Manufacturing Labour Demand, Technological Progress and Military Expenditure

Paul Dunne

**University of the West of England
and University of Cape Town**

Duncan Watson

University of Swansea

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See:

http://carecon.org.uk/Armsproduction

Introduction

- Continuing concern with economic effects of military spending: post Cold War debates
- Large reductions but pressure to increase now
- Magnitude of military spending does not provide measure of its overall importance to economies
- Concern with its impact in number of areas
- Important one employment effects of military spending and impact on technical progress
- Little empirical evidence
- Focus:
  - Manufacturing sector cross country
  - Aggregate time series versus case studies

- Use panel data methods

Data and Sample

- Countries considered limited by data availability: wanted to use hours data as well as employment

    1. Greece
    2. Portugal
    3. Spain
    4. Turkey
    5. Canada
    6. France
    7. UK
    8. US
    9. Italy
    10. Japan

Penn World Tables plus OECD Data plus SIPRI

- Range of data 1960 to 1999 but not all used cos reliability concerns

- Dependent variable
    - total hours worked in manufacturing
    - Total employment in manufacturing
- Measures of employment may be more accurate, but using hours tends to smooth out series

Theory

- Other work:
    - Simple reduced form model plus causality: Dunne and Smith (unemployment)
    - Cobb Douglas production function approach: employment function. Dunne and Watson (2000)
    - Problems with Cobb Douglas
        - Elasticity of substitution = 1
        - Technical progress neutral
        - Firms assumed on production frontier: but adjust costs etc?
- Better to use CES –Yildirim and Sezgin (2001)

- Assume that output follows a standard CES production function:

$$Q = g\left[s(K)^{-r} + (1-s)\left(Le^{lt}\right)^{-r}\right]^{-(v/r)}$$

  - n is returns to scale ;
  - g and s are production scale parameters
  - elasticity of substitution $s = 1 / (1+r)$
  - Technical progress is labour augmenting at rate l_t

- Marginal productivity conditions give log-linear labour demand function:

$$\ln(L) = c + \frac{1+s(v-1)}{v}\ln(Q) - s\ln(w/p) - (1-s)lt$$

- Coefficient on real wage is estimate of elasticity of substitution, allowing technical progress and returns to scale to be identified
- Often we just add in a military burden term to reflect crowding out: Yildirim and Sezgin (2001) in CES and Dunne and Watson (2000) in C-D

- Consider impact on technology. Yildirim and Sezgin (2001) introduce assumption M=kY and replace ln(Y) with ln(M), before using ARDL. Problems with this…

- We follow Hubert and Pain (1999) approach to analysing spill over of FDI endogenise technical progress but add military burden (MB)

$$l t = l_T T + l_M MB$$

- Military burden term reflects “Technological displacement” Diversion of resources from civilian to military purposes (particularly in the case of R&D) which can lead to detrimental effects on a nation’s technological position and employment levels.
- Any ‘spin-in’ effects resulting from adapting military research into the civilian sector may offset such effects.

- Need to take account of changes since the Cold War

- Allow for adjustment lags in employment and output to give a dynamic model with the technical progress (and so military spending) embedded in the long run steady state solution.

$$\Delta \ln(L_{it}) = a_0 + a_1 \Delta \ln(\mathrm{Q_{it}}) + a_2 \ln(L_{it-1}) + a_3 \ln(Q_{it-1})$$
$$+ a_4 t + a_5 \ln(M_{it-1})$$

Estimation Methods

Panel data models

- Pooled OLS model estimates:

  $y_{jt} = \alpha + \beta\, x_{jt} + u_{jt}$

- Fixed effects estimator allows the intercept to differ across countries

  $y_{jt} = \alpha_j + \beta\, x_{jt} + u_{jt}$

- Time fixed effects can also be allowed

  $y_{jt} = \alpha_t + \alpha_j + \beta\, x_{jt} + u_{jt}$

- Dynamic model

  $y_{jt} = \alpha_j + \beta\, x_{jt} + \lambda\, y_{jt-1} + u_{jt}$ (16)

  - the fixed effect estimator is not consistent as N goes to infinity for fixed T because of lagged dependent variable bias

- It is consistent as T goes to infinity and bias is small
- If the parameters differ over the groups then there is a further heterogeneity bias.

Results :

Table 1: Panel Results [1966-2001; All countries; dependent variable= $\Delta \log(L_{it})$]

	(1)	(2)	(3)	(4)
$\Delta \log(Q_{it})$	0.2143*	0.2351*	0.2103*	0.2132*
$\log(L_{i,t-1})$	-0.1259*	-0.0685*	-0.1209*	-0.0325**
$\log(Q_{i,t-1})$	0.0398**	0.0506*	0.0482*	0.0303**
$\log(W_{i,t-1}/P_{i,t-1})$	-0.0073	-0.0088	-0.0028	-0.0088
TIME	0.0003	-0.0006**	0.00007	-0.0003
Constant		0.1766**		0.0288
$\log(M_{i,t-1})$			-0.0114	-0.0035

(**) significant at 10%
(*) significant at 1%
(1) and (3) FEM
(2) and (4) REM

- Generally OK specification without milex variable

- Growth of employment:
  - positive effect of of growth of output
  - negative effect of level of employment
  - positive effect level of output
  - negative wage effect
  - positive effect of T for FE but RE only when M included

- negative military spending effect

- Consider arms producers

Table 2: Panel Results [1966-2001; Main arms producing countries; dependent variable= $\Delta \log(L_{it})$]

	(1)	(2)	(3)	(4)
$\Delta \log(Q_{it})$	0.3531*	0.3438*	0.3577*	0.3481*
$\log(L_{i,t-1})$	-0.0906*	-0.0850*	-0.1017*	-0.0935*
$\log(Q_{i,t-1})$	0.0926*	0.0846*	0.1233*	0.1058*
$\log(W_{i,t-1}/P_{i,t-1})$	-0.0229*	-0.0231*	-0.0207*	-0.0193**
TIME	-0.0010*	-0.0009*	-0.0016*	-0.0013*
Constant		-0.2009*		-0.3017*
$\log(M_{i,t-1})$			-0.0158*	-0.0112*

(**) significant at 10%
(*) significant at 1%
(1) and (3) FEM
(2) and (4) REM

- Consider Cold War period

Table 3: Panel Results [1965-1989; All countries; dependent variable= $\Delta\log(L_{it})$]

	(1)	(2)	(3)	(4)
$\Delta\log(Q_{it})$	0.2694*	0.2387*	0.2718*	0.2424*
$\log(L_{i,t-1})$	-0.1403*	-0.0374**	-0.1387*	-0.0444**
$\log(Q_{i,t-1})$	0.0784**	0.0302**	0.0810**	0.0362**
$\log(W_{i,t-1}/P_{i,t-1})$	-0.0049	-0.0069	-0.0037	-0.0066
TIME	-0.0007	-0.0002	-0.0007	-0.0003
Constant		0.0493		0.0665
$\log(M_{i,t-1})$			-0.0040	-0.0011

(**) significant at 10%
(*) significant at 1%
(1) and (3) FEM
(2) and (4) REM

Table 4: Panel Results [1965-1989; Main arms producing nations; dependent variable= $\Delta\log(L_{it})$]

	(1)	(2)	(3)	(4)
$\Delta\log(Q_{it})$	0.3144*	0.2920*	0.3279*	0.3056*
$\log(L_{i,t-1})$	-0.0872*	-0.0856	-0.0955*	-0.0898*
$\log(Q_{i,t-1})$	0.1068*	0.0858*	0.1274*	0.1002*
$\log(W_{i,t-1}/P_{i,t-1})$	-0.0269**	-0.0269**	-0.0277**	-0.0231**
TIME	-0.0014*	-0.0008*	-0.0016*	-0.0010*
Constant		-0.2055**		-0.2820*
$\log(M_{i,t-1})$			-0.0143**	-0.0089**

(**) significant at 10%
(*) significant at 1%
(1) and (3) FEM
(2) and (4) REM

Summary results for panel: Military expenditure effect

	Short Run		Long Run		Effect on TP	
	FEM	REM	FEM	REM	FEM	REM
All countries	-0.011	-0.004	-0.091	-0.123	-0.091	-0.122
Main arms producers	-0.016*	-0.011*	-0.157	-0.117	-0.154	-0.115
Cold War period	-0.004	-0.001	-0.029	-0.023	-0.029	-0.022
Main arms producers in Cold War period	-0.014**	-0.009**	-0.147	-0.100	-0.146	-0.098

- Significant results only for main arms producers –especially during the Cold War
- Effects are relatively small
- Negative short run effect on growth of employment
- Negative long run effect
- Negative effect of military spending on Technical progress
- Effects very much larger during the Cold War period

Conclusion

- Preliminary results
- Negative short run effect on growth employment
- No evidence of positive impact of military spending on technical progress and long run employment but:
    - Only really significant for main arms producers
    - Stronger during the Cold War period
- Seems fruitful avenue for further research using dynamic panel data methods

Individual Country Results

Individual country (full sample)

	Greece	Portugal	Spain	Turkey
$\Delta\log(Q_{it})$	-0.269**	0.192	0.875*	-0.014
$\log(L_{i,t-1})$	-1.10*	-0.610*	0.068	-0.323*
$\log(Q_{i,t-1})$	-0.272*	0.114	-0.141	0.290
$\log(W_{i,t-1}/P_{i,t-1})$	0.099**	-0.018	0.025	-0.020
TIME	0.012*	0.002	0.006*	-0.007
Constant	20.68*	7.66*	0.594	0.427
$\log(M_{i,t-1})$	0.019	-0.030	0.053	-0.022

	Canada	France	UK	US	Italy	Japan
$\Delta\log(Q_{it})$	0.511*	0.442*	0.0155	0.622*	0.182*	0.198*
$\log(L_{i,t-1})$	-0.321*	0.074	-0.468*	-0.052	-0.303 *	-0.325*
$\log(Q_{i,t-1})$	0.315*	0.059**	0.472*	0.242*	0.096**	0.082
$\log(W_{i,t-1}/P_{i,t-1})$	-0.073	-0.001	-0.05**	-0.098	-0.008	-0.031
TIME	-0.003*	-0.0006	-0.007*	-0.005*	-0.001	0.0007
Constant	-0.518	-1.89*	-0.094	-4.06*	2.68**	3.86
$\log(M_{i,t-1})$	-0.0152	-0.030*	-0.070*	0.003	0.033	0.017