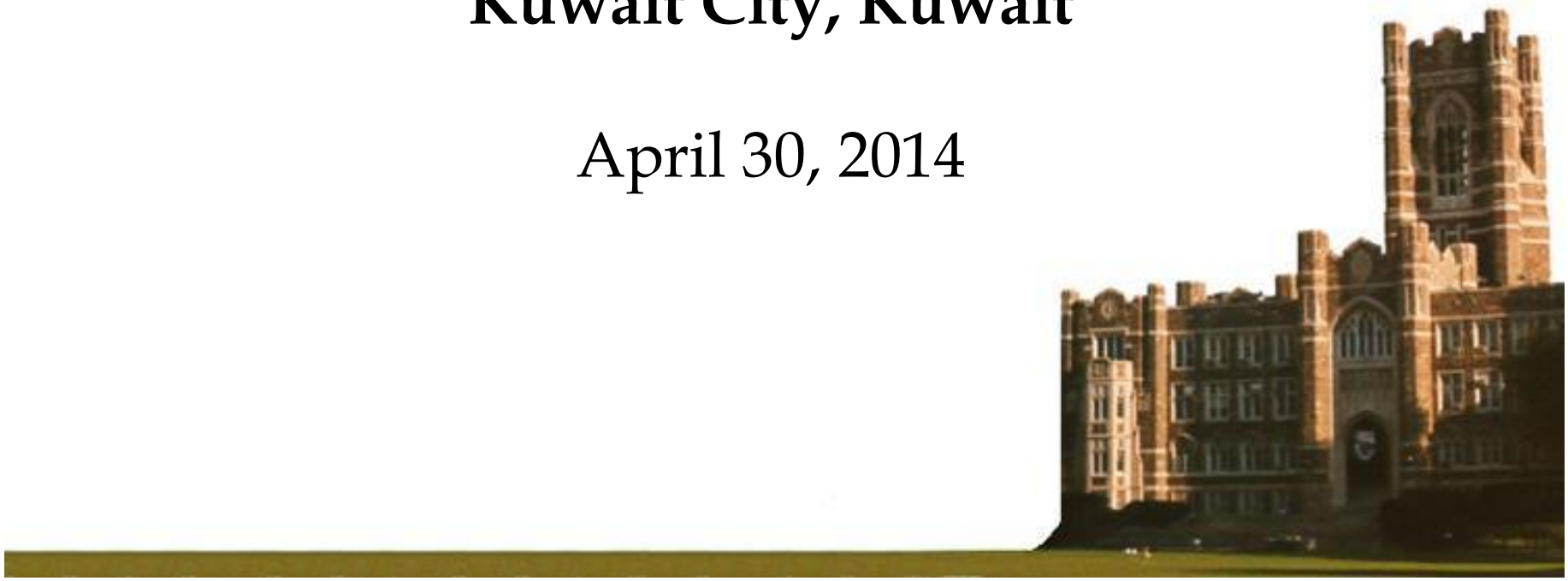
International Monetary Fund

Kuwait City, Kuwait

April 30, 2014



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Diversification and the Economy: The Role of Government in Enhancing Industrial Base

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Agenda

- Diversification & Economy
  - Industrial diversification, risk and growth
  - Empirical Evidence
- Government Involvement
  - Types of government involvement
  - Benefit from government sponsorship
  - Evidence from U.S.
  - Evidences from other countries
  - Case study of Taiwan

Diversification, Risk and Growth

- Industrial concentration impedes risk sharing, as such, sector-level idiosyncratic shock can easily escalates to economy wise shock.
- Sectoral concentration may expedite the GDP growth at certain period, with the natural resource endowments, or technology focused in a limited number of sectors. It is, however, not stable, and vulnerable to long-term macroeconomic shocks (Koren and Tenreyro, 2007 QJE).
- The higher variance of GDP resulting from sectoral concentration may entail a welfare loss that outweighs the benefits (Kalemli-Ozcan, Sorensen and Yosha, 2003 AER).

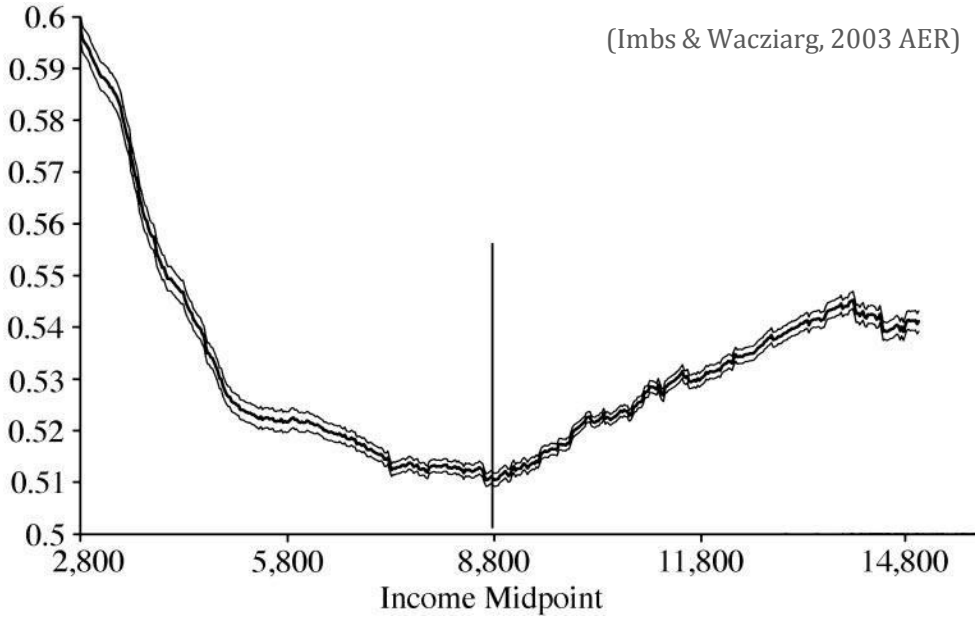
Diversification, Risk and Growth

- Economies at early stages of development are frequently shaken by large changes in growth rates, whereas advanced economies tend to experience relatively stable growth rates. (Lucas, 1988 JME)
- Diversification opportunities at early stages of development are limited by capital supply and technology, thus are also highly random and maybe stopped by crises.
- Economies that are “lucky” enough to receive good draws at the early stages will have more capital and thus will achieve better risk diversification and higher productivity. (Acemoglu & Zilibotti,1997 JPE)

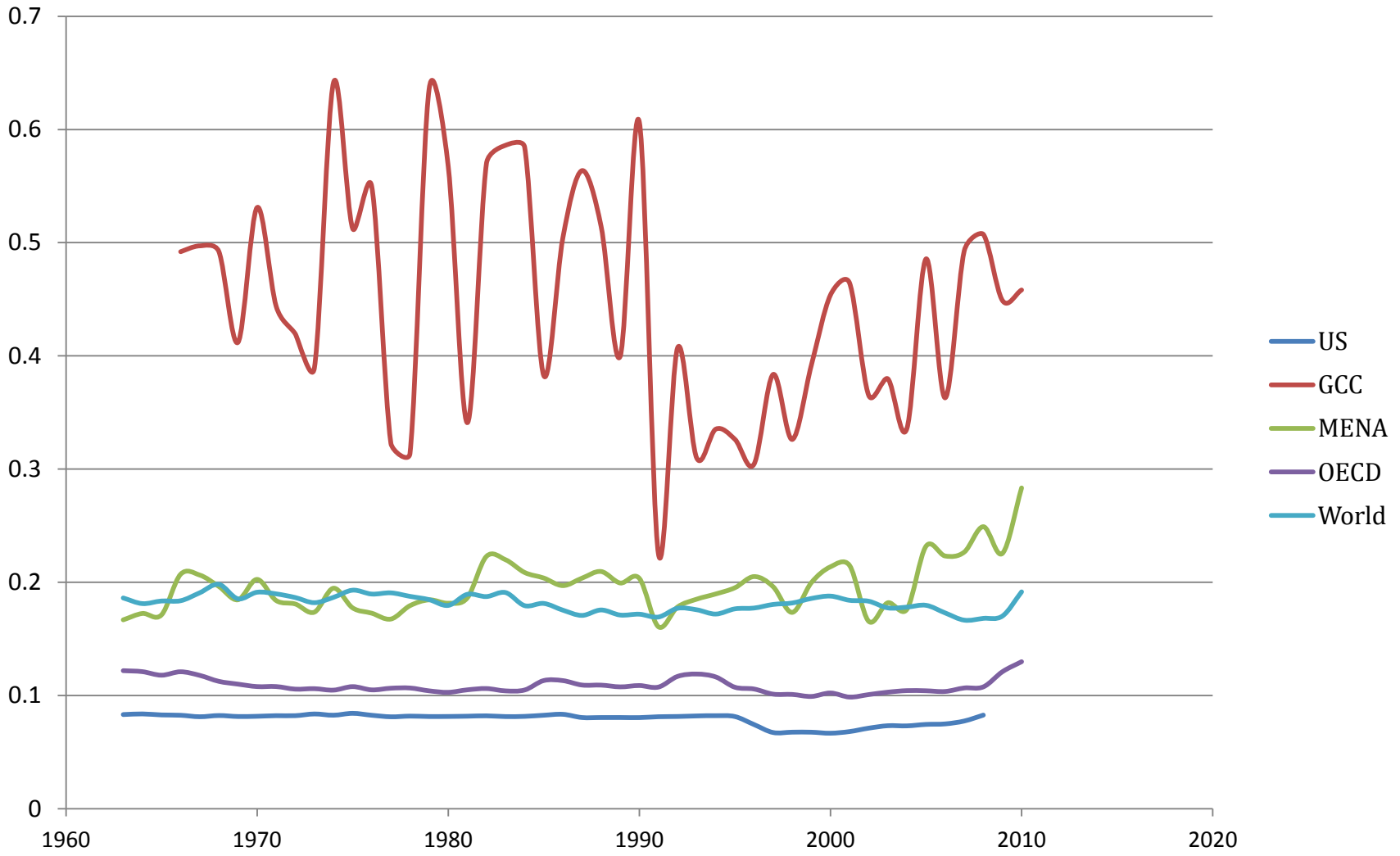
Diversification, Risk and Growth

- Empirically, Imbs & Wacziarg (2003 AER) show that industrial sectoral concentration follow a U-shaped pattern across a wide variety of data sources
  - Diversification helps to increase the income in the earlier stages
  - But there exists, relatively late in the development process, a point at which countries start specializing again.

(Imbs & Wacziarg, 2003 AER)



Diversification Pattern Around the World



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Data Source: United Nations

Questions to be Answered

- Given the evidence on industrial diversification, risk and growth, we want to show additional evidence that identifies different channel through which the diversification impacts the growth
  - Poverty Alleviation
  - Innovation
  - Flow of Foreign Capital
  - Women Empowerment
  - Entrepreneurship

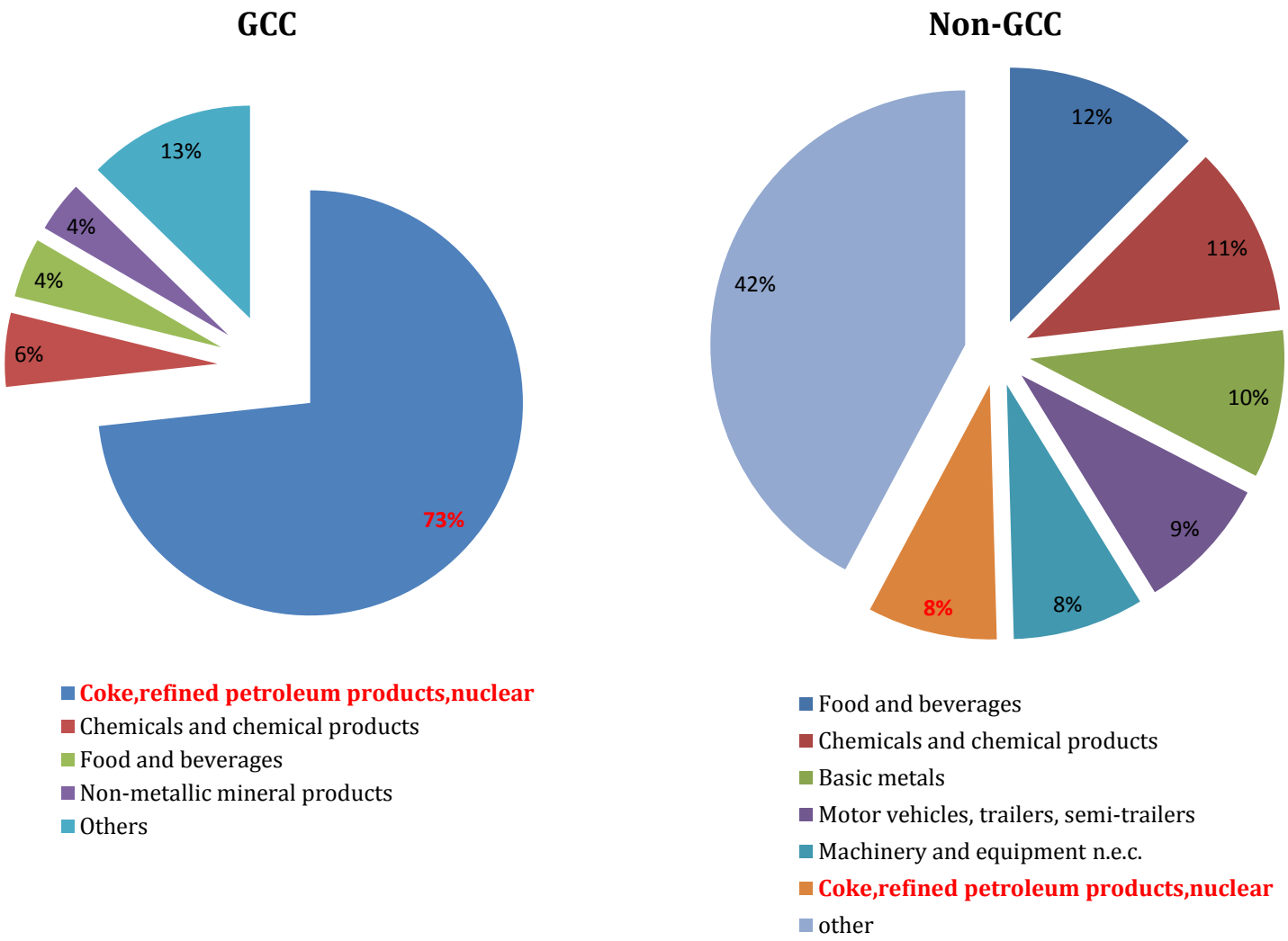
Measure of Diversification

- Herfindahl-Hirschman Index (HHI)
  - The sum of the squares of the shares of each industrial sectors in one country and one year
- Max-Min
  - The spread between the largest and smallest industrial sector shares
- Mean-Median
  - The spread between the mean and median value of the industrial sector shares
- Log of Variance
  - The log of variance of all the industrial sector shares

Data

- Industry-sectoral Output
  - UNIDO (United Nations Industrial Development Organization)
  - Coverage: 166 countries and districts, from 1963-2010
  - Two-digit industrial sectors: 23
  - Four-digit industrial sectors: 127
- Macro Factor Variables
  - WDI (World Development Indicators)
  - Coverage: 246 countries and districts, from 1960-2012
- Innovation
  - EPO Worldwide Patent Statistical Database (PATSTAT)

Industrial Sectors (2008)



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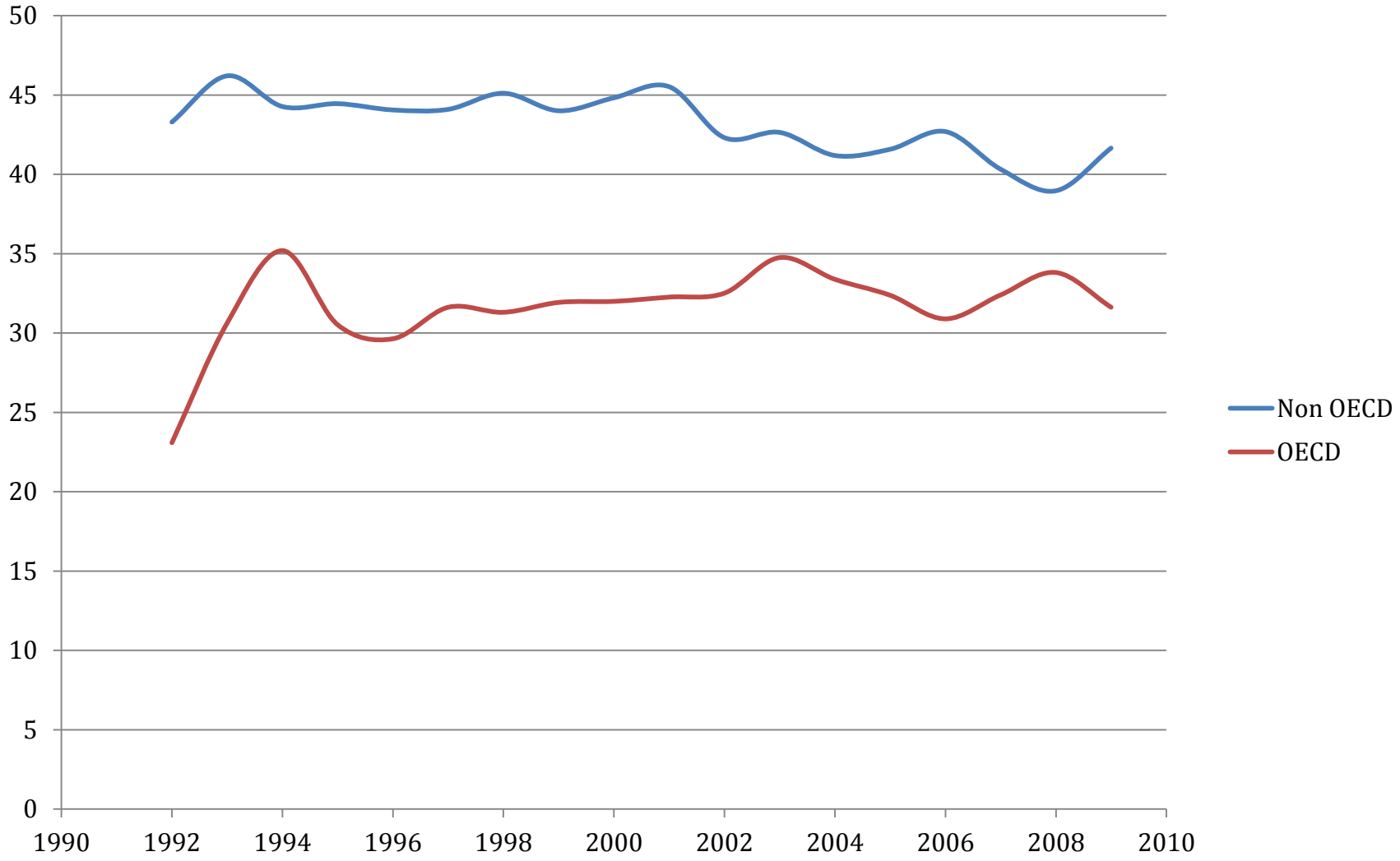
Summary Statistics

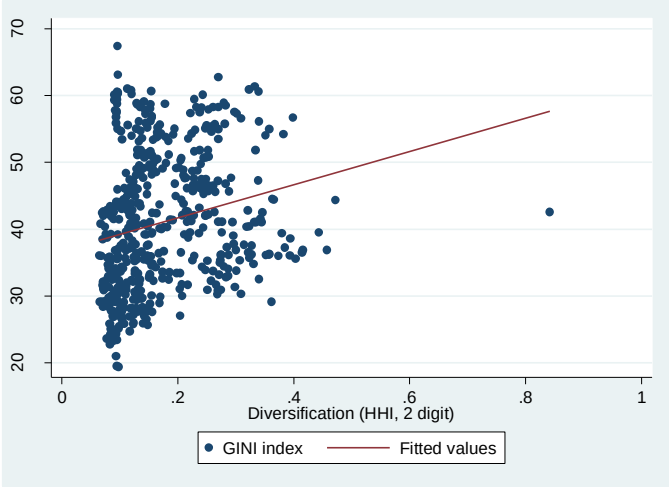
Variables	Mean	SD	p5	p25	p50	p75	p95
Key Variables of Interests							
GINI Index	40.93	10.06	26.86	32.74	40.11	48.38	58.54
Income Share Held by lowest 10%	2.400	1.130	0.590	1.390	2.505	3.290	4.130
Patent Number (Log)	5.106	2.759	0.693	2.773	5.097	7.192	9.509
FDI (Net, % of Total Economy Output)	-0.118	0.551	-0.618	-0.136	-0.0444	0.000353	0.194
Female/Male Employment Ratio	0.377	0.149	0.178	0.295	0.372	0.443	0.600
New Business Registration	9.635	1.506	7.094	8.562	9.829	10.66	12.07
Industrial Diversification Measures							
Herfindahl-Hirschman Index (HHI)	0.184	0.114	0.0791	0.101	0.146	0.233	0.411
Max-Min	0.319	0.153	0.135	0.199	0.281	0.410	0.612
Mean-Median	0.0269	0.0174	0.00750	0.0161	0.0242	0.0352	0.0527
Log of Variance	0.0788	0.0372	0.0376	0.0503	0.0699	0.0986	0.147

Poverty Alleviation
(GINI Index)



Poverty Alleviation (GINI Index)

VARIABLES	(1) GINI Index	(2) GINI Index	(3) GINI Index	(4) GINI Index
HHI	59.960***			
	(16.428)			
Max-Min		45.113***		
		(9.317)		
Mean-Median			301.383***	
			(79.153)	
Log Variance				234.323***
				(37.658)
Control	Yes	Yes	Yes	Yes
Constant	-22.551	-34.156*	1.732	-41.802**
	(19.037)	(18.504)	(17.795)	(18.334)
Observations	496	496	496	496
Adj. R-squared	0.120	0.173	0.082	0.200



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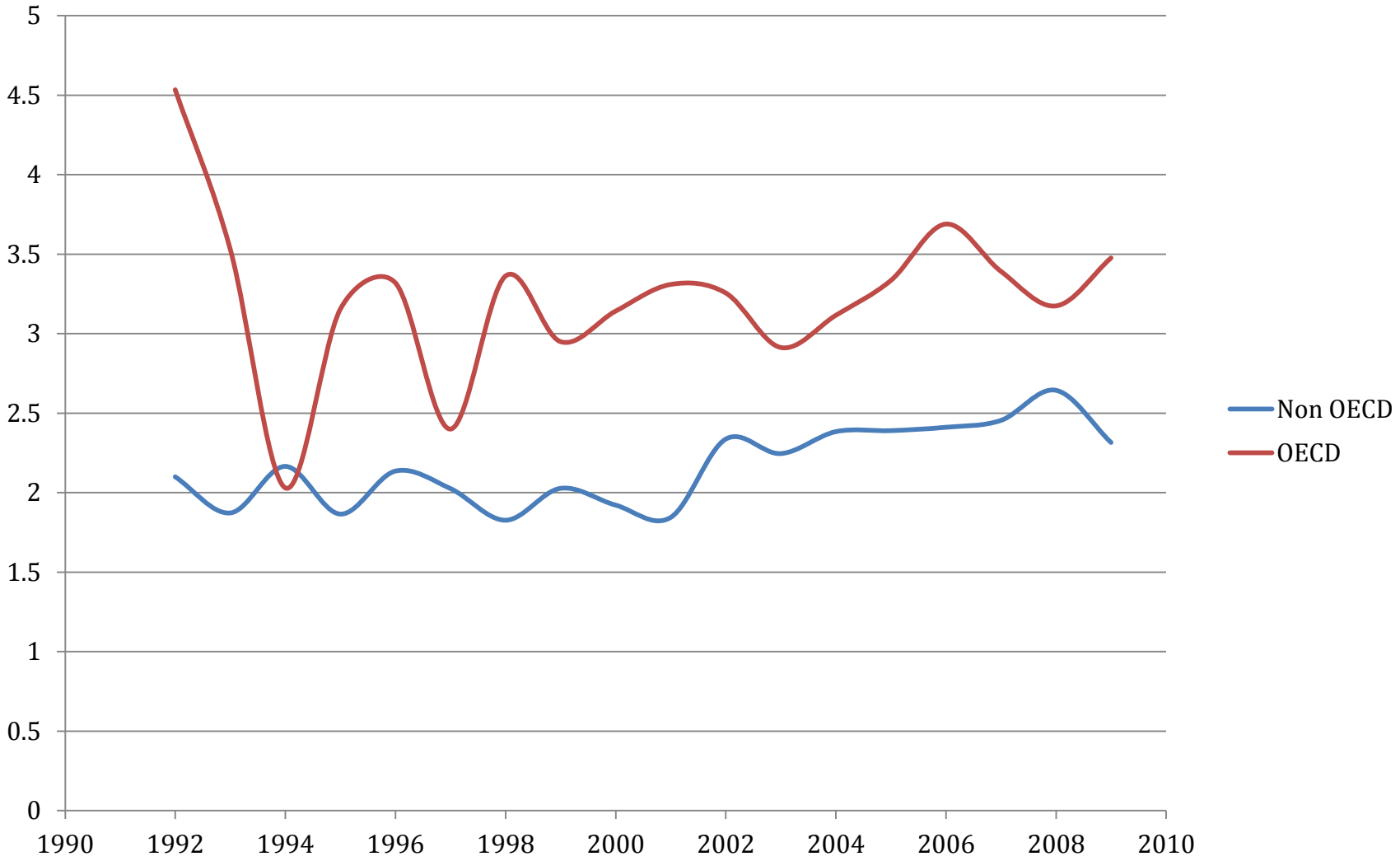
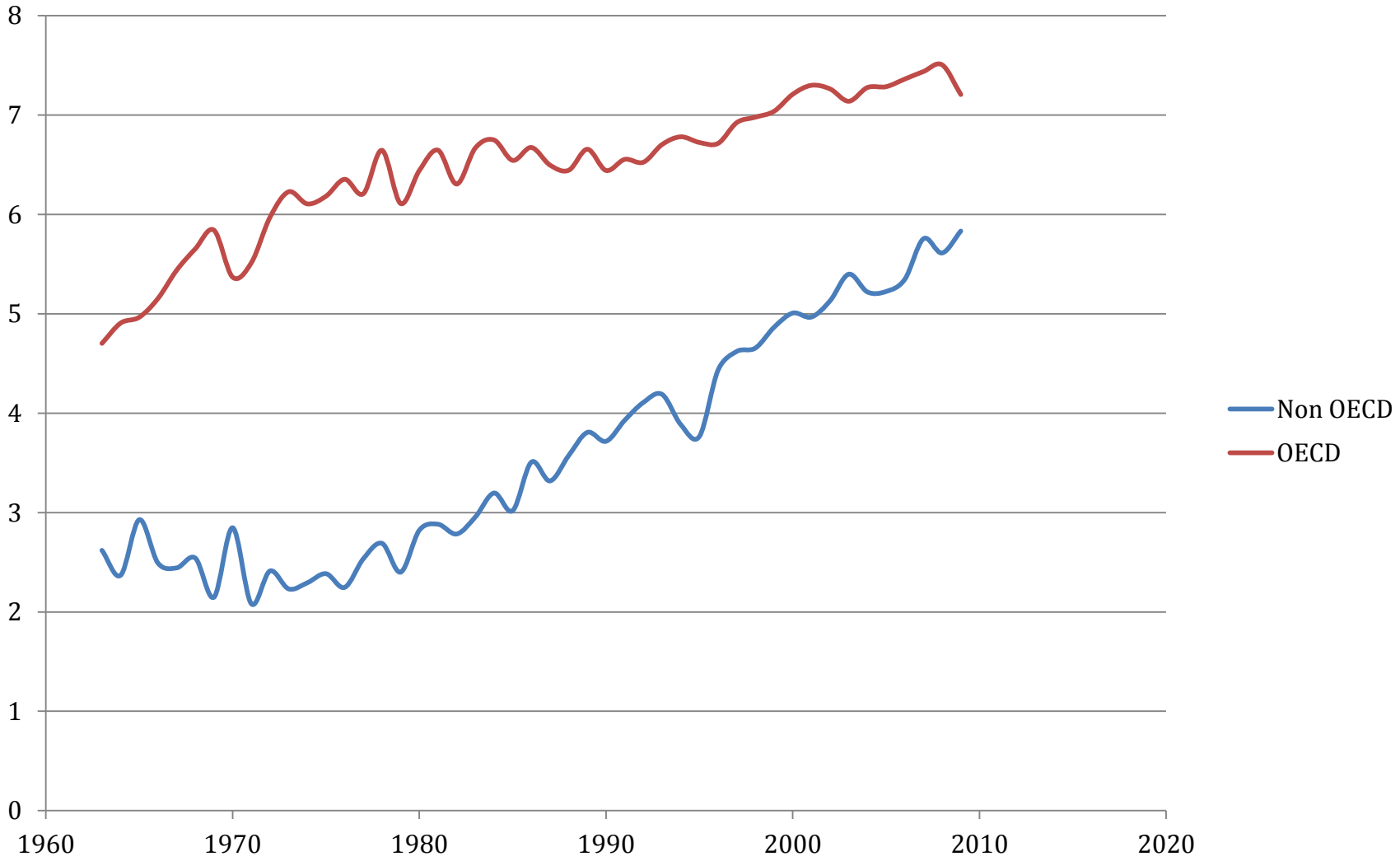
Poverty Alleviation
(Income Share Held by lowest 10%)



Poverty Alleviation
(Income Share Held by lowest 10%)

VARIABLES	(1) Income Share Held by lowest 10%	(2) Income Share Held by lowest 10%	(3) Income Share Held by lowest 10%	(4) Income Share Held by lowest 10%
HHI	-6.072***			
	(1.556)			
Max-Min		-5.239***		
		(0.962)		
Mean-Median			-21.048***	
			(7.783)	
Log Variance				-19.964***
				(5.065)
Control	Yes	Yes	Yes	Yes
Constant	9.179***	11.339***	5.598***	9.943***
	(2.091)	(2.029)	(1.967)	(2.261)
Observations	525	525	525	525
Adj. R-squared	0.135	0.210	0.060	0.169

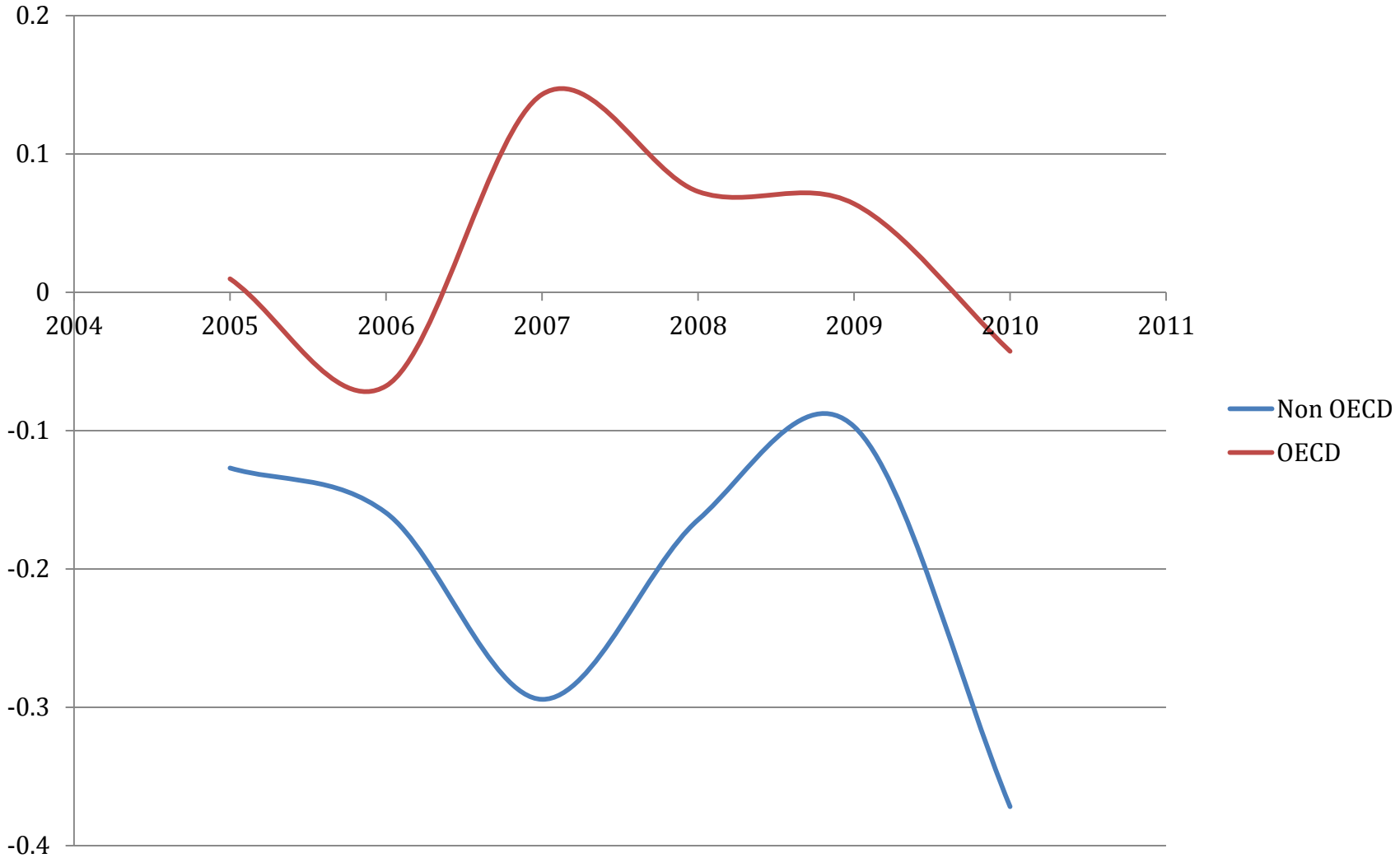
Innovation Patent Number (Log)



Innovation

VARIABLES	(1) Patent Number (Log)	(2) Patent Number (Log)	(3) Patent Number (Log)	(4) Patent Number (Log)
HHI	-4.200			
	(2.646)			
Max-Min		-3.488**		
		(1.556)		
Mean-Median			-42.400***	
			(10.570)	
Log Variance				-19.182***
				(6.027)
Control	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Constant	-20.655***	-19.163***	-20.223***	-18.466***
	(2.107)	(2.209)	(1.742)	(2.088)
Observations	2,254	2,249	2,249	2,249
Adj. R-squared	0.703	0.707	0.717	0.714

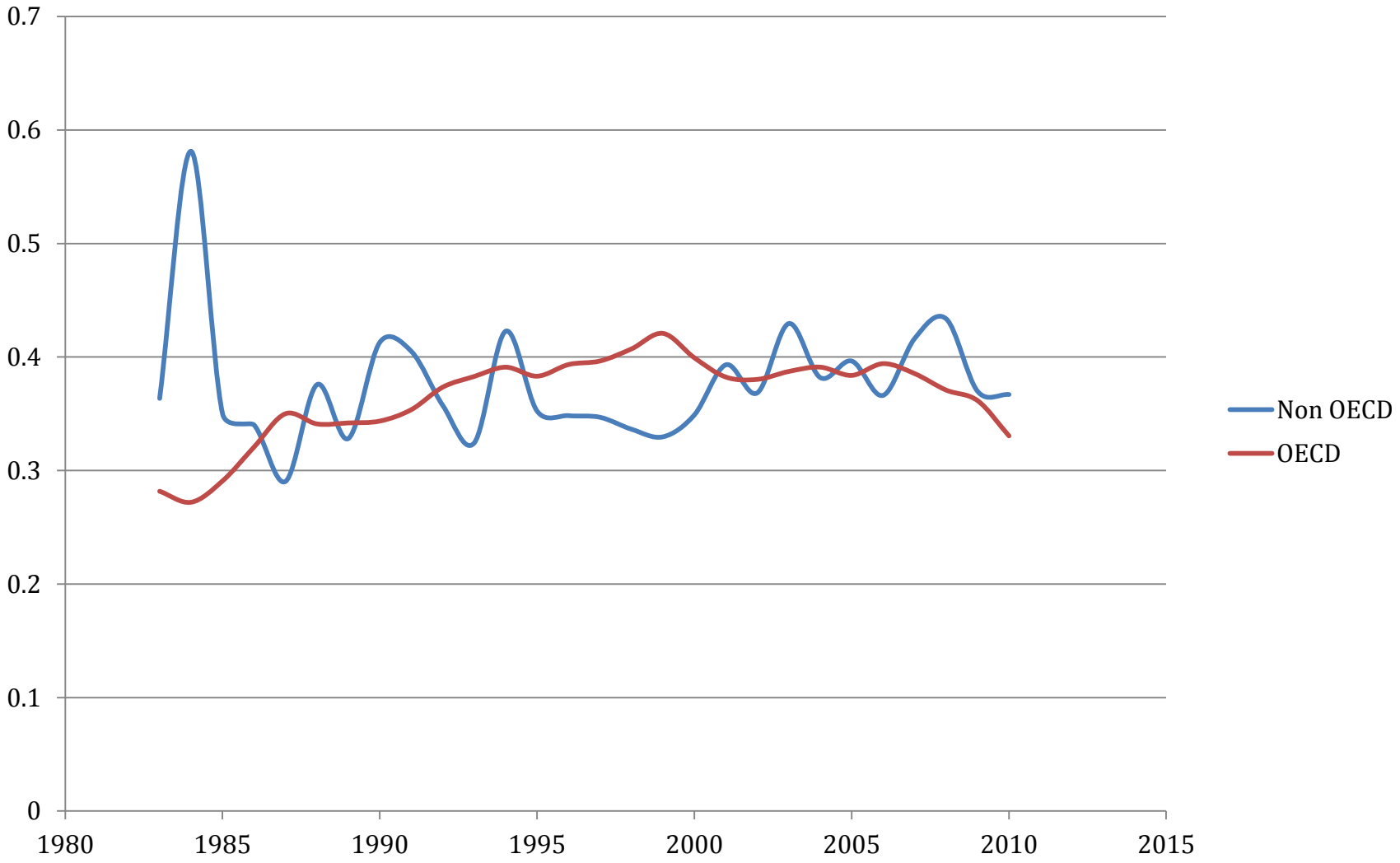
Flow of Foreign Capital FDI (Net, % of Total Economy Output)



Flow of Foreign Capital

VARIABLES	(1) FDI (Net, % of Total Economy Output)	(2) FDI (Net, % of Total Economy Output)	(3) FDI (Net, % of Total Economy Output)	(4) FDI (Net, % of Total Economy Output)
HHI	3.877			
	(2.440)			
Max-Min		2.369		
		(1.675)		
Mean-Median			19.407*	
			(11.615)	
Log Variance				14.030*
				(7.179)
Control	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Constant	10.832	13.022	1.853	10.756
	(12.354)	(13.854)	(8.505)	(11.596)
Observations	443	443	443	443
Adj. R-squared	0.371	0.368	0.395	0.384

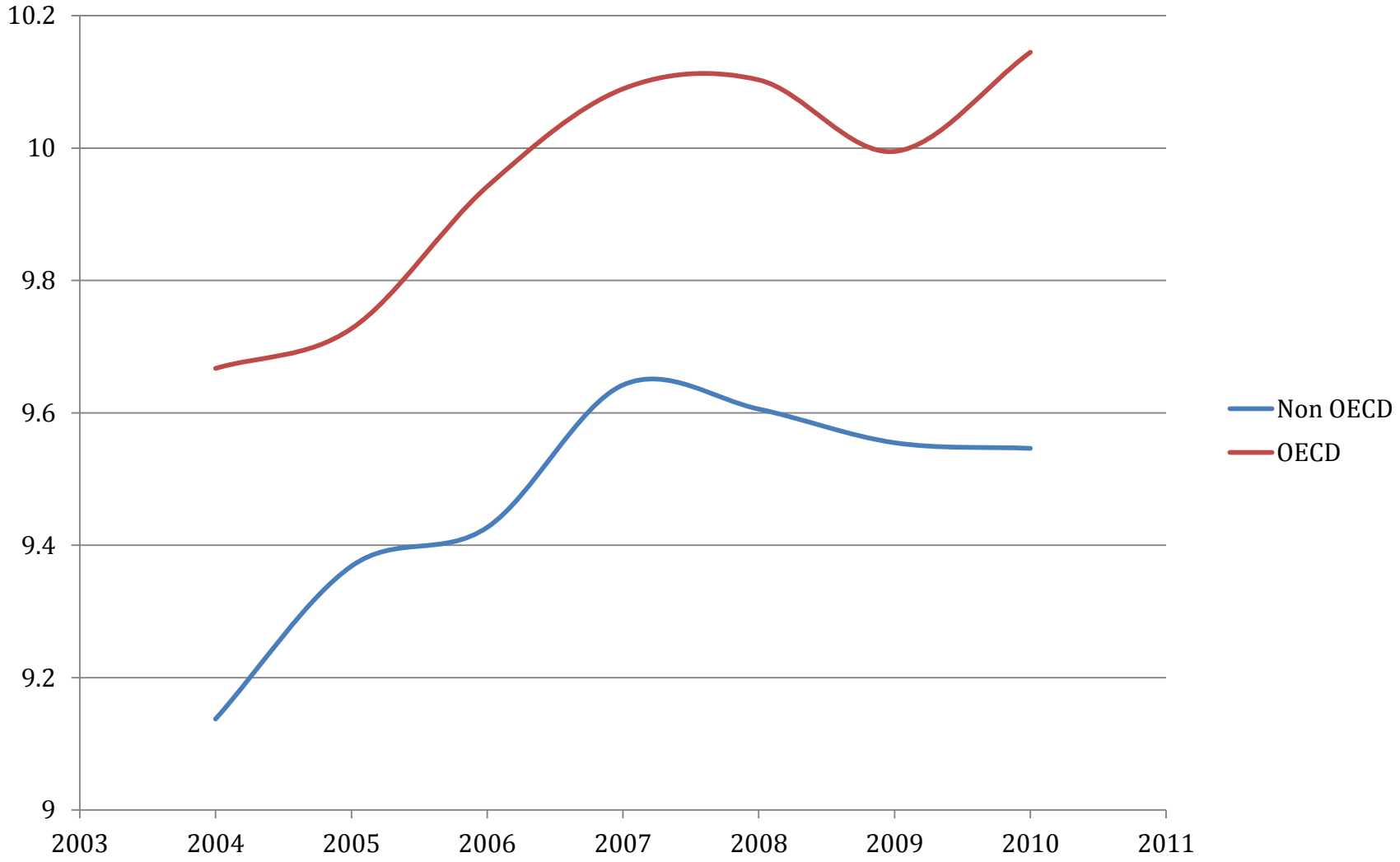
Women Empowerment (Female/Male Employment Ratio)



Women Empowerment

VARIABLES	(1) Female/Male Employment Ratio	(2) Female/Male Employment Ratio	(3) Female/Male Employment Ratio	(4) Female/Male Employment Ratio
HHI	-0.187*			
	(0.109)			
Max-Min		-0.103		
		(0.075)		
Mean-Median			-0.664*	
			(0.336)	
Log Variance				-0.486*
				(0.264)
Control	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Constant	-1.912	-1.855	-1.902	-1.869
	(1.169)	(1.185)	(1.155)	(1.159)
Observations	1,145	1,145	1,145	1,145
Adj. R-squared	0.546	0.545	0.545	0.546

Entrepreneurship (New Business Registration)



Entrepreneurship

VARIABLES	(1) New Business Registration	(2) New Business Registration	(3) New Business Registration	(4) New Business Registration
HHI	-1.595**			
	(0.655)			
Max-Min		-1.073**		
		(0.484)		
Mean-Median			1.515	
			(3.560)	
Log Variance				-2.522
				(2.439)
Control	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Constant	-30.836**	-31.241**	-27.027**	-29.036**
	(11.994)	(11.903)	(12.421)	(12.297)
Observations	425	425	425	425
Adj. R-squared	0.982	0.982	0.982	0.982

Can Government Play a Role?

- Governments can stimulate diversification of industrial sectors by subsidizing R&D expenditures and supplying venture capital with fiscal and regulatory frameworks.
- Governments in OECD countries have implemented a number of more direct programs to mobilize venture capital in support of small and technology-based firms to obtain sufficient capital and to produce public benefits in terms of innovation and job creation.
- Government involvement aim to remedy deficiencies in private capital markets, to leverage private sector financing and to reduce the aggregated macro level risk by diversifying the economy.

Benefit from Government Sponsorship

- Public benefits:
  - Government involvement is capable of yielding social rates of return greater than private rates of return. Schemes may attempt to gain public benefits by targeting small firms with good job creation potential or those who may develop technologies important to long-term growth.
- Funding gaps:
  - Governments may endeavor to fill a “funding gap” that prevents viable small businesses from obtaining sufficient funding on reasonable terms
- Certification effect:
  - By providing small amount of sponsorship, government certifies the firms and reduces the information asymmetry.
- Reduce macroeconomic shocks:
  - Sponsoring the nascent industry and technology helps to diversify the industrial sectors, and further reduce aggregated level macroeconomic shocks

Mechanism

- IFC
- Government Involvement
- Local Banks

New Business Formation

Economic Growth

- Interest Rate Subsidization
- Loan Guarantee
- Tax Incentives
- Government VCs

Types of Government Involvement

TYPE	PURPOSE	EXAMPLE
DIRECT SUPPLY OF CAPITAL:		
Research Funding	Provide R&D funding for small sized firms	**United States** - Small Business Innovation Research (SBIR)
Government equity investment	To make direct investments in venture capital firms or small firms	**Belgium** – Investment Company for Flanders (GIMV)
Government loans	To make low-interest, long-term and/or non-refundable loans to venture capital firms or small firms	**Denmark** – VækstFonden (Business Development Finance) Loan Programme
FINANCIAL INCENTIVES:		
Tax incentives	To provide tax incentives, particularly tax credits, to those investing in small firms or venture capital funds	**United Kingdom** – Enterprise Investment Scheme and Venture Capital Trusts
Loan guarantees	To guarantee a proportion of bank loans to qualified small businesses	**France** – Société Française de Garantie des Financements des Petites et Moyennes Entreprises (SOFARIS)
Equity guarantees	To guarantee a proportion of the losses of high-risk venture capital investments	**Finland** – Finnish Guarantee Board

Source: OECD

Tax Incentives

- Many governments choose tax incentives, particularly investor tax credits, as a means of stimulating particular types of investment.
- Incentives may be available for investments made directly in qualifying small companies or may be available for investments made in qualified pooled vehicles.
- An important decision in program design is whether the tax incentive should be given on the front-end or at the back-end, which is tied to any capital gains realized at exit. The first rewards all investors, whereas the second rewards only winners. Another difference between the two approaches is that front-end incentives may cause behavior motivated primarily by tax shelter considerations.

Tax Incentives in Canada

- ***Canada*** gives tax incentives to hybrid public/private funds as Labor-sponsored Venture Capital Corporations (LSVCCs).
- Asset growth of LSVCCs has been particularly rapid in the last decades (almost **50%** of Canadian venture capital assets). LSVCCs invest in Canadian SMEs and investments dedicated to early-stage deals represented **34%** of their investments.
- The attraction of LSVCCs is that an investor receives a federal tax credit of 15% on up to $ 3500 of investment held for five years. In addition to the federal credit, investors in Ontario and Quebec, which account for the bulk of LSVCC funds, receive a 15% tax credit on these investments.

Loan Guarantee

COUNTRY	PROGRAMME	% OF LOAN GUARANTEED	INTEREST RATE PREMIUM
UNITED STATES	7(a) Loan Guarantee	75	none [2% origination fee]
FRANCE	SOFARIS	50 to 70	0.6
UNITED KINGDOM	Loan Guarantee Scheme	85 if company > 2 years old 70 if company < 2 years old	0.5 fixed, 1.5 variable
CANADA	SBLA	85	1.75
PORTUGAL	SPGM	70	1.5
JAPAN	VEC Loan Guarantees	80	2.0

Source: OECD

- The great majority of OECD countries offer some form of government-backed guarantee covering loans to small firms. Under such a program, the government guarantees a percentage of a qualified loan made by a financial institution.
- In the event of borrower default, the loss incurred by the lender is only for that amount of the loan not covered by the guarantee. The intent of these programs is to encourage financial institutions, particularly commercial banks, to fund small firms which have viable projects but which cannot meet collateral requirements.

Loan Guarantee in U.S.

- In the ***United States,*** since 1953, the Small Business Administration has run the *7(a) Guaranteed Business Loan Program*. This scheme guarantees long-term loans to start-up and high-potential companies.

- These loans are then guaranteed by the SBA for up to 75 per cent of the amount provided by the commercial lender. Interest rates are negotiated between the borrower and the lending bank. The maximum amount currently guaranteed by the SBA is US$ 500,000.

- Between 1980 and 1991, the SBA guaranteed US$ 31 billion in loans through the 7(a) program. Today it is almost the same amount disbursed every other year.

- The default rate is less than 10%, on average.

U.S. Small Business Innovation Research (SBIR)

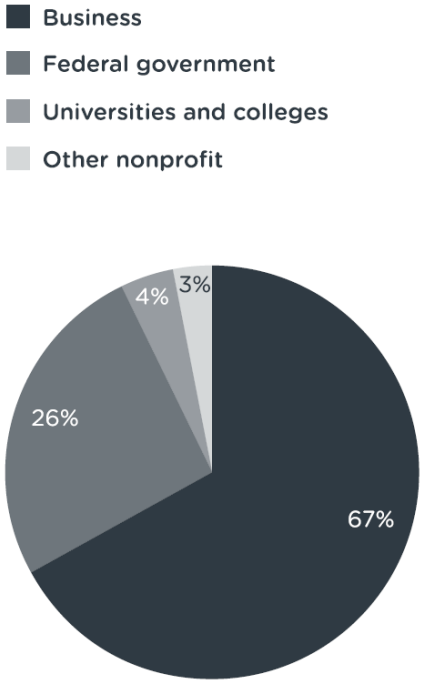
- The Small Business Innovation Research program is a United States Government program
- In 2010, over $1 Billion in research funds are granted. Over half the awards are to firms with fewer than 25 people and a third to firms of fewer than 10. A fifth are minority or women-owned businesses. A quarter of the companies in FY10 were first-time winners
- Some of America's most dynamic companies received support through federal programs while privately held entities, including Apple Computer, Compaq, FedEX, and Intel.
- In addition to funding firms, publicly sponsored funds during the 1960s provided early experience for many of the individuals who later went on to lead independent venture organizations.

SBIR Participating Agencies (as of 2010)

- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Education
- Department of Energy
- Department of Health and Human Services Department of Homeland Security
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation

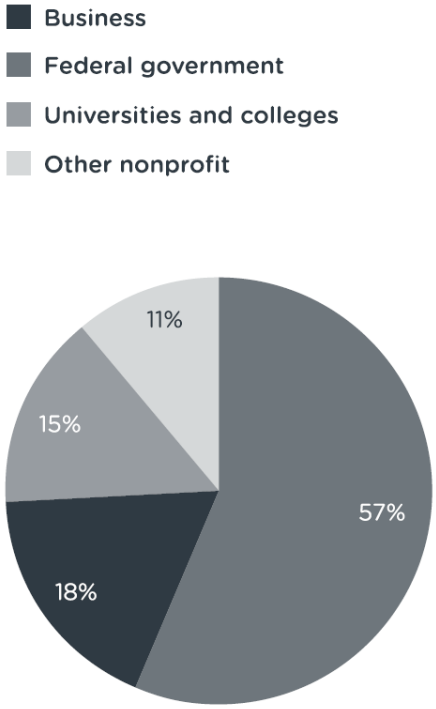
Source of R&D Funding in the US

Sources of funding for US R&D in 2008



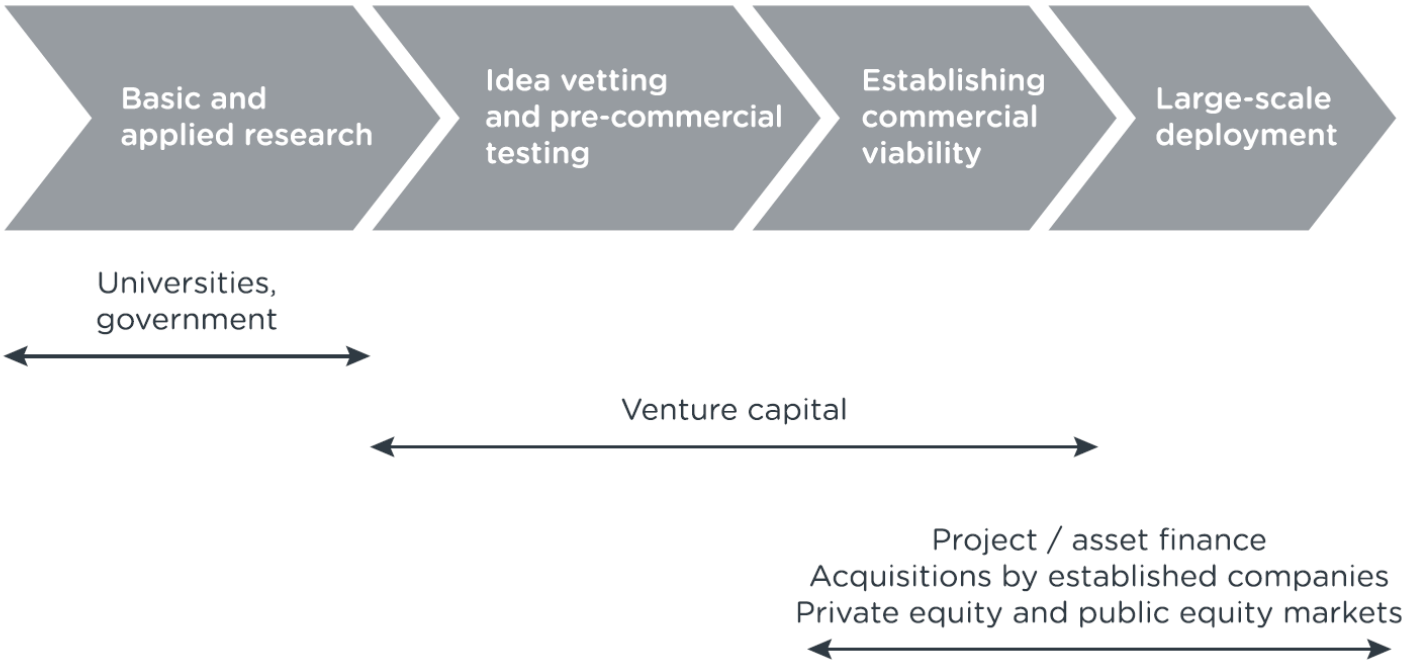
Source: National Science Foundation [67]

Sources of funding for basic research R&D in 2008



Source: Mazzucato (2011)

Stages of VC investment



- In the USA, government programs such as the Small Business Innovation Research (SBIR) program have provided 20–25 % of total funding for early stage technology firms. Thus government has played a leading role not only in the early stage, but also in the commercial viability stage.

Evidence from U.S. (Lerner 1998)

- SBIR awardees enjoyed substantially greater employment and sales growth.
- SBIR awardees are more likely to subsequently receive venture capital financing from private sectors.
- The superior performance of awardees was confined to firms in regions with substantial venture capital activity and was pronounced in high-technology industries.
- Distortions may exist, especially in regions with fewer high-tech firms and among firms receiving large subsidies.

Evidence from Other Countries

- **Germany**'s BJTU program (government equity investment) reduced the failure rate of companies (financed by the program) to 17%
- **Netherland**'s Technical Development Credits Scheme (TOK) program provides subordinated ten-year loans. Repayment is based on a firms revenues and in the event of technical or commercial failure the loan is forgiven.
- The Loan Guarantee Scheme (LGS) of the **United Kingdom** have a repayment schedule of between two and ten years. Companies in existence for less than two years are eligible for a 70 per cent guarantee on loans up to £100 000; older companies are eligible for an 85 per cent guarantee on loans up to £250 000.

Case Study - Taiwan

- Taiwan has a developed capitalist economy that ranks as the 19th- largest in the world by purchasing power parity (PPP).
- With the Technocracy-centered economic planning under Martial Law until 1987, real growth in GDP has averaged about 8% during the past three decades.
- Industries have gradually moved to capital and technology-intensive industries from more labor-intensive industries, with electronics and information technology accounting for 35% of the industrial structure.
- Industry in Taiwan primarily consists of many small and medium-sized enterprises (SME) with fewer large enterprises.

Case Study - Taiwan

- Since the early 1970s, the Taiwanese government has been the force behind the push for enhanced technological capability.
- Two institutions are established: (i) the Industrial Technology Research Institute (ITRI); and (ii) the Hsinchu Science based Industrial Park.
- Dramatic growth in the investment of industrial R&D (in the form of subsidies) rose from US$0.25bn in 1982, to US$2.24bn in 1999. These R&D resources are distributed across industries.
- Private firms were able to expand their technological base in the 20 years since ITRI was first established in 1973.
- Furthermore, because ITRI was first established in 1973, more than 15 000 skilled personnel have been subsequently spun-off from ITRI into the private sector, a move that has significantly contributed to improving the core competencies of private firms.

Government Investment and Industry Growth

VARIABLES	(1) Industry Growth
Government Investment (lagged)	0.875*
	(0.473)
Constant	0.134**
	(0.055)
Industry Control	Yes
Observations	148
R-squared	0.111
Adj. R-squared	0.053

- Data source: National Statistics, Republic of China (Taiwan)

Banking Deregulation

- Commercial banks in the United States faced stringent regulatory restrictions back in 1970s.
  - They were restricted for the most part to classic financial intermediation—deposit-taking and lending—to the exclusion, for example, of underwriting many corporate securities and insurance products.
  - They were limited in the geographical scope of their operations.
- Today, almost all of these restrictions have been lifted
  - Interest rate ceilings on deposits were phased out in the early 1980s
  - State usury laws have been weakened
  - Limits to banks' ability to engage in other financial activities have been almost completely eliminated
- The regulatory change was followed by better performance of the real economy. State economies grew faster and had higher rates of new business formation after this deregulation. At the same time, macroeconomic stability improved. By opening up markets and allowing the banking system to integrate across the nation, deregulation made local economies less sensitive to the fortunes of their local banks.

New Incorporations and Banking Deregulation

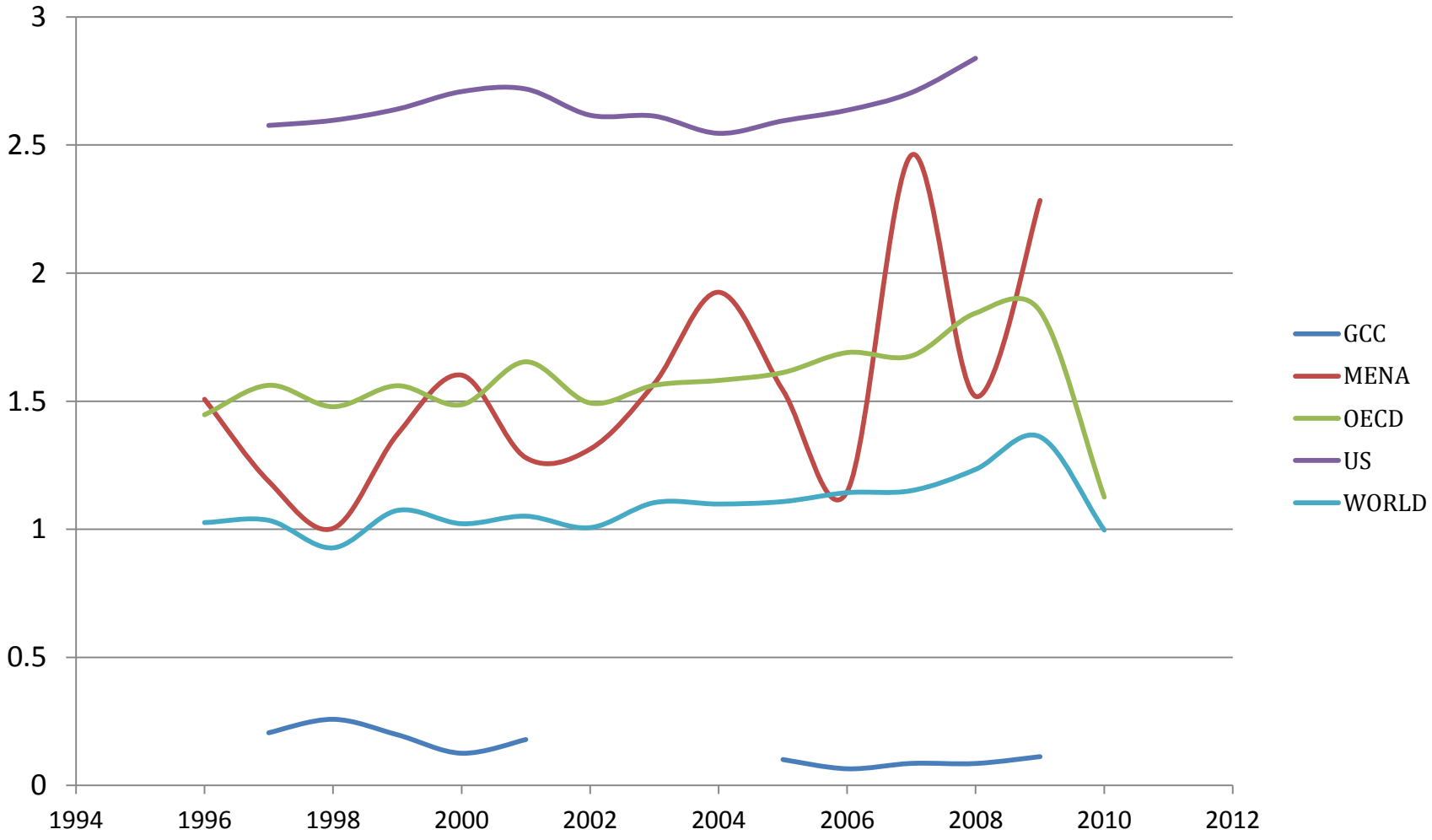
	Log of new incorporations per capita		Growth of new incorporations per capita	
Post-branching	0.0279	0.0981*	0.0312*	0.0390*
	(0.0186)	(0.0175)	(0.0128)	(0.0138)
Post-interstate banking	0.1169*	0.0572*	–0.0057	–0.0133
	(0.0243)	(0.0229)	(0.0164)	(0.0178)
Share of employment in mining	—	6.30*	—	0.75
		(0.92)		(0.75)
Share of employment in construction	—	9.59*	—	0.42
		(0.70)		(0.63)
Share of employment in manufacturing	—	2.89*	—	0.52
		(0.69)		(0.57)
Share of employment in transportation	—	6.00*	—	1.41
		(1.99)		(1.59)
Share of employment in trade	—	6.11*	—	0.09
		(1.03)		(0.83)
Share of employment in finance	—	6.04*	—	–2.87*
		(1.98)		(1.58)
Share of employment in services	—	2.68*	—	–0.64
		(0.82)		(0.67)
N	949	890	901	850
Within R^2	0.3554	0.5166	0.1933	0.2259

Strahan (2003)

Government Expenditure in R&D

Variable	New Firm Formation Rates	New Firm Formation Rates
Government R&D Expenditure		0.069 ***
Population log	0.230 ***	0.202 ***
Population Change	0.498 ***	0.496 ***
Establishment Density	0.469 ***	0.477 ***
Establishment Size	-0.399 ***	-0.398 ***
Unemployment Rate log	0.033 ***	0.045 ***
High School Education	-0.170 ***	-0.184 ***
Foreign Population	-0.062 ***	-0.063 ***
Trend	-0.055 ***	-0.054 ***
Constant	0***	0 ***
Number of obs.	3,546	3,546
Adjusted R2	0.612	0.613

Business R&D as a percentage of GDP



Risk of loss for different stages at which investments are made (%)

Point at which investment made	Risk of loss
Seed stage	66.2%
Start-up stage	53.0%
Second stage	33.7%
Third stage	20.1%
Bridge or pre-public stage	20.9%

Source: Mazzucato (2011)

Take Away

- Industrial diversification enhances the stable growth
- The diversification effects is not limited to the overall volatility or growth, but impacts the economy through multiple channels
- Government's involvement in the R&D, especially its sponsorship for small and medium sized entrepreneurs are important and crucial. Deregulation of the banking and capital market are also helpful.

Thank You!