



The contribution of owner-occupied dwellings
to productivity growth in Sweden

Erik Glans

September 2019

Abstract

The present paper provides an analytical expression of how to calculate the productivity contribution of owner occupied dwellings to labour productivity growth measured as value added per hour worked. It also shows how the imputed value added of owner occupied dwellings has contributed to labour productivity growth in the Swedish business sector according to the national accounts from 1993 to 2018.

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1 Introduction

Owner occupied dwellings are included in the business sector of the national accounts and can contribute substantially to both increases and reductions in the measured labour productivity of the business sector. Analyses of productivity developments relevant for profitability and unit labour costs should in most cases exclude this contribution. This paper examines the role of owner-occupied dwellings for total labour productivity growth in the Swedish business sector since 1993. It also derives an algebraic expression for the calculation of this productivity contribution. This expression is useful in forecasting expected future productivity contributions. This can be useful in shift share analyses or long term forecasts. At the NIER it is used to calculate a total productivity growth rate for the business sector implied by the disaggregated assumptions made in models such as the price model PRIOR.

2 Data and Definitions

Data are taken from the most recent published Swedish national accounts available in september 2019. Labour productivity growth is defined as the development of chain linked value added in reference prices per hour worked. Value added of owner-occupied dwellings is an imputed value for the surplus generated by single family and two family houses for their owners, minus input use. The sector code in the national accounts is L68A. As the sector does not have any hours worked, it does not have a productivity level or productivity growth rate.

3 The Productivity Contribution

Table 1 below shows productivity growth in the business sector including and excluding owner occupied dwellings, the difference between the two and the volume change in value added for owner occupied dwellings from 1994 to 2018. These data are all in reference prices and not adjusted for calendar effects.

Table 1 Productivity and Value Added Growth

Percentage change and percent, respectively

	Business sector Productivity growth	Excluding L68A	Difference	Value added growth L68A
1994	3,25	3,60	-0,36	-0,11
1995	3,32	3,40	-0,08	4,94
1996	2,02	2,17	-0,15	-0,23
1997	5,41	5,68	-0,27	0,13
1998	3,14	3,37	-0,24	1,03
1999	1,67	1,91	-0,24	0,81
2000	4,81	5,05	-0,24	2,48
2001	0,60	0,66	-0,07	0,37
2002	4,76	4,89	-0,13	-0,19
2003	4,80	4,82	-0,02	2,22
2004	5,39	5,92	-0,53	-4,55
2005	3,17	3,53	-0,36	-4,32
2006	4,16	4,40	-0,24	0,73
2007	0,02	0,20	-0,18	-0,01
2008	-2,99	-3,21	0,22	4,80
2009	-2,25	-2,50	0,24	-0,65
2010	4,73	5,36	-0,63	-5,59
2011	1,39	1,75	-0,36	-4,61
2012	-0,43	-0,71	0,28	6,17
2013	0,97	1,02	-0,05	0,02
2014	1,96	2,10	-0,14	-0,32
2015	3,55	3,94	-0,39	-5,48
2016	-0,26	-0,19	-0,07	-0,17
2017	1,30	1,43	-0,13	-1,08
2018	0,66	0,71	-0,05	1,27
Arithmetic average	2,21	2,37	-0,17	-0,09

Note. L68A refers to owner occupied dwellings.

Source: Statistics Sweden.

The large swings in value added for owner occupied dwellings might correspond to changes in input use of financial intermediation services indirectly measured. The average productivity contribution has been negative, reducing the arithmetic average of productivity growth in the business sector by 0,17 percentage points per year.

4 An Algebraic Expression for the Productivity Contribution

Since the sector does not have a well-defined productivity growth rate, one cannot calculate its productivity growth contribution in the usual manner using the value added weight in current prices. Instead, the expression below may be used.

$$\dot{p}_t^{tot} - \dot{p}_t^{ex} = \omega_{t-1} (1 + \dot{p}_t^{ex}) \frac{(\dot{v}_t^{I68a} - \dot{v}_t^{ex})}{(1 + \dot{v}_t^{ex})}$$

NOTATION

\dot{p}_t^{tot} Labour productivity growth rate in the total business sector.

\dot{p}_t^{ex} Labour productivity growth rate in the business sector excluding owner occupied dwellings.

ω_{t-1} Value added in owner occupied dwellings as a share of value added in the total business sector in current prices in the previous year.

\dot{v}_t^{I68a} Volume growth of value added in reference prices for owner occupied dwellings.

\dot{v}_t^{ex} Volume growth of value added in reference prices in the business sector excluding owner occupied dwellings.

This expression can be used to forecast the productivity contribution if one has an idea about expected value added shares in current prices and growth rates of value added volumes. It can also be used in shift-share calculations.

5 Appendix: Derivation of the Algebraic Expression

Let h_t^i be hours worked in sector i in year t . The productivity level in year $t-1$ in current prices (of year $t-1$) in the business sector as a whole is

$$pc_{t-1}^{tot} = \frac{vc_{t-1}^{ex} + vc_{t-1}^{I68a}}{h_{t-1}^{ex}}$$

where vc_{t-1}^i is value added in current prices in sector i in year $t-1$.

Note that

$$h_{t-1}^{ex} = \frac{vc_{t-1}^{ex}}{pc_{t-1}^{ex}}$$

Hence, the expression for productivity in current prices can be rewritten as

$$pc_{t-1}^{tot} = pc_{t-1}^{ex} + pc_{t-1}^{ex} \frac{vc_{t-1}^{l68a}}{vc_{t-1}^{ex}}$$

Productivity growth and value added growth are given by

$$\dot{p}_t^i = \frac{p_t^i}{pc_{t-1}^i} - 1$$

and

$$\dot{v}_t^i = \frac{v_t^i}{vc_{t-1}^i} - 1$$

where p_t^i and v_t^i are valued in the prices of the previous year. The expression for productivity can thus be written as

$$p_t^{tot} = \frac{(1 + \dot{v}_t^{ex})vc_{t-1}^{ex} + (1 + \dot{v}_t^{l68a})vc_{t-1}^{l68a}}{h_t^{ex}} = p_t^{ex} + p_t^{ex} \frac{(1 + \dot{v}_t^{l68a})vc_{t-1}^{l68a}}{(1 + \dot{v}_t^{ex})vc_{t-1}^{ex}}$$

where \dot{v}_t^i is the volume growth rate of value added for sector i in year t .

Using the expression for productivity growth, we obtain

$$\dot{p}_t^{tot} = \frac{p_t^{tot}}{pc_{t-1}^{tot}} - 1 = \frac{p_t^{ex} \left[1 + \frac{(1 + \dot{v}_t^{l68a})vc_{t-1}^{l68a}}{(1 + \dot{v}_t^{ex})vc_{t-1}^{ex}} \right]}{pc_{t-1}^{ex} \left[1 + \frac{vc_{t-1}^{l68a}}{vc_{t-1}^{ex}} \right]} - 1$$

Note that the owner-occupied sectors value added as a share of total business sector value added in current prices in year $t-1$ is denoted by ω_{t-1} in the algebraic expression and is given by

$$\omega_{t-1} = \frac{vc_{t-1}^{l68a}}{vc_{t-1}^{l68a} + vc_{t-1}^{ex}}$$

Note that

$$\omega_{t-1} = \frac{\frac{vC_{t-1}^{168a}}{vC_{t-1}^{ex}}}{1 + \frac{vC_{t-1}^{168a}}{vC_{t-1}^{ex}}}$$

Using the general result that

$$\frac{1+a \cdot b}{1+b} = 1 + \frac{b}{1+b}(a-1)$$

we can rewrite the expression for total productivity growth as

$$\dot{p}_t^{tot} = \frac{p_t^{ex}}{pC_{t-1}^{ex}} \left[1 + \frac{\frac{vC_{t-1}^{168a}}{vC_{t-1}^{ex}} \left(\frac{(1+\dot{v}_t^{168a})}{(1+\dot{v}_t^{ex})} - 1 \right)}{\left[1 + \frac{vC_{t-1}^{168a}}{vC_{t-1}^{ex}} \right]} \right] - 1$$

Substituting in ω :

$$\dot{p}_t^{tot} = \frac{p_t^{ex}}{pC_{t-1}^{ex}} \left[1 + \omega_{t-1} \left(\frac{(1+\dot{v}_t^{168a})}{(1+\dot{v}_t^{ex})} - 1 \right) \right] - 1$$

Rewriting the terms inside the parentheses yields

$$\frac{(1+\dot{v}_t^{168a})}{(1+\dot{v}_t^{ex})} - 1 = \frac{\dot{v}_t^{168a} - \dot{v}_t^{ex}}{1+\dot{v}_t^{ex}}$$

Thus, we can rewrite the expression for productivity growth in the business sector as a whole as follows.

$$\dot{p}_t^{tot} = \frac{p_t^{ex}}{pC_{t-1}^{ex}} \omega_{t-1} \left[\frac{\dot{v}_t^{168a} - \dot{v}_t^{ex}}{1+\dot{v}_t^{ex}} \right] + \frac{p_t^{ex}}{pC_{t-1}^{ex}} - 1$$

$$\dot{p}_t^{tot} = (1 + \dot{p}_t^{ex}) \omega_{t-1} \left[\frac{\dot{v}_t^{168a} - \dot{v}_t^{ex}}{1+\dot{v}_t^{ex}} \right] + \dot{p}_t^{ex}$$

Subtracting productivity growth of the business sector excluding owner-occupied dwellings from both sides of the equation yields the algebraic expression for the productivity contribution that is presented in Section 4.