PRODUCTION TECHNOLOGY, PATENT AND CARBON EMISSION

Soumyananda Dinda

Chandragupt Institute of Management Patna

BACKGROUND

- Climate Change challenges to the existing production technology
- Clean technology
- Innovation and Patent Rights

PATENT

- Patent is an important legal document, issued by an authorized government agent, granting the right to exclude anyone else from the production or use of a specific new device, or process' for certain defined years
- The right embedded in the patent can be assigned by the inventor to somebody else, usually to his employer, a corporation, and/or sold to or licensed for use by somebody
- Purpose of patent system is to encourage technological progress

PRODUCTION TECHNOLOGY

- Patent registration is considered as a proxy for innovation and provides country's technological capabilities
- The patent registration of a country shows the trends in the improvement of technological strength
- production design patent (DGPNT) as a proxy of production technology
- Production design patent is issued for new, original and ornamental design for an article of manufacture

US PATENT AT USPTO

- The US economy dominates in the world
- The US might have been attempted to innovate green technology
- Patent registration at the USPTO is high and dominates its position in the world over last several decades.
- The US should have the efficient technology - both in terms of productivity and energy saving innovations
- ORNL shows the US is on the top polluters list
- It contradicts general believe that the modern sophisticated upgrading technology helps to *mitigate climate change*.
- How far is it true?

OBJECTIVE

- Does the upgraded technology reduce emission?
- Is it true?
- What is the causal relationship among upgraded technology, income, emission?
- What will be the policy?

THEORETICAL BACKGROUND

$$y = f(k) \qquad f_k > 0 \qquad f_{kk} < 0$$

$$p = \frac{\mu y}{A} \qquad 0 < \mu < 1$$

$$\ln p = \ln \mu + \ln y - \ln A$$

$$\frac{\dot{p}}{p} = \frac{\dot{y}}{y} - \frac{\dot{A}}{A}$$

CONT…

$$\mu = \mu_0 e^{\theta t}$$

$$\ln \mu = \ln \mu_0 + \theta t$$

$$\ln p = \ln \mu_0 + \theta t + \ln y - \ln A$$

$$\frac{\dot{p}}{p} = \theta + \frac{\dot{y}}{y} - \frac{\dot{A}}{A}$$

DATA

- CO2 Emission taken from Carbon Dioxide Information Analysis Centre (CDIAC)
- DGPNT from USPTO
- RGDP from PWT6.3
- Period: 1963 - 2007

FIGURE 1: TRENDS OF DESIGN PATENTS

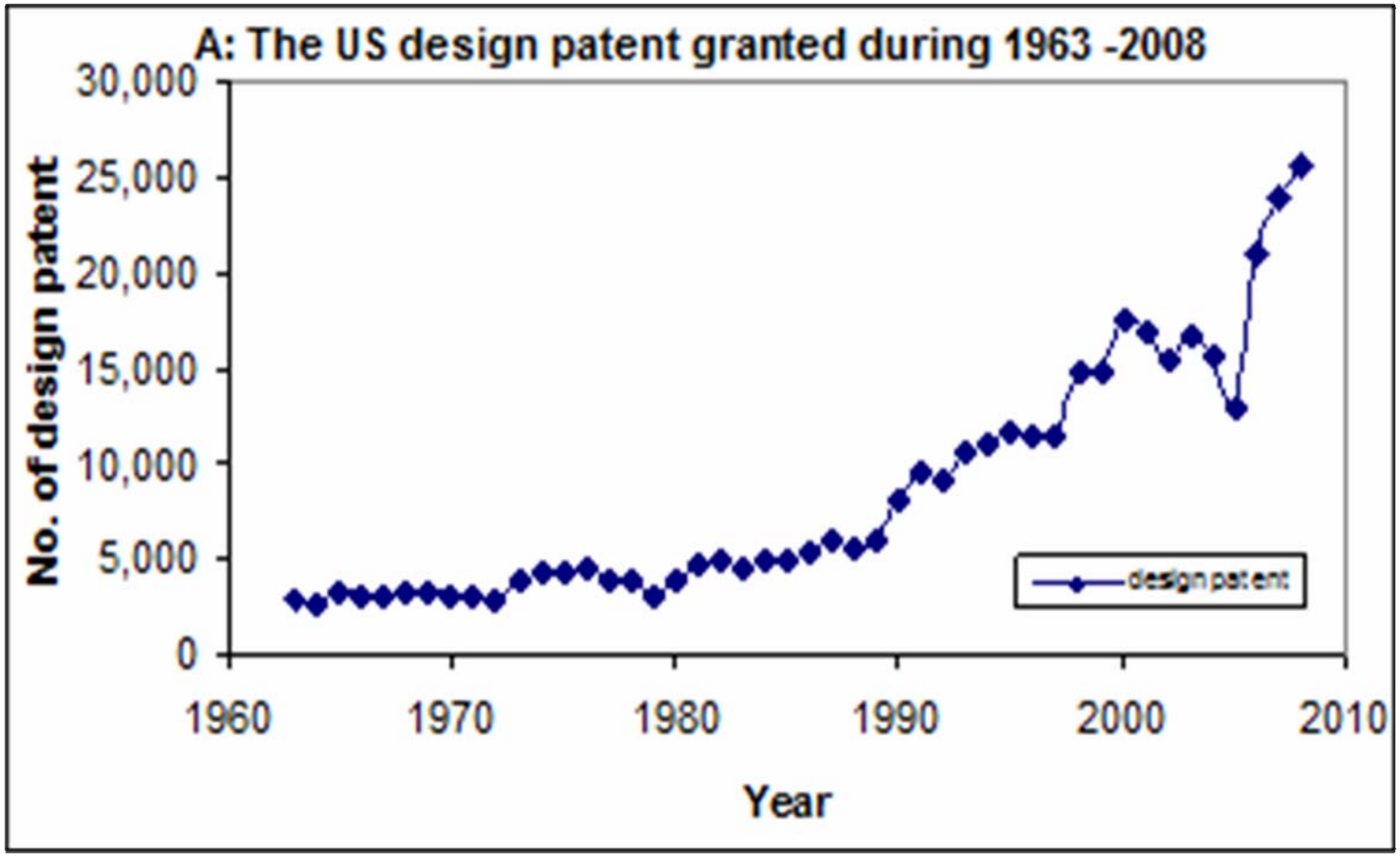


FIGURE 1: TRENDS OF TOTALCO_2 EMISSION

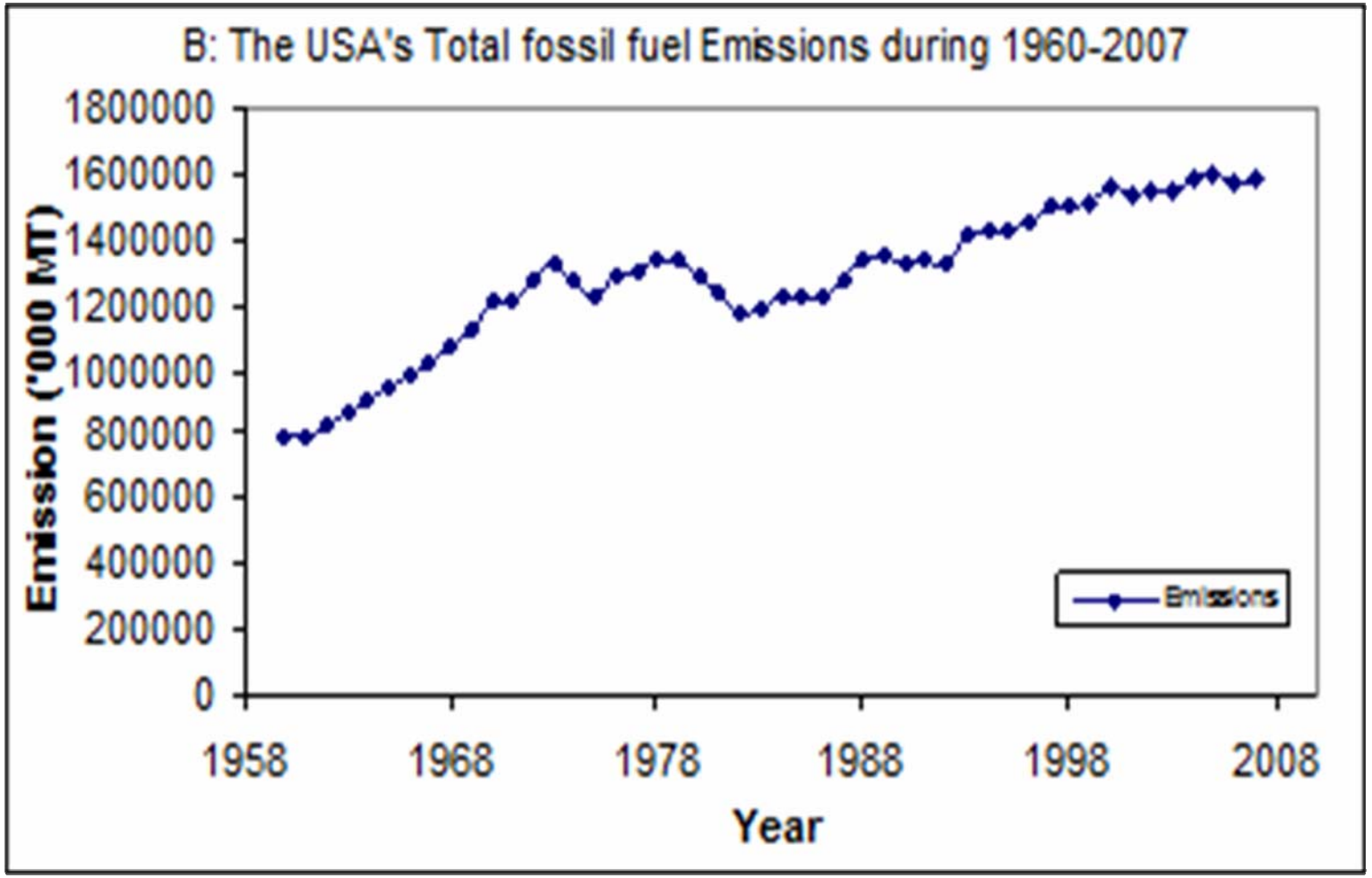


FIGURE 1: TRENDS OF PER CAPITA CO_2 EMISSION

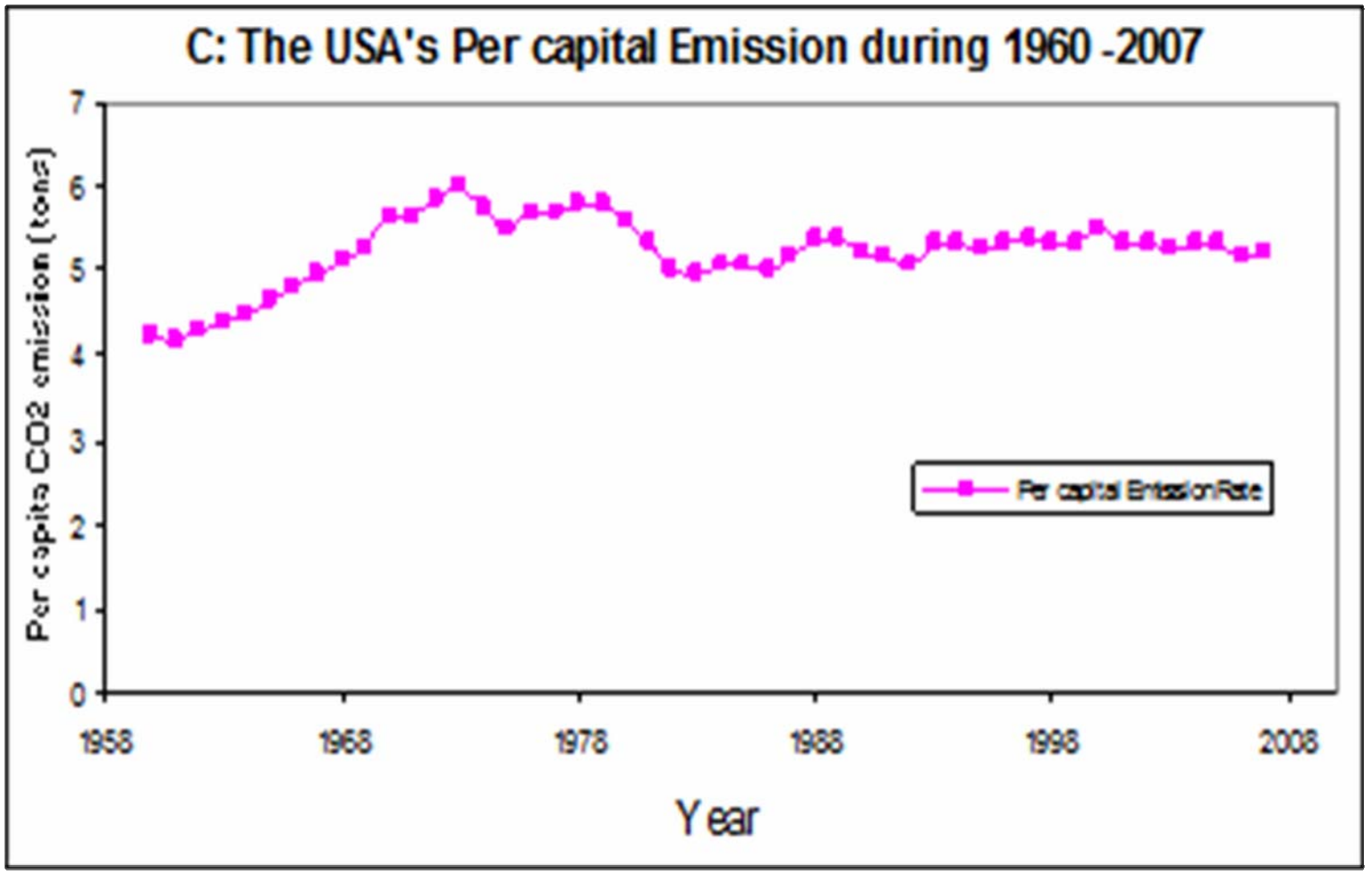


TABLE 1: DECADE-WISE AVERAGE GROWTH RATE OF INCOME (RGDPCH), CO_2 EMISSION (PCCO2) AND PRODUCTION DESIGN PATENT (DGPNT) IN THE USA

Decade	PcCO2	RGDPCH	DGPNT
1963-69	3.18	3.69	1.96
1970-79	0.28	2.40	-0.30
1980-89	-0.38	2.29	4.34
1990-99	0.23	2.08	6.08
2000-07	-0.63	1.11	4.04
1963-07	0.39	2.24	4.76

FIGURE 2: DECADE-WISE AVERAGE GROWTH RATES OF INCOME, EMISSION AND PRODUCTION DESIGN PATENT IN THE USA

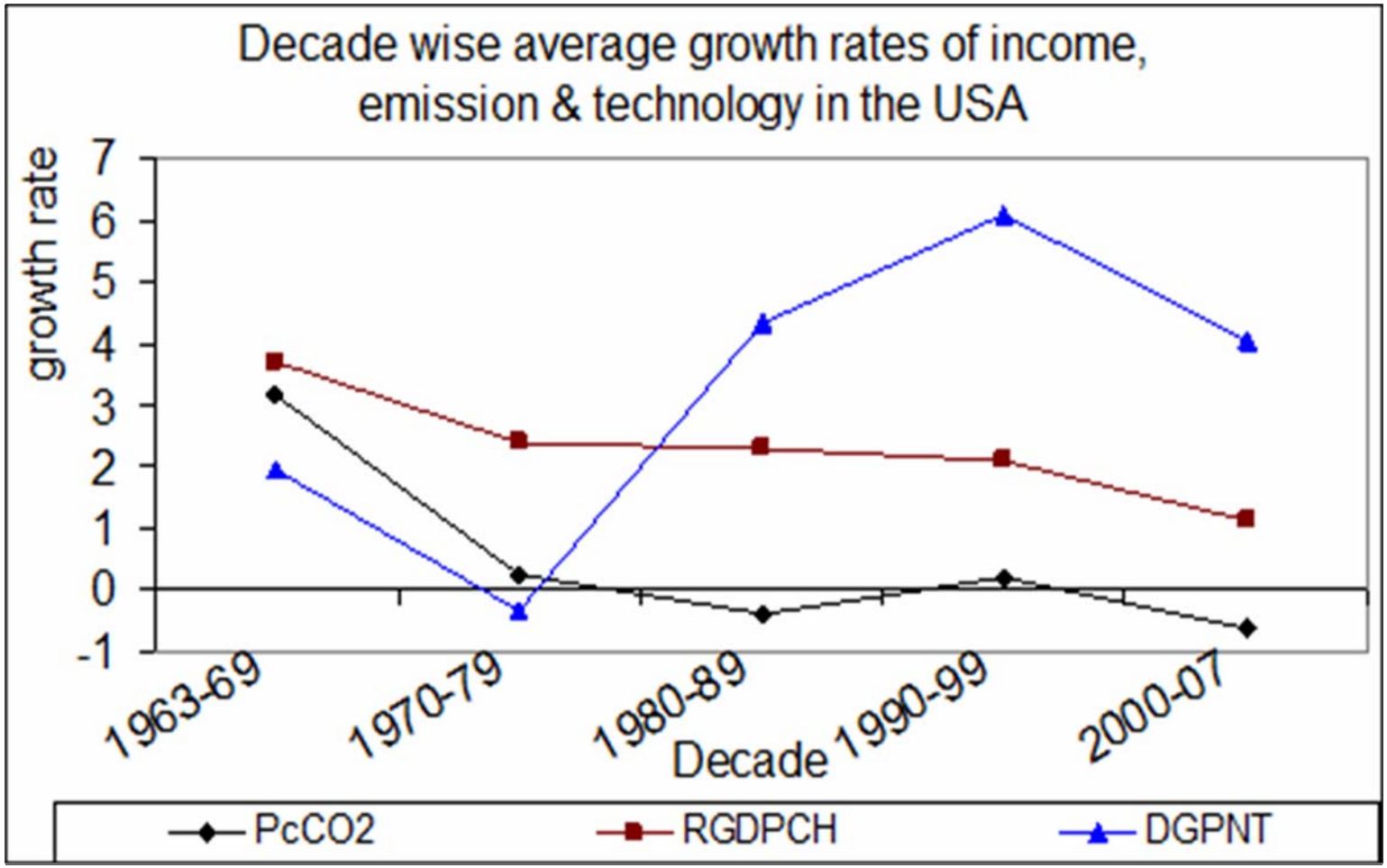


TABLE 2: RESULTS OF UNIT ROOT AND CO-INTEGRATION TEST

A: Unit root test					
	ADF		KPSS		
Variables	Level	1st Difference	Trend Stationary		
lnCO2	-3.15	-4.91***	0.1515**		
ln GDPNT	-2.19	-5.304***	0.2301***		
ln RGDPCH	-0.86	-5.13**	0.1526**		
B: Co-integration Test					
		Eigen value	LR	Critical value 5%	Critical value 1%
H_o: r = 0	H_1:	0.435	44.408**	42.44	48.45
H_o: r = 1	H_1:	0.299	19.856	25.32	30.45

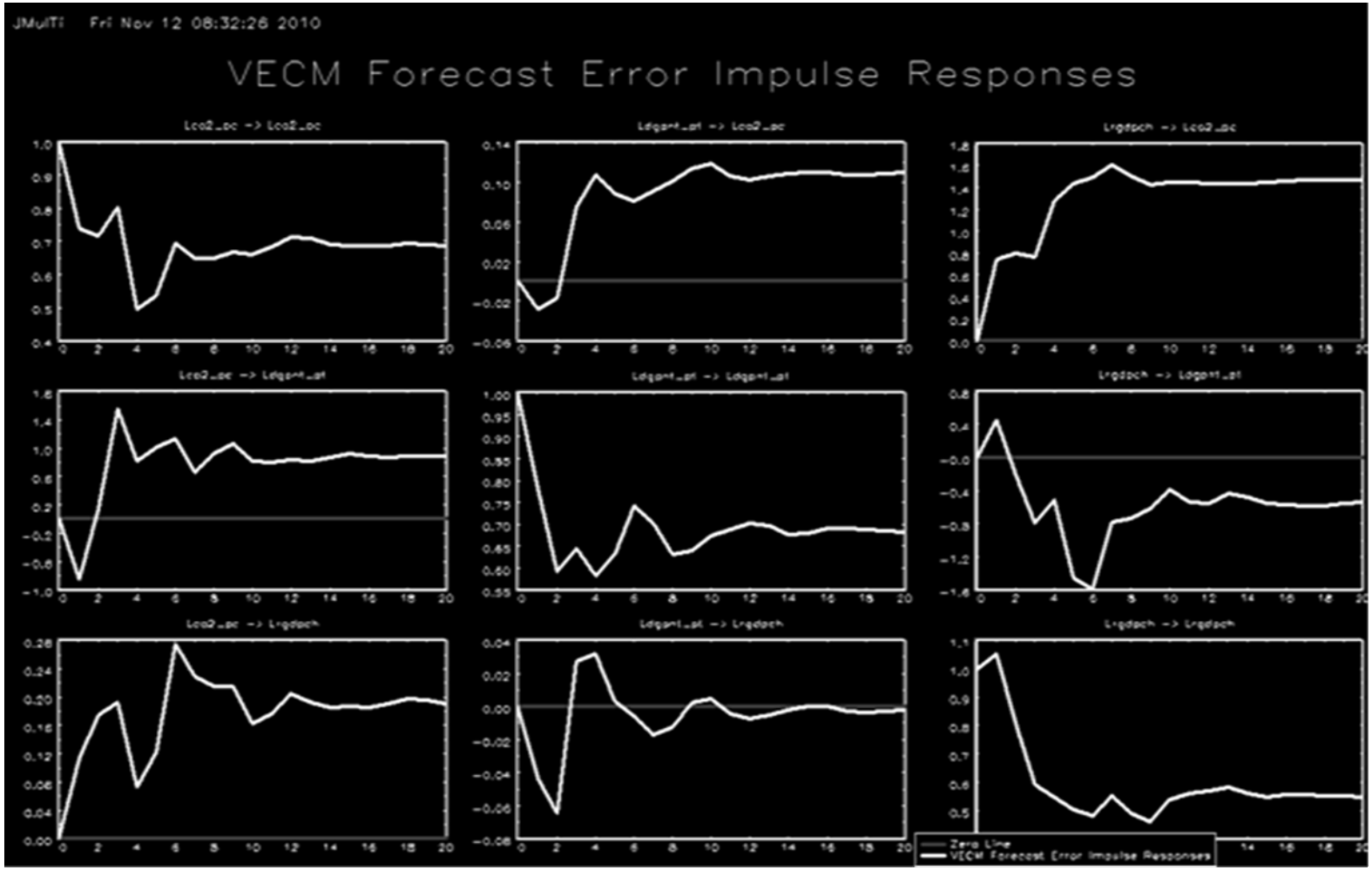
TABLE 3: RESULTS OF VECTOR ERROR CORRECTION MODEL

Estimated Co integration relation			
	ln PcCO2	ln DGPNT	ln RGDPCH
Cointigrating vector	1	**-0.169** (-2.597)	**-2.819** (-4.66)
Loading coefficients			
Variables	D(ln $PcCO_2$)	D(ln DGPNT)	D(ln RGDPCH)
Error Correction	**-0.233***** (-2.93)	0.366 (0.768)	0.083 (1.277)
Deterministic term			
Constant	**-5.999***** (-2.934)	9.394 (0.767)	2.15 (1.293)
Trend (t)	**-0.016***** (-2.97)	0.028 (0.832)	0.006 (1.244)

TABLE 3: RESULTS OF VECM (CONT……..)

VAR			
Variables	D(ln $PcCO_2$)	D(ln DGPNT)	D(ln RGDPCH)
D(L$PcCO_2$(-1))	-0.027 (-0.164)	-1.215 (-1.24)	0.03 (0.226)
D(LDGPNT(-1))	**-0.068**** (-2.31)	-0.157 (-0.89)	-0.03 (-1.24)
D(LRGDPCH(-1))	0.087 (0.37)	1.487 (1.053)	0.285 (1.49)
D(L$PcCO_2$(-2))	0.035 (0.219)	0.171 (0.18)	-0.034 (-0.265)
D(LDGPNT(-2))	-0.010 (-0.283)	-0.179 (-0.863)	-0.011 (-0.385)
D(LRGDPCH(-2))	**-0.437**** (-2.299)	1.073 (0.94)	-0.081 (-0.521)
D(L$PcCO_2$(-3))	0.243 (1.6)	1.147 (1.26)	0.004 (0.033)
D(LDGPNT(-3))	**0.077**** (2.278)	0.056 (0.28)	**0.08***** (2.91)
D(LRGDPCH(-3))	-0.39 (-1.94)	0.17 (0.14)	-0.011 (-0.065)

FIGURE 3: VECM FORECAST ERROR IMPULSE RESPONSES



CONCLUSION

- Production design innovations raise carbon emission in long run
- progress in production technology reduce CO_2 emission growth in short run
- A specific kind of causality running from production design innovation to CO_2 emission in the USA during 1963 – 2007
- The impulse responses of production design patents suggest shortening the patent rights

Thank you